DelDOT
Delaware Department of Transportation

Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge

New Castle County, DE

March 2018

Contract No. T201407404

Semi-Final Stormwater Management Report

WRA

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Project Overview

A. *Project Objectives*

The proposed project includes the rehabilitation of the I-95 corridor from south of the Christina River Bridge to north of the Brandywine River Bridge at the I-95/DE 202 interchange. Planned construction includes the repair/rehabilitation of nineteen bridges; I-95 resurfacing and pavement reconstruction including roadway profile adjustment; and ramp reconstruction within project limits. The scope of work for the I-95 viaduct bridges includes removing and replacing the top 2-inch protective layer of concrete on the bridge decks to maintain the integrity of the underlying structural concrete; replacing the concrete traffic barriers and roadway expansion joints; painting the bridges; and completing other steel and concrete repairs. The roadway scope of work includes resurfacing and repair of I-95 pavement and will also entail conversion of the closed section drainage system between the southern project limits and the I-95 viaduct bridges to open-section drainage, as well as adjustment of the roadway profile north of the viaduct and south of the Brandywine River Bridges in order to accommodate minimum overpass bridge clearances within this section of the project. I-95 will remain open during this work; however, lane closures and a “contra-flow” maintenance traffic pattern are proposed to expedite construction. Closure of certain ramps along the corridor will also be required during the planned construction. Figure 1 below shows the location of the proposed project limits.

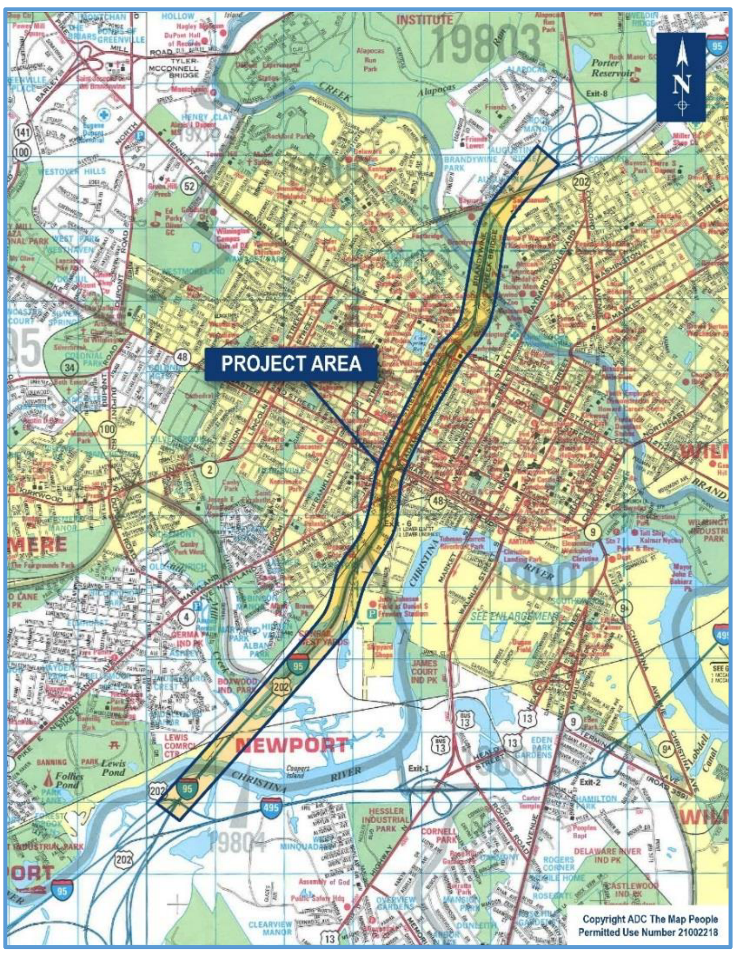


Figure 1 – ADC Location Map
[Copyright ADC The Map People, Permitted Use Number 21002218]

B. General Hydrology

The project is located within the Brandywine-Christina Watershed (02040205). Per the NRCS Web Soil Survey, most of the soil within the project area is classified as HSG 'C'; however, portions of the project are classified as HSG 'B'. All drainage within the project limits ultimately flows into the Christina River either as a direct discharge to its tidal waters or into a combined sewer system, which ultimately joins with the Christina River to the east of the I-95 corridor.

Thirteen (13) points-of-investigations (POI's) have been identified within the project limits. The southern portion of the project (POI's 1 through 7) drains directly into the Christina River. The northern segment of the project site (POI's 8 through 13) discharges to the City of Wilmington Combined Sewer Outfall (CSO), which collects sanitary sewage and stormwater from the surrounding area and conveys it to the Wilmington Water Treatment Plant (WWTP) located at 12th Street and Hay Rd, immediately east of the I-495/12 Street Interchange. The POIs are described as follows:

POI 1 – Station 1206+70, 105' RT

POI 1 has been designated as the collection point for all project site drainage south of the Christina River Bridge. Under existing conditions, I-95 is crowned with some super elevation south of the northbound/southbound roadway merge, with drainage flowing along the curb line to existing drainage inlets, which outlet to the tidal marsh surrounding or directly to the Christina River. Under proposed conditions, the curb along the outside of I-95 NB, as well as the outside shoulder drainage system, will be partially removed. This removal will allow the NB runoff to flow into a proposed gravel trench, ultimately discharging into the Christina River. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. There is an increase of 0.09 acres of impervious area within POI 1.

LOI 2 – Station 1212+80, 142' LT

LOI 2 is in the Christina River, conveying runoff from I-95 southbound as well as a portion of I-95 northbound. Under existing conditions, I-95 is crowned, with drainage flowing along the curb line to existing drainage inlets, which outlets the water at concentrated points into the Christina River. Under proposed conditions, the curb along the outside of I-95, as well as the outside shoulder drainage system, will be removed. This removal will allow the runoff to flow into a proposed gravel trench, ultimately discharging into the Christina River. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. There is an increase of 0.03 acres of impervious area within LOI 2.

LOI 3 – Station 1213+57, 166' RT

LOI 3 is located along the Christina River tidal marsh and conveys runoff from I-95 northbound as well as a portion of I-95 southbound. Under existing conditions, I-95 is crowned, with drainage flowing along the curb line to existing drainage inlets, which outlets the runoff at concentrated points into the Christina River marsh. Under proposed conditions, the curb along the outside of I-95, as well as the outside shoulder drainage system, will be removed. This removal will allow the runoff to flow into a proposed gravel trench, ultimately discharging into the Christina River. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. There is an increase of 0.03 acres of impervious area within LOI 3.

LOI 4 – Station 1224+17, 99' LT

LOI 4 is located along the Christina River marsh and conveys runoff from I-95 southbound. Under existing conditions, I-95 is crowned, with drainage flowing along the curb line to existing drainage inlets, which outlets runoff at concentrated points into the Christina River. Under proposed conditions, the curb along the outside of I-95, as well as the outside shoulder drainage system, will be removed. This removal will allow the runoff to flow into a proposed gravel trench, ultimately discharging into the Christina River. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. There is an increase of 0.02 acres of impervious area within LOI 4.

LOI 5 – Station 1224+48, 142' RT

LOI 5 is located along the Christina River tidal marsh, conveying runoff from I-95 northbound as well as a portion of I-95 southbound. Under existing conditions, I-95 is crowned, with drainage flowing along the curb line to existing drainage inlets, which outlets runoff at concentrated points into the Christina River. Under proposed conditions, the curb along the outside of I-95, as well as the outside shoulder drainage system, will be removed. This removal will allow the runoff to flow into a proposed gravel trench, ultimately discharging into the Christina River. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. There is an increase of 0.03 acres of impervious area within LOI 5.

LOI 6A – Station 1235+14, 172' LT

LOI 6A is located along the Christina River tidal marsh and conveys runoff from I-95 southbound as well as a portion of I-95 northbound. Under existing conditions, I-95 is crowned, with drainage flowing along the curb line to existing drainage inlets, which outlets runoff at concentrated points into the Christina River. Under proposed conditions, the curb along the outside of I-95, as well as the outside shoulder drainage system, will be removed. This removal will allow the runoff to flow into a proposed gravel trench, ultimately discharging into the Christina River. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. There is an increase of 0.09 acres of impervious area within LOI 6A.

LOI 6B – Station 1235+48, 193' RT

LOI 6B is located along the Christina River tidal marsh and conveys runoff from I-95 northbound as well as a portion of I-95 southbound. Under existing conditions, I-95 is crowned, with drainage flowing along the curb line to existing drainage inlets, which outlets runoff at concentrated points into the Christina River. Under proposed conditions, the curb along the outside of I-95, as well as the outside shoulder drainage system, will be removed. This removal will allow the runoff to flow into a proposed gravel trench, ultimately discharging into the Christina River. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. The only increase in impervious area within this POI is the maintenance pavement that is being added to the outside shoulders of I-95. There is an increase of 0.09 acres of impervious area within LOI 6B.

POI 7 – Station 1277+85, 171' RT

POI 7 is designated as the collection point for runoff between the Christina River tidal marsh and the main I-95 viaduct (i.e. the area between LOI 6A, LOI 6B, and POI 8). Runoff from this segment ultimately discharges to a closed drainage system and ultimately discharges to the Christina River.

This POI does not discharge to the City of Wilmington CSI and has no increase in impervious area. Bridge deck replacement is the only work being proposed in POI 7. The drainage from the existing and proposed bridge decks drains into scuppers which outfall along the bridge piers and then flows into storm drain system. There is neither a net increase nor net decrease in impervious area within the drainage area to POI 7; thus, no hydrologic change will occur under proposed conditions.

POI 8 – Station 1291+77, 116' RT

POI 8 is in an existing closed storm drain system and the first POI that is a part of the City of Wilmington CSO (CSO 30). This system is not being impacted from the proposed project. Bridge deck replacement is the only work being proposed in POI 8. There is neither a net increase nor net decrease in impervious area within the drainage area to POI 8; thus, no hydrologic change will occur under proposed conditions. All stormwater from this POI will be treated by the CSO.

POI 9 – Station 1301+02, 274' RT

POI 9 is in an existing closed storm drain system which is a part of the City of Wilmington CSO 30. There is a minimal impact to the existing storm drain under proposed conditions within this POI. The proposed work within this POI includes full depth reconstruction of the ramp from I-95 North to S. Adams Street. There is a total of 0.09 acre increase of impervious area within this POI. All stormwater from this POI will be treated by the CSO.

POI 10 – Station 1309+03, 181' RT

POI 10 is in an existing closed storm drain system which is a part of the City of Wilmington CSO 30. All drainage from this POI will be treated by the CSO system. The main portion of work within this POI is the reconstruction of Ramps B, C and D. There is a 0.61 acre increase in impervious area within POI 10. All stormwater from this POI will be treated by the CSO system.

POI 11 – Station 1322+77, 245' RT

POI 11 is in an existing closed storm drain system, conveying drainage runoff from the I-95 viaduct and ramps. It is a part of the City of Wilmington CSO 30. The proposed work within this POI consists of full depth reconstruction of I-95 as well as the on and off ramps. A realignment of the existing storm drain system within this POI will be proposed to account for the widening of I-95 in the vicinity. To reduce the amount of excavation in this area, due to large sections of rock located beneath the surface of I-95, a slotted drain is proposed in lieu of a traditional closed drainage system. All stormwater from this POI will be treated by the CSO system. This POI represents the majority of the runoff from the at-grade section of the project with a total LOC of approximately 14.99 acres. Due to roadway reconstruction, a minimal decrease in impervious area (1.35 acres) results. All stormwater from POI 11 will be treated by the CSO system.

POI 12 – Station 1360+84, 148' RT

POI 12 conveys drainage from Ramp J and is located in an existing closed storm drain system which is a part of the City of Wilmington CSO 24. The proposed work within this POI involves widening Ramp J. There is a total of 0.66 acres of impervious area within the POI 12 LOD, which represents an increase of approximately 0.03 acers. All stormwater from POI 12 will be treated by the CSO system.

POI 13 – Station 1450+92, 96' RT

POI 13 conveys drainage at the northern limit of the project which discharge into the Brandywine River, but is considered a part of the City of Wilmington CSO 26. Minimal full-depth reconstruction is proposed within this POI with some pavement removal resulting in a decrease of 0.09 acres of impervious area.

C. *Soils Classification*

According to the DNREC ArcGIS web application, the underlying soils in the project area are as follows:

- BkD – (C) – Brinklow channery loam, 15-25% slopes
- DcB – (C) – Delanco-Codorus-Hatboro complex, 0-8% slopes, flooded
- Ln – (C/D) – Lenape-Nanticoke complex, very frequently flooded, tidal
- MuB – (C) – Mattapex-Urban land complex, 0-5% slopes
- NM – (C/D) – Nanticoke and Mannington soils, very frequently flooded, tidal
- NtB – (B) – Neshaminy silt loam, 3-8% slopes
- NvE – (B) – Neshaminy-Montalto silt loams, 25-45% slopes, very stony
- NxB – (B) – Neshaminy-Urban land complex 0-8% slopes
- TaB – (B) – Talleyville silt loam, 3-8% slopes
- UaB – (C) – Udorthents, bedrock substratum, 0-8% slopes
- UwA – (C) – Udorthents, wet substratum, 0-2% slopes

Soils mapping can be found in the GIS desktop materials provided in Appendix C.

II. Stormwater Management Approach

A. Analysis Methodology

The proposed stormwater management concept is consistent with the policies set forth in the revised Delaware Department of Natural Resources and Environmental Control (DNREC), Delaware Sediment and Stormwater Regulations. In addition, the concept has been developed in accordance with the DelDOT Erosion and Sediment Control and Stormwater Management Design Guide (ES_2M) and in the DelDOT Road Design Manual, Chapter 6 – Drainage and Stormwater Management, July 2008 and all pertinent DelDOT Standards and Specifications.

The following summarizes the methodologies, programs and assumptions utilized herein:

- Delaware Sediment and Stormwater Regulations, Delaware Department of Natural Resources and Environmental Control (DNREC), 2014.
- Department of Natural Resources and Environmental Control (August, 2015). *Delaware Urban Runoff Management Model Version 2 (DURMM V2), Delaware*
- Erosion and Sediment Control and Stormwater Management Design Guide (ES_2M), DelDOT
- Road Design Manual, Chapter 6 – Drainage and Stormwater Management, DelDOT, July 2008.
- Delaware Department of Transportation (2007). LiDAR elevation data for 2-foot contours. (GIS-format.)
- New Castle County Soil Survey Data (updated). Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. (http://websoilsurvey.nrcs.usda.gov) (Acquired February 2018).
- U.S. Department of Agriculture, Natural Resources Conservation Service. (2003). *Technical Release No. 55, Urban Hydrology for Small Watersheds*, (TR-55, Version 2.1). [Software].
- U.S. Department of Agriculture, Natural Resources Conservation Service. (1992).
- Support data are assumed to be most recent and best available data to supplement surveyed and observed field data.

B. Proposed Limit of Disturbance

The limit of disturbance (LOD) is defined as any area that requires full-depth construction and impacts subsoils. The limit of construction (LOC) is the area where any work is being taken place within the project limits, which includes pavement resurfacing. The LOD is within the LOC and includes any area being disturbed, including areas located beneath bridges. A small amount of new pavement over existing pervious area is proposed for new ramps required for the proposed widening of ramps. For this report, any area that has the potential to require full depth construction is included in the LOD in order to obtain a “worst case scenario”. After the determination of full-depth and reconstruction limits, a total LOD of 30.84 acres is estimated as shown on the existing and proposed drainage area maps.

C. Stormwater Management Summary

As a result of previous discussion with DelDOT staff at an initial Concurrence Meeting (July 11, 2017) and a separate meeting with DNREC and DelDOT on August 2, 2017, it was confirmed that the adjacent wetlands along the at-grade section of the project (south of the I-95 viaduct) presented a significant impediment to DelDOT standard BMPs. It was agreed to pursue alternate treatment methods in order to avoid extensive impacts to the tidal marsh. This is proposed to entail use of the DelDOT water quality bank, which is being augmented by on-going stormwater retrofit projects in the area. It has been noted that the conversion of the closed-section to open-section drainage modifications in this area, along with the implementation of the gravel trench along the length of this segment provide some additional water quality benefit; however, they do not meet the DelDOT or DNREC criteria for BMP, hence the reliance on the bank to address stormwater management. Their benefit may be to the DelDOT TMDL program if pursued.

The drainage area boundary which separates runoff from the Christina River and the CSO treatment plant respectively is located between POI 7 and POI 8. Table 1 below shows the required RPv, per POI/LOI outside of the CSO Limits based off the LOC as well as the LOD area and the impervious area within the LOD.

POI/LOI	LOC (AC)	Impervious Area within LOC (AC)	LOD (AC)	Impervious Area		RPv (CF)
				Existing Impervious within LOD (AC)	Proposed Impervious within LOD (AC)	
1	11.51	10.89	1.31	0.75	0.84	1,595
2	1.18	0.88	0.44	0.20	0.23	439
3	1.42	1.09	0.62	0.36	0.39	699
4	0.9	0.65	0.3	0.15	0.17	321
5	1.63	1.33	0.52	0.30	0.33	608
6	13.1	10.13	6.19	3.30	3.47	5,771
7	6.85	5.15	0.00	0.00	0.00	0.00
TOTAL:	36.59	30.12	9.38	5.06	5.43	9,433

Table 1: RPv Outside the CSO Limits

Table 2 below shows the RPv per POI/LOI within the CSO Limits based off the LOC and LOD area's and the impervious area within the LOD. It is noted that this RPv requirement is considered met by the conveyance of all runoff to the City of Wilmington CSO, and therefore, the RPv debit is not proposed to be accommodated through the use of the DelDOT water quality bank.

POI/LOI	LOC (AC)	Impervious Area within LOC (AC)	LOD (AC)	Impervious Area		RPv (CF)
				Existing Impervious within LOD (AC)	Proposed Impervious within LOD (AC)	
8	5.56	4.63	0.00	0.00	0.00	0.00
9	2.07	1.82	0.12	0.10	0.09	107
10	6.57	5.36	2.24	1.47	0.61	0.00
11	18.64	14.99	17.78	13.78	12.43	14,722
12	2.99	2.41	0.91	0.63	0.66	1,145
13	1.36	1.13	0.40	0.35	0.26	83
TOTAL:	37.19	30.34	21.45	16.33	14.05	16,057

Table 2: RPv Runoff Reduction Within the CSO Limits

All RPv computations are included in the DURMM computations in Appendix B. The total RPv for the proposed to be debited is the non-CSO RPV of 9,43 cubic feet.

All other requirements for Cv and Fv are to be met by ensuring stable conveyance of runoff away from the project in accordance with DEDOT drainage requirements, which includes the consideration of the capacity of the closed system discharging to the CSO. The hydraulic capacity of this system is currently being confirmed through hydraulic modeling based upon field-surveyed conditions and data gathered through an extensive CCTV pipe inspection program, which is on-going.

APPENDIX A

Drainage Area Maps

LEGEND	
	WETLANDS
	WATERS OF THE US
LOC	LIMIT OF CONSTRUCTION
LOD	LIMIT OF DISTURBANCE (WITHIN LOC)
	EXISTING STORM DRAIN SYSTEM
	SOILS BOUNDARY
	POI / LOI BOUNDARY
	IMPERVIOUS WITHIN LOC
	EXISTING IMPERVIOUS WITHIN LOD
	IMPERVIOUS REMOVED WITHIN LOD

DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUMS / REVISIONS

SCALE 0 200 400 600 FEET

REHABILITATION OF I-95 FROM WILMINGTON VIADUCT TO NORTH OF BRANDYWINE RIVER BRIDGE

CONTRACT T201407404 | COUNTY NEW CASTLE

BRIDGE NO.

DESIGNED BY: K.D.V.

CHECKED BY: B.P.G.

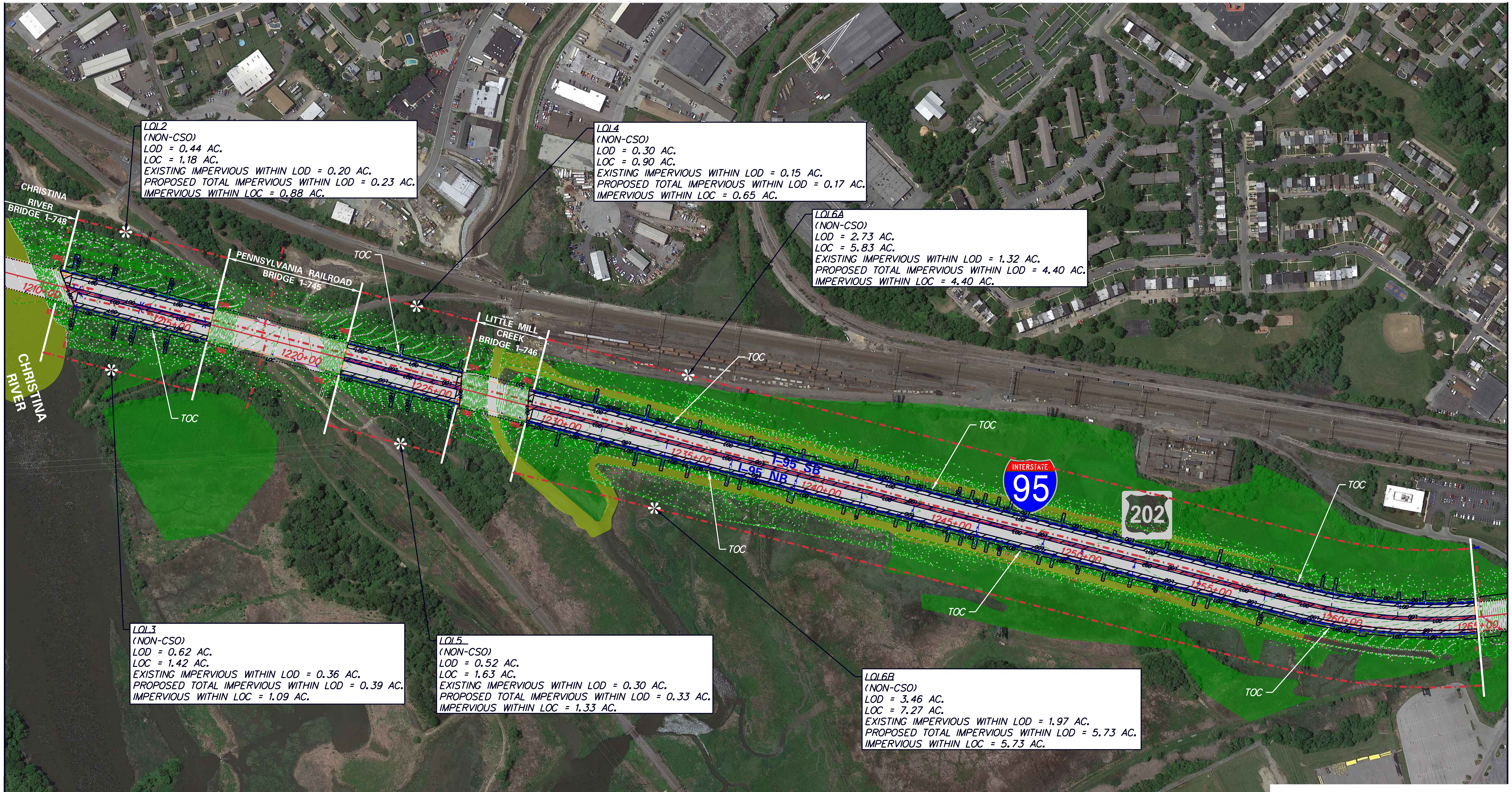
CONCEPT STORMWATER MANAGEMENT MAP

SHEET NO. 1

TOTAL SHTS. 5

INTERSTATE 95 Wilmington Corridor Rehabilitation

MATCH LINE SEE WQ-01



MATCH LINE SEE WQ-03

LEGEND	
	WETLANDS
	WATERS OF THE US
--- LOC ------------	LIMIT OF CONSTRUCTION
———— LOD —	LIMIT OF DISTURBANCE (WITHIN LOC)
	EXISTING STORM DRAIN SYSTEM
	SOILS BOUNDARY
	POI / LOI BOUNDARY
	IMPERVIOUS WITHIN LOC
	EXISTING IMPERVIOUS WITHIN LOD
	IMPERVIOUS REMOVED WITHIN LOD

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DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUMS / REVISIONS

SCALE
0 200 400 600
FEET

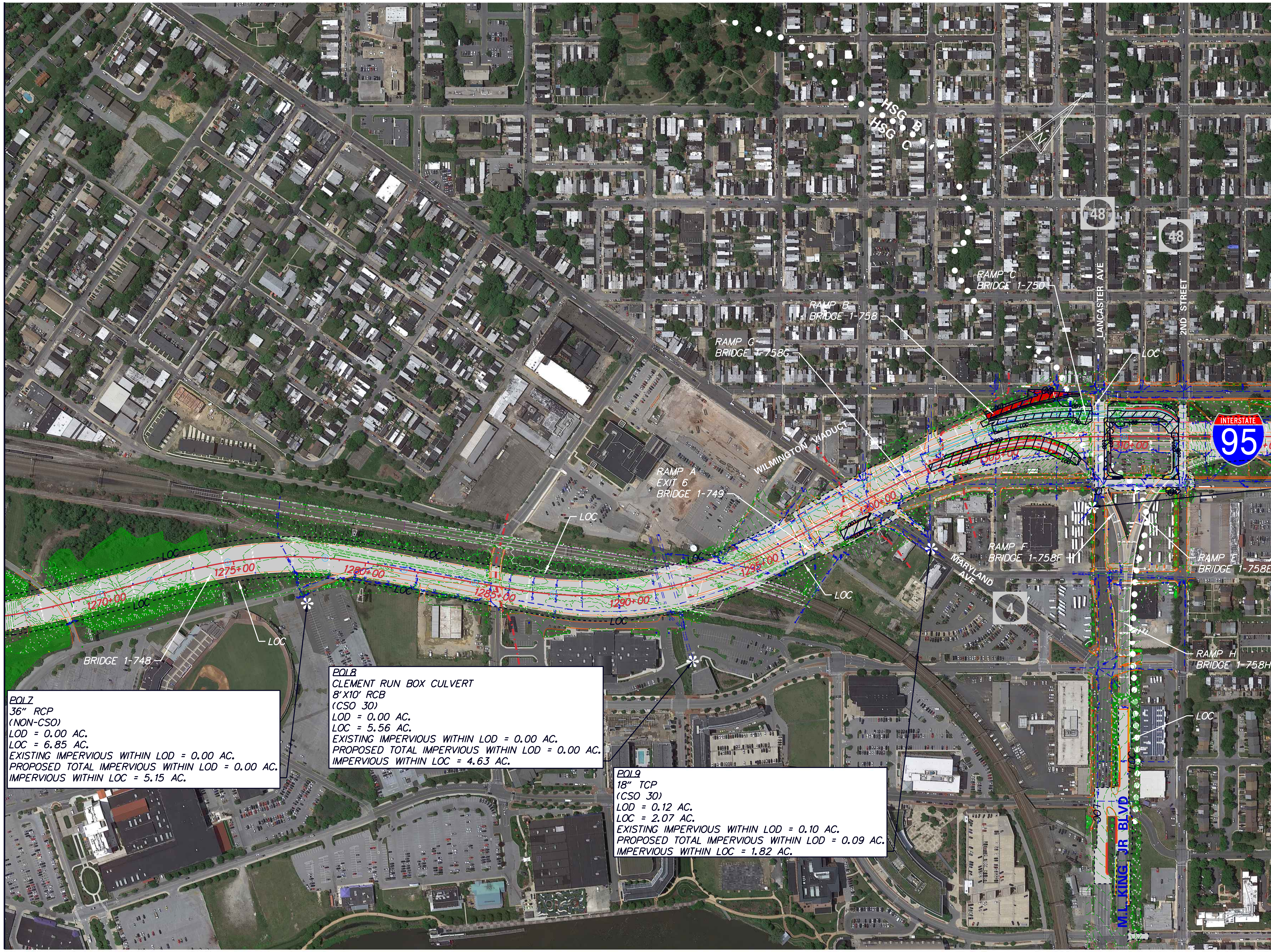
REHABILITATION OF I-95 FROM WILMINGTON VIADUCT TO NORTH OF BRANDYWINE RIVER BRIDGE

CONTRACT: T201407404
COUNTY: NEW CASTLE

BRIDGE NO.
DESIGNED BY: K.D.V.
CHECKED BY: B.P.G.

CONCEPT STORMWATER MANAGEMENT MAP

SHEET NO. 2
TOTAL SHTS. 5



POI 10
NORRIS RUN BOX CULVERT
6'-2" X 6'-3" RCB
(CSO 30)
LOD = 2.24 AC.
LOC = 6.57 AC.
EXISTING IMPERVIOUS WITHIN LOD = 1.47 AC.
PROPOSED TOTAL IMPERVIOUS WITHIN LOD = 0.61 AC.
IMPERVIOUS WITHIN LOC = 5.36 AC.

95 Wilmington Corridor Rehabilitation

LEGEND	
	WETLANDS
	WATERS OF THE US
- - LOC - - - - - -	LIMIT OF CONSTRUCTION
——— LOD ———	LIMIT OF DISTURBANCE (WITHIN LOC)
	EXISTING STORM DRAIN SYSTEM
	SOILS BOUNDARY
	POI/LOI BOUNDARY
	IMPERVIOUS WITHIN LOC
	EXISTING IMPERVIOUS WITHIN LOD
	IMPERVIOUS REMOVED WITHIN LOD

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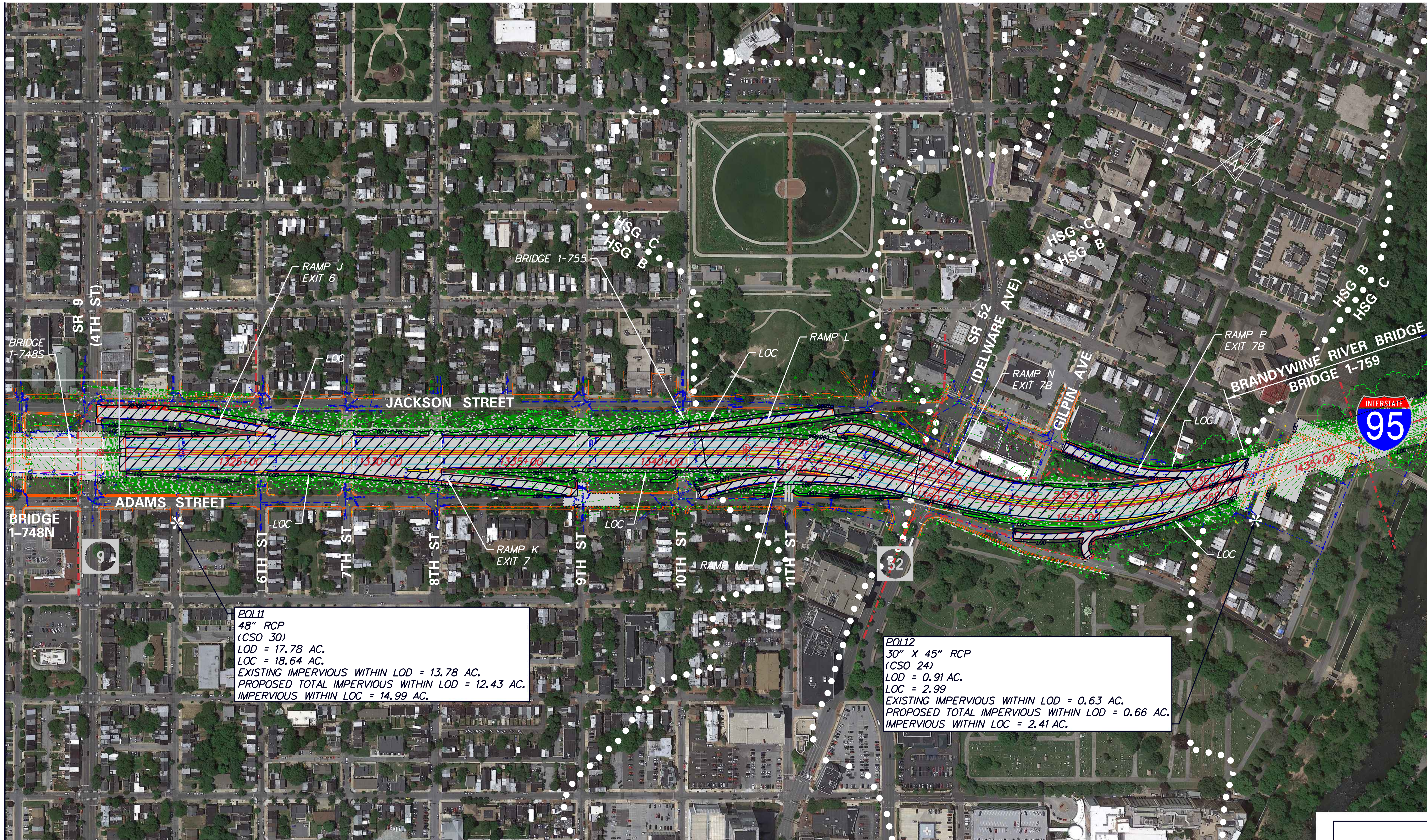
DELAWARE DEPARTMENT OF TRANSPORTATION	ADDENDUMS / REVISIONS	SCALE 0 200 400 600 FEET	REHABILITATION OF I-95 FROM WILMINGTON VIADUCT TO NORTH OF BRANDYWINE RIVER BRIDGE	CONTRACT T201407404 COUNTY NEW CASTLE	BRIDGE NO. DESIGNED BY: K.D.V. CHECKED BY: B.P.G.	CONCEPT STORMWATER MANAGEMENT MAP	SHEET NO. 3 TOTAL SHTS. 5

MATCH LINE SEE WQ-03



MATCH LINE SEE WQ-05

LEGEND	
	WETLANDS
	WATERS OF THE US
----------LOC---	LIMIT OF CONSTRUCTION
——LOD——	LIMIT OF DISTURBANCE (WITHIN LOC)
	EXISTING STORM DRAIN SYSTEM
	SOILS BOUNDARY
	POI /LOI BOUNDARY
	IMPERVIOUS WITHIN LOC
	EXISTING IMPERVIOUS WITHIN LOD
	IMPERVIOUS REMOVED WITHIN LOD

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DELAWARE
DEPARTMENT OF TRANSPORTATION

ADDENDUMS / REVISIONS

SCALE
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FEET

REHABILITATION OF I-95 FROM WILMINGTON VIADUCT TO NORTH OF BRANDYWINE RIVER BRIDGE

CONTRACT	BRIDGE NO.
T201407404	DESIGNED BY: K.D.V.
COUNTY	
NEW CASTLE	CHECKED BY: B.P.G.

CONCEPT STORMWATER MANAGEMENT MAP

SHEET NO. 4
TOTAL SHTS. 5

95 Wilmington Corridor Rehabilitation

MATCH LINE SEE WQ-04

LEGEND	
	WETLANDS
	WATERS OF THE US
---------- LOC ----	LIMIT OF CONSTRUCTION
——— LOD ———	LIMIT OF DISTURBANCE (WITHIN THE LOC)
	EXISTING STORM DRAIN SYSTEM
	SOILS BOUNDARY
	POI / LOI BOUNDARY
	IMPERVIOUS WITHIN LOC
	EXISTING IMPERVIOUS WITHIN LOD
	IMPERVIOUS REMOVED WITHIN LOD

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DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUMS / REVISIONS

SCALE
0 200 400 600
FEET

REHABILITATION OF I-95 FROM WILMINGTON VIADUCT TO NORTH OF BRANDYWINE RIVER BRIDGE

CONTRACT	BRIDGE NO.
T201407404	DESIGNED BY: K.D.V.
COUNTY	
NEW CASTLE	CHECKED BY: B.P.G.

CONCEPT STORMWATER MANAGEMENT MAP

SHEET NO. 5

TOTAL SHTS. 5

APPENDIX B

DURMM Computations

PROJECT:	I-95 Corridor Improvements POI 1
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
			Curve Numbers for Hydrologic Soil Type							
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.62	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	10.89	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
Subarea Contributing Area per Soil Type (ac)			0		0		11.51		0	

Subarea Contributing Area (ac) 11.51
Subarea Weighted RCN 97

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 11.5

Weighted Runoff Curve Number (RCN) 97

PROJECT:	I-95 Corridor Improvements POI 1
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	1.31	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.75	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.84	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	64%	0%

Step 2 - Subarea LOD Runoff Calculations				
2.1 RCN per HSG	0.00	0.00	89.39	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.91	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.58	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	1.31
2.7 Subarea Weighted RCN	89.39
2.8 Subarea Weighted RPv (in.)	1.91
2.9 Subarea Weighted Target Runoff (in.)	1.58

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD	
4.1 Combined LOD (ac)	1.31
4.2 Weighted RCN	89.39
4.3 Weighted RPv (in.)	1.91
4.4 Weighted Target Runoff (in.)	1.58
4.5 Estimated Annual Runoff (in.)	27.01
4.6 Req'd Runoff Reduction within LOD (in.)	0.34
4.7 Req'd Runoff Reduction within LOD (%)	18%

Step 5 - Cv Unit Discharge	
5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge	
6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements POI 1
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	11.51
1.2 C.A. RCN	97
1.3 LOD Area (ac)	1.31
1.4 LOD RCN	89
1.5 Outside LOD Area (ac)	10.2
1.6 Outside LOD RCN	98

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.062	0.062
3.5 Ia/P ratio	0.01	0.01
3.6 Unit Peak Discharge, qu (csm/in)	835	836
3.7 Runoff (in.)	4.52	7.72
3.8 Peak Discharge, qp (cfs)	60.16	102.79
3.9 Equiv. unit peak discharge (cfs/ac)	5.90	10.08

PROJECT: I-95 Corridor Improvements POI 1
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	11.51		11.51		11.51		11.51		11.51	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	97.13		N/A		N/A		N/A		N/A	
1.3 Initial RCN	96.71									
1.4 RPv for Contributing Area (in.)	2.38									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.04									
1.6 Req'd RPv Reduction for Contributing Area (%)	2%									
1.7 RPv allowable discharge rate (cfs)	0.11									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.38		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	96.71		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	96.71		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	35.58		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	35.58		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	96.71		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.38		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	99,244		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	96.71		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	35.58		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	97.13		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.04		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	139		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	1,595		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements LOI 2
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
			Curve Numbers for Hydrologic Soil Type							
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.3	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	0.88	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
	Subarea Contributing Area per Soil Type (ac)		0		0		1.18		0	

Subarea Contributing Area (ac)	1.18
Subarea Weighted RCN	92

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 1.18

Weighted Runoff Curve Number (RCN) 92

PROJECT:	I-95 Corridor Improvements LOI 2
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	0.44	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.2	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.23	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	52%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	86.55	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.74	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.47	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	0.44
2.7 Subarea Weighted RCN	86.55
2.8 Subarea Weighted RPv (in.)	1.74
2.9 Subarea Weighted Target Runoff (in.)	1.47

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	0.44
4.2 Weighted RCN	86.55
4.3 Weighted RPv (in.)	1.74
4.4 Weighted Target Runoff (in.)	1.47
4.5 Estimated Annual Runoff (in.)	24.12
4.6 Req'd Runoff Reduction within LOD (in.)	0.27
4.7 Req'd Runoff Reduction within LOD (%)	16%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements LOI 2
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	1.18
1.2 C.A. RCN	92
1.3 LOD Area (ac)	0.44
1.4 LOD RCN	87
1.5 Outside LOD Area (ac)	0.74
1.6 Outside LOD RCN	95

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.105	0.105
3.5 Ia/P ratio	0.02	0.01
3.6 Unit Peak Discharge, qu (csm/in)	833	835
3.7 Runoff (in.)	4.23	7.41
3.8 Peak Discharge, qp (cfs)	4.08	7.15
3.9 Equiv. unit peak discharge (cfs/ac)	5.51	9.67

PROJECT:	I-95 Corridor Improvements LOI 2
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	1.18		1.18		1.18		1.18		1.18	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	94.04		N/A		N/A		N/A		N/A	
1.3 Initial RCN	91.90									
1.4 RPv for Contributing Area (in.)	2.06									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.10									
1.6 Req'd RPv Reduction for Contributing Area (%)	5%									
1.7 RPv allowable discharge rate (cfs)	0.03									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.06		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	91.90		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	91.90		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	29.76		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	29.76		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	91.90		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.06		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	8,843		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	91.90		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	29.76		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	94.04		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.10		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	372		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	439		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements LOI 3
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.33	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	1.09	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										

Curve Numbers for Hydrologic Soil Type

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	0	1.42	0

Subarea Contributing Area (ac) 1.42

Subarea Weighted RCN 92

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 1.42

Weighted Runoff Curve Number (RCN) 92

PROJECT:	I-95 Corridor Improvements LOI 3
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	0.62	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.36	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.39	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	63%	0%

Step 2 - Subarea LOD Runoff Calculations				
2.1 RCN per HSG	0.00	0.00	89.10	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.89	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.58	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	0.62
2.7 Subarea Weighted RCN	89.10
2.8 Subarea Weighted RPv (in.)	1.89
2.9 Subarea Weighted Target Runoff (in.)	1.58

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD	
4.1 Combined LOD (ac)	0.62
4.2 Weighted RCN	89.10
4.3 Weighted RPv (in.)	1.89
4.4 Weighted Target Runoff (in.)	1.58
4.5 Estimated Annual Runoff (in.)	26.70
4.6 Req'd Runoff Reduction within LOD (in.)	0.31
4.7 Req'd Runoff Reduction within LOD (%)	16%

Step 5 - Cv Unit Discharge	
5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge	
6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements LOI 3
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	1.42
1.2 C.A. RCN	92
1.3 LOD Area (ac)	0.62
1.4 LOD RCN	89
1.5 Outside LOD Area (ac)	0.8
1.6 Outside LOD RCN	95

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.105	0.105
3.5 Ia/P ratio	0.02	0.01
3.6 Unit Peak Discharge, qu (csm/in)	833	835
3.7 Runoff (in.)	4.22	7.40
3.8 Peak Discharge, qp (cfs)	4.40	7.72
3.9 Equiv. unit peak discharge (cfs/ac)	5.50	9.65

PROJECT:	I-95 Corridor Improvements LOI 3
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	1.42		1.42		1.42		1.42		1.42	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	94.38		N/A		N/A		N/A		N/A	
1.3 Initial RCN	92.42									
1.4 RPv for Contributing Area (in.)	2.10									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.14									
1.6 Req'd RPv Reduction for Contributing Area (%)	6%									
1.7 RPv allowable discharge rate (cfs)	0.05									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.10		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	92.42		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	92.42		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	30.36		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	30.36		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	92.42		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.10		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	10,810		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	92.42		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	30.36		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	94.38		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.14		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	492		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	699		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements LOI 4
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.25	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	0.65	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
	Subarea Contributing Area per Soil Type (ac)		0		0		0.9		0	

Subarea Contributing Area (ac)	0.9
Subarea Weighted RCN	91

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) **0.9**

Weighted Runoff Curve Number (RCN) **91**

PROJECT:	I-95 Corridor Improvements LOI 4
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	0.3	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.15	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.17	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	57%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	87.60	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.80	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.51	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	0.30
2.7 Subarea Weighted RCN	87.60
2.8 Subarea Weighted RPv (in.)	1.80
2.9 Subarea Weighted Target Runoff (in.)	1.51

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	0.30
4.2 Weighted RCN	87.60
4.3 Weighted RPv (in.)	1.80
4.4 Weighted Target Runoff (in.)	1.51
4.5 Estimated Annual Runoff (in.)	25.17
4.6 Req'd Runoff Reduction within LOD (in.)	0.30
4.7 Req'd Runoff Reduction within LOD (%)	16%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements LOI 4
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	0.9
1.2 C.A. RCN	91
1.3 LOD Area (ac)	0.3
1.4 LOD RCN	88
1.5 Outside LOD Area (ac)	0.6
1.6 Outside LOD RCN	93

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.151	0.151
3.5 Ia/P ratio	0.03	0.02
3.6 Unit Peak Discharge, qu (csm/in)	832	834
3.7 Runoff (in.)	4.02	7.19
3.8 Peak Discharge, qp (cfs)	3.14	5.62
3.9 Equiv. unit peak discharge (cfs/ac)	5.23	9.36

PROJECT:	I-95 Corridor Improvements LOI 4
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	0.90		0.90		0.90		0.90		0.90	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	93.66		N/A		N/A		N/A		N/A	
1.3 Initial RCN	91.33									
1.4 RPv for Contributing Area (in.)	2.03									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.10									
1.6 Req'd RPv Reduction for Contributing Area (%)	5%									
1.7 RPv allowable discharge rate (cfs)	0.02									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.03		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	91.33		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	91.33		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	29.12		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	29.12		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	91.33		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.03		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	6,630		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	91.33		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	29.12		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	93.66		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.10		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	357		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	321		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements LOI 5
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type: A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.3	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	1.33	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	0	1.63	0

Subarea Contributing Area (ac)	1.63
Subarea Weighted RCN	94

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 1.63

Weighted Runoff Curve Number (RCN) 94

PROJECT:	I-95 Corridor Improvements LOI 5
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	0.52	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.3	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.33	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	63%	0%

Step 2 - Subarea LOD Runoff Calculations				
2.1 RCN per HSG	0.00	0.00	89.23	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.90	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.58	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	0.52
2.7 Subarea Weighted RCN	89.23
2.8 Subarea Weighted RPv (in.)	1.90
2.9 Subarea Weighted Target Runoff (in.)	1.58

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD	
4.1 Combined LOD (ac)	0.52
4.2 Weighted RCN	89.23
4.3 Weighted RPv (in.)	1.90
4.4 Weighted Target Runoff (in.)	1.58
4.5 Estimated Annual Runoff (in.)	26.84
4.6 Req'd Runoff Reduction within LOD (in.)	0.32
4.7 Req'd Runoff Reduction within LOD (%)	17%

Step 5 - Cv Unit Discharge	
5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge	
6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements LOI 5
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	1.63
1.2 C.A. RCN	94
1.3 LOD Area (ac)	0.52
1.4 LOD RCN	89
1.5 Outside LOD Area (ac)	1.11
1.6 Outside LOD RCN	96

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.105	0.105
3.5 Ia/P ratio	0.02	0.01
3.6 Unit Peak Discharge, qu (csm/in)	833	835
3.7 Runoff (in.)	4.29	7.48
3.8 Peak Discharge, qp (cfs)	6.20	10.82
3.9 Equiv. unit peak discharge (cfs/ac)	5.59	9.75

PROJECT:	I-95 Corridor Improvements LOI 5
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		**BMP 2**		**BMP 3**		**BMP 4**		**BMP 5**	
	Type	**0-No BMP**	**Type**	--	**Type**	--	**Type**	--	**Type**	--
Step 1 - Calculate Initial RPv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	1.63		1.63		1.63		1.63		1.63	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	95.14		N/A		N/A		N/A		N/A	
1.3 Initial RCN	93.58									
1.4 RPv for Contributing Area (in.)	2.17									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.10									
1.6 Req'd RPv Reduction for Contributing Area (%)	5%									
1.7 RPv allowable discharge rate (cfs)	0.04									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.17		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	93.58		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	93.58		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	31.71		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	31.71		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	93.58		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.17		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	12,845		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	93.58		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	31.71		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	95.14		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.10		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	373		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	608		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements LOI 6
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A *Acres*	A *RCN*	B *Acres*	B *RCN*	C *Acres*	C *RCN*	D *Acres*	D *RCN*
			Curve Numbers for Hydrologic Soil Type							
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	2.97	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	10.13	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
	Subarea Contributing Area per Soil Type (ac)		0		0		13.1		0	

Subarea Contributing Area (ac)	13.1
Subarea Weighted RCN	93

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 13.1

Weighted Runoff Curve Number (RCN) 93

PROJECT:	I-95 Corridor Improvements LOI 6
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	6.19	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	3.3	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	3.47	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	56%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	87.45	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.80	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.54	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	6.19
2.7 Subarea Weighted RCN	87.45
2.8 Subarea Weighted RPv (in.)	1.80
2.9 Subarea Weighted Target Runoff (in.)	1.54

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	6.19
4.2 Weighted RCN	87.45
4.3 Weighted RPv (in.)	1.80
4.4 Weighted Target Runoff (in.)	1.54
4.5 Estimated Annual Runoff (in.)	25.02
4.6 Req'd Runoff Reduction within LOD (in.)	0.26
4.7 Req'd Runoff Reduction within LOD (%)	14%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements LOI 6
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	13.1
1.2 C.A. RCN	93
1.3 LOD Area (ac)	6.19
1.4 LOD RCN	87
1.5 Outside LOD Area (ac)	6.91
1.6 Outside LOD RCN	97

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.062	0.062
3.5 Ia/P ratio	0.01	0.01
3.6 Unit Peak Discharge, qu (csm/in)	835	836
3.7 Runoff (in.)	4.46	7.66
3.8 Peak Discharge, qp (cfs)	40.22	69.08
3.9 Equiv. unit peak discharge (cfs/ac)	5.82	10.00

PROJECT: I-95 Corridor Improvements LOI 6
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	13.10		13.10		13.10		13.10		13.10	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	94.47		N/A		N/A		N/A		N/A	
1.3 Initial RCN	92.56									
1.4 RPv for Contributing Area (in.)	2.11									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.12									
1.6 Req'd RPv Reduction for Contributing Area (%)	6%									
1.7 RPv allowable discharge rate (cfs)	0.47									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.11		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	92.56		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	92.56		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	30.52		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	30.52		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	92.56		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.11		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	100,138		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	92.56		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	30.52		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	94.47		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.12		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	441		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	5,771		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements POI 7
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	1.7	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	5.15	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
	Subarea Contributing Area per Soil Type (ac)		0		0		6.85		0	

Subarea Contributing Area (ac) 6.85

Subarea Weighted RCN 92

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 6.85

Weighted Runoff Curve Number (RCN) 92

PROJECT:	I-95 Corridor Improvements POI 7
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	0	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	0%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	0.00	0.00
2.2 RPv per HSG (in.)	0.00	0.00	0.00	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	0.00	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.00	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.00	0.00

2.6 Subarea LOD (ac)	0.00
2.7 Subarea Weighted RCN	0.00
2.8 Subarea Weighted RPv (in.)	0.00
2.9 Subarea Weighted Target Runoff (in.)	0.00

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	0.00
4.2 Weighted RCN	#DIV/0!
4.3 Weighted RPv (in.)	#DIV/0!
4.4 Weighted Target Runoff (in.)	#DIV/0!
4.5 Estimated Annual Runoff (in.)	#DIV/0!
4.6 Req'd Runoff Reduction within LOD (in.)	#DIV/0!
4.7 Req'd Runoff Reduction within LOD (%)	#DIV/0!

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	#DIV/0!

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	#DIV/0!

PROJECT:	I-95 Corridor Improvements POI 7
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	6.85
1.2 C.A. RCN	92
1.3 LOD Area (ac)	0
1.4 LOD RCN	0
1.5 Outside LOD Area (ac)	6.85
1.6 Outside LOD RCN	92

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				----------	N/A	0.00
				----------	N/A	0.00
				----------	N/A	0.00
Shallow Concentrated				N/A	----------	0.00
				N/A	----------	0.00
				N/A	----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.174	0.174
3.5 Ia/P ratio	0.04	0.02
3.6 Unit Peak Discharge, qu (csm/in)	831	833
3.7 Runoff (in.)	3.90	7.05
3.8 Peak Discharge, qp (cfs)	34.68	62.86
3.9 Equiv. unit peak discharge (cfs/ac)	5.06	9.18

PROJECT:	I-95 Corridor Improvements POI 7
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		**BMP 2**		**BMP 3**		**BMP 4**		**BMP 5**	
	Type	**0-No BMP**	**Type**	**--**	**Type**	**--**	**Type**	**--**	**Type**	**--**
Step 1 - Calculate Initial RPv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	6.85		6.85		6.85		6.85		6.85	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	#DIV/0!		N/A		N/A		N/A		N/A	
1.3 Initial RCN	92.04									
1.4 RPv for Contributing Area (in.)	#DIV/0!									
1.5 Req'd RPv Reduction for Contributing Area (in.)	#DIV/0!									
1.6 Req'd RPv Reduction for Contributing Area (%)	#DIV/0!									
1.7 RPv allowable discharge rate (cfs)	#DIV/0!									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	#DIV/0!		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	92.04		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	29.93		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	29.93		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	92.04		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	#DIV/0!		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	#DIV/0!		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	#DIV/0!		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	#DIV/0!		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	#DIV/0!		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	#DIV/0!		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	#DIV/0!		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements POI 8
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
			Curve Numbers for Hydrologic Soil Type							
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.93	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	4.63	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
	Subarea Contributing Area per Soil Type (ac)		0		0		5.56		0	

Subarea Contributing Area (ac) 5.56
Subarea Weighted RCN 94

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 5.56

Weighted Runoff Curve Number (RCN) 94

PROJECT:	I-95 Corridor Improvements POI 8
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	0	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	0%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	0.00	0.00
2.2 RPv per HSG (in.)	0.00	0.00	0.00	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	0.00	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.00	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.00	0.00

2.6 Subarea LOD (ac)	0.00
2.7 Subarea Weighted RCN	0.00
2.8 Subarea Weighted RPv (in.)	0.00
2.9 Subarea Weighted Target Runoff (in.)	0.00

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	0.00
4.2 Weighted RCN	#DIV/0!
4.3 Weighted RPv (in.)	#DIV/0!
4.4 Weighted Target Runoff (in.)	#DIV/0!
4.5 Estimated Annual Runoff (in.)	#DIV/0!
4.6 Req'd Runoff Reduction within LOD (in.)	#DIV/0!
4.7 Req'd Runoff Reduction within LOD (%)	#DIV/0!

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	#DIV/0!

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	#DIV/0!

PROJECT:	I-95 Corridor Improvements POI 8
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	5.56
1.2 C.A. RCN	94
1.3 LOD Area (ac)	0
1.4 LOD RCN	0
1.5 Outside LOD Area (ac)	5.56
1.6 Outside LOD RCN	94

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.151	0.151
3.5 Ia/P ratio	0.03	0.02
3.6 Unit Peak Discharge, qu (csm/in)	832	834
3.7 Runoff (in.)	4.11	7.28
3.8 Peak Discharge, qp (cfs)	29.69	52.73
3.9 Equiv. unit peak discharge (cfs/ac)	5.34	9.48

PROJECT:	I-95 Corridor Improvements POI 8
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	5.56		5.56		5.56		5.56		5.56	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	#DIV/0!		N/A		N/A		N/A		N/A	
1.3 Initial RCN	93.99									
1.4 RPv for Contributing Area (in.)	#DIV/0!									
1.5 Req'd RPv Reduction for Contributing Area (in.)	#DIV/0!									
1.6 Req'd RPv Reduction for Contributing Area (%)	#DIV/0!									
1.7 RPv allowable discharge rate (cfs)	#DIV/0!									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	#DIV/0!		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	93.99		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	32.19		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	32.19		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	93.99		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	#DIV/0!		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	#DIV/0!		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	#DIV/0!		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	#DIV/0!		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	#DIV/0!		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	#DIV/0!		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	#DIV/0!		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	#DIV/0!		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements POI 9
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.25	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	1.82	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	0	2.07	0

Subarea Contributing Area (ac)	2.07
Subarea Weighted RCN	95

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 2.07

Weighted Runoff Curve Number (RCN) 95

PROJECT:	I-95 Corridor Improvements POI 9
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	0.12	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.1	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.09	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	75%	0%

Step 2 - Subarea LOD Runoff Calculations				
2.1 RCN per HSG	0.00	0.00	92.00	0.00
2.2 RPv per HSG (in.)	0.00	0.00	2.07	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.82	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	0.12
2.7 Subarea Weighted RCN	92.00
2.8 Subarea Weighted RPv (in.)	2.07
2.9 Subarea Weighted Target Runoff (in.)	1.82

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD	
4.1 Combined LOD (ac)	0.12
4.2 Weighted RCN	92.00
4.3 Weighted RPv (in.)	2.07
4.4 Weighted Target Runoff (in.)	1.82
4.5 Estimated Annual Runoff (in.)	29.88
4.6 Req'd Runoff Reduction within LOD (in.)	0.25
4.7 Req'd Runoff Reduction within LOD (%)	12%

Step 5 - Cv Unit Discharge	
5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge	
6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements POI 9
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	2.07
1.2 C.A. RCN	95
1.3 LOD Area (ac)	0.12
1.4 LOD RCN	92
1.5 Outside LOD Area (ac)	1.95
1.6 Outside LOD RCN	95

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.105	0.105
3.5 Ia/P ratio	0.02	0.01
3.6 Unit Peak Discharge, qu (csm/in)	833	835
3.7 Runoff (in.)	4.25	7.44
3.8 Peak Discharge, qp (cfs)	10.80	18.91
3.9 Equiv. unit peak discharge (cfs/ac)	5.54	9.70

PROJECT: I-95 Corridor Improvements POI 9
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	2.07		2.07		2.07		2.07		2.07	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	96.12		N/A		N/A		N/A		N/A	
1.3 Initial RCN	95.10									
1.4 RPv for Contributing Area (in.)	2.27									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.01									
1.6 Req'd RPv Reduction for Contributing Area (%)	1%									
1.7 RPv allowable discharge rate (cfs)	0.01									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.27		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	95.10		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	95.10		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	33.55		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	33.55		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	95.10		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.27		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	17,050		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	95.10		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	33.55		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	96.12		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.01		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	52		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	107		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements POI 10
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
			Curve Numbers for Hydrologic Soil Type							
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39	0.7	61	0.51	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98	3.22	98	2.14	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
	Subarea Contributing Area per Soil Type (ac)		0		3.92		2.65		0	

Subarea Contributing Area (ac) 6.57

Subarea Weighted RCN 92

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 6.57

Weighted Runoff Curve Number (RCN) 92

PROJECT:	I-95 Corridor Improvements POI 10
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	2.24	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	1.47	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.61	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	27%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	80.54	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.42	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.65	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	2.24
2.7 Subarea Weighted RCN	80.54
2.8 Subarea Weighted RPv (in.)	1.42
2.9 Subarea Weighted Target Runoff (in.)	1.65

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	2.24
4.2 Weighted RCN	80.54
4.3 Weighted RPv (in.)	1.42
4.4 Weighted Target Runoff (in.)	1.65
4.5 Estimated Annual Runoff (in.)	18.75
4.6 Req'd Runoff Reduction within LOD (in.)	-0.24
4.7 Req'd Runoff Reduction within LOD (%)	-17%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements POI 10
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	6.57
1.2 C.A. RCN	92
1.3 LOD Area (ac)	2.24
1.4 LOD RCN	81
1.5 Outside LOD Area (ac)	4.33
1.6 Outside LOD RCN	98

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.041	0.041
3.5 Ia/P ratio	0.01	0.01
3.6 Unit Peak Discharge, qu (csm/in)	835	836
3.7 Runoff (in.)	4.59	7.79
3.8 Peak Discharge, qp (cfs)	25.95	44.05
3.9 Equiv. unit peak discharge (cfs/ac)	5.99	10.17

PROJECT: I-95 Corridor Improvements POI 10
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	6.57		6.57		6.57		6.57		6.57	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	94.23		N/A		N/A		N/A		N/A	
1.3 Initial RCN	92.19									
1.4 RPv for Contributing Area (in.)	2.08									
1.5 Req'd RPv Reduction for Contributing Area (in.)	-0.08									
1.6 Req'd RPv Reduction for Contributing Area (%)	-4%									
1.7 RPv allowable discharge rate (cfs)	0.13									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.08		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	92.19		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	92.19		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	30.10		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	30.10		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	92.19		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.08		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	49,676		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	92.19		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	30.10		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	94.23		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	YES		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	-1933.81		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	N/A		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	N/A		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	N/A		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements POI 11
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
			Curve Numbers for Hydrologic Soil Type							
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39	2.68	61	0.97	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98	11.75	98	3.24	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	14.43	4.21	0

Subarea Contributing Area (ac)	18.64
Subarea Weighted RCN	91

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 18.6

Weighted Runoff Curve Number (RCN) 91

PROJECT:	I-95 Corridor Improvements POI 11
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	17.78	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	13.78	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	12.43	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	70%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	90.78	0.00
2.2 RPv per HSG (in.)	0.00	0.00	2.00	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.77	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	17.78
2.7 Subarea Weighted RCN	90.78
2.8 Subarea Weighted RPv (in.)	2.00
2.9 Subarea Weighted Target Runoff (in.)	1.77

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	17.78
4.2 Weighted RCN	90.78
4.3 Weighted RPv (in.)	2.00
4.4 Weighted Target Runoff (in.)	1.77
4.5 Estimated Annual Runoff (in.)	28.51
4.6 Req'd Runoff Reduction within LOD (in.)	0.23
4.7 Req'd Runoff Reduction within LOD (%)	11%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements POI 11
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	18.64
1.2 C.A. RCN	91
1.3 LOD Area (ac)	17.78
1.4 LOD RCN	91
1.5 Outside LOD Area (ac)	0.86
1.6 Outside LOD RCN	105

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

- a smooth surface
- b fallow (no residue)
- c cultivated < 20% Res.
- d cultivated > 20% Res.
- e grass - range, short
- f grass, dense
- g grass, bermuda
- h woods, light
- i woods, dense
- j range, natural

Shallow Concentrated Surface Codes

- u unpaved surface
- p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.041	0.041
3.5 Ia/P ratio	0.01	0.01
3.6 Unit Peak Discharge, qu (csm/in)	835	836
3.7 Runoff (in.)	5.41	8.59
3.8 Peak Discharge, qp (cfs)	6.08	9.65
3.9 Equiv. unit peak discharge (cfs/ac)	7.07	11.23

PROJECT:	I-95 Corridor Improvements POI 11
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	18.64		18.64		18.64		18.64		18.64	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	93.73		N/A		N/A		N/A		N/A	
1.3 Initial RCN	91.43									
1.4 RPv for Contributing Area (in.)	2.04									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.22									
1.6 Req'd RPv Reduction for Contributing Area (%)	11%									
1.7 RPv allowable discharge rate (cfs)	1.49									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.04		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	91.43		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	91.43		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	29.23		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	29.23		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	91.43		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.04		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	137,717		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	91.43		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	29.23		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	93.73		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.22		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	790		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	14,722		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements POI 12
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39	0.39	61	0.19	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98	0.63	98	1.78	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										
Subarea Contributing Area per Soil Type (ac)			0		1.02		1.97		0	

Subarea Contributing Area (ac) 2.99

Subarea Weighted RCN 92

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 2.99

Weighted Runoff Curve Number (RCN) 92

PROJECT:	I-95 Corridor Improvements POI 12
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data

	HSG A	HSG B	HSG C	HSG D
1.1 HSG Area Within LOD (ac)		0	0.91	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.63	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.66	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	73%	0%

Step 2 - Subarea LOD Runoff Calculations

	HSG A	HSG B	HSG C	HSG D
2.1 RCN per HSG	0.00	0.00	91.41	0.00
2.2 RPv per HSG (in.)	0.00	0.00	2.03	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.69	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	0.91
2.7 Subarea Weighted RCN	91.41
2.8 Subarea Weighted RPv (in.)	2.03
2.9 Subarea Weighted Target Runoff (in.)	1.69

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***

	Area 1	Area 2	Area 3	Area 4
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	0.91
4.2 Weighted RCN	91.41
4.3 Weighted RPv (in.)	2.03
4.4 Weighted Target Runoff (in.)	1.69
4.5 Estimated Annual Runoff (in.)	29.21
4.6 Req'd Runoff Reduction within LOD (in.)	0.35
4.7 Req'd Runoff Reduction within LOD (%)	17%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements POI 12
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	2.99
1.2 C.A. RCN	92
1.3 LOD Area (ac)	0.91
1.4 LOD RCN	91
1.5 Outside LOD Area (ac)	2.08
1.6 Outside LOD RCN	92

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.198	0.198
3.5 Ia/P ratio	0.04	0.02
3.6 Unit Peak Discharge, qu (csm/in)	830	833
3.7 Runoff (in.)	3.87	7.01
3.8 Peak Discharge, qp (cfs)	10.44	18.98
3.9 Equiv. unit peak discharge (cfs/ac)	5.02	9.13

PROJECT:	I-95 Corridor Improvements POI 12
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	**0-No BMP**	**Type**	--	**Type**	--	**Type**	--	**Type**	--
Step 1 - Calculate Initial RPv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	2.99		2.99		2.99		2.99		2.99	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	93.87		N/A		N/A		N/A		N/A	
1.3 Initial RCN	91.65									
1.4 RPv for Contributing Area (in.)	2.05									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.11									
1.6 Req'd RPv Reduction for Contributing Area (%)	5%									
1.7 RPv allowable discharge rate (cfs)	0.08									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.05		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	91.65		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	91.65		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	29.48		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	29.48		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	91.65		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.05		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	22,237		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	91.65		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	29.48		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	93.87		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.11		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	383		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	1,145		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements POI 13
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type: A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39		61	0.23	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98		98	1.13	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	0	1.36	0

Subarea Contributing Area (ac) 1.36

Subarea Weighted RCN 94

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 1.36

Weighted Runoff Curve Number (RCN) 94

PROJECT:	I-95 Corridor Improvements POI 13
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data

	HSG A	HSG B	HSG C	HSG D
1.1 HSG Area Within LOD (ac)		0	0.4	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	0.35	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	0.26	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	65%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	89.60	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.92	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.87	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	0.40
2.7 Subarea Weighted RCN	89.60
2.8 Subarea Weighted RPv (in.)	1.92
2.9 Subarea Weighted Target Runoff (in.)	1.87

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***

	Area 1	Area 2	Area 3	Area 4
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	0.40
4.2 Weighted RCN	89.60
4.3 Weighted RPv (in.)	1.92
4.4 Weighted Target Runoff (in.)	1.87
4.5 Estimated Annual Runoff (in.)	27.24
4.6 Req'd Runoff Reduction within LOD (in.)	0.06
4.7 Req'd Runoff Reduction within LOD (%)	3%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements POI 13
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	1.36
1.2 C.A. RCN	94
1.3 LOD Area (ac)	0.4
1.4 LOD RCN	90
1.5 Outside LOD Area (ac)	0.96
1.6 Outside LOD RCN	96

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet				-----------	N/A	0.00
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated				N/A	-----------	0.00
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.10

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	0.105	0.105
3.5 Ia/P ratio	0.02	0.01
3.6 Unit Peak Discharge, qu (csm/in)	833	835
3.7 Runoff (in.)	4.31	7.49
3.8 Peak Discharge, qp (cfs)	5.38	9.38
3.9 Equiv. unit peak discharge (cfs/ac)	5.61	9.77

PROJECT: I-95 Corridor Improvements POI 13
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	1.36		1.36		1.36		1.36		1.36	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	95.37		N/A		N/A		N/A		N/A	
1.3 Initial RCN	93.94									
1.4 RPv for Contributing Area (in.)	2.19									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.02									
1.6 Req'd RPv Reduction for Contributing Area (%)	1%									
1.7 RPv allowable discharge rate (cfs)	0.03									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	2.19		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	93.94		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	93.94		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	32.14		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	32.14		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	93.94		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	2.19		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	10,831		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	93.94		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	32.14		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	95.37		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.02		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	61		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	83		N/A		N/A		N/A		N/A	

APPENDIX C

Concurrence Meeting Materials

Contract Number: T201707406

Contract Name: Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge Southern Contract

Date: July 11, 2017

DelDOT Stormwater Management Concurrence Meeting #1

This meeting is to assess and concur on the current and potential future stormwater management aspects of the project. This meeting should occur after the Survey Plans have been submitted and 1 month before the Preliminary Plans are completed. The DelDOT Project Manager is responsible for setting up the meeting. If the project will be in the Christina or Dragon Run watersheds, than the NPDES Engineer needs to be included in this meeting as well.

Required material for the designer to present electronically at the meeting:

A. Aerial map overlaid with proposed alignment.
   - Mapping depicts entire project limits with the exception of mill-and-overlay only section which extends approximately 3,900 LF south along I-95

B. LOD (Limit of Disturbance) delineation.
   - The LOD have been defined for this contract as the limits of full-depth pavement reconstruction, removal of existing bituminous curb, maintenance pavement construction and side-slope tie-in. Areas of abutment reconstruction underneath existing bridges 1-748 (Christina River) and 1-745 (Pennsylvania Railroad) are not included within the contract LOD.

C. On-Line Background Information. DSSR GIS Web Application
   1. Streams and water features
   2. Contour features
   3. Tax ditches
   4. Wellhead protection and / or recharge areas
   5. 2012 land use / land cover
   6. Hydrologic soil groups
   7. Wetlands
   8. Depth to water table

Contract Number: T201707406

Contract Name: Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge Southern Contract

Date: July 11, 2017

Discussion Points:

✓ Narrative of the project, existing drainage patterns and structures

- The intent of this contract is to complete mainline pavement resurfacing, shoulder reconstruction, traffic barrier/maintenance pavement reconstruction, bridge rehabilitation and drainage repairs/rehabilitation within the project limits.

✓ Any special design criteria such as, but not limited to: Watershed Plan, TMDL Requirements, Recharge Area, Flooding/Sump Areas

- No special criteria have been identified; however, the close proximity of adjacent natural resources is the primary design constraint. The project is outside the limits of the City of Wilmington Combined Sewer Outfall (CSO) system

Water Quality:

✓ LOD Concurrence

✓ Standard Plan or Detailed Plan
(Meeting Standard Plan criteria does not release designer from meeting drainage requirements as per Chapter 6 of the Road Design Manual)

- The contract LOD is anticipated to be less than 5 acres, is linear in nature due to the maintenance pavement construction and, therefore, use of the Standard Plan is requested.
- In support of the use of the Standard Plan, approximately 4.7 acres of runoff currently conveyed via the existing closed section, bituminous curb and deteriorated pipe outfalls into the adjacent wetlands and waters of the U.S. will be conveyed by sheet flow induced by the proposed open section and gravel diaphragms at the roadway edge.

✓ Infiltration Feasibility

- Infiltration is infeasible due to the high groundwater resulting from the adjacent environmental resources.

Contract Number: T201707406

Contract Name: Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge Southern Contract

Date: July 11, 2017

✓ Potential RPv BMPs

- Implementation of other RPv BMPs is severely restricted by the adjacent wetlands and waters of the U.S.
- Although not meeting all of the DNREC criteria for sheet-flow-to-buffer credit, the conversion of the open to closed section roadway provides a qualitative measure of RPv

Water Quantity:

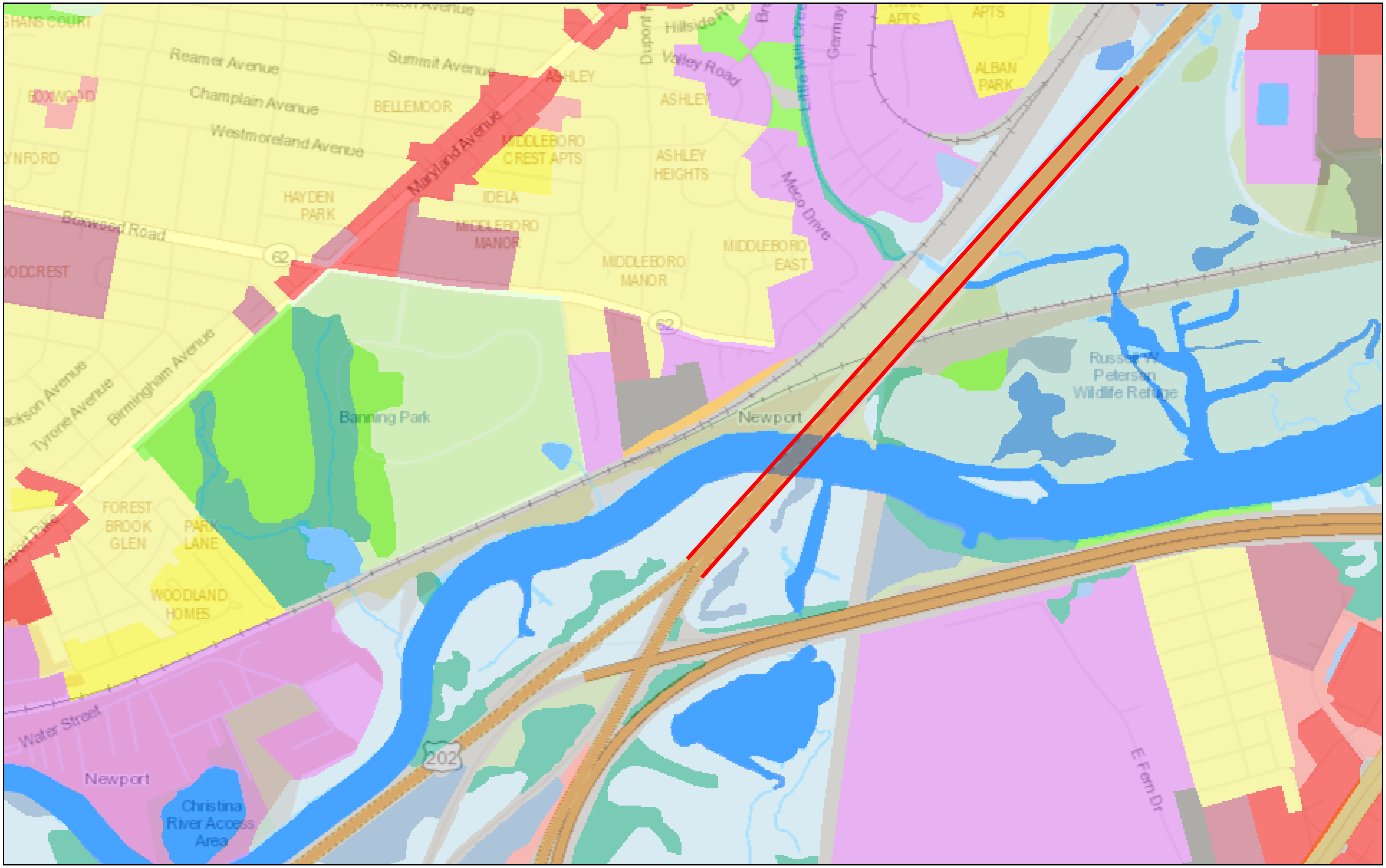
✓ Points of Analysis

- Six (6) Points of Investigation/Lines of Investigation have been identified along the contract limits as depicted on the provided mapping.

✓ Cv and Fv Approach

- All POIs/LOIs discharge either directly to the Christina River or to the tidal marsh within its floodplain. The maximum, net impervious area increase at any one POI/LOI is 0.09 acres and the net impervious area increase for the entire contract is 0.38 acres. Therefore, the net impact to the Runoff Curve within the rivers watershed is considered negligible relative to Cv and Fv.

Stormwater Assessment Study



June 20, 2017

Landuse Landcover 2012

Single Family Dwellings	Transportation/Communication/Utilities	Rangeland	Emergent Wetlands - Tidal and Non-tidal
Multi-Family Dwellings	Transportation/Communication/Utilities	Deciduous Forest	Forested Wetlands - Tidal and Non-tidal
Commercial	Transportation/Communication/Utilities	Shrub/Brush Rangeland	Scrub/Shrub Wetlands - Tidal and Non-tidal
Commercial	Mixed Urban/Built-up	Man-made Reservoirs and Impoundments	Scrub/Shrub Wetlands - Tidal and Non-tidal
Industrial	Institutional/Governmental	Open Water	Extraction and Transitional
	Recreational	Emergent Wetlands - Tidal and Non-tidal	

1:18,056

0 0.15 0.3 0.6 mi

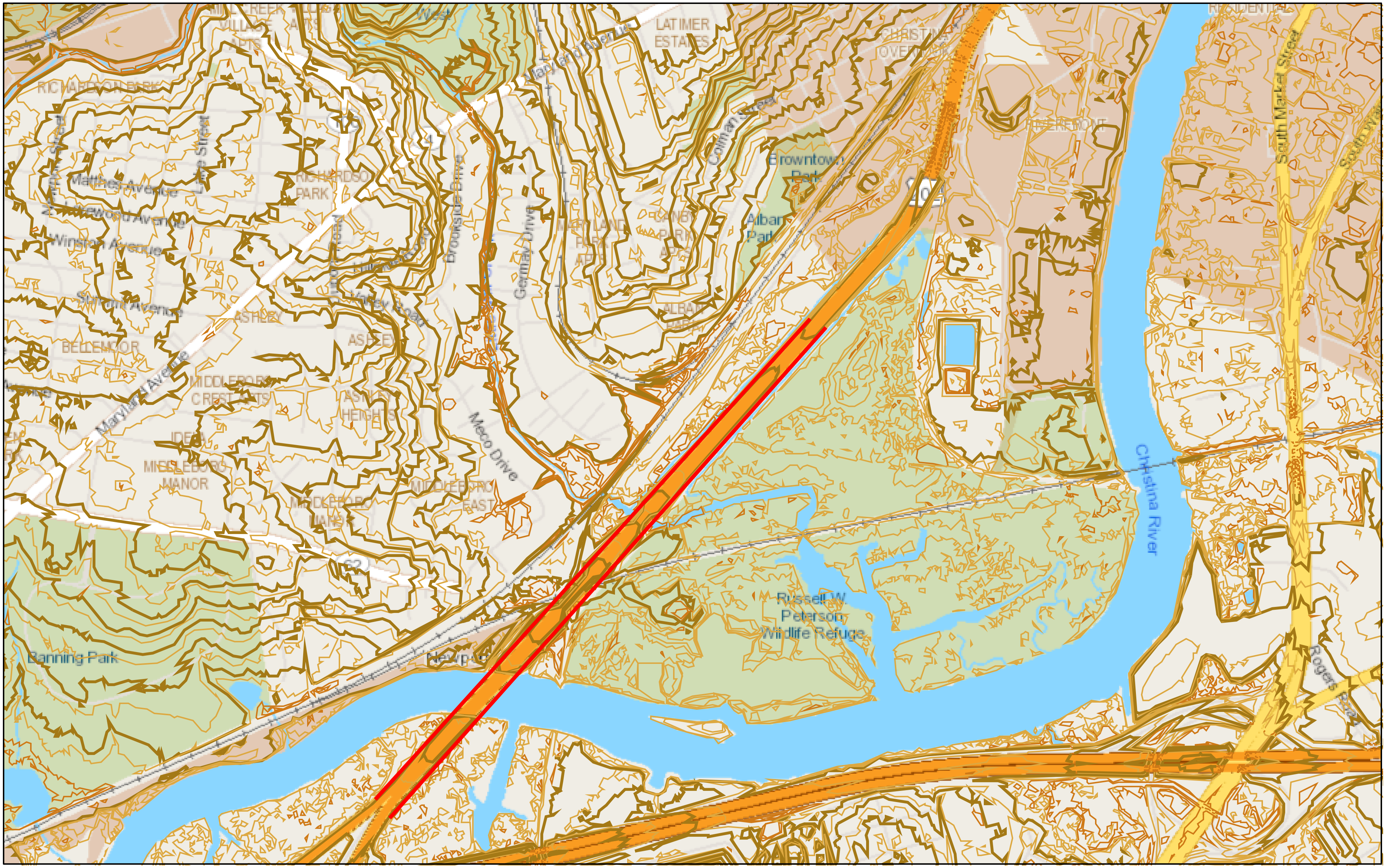
0 0.175 0.35 0.7 km

FirstMap 2016

Wilmington I-95 South
Land Use 2012

DNREC Stormwater
2017

Stormwater Assessment Study



June 20, 2017

Contours Feature Service

INDEX

DEPRESSION

DEPRESSION

HIDDEN

HIDDEN

INTERVAL

Wilmington I-95 South
Contour Features

1:18,056

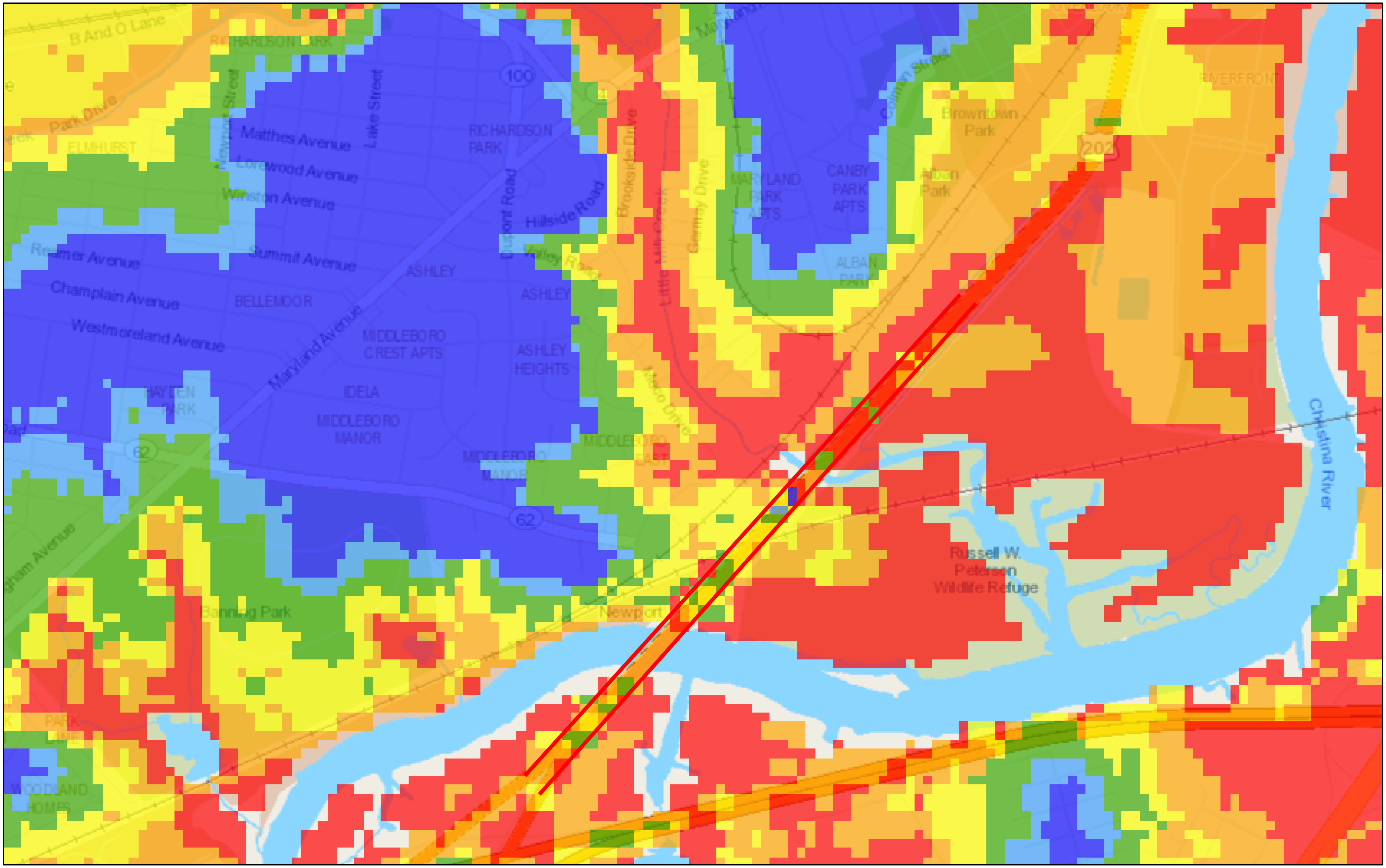
0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016

DNREC Stormwater
2017

Stormwater Assessment Study



June 20, 2017

DGS_DepthToWater_WET

- 0 - 3
- 3 - 6
- 6 - 9
- 9 - 16
- 16 - 20
- > 20

Wilmington I-95 South
Depth to Water Table

1:18,056

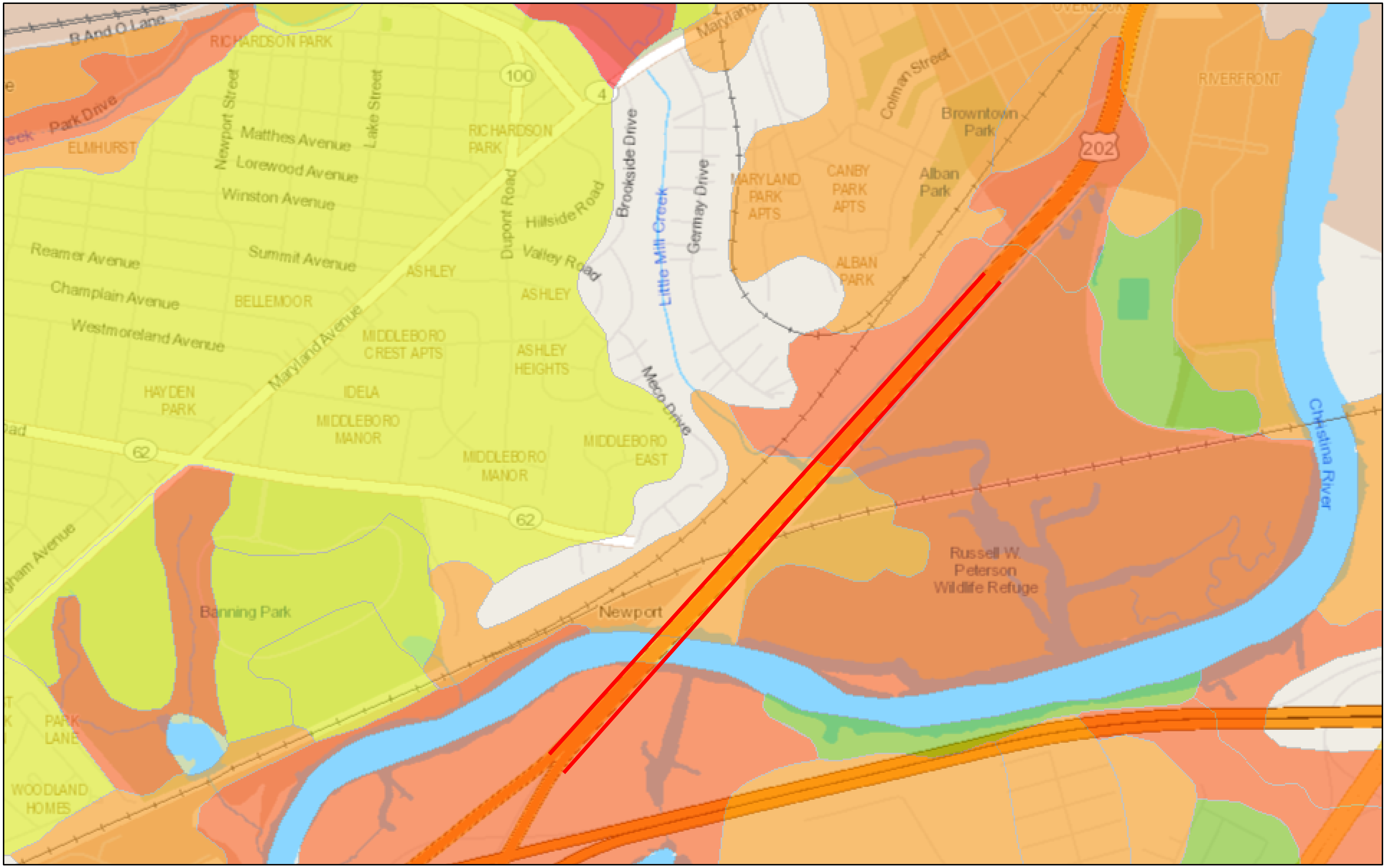
0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016
Matthew J. Martin and A. Scott Andres

DNREC Stormwater
2017

Stormwater Assessment Study



June 20, 2017

Soils - New Castle County

- A
- B
- B/D
- C
- C/D

Wilmington I-95 South
Hydrologic Soil Groups

1:18,056

0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016

DNREC Stormwater
2017

Stormwater Assessment Study

June 21, 2017

FEMA Flood Maps

- A
- AE
- AE, FLOODWAY
- AO
- VE
- X, 0.2 PCT ANNUAL CHANCE FLOOD HAZARD

Wilmington I-95 South
Stream and Water Features

1:18,056

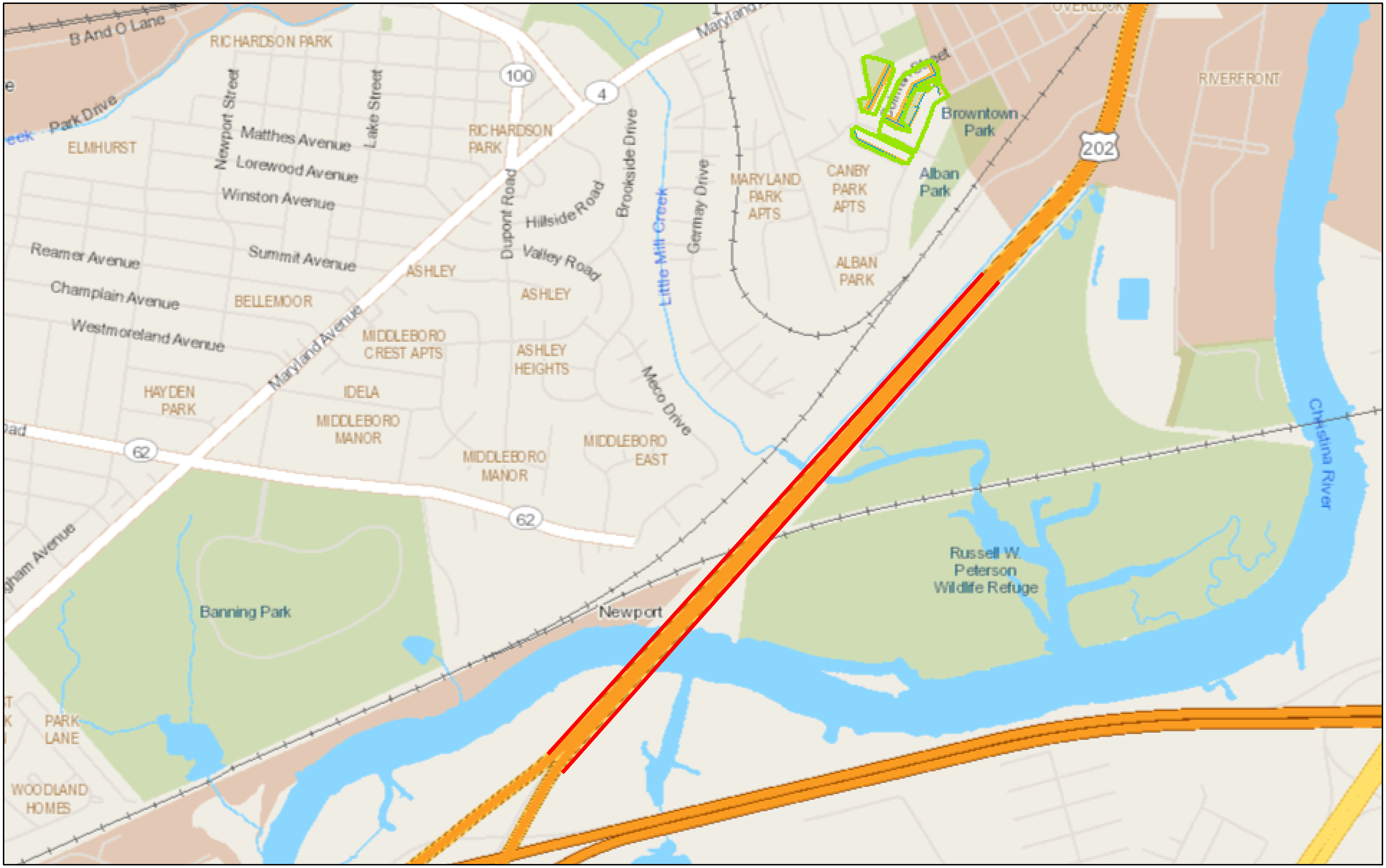
0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016
FEMA

DNREC Stormwater
2017

Stormwater Assessment Study



June 20, 2017

Tax Ditch Watersheds

Tax Ditch Channels

Tax Ditch Right of Way

Wilmington I-95 South Tax Ditches

1:18,056

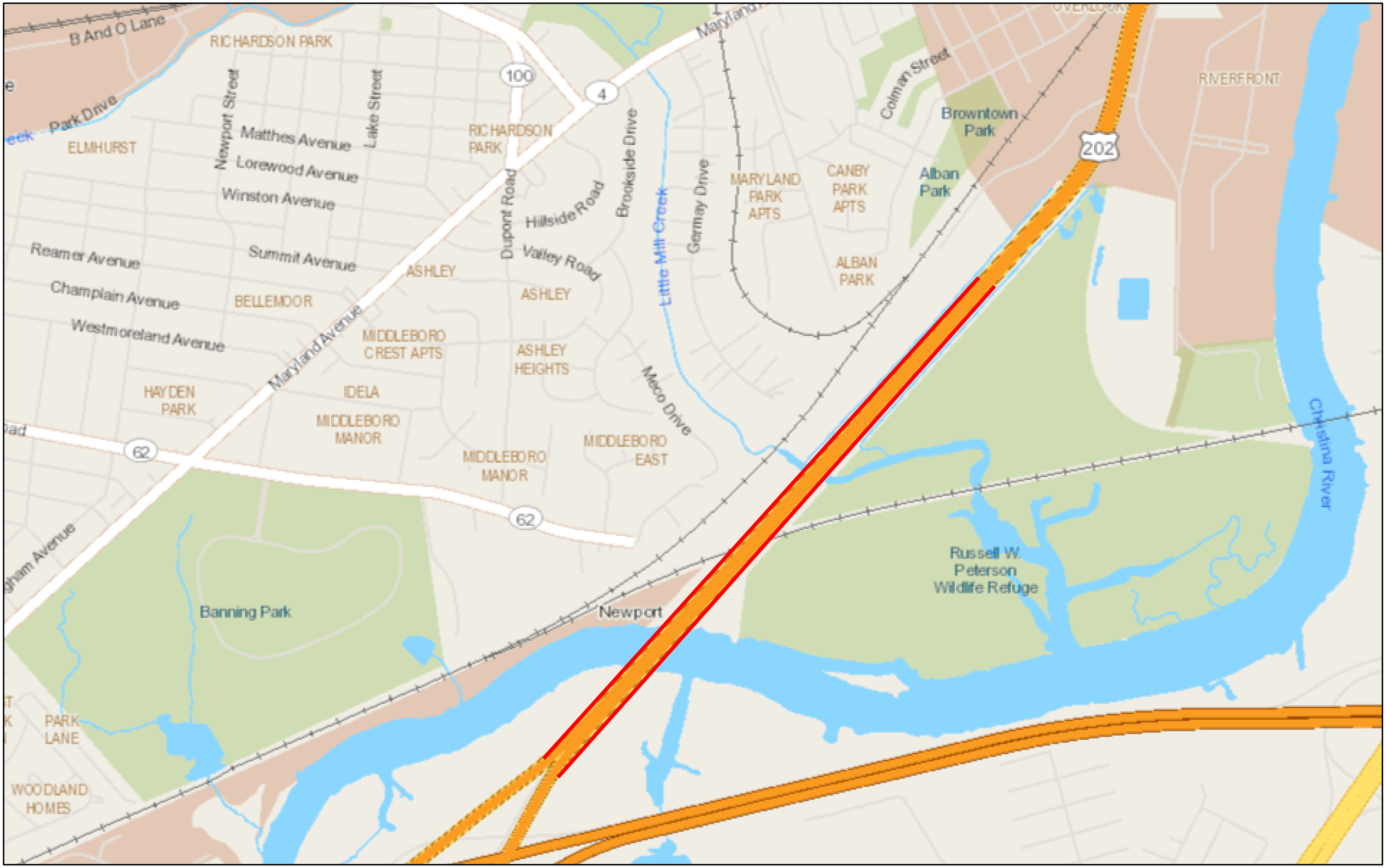
0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016

DNREC Stormwater 2017

Stormwater Assessment Study



June 20, 2017

Wilmington I-95 South
Wellhead protection areas

1:18,056

0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016

DNREC Stormwater
2017

Stormwater Assessment Study

June 20, 2017

State Wetlands Mapping Project

- Estuarine Non-Vegetated
- Estuarine Vegetated
- Palustrine Emergent
- Palustrine Forested Deciduous
- Palustrine Open Water/ Flats
- Palustrine Scrub/shrub
- Palustrine Tidal Emergent
- Palustrine Tidal Forested
- Palustrine Tidal Scrub/Shrub

Wilmington I-95 South Wetlands

1:18,056

0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016

DNREC Stormwater
2017

PROJECT:	I-95 Corridor Improvements_T201707406
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39	0	61	1.98	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98	0	98	3.12	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	0	5.1	0

Subarea Contributing Area (ac)	5.1
Subarea Weighted RCN	89

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 5.1

Weighted Runoff Curve Number (RCN) 89

PROJECT:	I-95 Corridor Improvements_T201707406
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	5.1	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		0	3.12	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		0	3.15	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	62%	0%

Step 2 - Subarea LOD Runoff Calculations				
2.1 RCN per HSG	0.00	0.00	88.82	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.88	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.61	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	5.10
2.7 Subarea Weighted RCN	88.82
2.8 Subarea Weighted RPv (in.)	1.88
2.9 Subarea Weighted Target Runoff (in.)	1.61

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD	
4.1 Combined LOD (ac)	5.10
4.2 Weighted RCN	88.82
4.3 Weighted RPv (in.)	1.88
4.4 Weighted Target Runoff (in.)	1.61
4.5 Estimated Annual Runoff (in.)	26.42
4.6 Req'd Runoff Reduction within LOD (in.)	0.27
4.7 Req'd Runoff Reduction within LOD (%)	14%

Step 5 - Cv Unit Discharge	
5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge	
6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements_T201707406
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	N/A
1.2 C.A. RCN	N/A
1.3 LOD Area (ac)	N/A
1.4 LOD RCN	N/A
1.5 Outside LOD Area (ac)	N/A
1.6 Outside LOD RCN	N/A

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet	83	0.015	d	0.17	N/A	0.17
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated	436	0.0125	u	N/A	1.8	0.07
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel	426		N/A		2.0	0.06
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.30

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	#N/A	#N/A
3.5 Ia/P ratio	#N/A	#N/A
3.6 Unit Peak Discharge, qu (csm/in)	#N/A	#N/A
3.7 Runoff (in.)	#VALUE!	#VALUE!
3.8 Peak Discharge, qp (cfs)	#VALUE!	#VALUE!
3.9 Equiv. unit peak discharge (cfs/ac)	0.00	0.00

PROJECT: I-95 Corridor Improvements_T201707406
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	5.10		5.10		5.10		5.10		5.10	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	91.97		N/A		N/A		N/A		N/A	
1.3 Initial RCN	88.82									
1.4 RPv for Contributing Area (in.)	1.88									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.27									
1.6 Req'd RPv Reduction for Contributing Area (%)	14%									
1.7 RPv allowable discharge rate (cfs)	0.40									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	1.88		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	88.82		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	88.82		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	26.42		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	26.42		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	88.82		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	1.88		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	34,746		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	88.82		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	26.42		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	91.97		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.27		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	963		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	4,912		N/A		N/A		N/A		N/A	

PROJECT:	**I-95 Corridor Improvements_T201707406**
DRAINAGE SUBAREA ID:	**Brandywine-Christina (02040205)**
LANDUSE TYPE:	
TMDL WATERSHED:	

TOTAL MAXIMUM DAILY LOAD (TMDL) WORKSHEET

	BMP 1				**BMP 2**				**BMP 3**				**BMP 4**				**BMP 5**			
	Type:	**0-No BMP**			**Type:**	--			**Type:**	--			**Type:**	--			**Type:**	--		
Step 1 - Calculate Annual Runoff Volume	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**
1.1 Total contributing area to BMP (ac)	5.10																			
1.2 Initial RCN	89																			
1.3 Annual runoff volume (in.)	26.42																			
1.4 Annual runoff volume (liters)	1.38E+07																			
Step 2 - Calculate Annual Pollutant Load																				
2.1 EMC (mg/L)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
2.2 Load (mg/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
2.3 Stormwater Load (lb/ac/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
Step 3 - Adjust for Pollutant Reduction																				
3.1 BMP annual runoff reduction (%)	0%				N/A				N/A				N/A				N/A			
3.2 Adjusted annual runoff volume (in)	26.42				N/A				N/A				N/A				N/A			
3.3 Adjusted annual runoff volume (liters)	1.38E+07				N/A				N/A				N/A				N/A			
3.4 Adjusted load from annual reductions (lb/ac/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.5 BMP removal efficiency (%)		0%	0%	0%		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.6 Treatment train removal efficiency (%)		0%	0%	0%		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.7 BMP effluent concentration (mg/L)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.8 Final Adjusted load (lb/ac/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.9 Final Adjusted load (lb/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
Step 4 - Pollutant Reduction Met? *(For Informational Purposes)*																				
4.1 TMDL (lb/ac/yr)		#N/A	#N/A	#N/A																
4.2 Reduction met?		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
4.3 Removed Load (lb/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A

PROJECT: I-95 Corridor Improvements_T201707406
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

CONVEYANCE EVENT (Cv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type:	**0-No BMP**	**Type:**	--	**Type:**	--	**Type:**	--	**Type:**	--
Step 1 - Calculate Initial Cv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	5.10		5.10		5.10		5.10		5.10	
1.2 Initial RCN	88.82									
1.3 10-Year Rainfall (in.)	4.8									
1.4 Cv runoff volume (in.)	3.56									
1.5 LOD allowable unit discharge (cfs/ac)	0.75									
1.6 Equiv. unit discharge outside LOD (cfs/ac)	0.00									
1.7 Cv allowable discharge rate (cfs)	3.83									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0.00		N/A		N/A		N/A		N/A	
2.2 Storage volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.3 Storage volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.4 Runoff volume after reduction (in.)	3.56		N/A		N/A		N/A		N/A	
2.5 CN*	88.82		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.2 Annual runoff after reduction (in.)	3.56		N/A		N/A		N/A		N/A	
3.3 Adjusted ACN	88.82		N/A		N/A		N/A		N/A	
3.4 Event-based runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate Cv with BMP Reductions										
4.1 Cv runoff volume after all reductions (in.)	3.56		N/A		N/A		N/A		N/A	
4.2 Total Cv runoff reduction (%)	0%		N/A		N/A		N/A		N/A	
4.3 Adjusted RCN for H&H modeling	88.82		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements_T201707406
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

FLOODING EVENT (Fv) WORKSHEET

	BMP 1		**BMP 2**		**BMP 3**		**BMP 4**		**BMP 5**	
	Type:	**0-No BMP**	**Type:**	--	**Type:**	--	**Type:**	--	**Type:**	--
Step 1 - Calculate Initial Fv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	5.10		5.10		5.10		5.10		5.10	
1.2 Initial RCN	88.82									
1.3 100-Year Rainfall (in.)	8.0									
1.4 Fv runoff volume (in.)	6.67									
1.5 LOD allowable unit discharge (cfs/ac)	2.25									
1.6 Equiv. unit discharge outside LOD (cfs/ac)	0.00									
1.7 Fv allowable discharge rate (cfs)	11.48									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0.00		N/A		N/A		N/A		N/A	
2.2 Storage volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.3 Storage volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.4 Runoff volume after reduction (in.)	6.67		N/A		N/A		N/A		N/A	
2.5 CN*	88.82		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.2 Annual runoff after reduction (in.)	6.67		N/A		N/A		N/A		N/A	
3.3 Adjusted ACN	88.82		N/A		N/A		N/A		N/A	
3.4 Event-based runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate Fv with BMP Reductions										
4.1 Fv runoff volume after all reductions (in.)	6.67		N/A		N/A		N/A		N/A	
4.2 Total Fv runoff reduction (%)	0%		N/A		N/A		N/A		N/A	
4.3 Adjusted RCN for H&H modeling	88.82		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements_T201707406		
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)		
COUNTY:	New Castle	**UNIT HYDROGRAPH:**	DMV
TMDL Watershed:	0	**LANDUSE:**	0
DURMM OUTPUT WORKSHEET			**DURMM v2.00.150802**

Site Data

Contributing Area to BMPs (ac.)	5.10			
C.A. RCN	88.68			
Subarea LOD (ac.)	5.10			
Subarea RCN	88.82			
Upstream Subarea ID				
Upstream Subarea LOD (ac.)	0.00	0.00	0.00	0.00
Combined LOD with Upstream Areas (ac.)	5.10			
Combined RCN with Upstream Areas (ac.)	88.82			
Watershed TMDL-TN (lb/ac/yr)	#N/A			
Watershed TMDL-TP (lb/ac/yr)	#N/A			
Watershed TMDL-TSS (lb/ac/yr)	#N/A			

BMP Data	**BMP 1**	**BMP 2**	**BMP 3**	**BMP 4**	**BMP 5**
	0-No BMP	--	--	--	--
RPv runoff volume after all reductions (in.)	1.88	N/A	N/A	N/A	N/A
Total RPv runoff reduction (in.)	0.00	N/A	N/A	N/A	N/A
Total RPv runoff reduction (%)	100%	N/A	N/A	N/A	N/A
Req'd runoff reduction met?	NO	N/A	N/A	N/A	N/A
RPv Offset Volume (cu. ft.)	4,912	N/A	N/A	N/A	N/A
Adjusted pollutant load, TN (lb/ac/yr)	#N/A	N/A	N/A	N/A	N/A
Adjusted pollutant load, TP (lb/ac/yr)	#N/A	N/A	N/A	N/A	N/A
Adjusted pollutant load, TSS (lb/ac/yr)	#N/A	N/A	N/A	N/A	N/A
Cv runoff volume after all reductions (in.)	3.56	N/A	N/A	N/A	N/A
Fv runoff volume after all reductions (in.)	6.67	N/A	N/A	N/A	N/A

Resource Protection Event (RPV)

RPv for Contributing Area (in.)	1.88	
Annual Runoff for Contributing Area (in.)	26.42	
Req'd RPv Reduction for Contributing Area (in.)	0.27	
Req'd RPv Reduction for Contributing Area (%)	14%	
RPv Runoff Reduction Shortfall or Credit (cu.ft.)	4912.18	SHORTFALL
C.A. allowable discharge rate (cfs)	0.40	
Adjusted CN after all reductions	88.82	
Equivalent RCN for H&H Modeling	91.97	

Conveyance Event (Cv)

Cv runoff volume (in.)	3.56
Stds-based allowable discharge (cfs)	3.83
Equivalent RCN for H&H Modeling	88.82

Flooding Event (Fv)

Fv runoff volume (in.)	6.67
Stds-based allowable discharge (cfs)	11.48
Equivalent RCN for H&H Modeling	88.82

Adjusted Subarea Data for Downstream DURMM Modeling

Subarea ID	ne-Christina (02040205)
Contributing Area (ac.)	5.10
C.A. RCN	88.68
LOD Area (ac.)	5.10
Weighted Target Runoff (in.)	1.61
Adjusted CN after all reductions	88.82
Adjusted RPv (in.)	1.88
Adjusted Cv (in.)	3.56
Adjusted Fv (in.)	6.67

Adjusted Subarea Data for Nutrient Protocol Modeling

Contributing Area (ac.)	5.10
LOD Area (ac.)	5.10
TN Pollutant Load (lb/yr)	#N/A
TP Pollutant Load (lb/yr)	#N/A
TSS Pollutant Load (lb/yr)	#N/A
Percent Impervious Cover	62%

Adjusted Subarea Data for the Summary Table for Sub-Areas Draining to a Common Point of Interest

Subarea ID	ne-Christina (02040205)	
Contributing Area (ac.)	5.10	
Runoff Reduction Shortfall or Credit (cu.ft.)	4912.18	SHORTFALL
Adjusted CN after all reductions	88.82	
Cv RCN for H&H Modeling	88.82	
Fv RCN for H&H Modeling	88.82	
TN Pollutant Load (lb/yr)	#N/A	
TP Pollutant Load (lb/yr)	#N/A	
TSS Pollutant Load (lb/yr)	#N/A	

Class	BMP Category	DURMM Variant	TN Reduction	TP Reduction	TSS Reduction	Retention Allowable	Annual Runoff Reduction, RPv, A/B Soil	Annual Runoff Reduction, RPv, C/D Soil	Runoff Reduction, Cv	Runoff Reduction, Fv
No BMP	N/A	0-No BMP	0%	0%	0%	0%	0%	0%	0%	0%
Retention Practice	1.0 Infiltration	1-A Infiltration Trench	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	1.0 Infiltration	1-B Infiltration Basin	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	1.0 Infiltration	1-C Underground Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-A Traditional Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-A Traditional Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-B In-Situ Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-B In-Situ Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-C Streetscape Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-C Streetscape Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-D Engineered Tree Pits - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-D Engineered Tree Pits - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-E Stormwater Planters - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-E Stormwater Planters - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-F Advanced Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-F Advanced Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-A Porous Asphalt (PA)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-B Pervious Concrete (PC)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-C Permeable Concrete Pavers (PP) & (CP)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-D Plastic & Composite Grid Pavers (GP)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Annual Runoff Reduction Practice	4.0 Vegetated Roofs	4-A Extensive Vegetated Roofs	100% of Load Reduction	100% of Load Reduction	0% of Load Reduction	0%	50% Annual RR	0% Annual RR	5% Runoff Reduction	1% Runoff Reduction
Annual Runoff Reduction Practice	4.0 Vegetated Roofs	4-B Intensive Vegetated Roofs	100% of Load Reduction	100% of Load Reduction	0% of Load Reduction	0%	75% Annual RR	0% Annual RR	8% Runoff Reduction	2% Runoff Reduction
Retention Practice	5.0 Rainwater Harvesting	5-A Seasonal Rainwater Harvesting	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	5.0 Rainwater Harvesting	5-B Continuous Rainwater Harvesting	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	75%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Annual Runoff Reduction Practice	6.0 Restoration Practices	6-A Step Pool RSCS	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	6.0 Restoration Practices	6-B Seepage Wetland RSCS	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	6.0 Restoration Practices	6-C Streambank Stabilization	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	7.0 Rooftop Disconnection	7-A Rooftop Disconnection	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	25% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	8.0 Vegetated Channels	8-A Bioswale	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	50% Annual RR	25% Annual RR	2% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	8.0 Vegetated Channels	8-B Grassed Channel	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	20% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-A Sheet Flow to Turf Filter Strip	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	25% Annual RR	10% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-A Sheet Flow to Forested Filter Strip	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	40% Annual RR	20% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-B Sheet Flow to Turf Open Space	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	50% Annual RR	20% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-B Sheet Flow to Forested Open Space	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	65% Annual RR	40% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Stormwater Treatment Practice	10.0 Detention Practices	10-A Dry Detention Pond	5% Removal Efficiency	10% Removal Efficiency	10% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	10.0 Detention Practices	10-B Dry Extended Detention (ED) Pond	20% Removal Efficiency	20% Removal Efficiency	60% Removal Efficiency	0%	10% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	10.0 Detention Practices	10-C Underground Detention Facilities	5% Removal Efficiency	10% Removal Efficiency	10% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-A Non-Structural Sand Filter	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-B Surface Sand Filter	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-C 3-Chamber Underground Sand Filter	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-D Perimeter Sand Filter (DE Sand Filter)	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-A Traditional Constructed Wetlands	30% Removal Efficiency	40% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-B Wetland Swales	20% Removal Efficiency (+ 100% of Load Reduction)	30% Removal Efficiency (+ 100% of Load Reduction)	60% Removal Efficiency (+ 100% of Load Reduction)	0%	15% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-C Ephemeral Constructed Wetlands	20% Removal Efficiency (+ 100% of Load Reduction)	30% Removal Efficiency (+ 100% of Load Reduction)	60% Removal Efficiency (+ 100% of Load Reduction)	0%	40% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-D Submerged Gravel Wetlands	0% Removal Efficiency	0% Removal Efficiency	0% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	13.0 Wet Pond	13-A Wet Pond	20% Removal Efficiency	45% Removal Efficiency	60% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	13.0 Wet Pond	13-B Wet Extended Detention (ED) Pond	20% Removal Efficiency	45% Removal Efficiency	60% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-A Compost Amended Soil - HSG A	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	38% Annual RR	0% Annual RR	4% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-B Compost Amended Soil - HSG B	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	50% Annual RR	0% Annual RR	5% Runoff Reduction	1% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-C Compost Amended Soil - HSG C	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	29% Annual RR	3% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-D Compost Amended Soil - HSG D	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	13% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	15.0 Proprietary Practices	15-A Hydrodynamic Structures	5% Removal Efficiency	10% Removal Efficiency	10% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	16.0 Source Controls	16-A Nutrient Management	17% Removal Efficiency	22% Removal Efficiency	0% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	16.0 Source Controls	16-B Street Sweeping	3% Removal Efficiency	3% Removal Efficiency	9% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction

Summary Table for Sub-Areas Draining to a Common Point of Interest (POI)[1]

POI: ______________________________

Ref. #	Sub-Area ID[2]	Contributing Area (ac)	RPv Runoff Reduction Shortfall(+) or Credit(-) (cu.ft.)[3]	Adjusted RPv CN after all reductions[4]	Cv RCN for H&H Modeling[4]	Fv RCN for H&H Modeling[4]	TN Pollutant Load (lb/yr)	TP Pollutant Load (lb/yr)	TSS Pollutant Load (lb/yr)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
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21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
Totals to Common POI		**0.00 ac**	**0 cu.ft.**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**0.00 lb/yr**	**0.00 lb/yr**	**0.00 lb/yr**
RPv Runoff Reduction Goal Met?			**YES**						
If Not, Total Offset Volume Required			**N/A**						

Notes:

1. As long as the site lies within the same watershed, all sub-areas within the site can be tallied to reflect global site conditions; or, the summary table can be used to show conditions to a specific POI.
2. Only the most downstream sub-area information should be entered for a series of sub-areas that drain directly into each other, as the upstream areas will already be accounted for in the DURMM computations.
3. A RPv runoff reduction shortfall should be entered as a positive number, as it is the runoff volume still needed to be reduced. A RPv credit should be entered as a negative number, as it indicates the additional volume that was reduced past the requirement.
4. To portray an accurate total weighted CN value for the RPv, Cv and Fv events, an entry must be made for every defined sub-area. If a sub-area's contributing drainage acreage is entered, but not its corresponding CN value, then the total weighted CN will be skewed.

Contract Number: T201407404
Contract Name: Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge Northern Contract
Date: July 11, 2017

DelDOT Stormwater Management Concurrence Meeting #1

This meeting is to assess and concur on the current and potential future stormwater management aspects of the project. This meeting should occur after the Survey Plans have been submitted and 1 month before the Preliminary Plans are completed. The DelDOT Project Manager is responsible for setting up the meeting. If the project will be in the Christina or Dragon Run watersheds, than the NPDES Engineer needs to be included in this meeting as well.

Required material for the designer to present electronically at the meeting:

A. Aerial map overlaid with proposed alignment.
   - Mapping depicts entire project limits with the exception of mill-and-overlay only section which extends approximately 2,700 LF south along I-95

B. LOD (Limit of Disturbance) delineation.
   - The LOD have been defined for this contract as the limits of full-depth pavement reconstruction, including ramps, sidewalks and bridge approaches. The LOD does not include the proposed deck rehabilitation of the main Wilmington Viaduct Bridges 1-748N and 1-748S. Areas of roadway reconstruction underneath existing 6th, 7th, 8th, 9th, 10th and 11th Street bridges not included within the contract LOD.

C. On-Line Background Information. DSSR GIS Web Application
   1. Streams and water features
   2. Contour features
   3. Tax ditches
   4. Wellhead protection and / or recharge areas
   5. 2012 land use / land cover
   6. Hydrologic soil groups
   7. Wetlands
   8. Depth to water table

Contract Number: T201407404

Contract Name: Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge Northern Contract

Date: July 11, 2017

Discussion Points:

- ✓ Narrative of the project, existing drainage patterns and structures
- The primary goals of this contract are to complete bridge reconstruction/rehabilitation and reconstruction/lowering of the I-95 mainline to increase bridge clearance. Due to constructability and maintenance of traffic considerations, reconstruction of various ramps is also proposed. Reconstruction of a limited amount of close storm drain system will also be required to implement the proposed contract goals.
- ✓ Any special design criteria such as, but not limited to: Watershed Plan, TMDL Requirements, Recharge Area, Flooding/Sump Areas
  - The majority of the projects closed storm drain system will discharge to the City of Wilmington Combined Sewer Outfall (CSO) system. CSOs 24, 26 and 30 will receive discharge from the project LOD.

Water Quality:

- ✓ LOD Concurrence

- ✓ Standard Plan or Detailed Plan
  (Meeting Standard Plan criteria does not release designer from meeting drainage requirements as per Chapter 6 of the Road Design Manual)
  - The Standard Plan is not considered to apply to this contract due to the large amount of total disturbance proposed; however, only 1.78 acres of disturbance outside of the CSOs is proposed for this “non-CSO” section of the contract immediately south of Bridges 1-748N and 1-748S and north of Contract T201707406. Within this section, 0.34 acres of new impervious area is proposed; however, this is a result of the construction of maintenance pavement in conjunction with the traffic barrier reconstruction that is proposed. Within the “non-CSO” segment of the project, approximately 4.0 acres of runoff currently conveyed via the existing closed section, bituminous curb and deteriorated pipe outfalls into the adjacent wetlands and waters of the U.S. will be conveyed by sheet flow induced by the proposed open section and gravel diaphragms at the roadway edge.

Contract Number: T201407404

Contract Name: Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge Northern Contract

Date: July 11, 2017

- The City of Wilmington has been contacted regarding the area of the project discharging to CSOs 24, 26 and 30. It has been conveyed that approximately 0.37 acres of new pavement, total, will discharge to the CSO. To date, no requirements for treatment of runoff from the area discharging to the CSOs has been conveyed.

✓ Infiltration Feasibility

- Infiltration is infeasible due to the existence of rock at a relatively shallow elevation within the contract limits.

✓ Potential RPv BMPs

- Implementation of other RPv BMPs is severely restricted by the restricted right-of-way and the presence of underlying rock.
- Although not meeting all of the DNREC criteria for sheet-flow-to-buffer credit, the conversion of the open to closed section roadway provides a qualitative measure of RPv

Water Quantity:

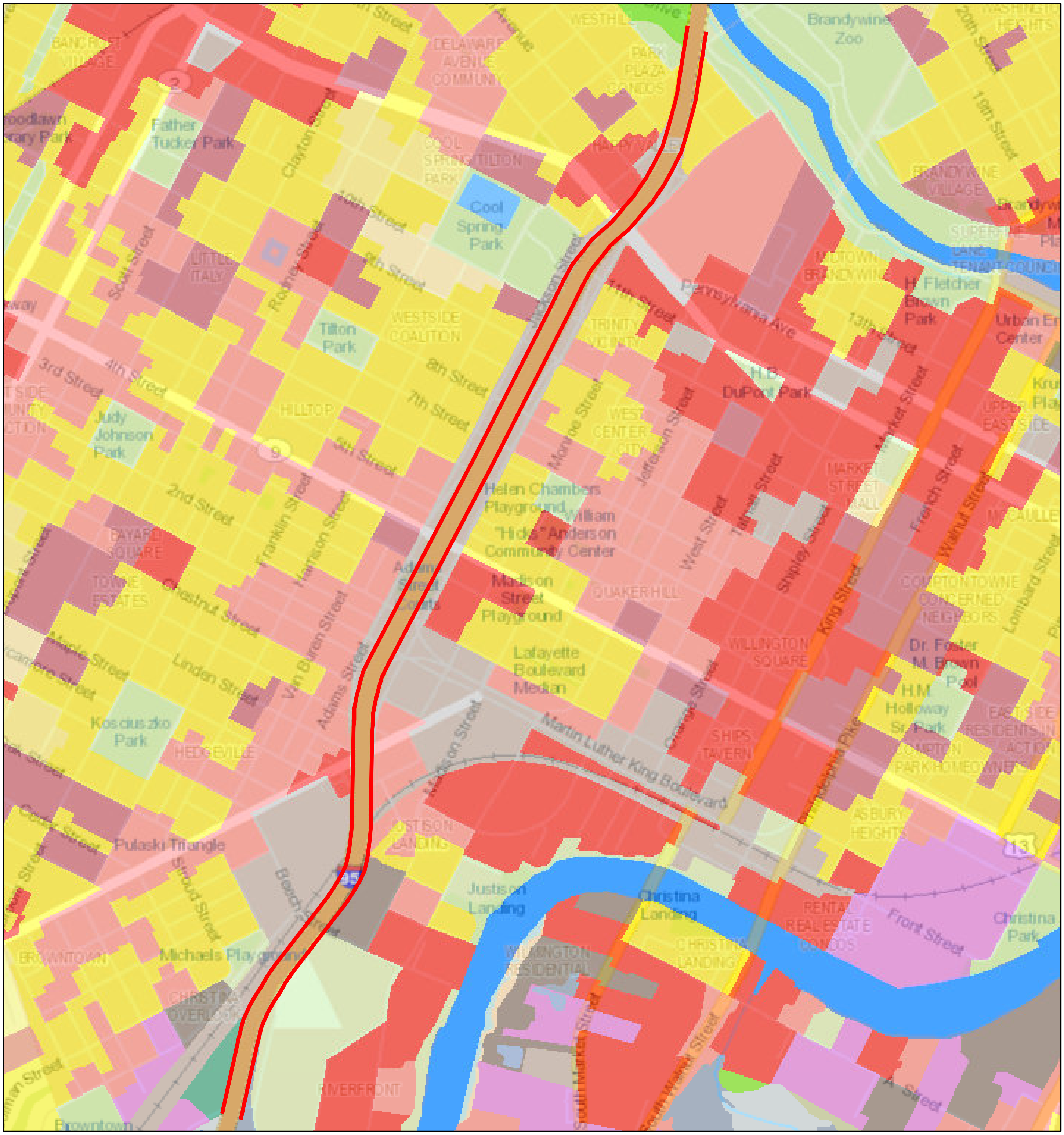
✓ Points of Analysis

- Seven (7) Points of Investigation/Lines of Investigation have been identified along the contract limits as depicted on the provided mapping.

✓ Cv and Fv Approach

- The POIs/LOIs in the non-CSO section discharge either directly to the Christina River or to the tidal marsh within its floodplain. The maximum, net impervious area increase at these POIs is 0.34 acres. Therefore, the net impact to the Runoff Curve within the rivers watershed is considered negligible relative to Cv and Fv.
- The net increase of 0.37 acres of impervious area within the CSO section of the contract is proposed to be accommodated by providing adequate conveyance within the closed storm drain system and ensuring that adverse impacts do not result based upon hydraulic grade line analysis.

Stormwater Assessment Study



June 20, 2017

Landuse Landcover 2012

- Mixed Residential
- Single Family Dwellings
- Multi-Family Dwellings
- Commercial
- Commercial
- Industrial
- Transportation/Communication/Utilities
- Transportation/Communication/Utilities
- Transportation/Communication/Utilities
- Transportation/Communication/Utilities
- Transportation/Communication/Utilities
- Mixed Urban/Built-up
- Mixed Urban/Built-up
- Institutional/Governmental
- Recreational
- Deciduous Forest
- Shrub/Brush Rangeland
- Man-made Reservoirs and Impoundments
- Open Water
- Open Water
- Emergent Wetlands - Tidal and Non-tidal
- Emergent Wetlands - Tidal and Non-tidal
- Forested Wetlands - Tidal and Non-tidal
- Scrub/Shrub Wetlands - Tidal and Non-tidal
- Sandy Areas and Shoreline
- Extraction and Transitional

FirstMap 2016

1:18,056

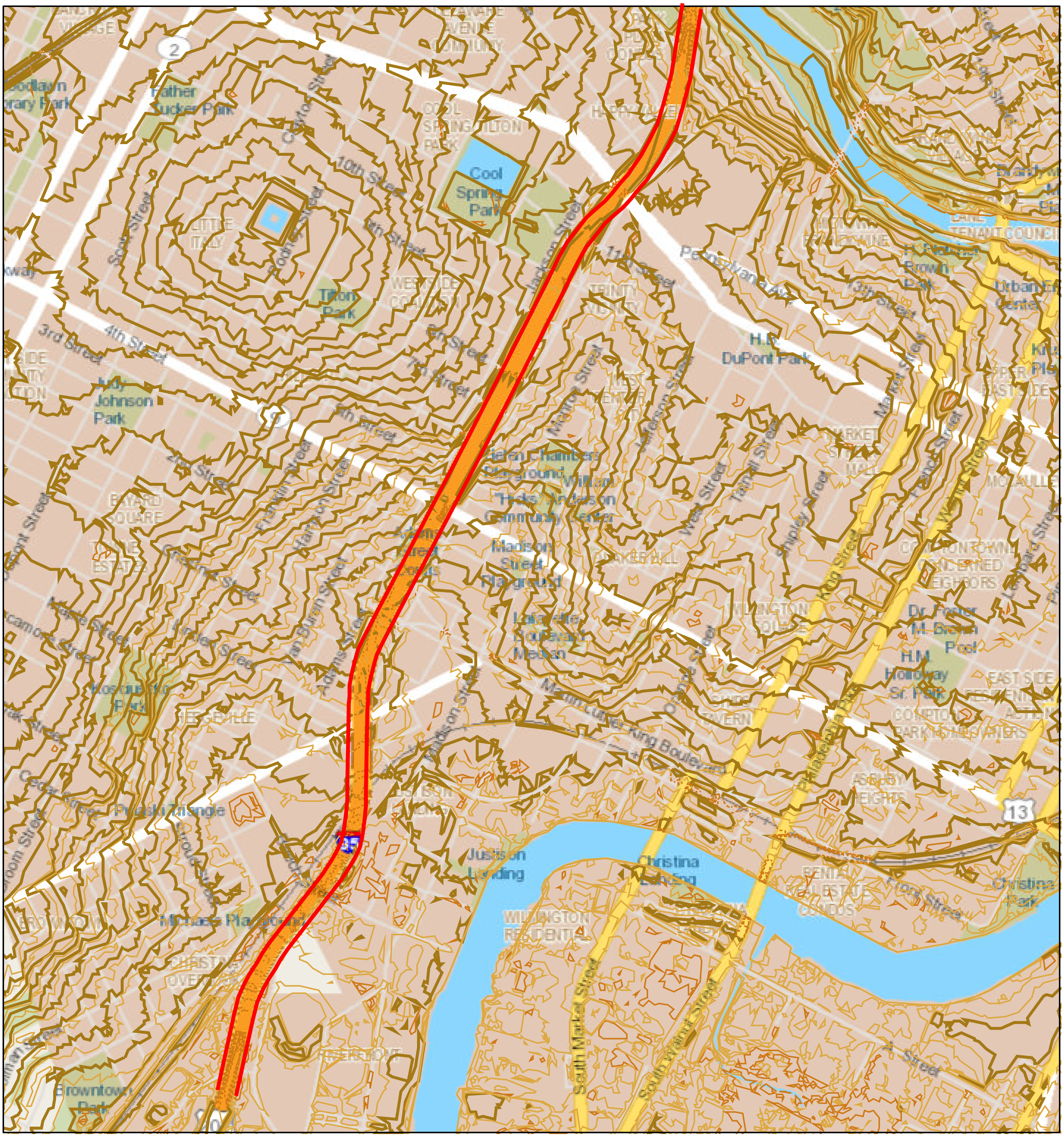
0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

Wilmington I-95 North
Land use 2012

DNREC Stormwater
2017

Stormwater Assessment Study



June 20, 2017

Contours Feature Service

INDEX

DEPRESSION

DEPRESSION

HIDDEN

HIDDEN

INTERVAL

1:18,056

0 0.15 0.3 0.6 mi

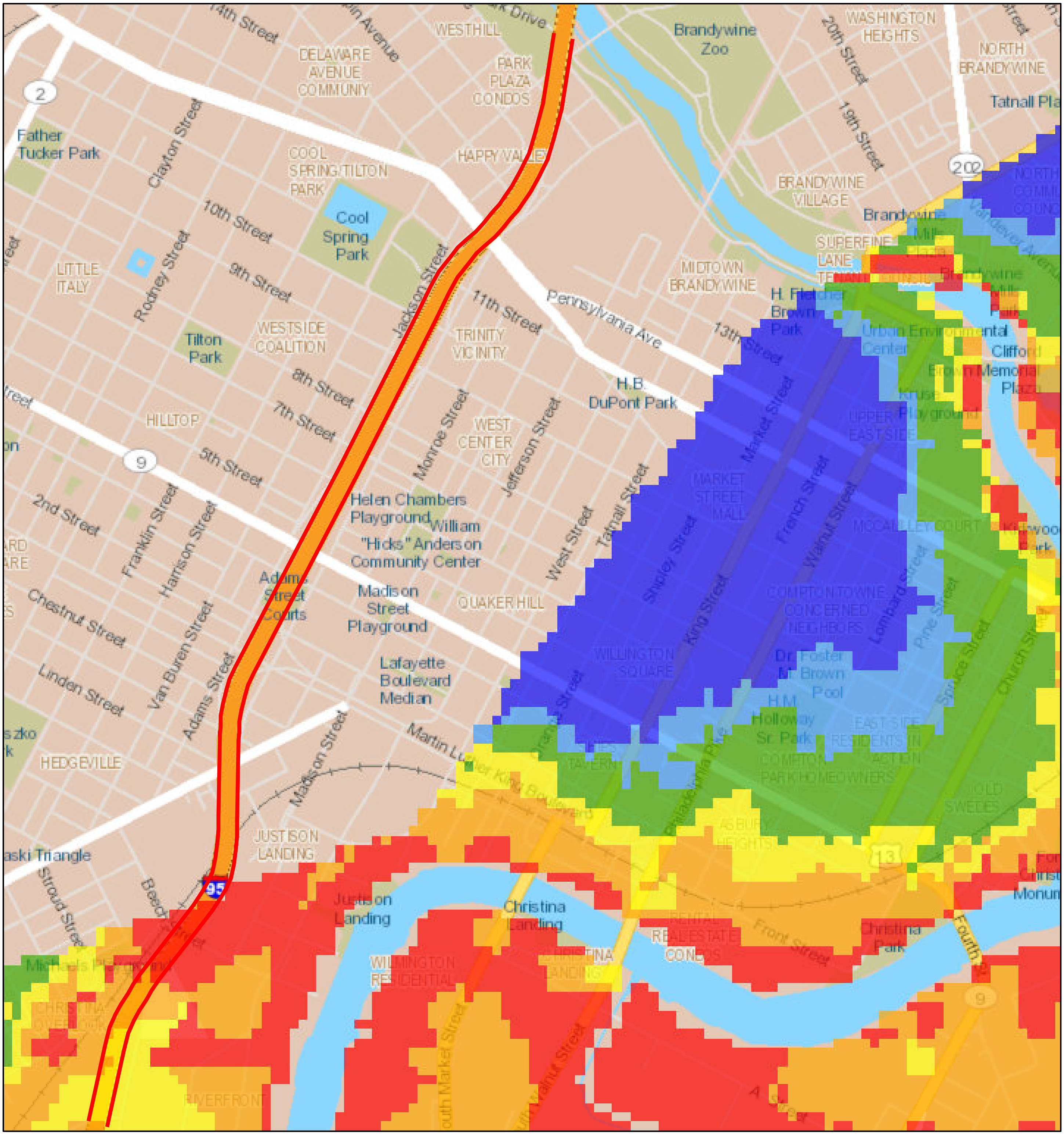
0 0.175 0.35 0.7 km

FirstMap 2016

Wilmington I-95 North
Contour Features

DNREC Stormwater
2017

Stormwater Assessment Study



June 20, 2017

DGS_DepthToWater_WET

- 0 - 3
- 3 - 6
- 6 - 9
- 9 - 16
- 16 - 20
- > 20

1:18,056

0 0.15 0.3 0.6 mi

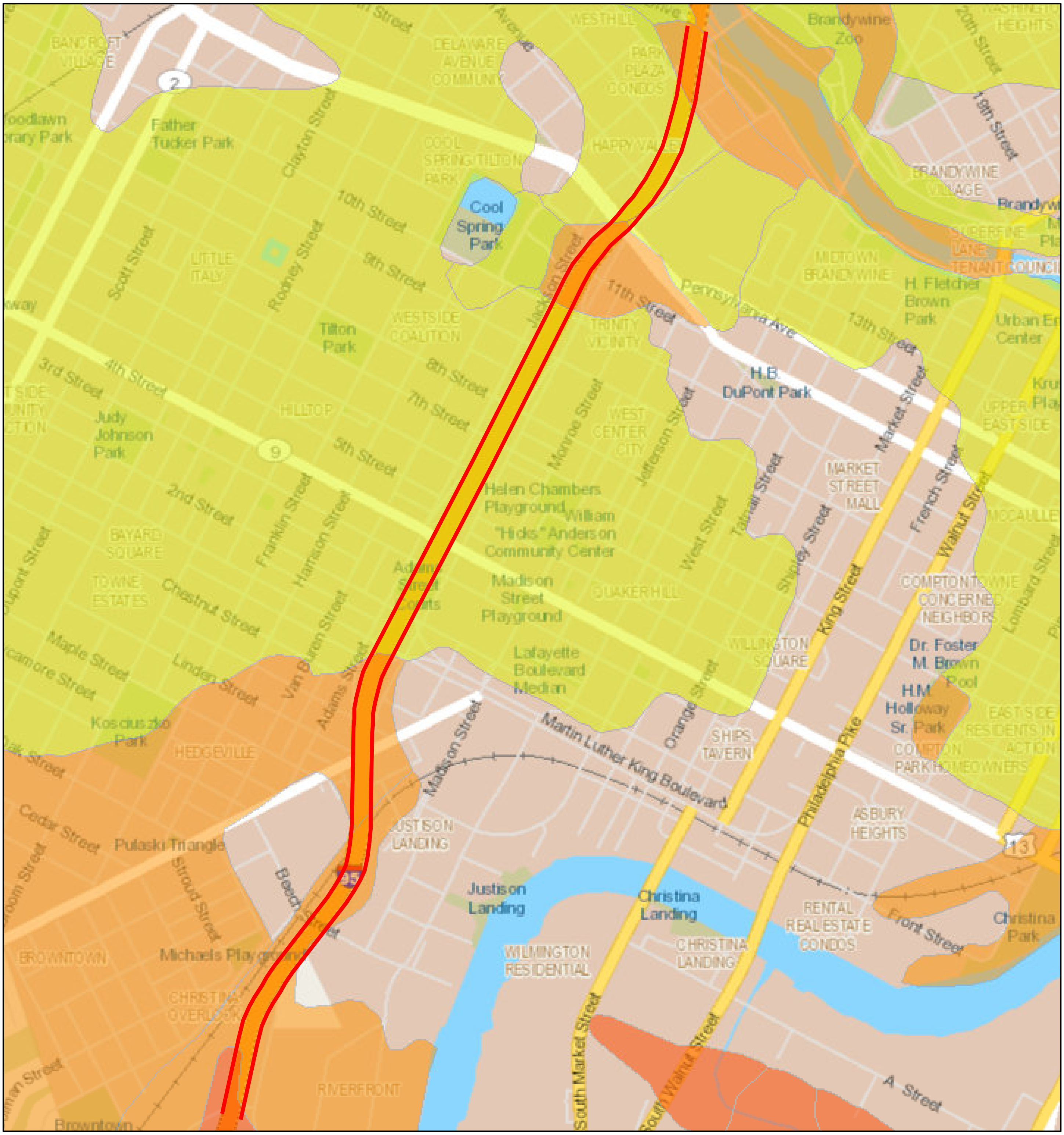
0 0.175 0.35 0.7 km

Wilmington I-95 South
Depth to Water Table

FirstMap 2016
Matthew J. Martin and A. Scott Andres

DNREC Stormwater
2017

Stormwater Assessment Study



June 20, 2017

Soils - New Castle County

B

C

C/D

1:18,056

0 0.15 0.3 0.6 mi

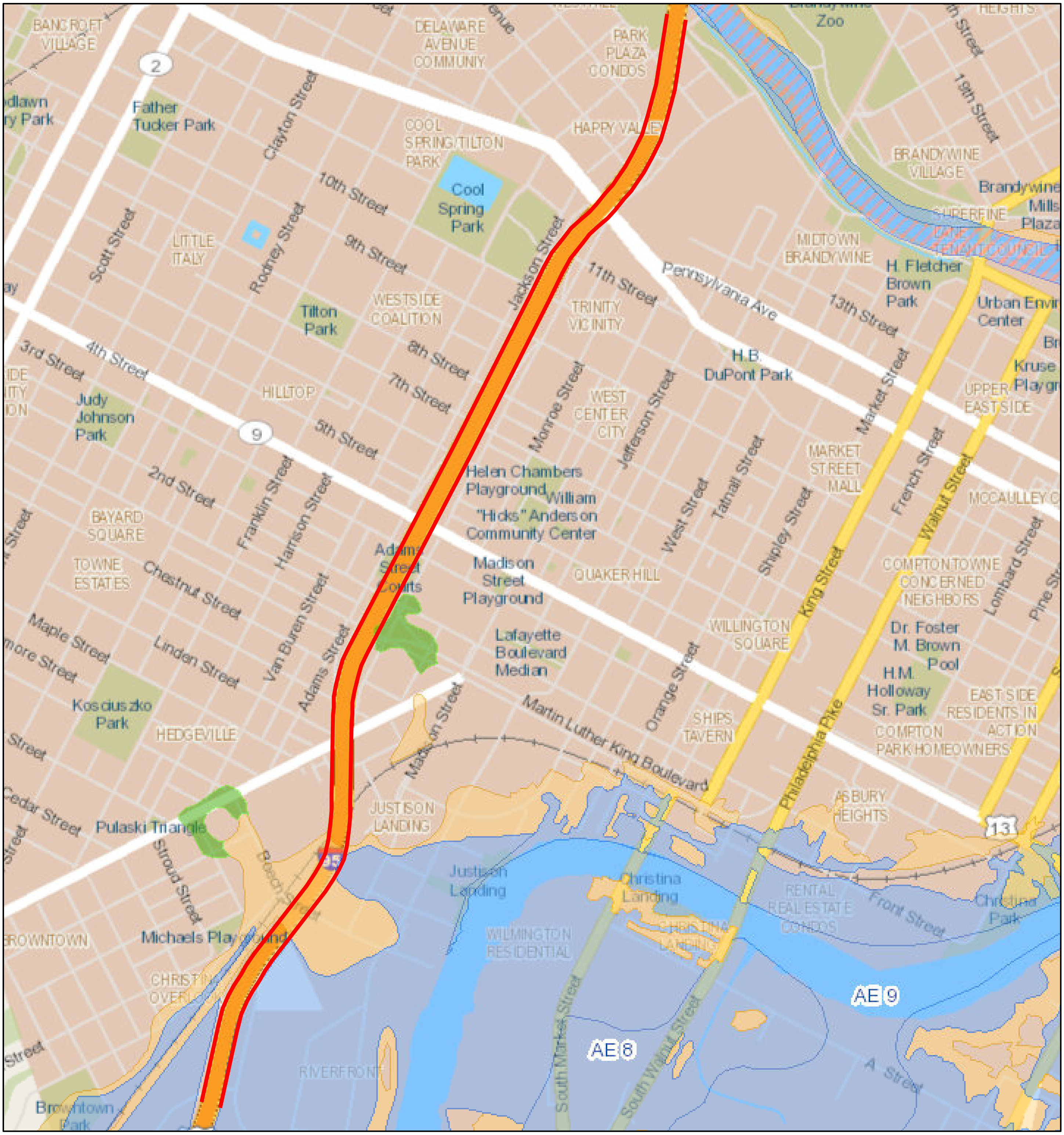
0 0.175 0.35 0.7 km

FirstMap 2016

Wilmington I-95 North
Hydrologic Soil Groups

DNREC Stormwater
2017

Stormwater Assessment Study



June 21, 2017

1:18,056

0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FEMA Flood Maps

- A
- AE
- AE, FLOODWAY
- AO
- VE
- X, 0.2 PCT ANNUAL CHANCE FLOOD HAZARD

Wilmington I-95 South
Stream and Water Features

FirstMap 2016
FEMA

DNREC Stormwater
2017

Stormwater Assessment Study

June 20, 2017

Tax Ditch Watersheds

Tax Ditch Channels

Tax Ditch Right of Way

1:18,056

0 0.15 0.3 0.6 mi

0 0.175 0.35 0.7 km

FirstMap 2016

Wilmington I-95 North Tax Ditches

DNREC Stormwater 2017

Stormwater Assessment Study

June 20, 2017

1:18,056

0	0.15	0.3		0.6 mi	
0	0.175	0.35	0.7	km	

FirstMap 2016

Wilmington I-95 North
Wellhead protection areas

DNREC Stormwater
2017

Stormwater Assessment Study

June 20, 2017

1:18,056

0	0.15	0.3	0.6 mi
0	0.175	0.35	0.7 km

State Wetlands Mapping Project

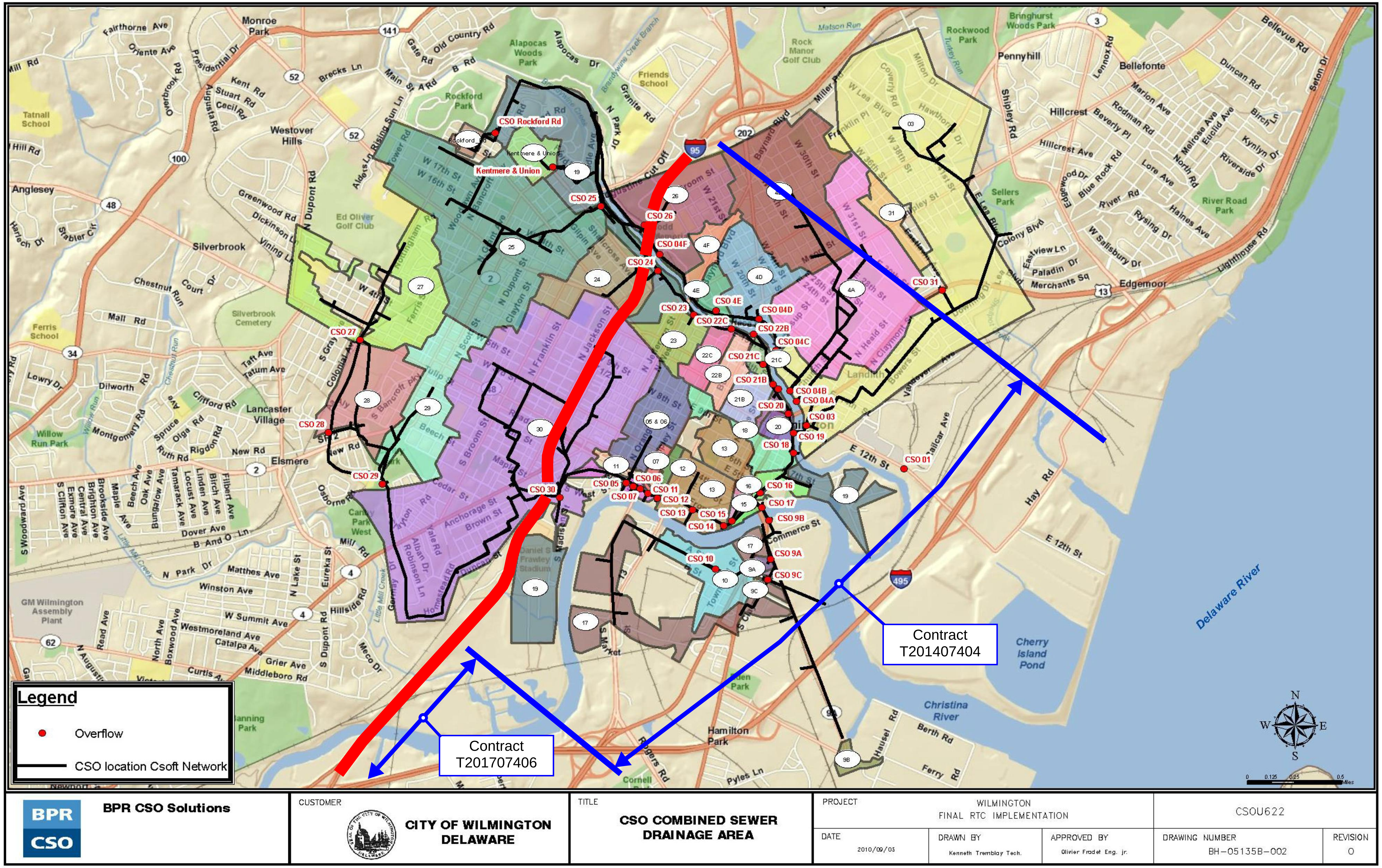
- Estuarine Non-Vegetated
- Estuarine Vegetated
- Palustrine Emergent
- Palustrine Forested Deciduous
- Palustrine Open Water/ Flats
- Palustrine Scrub/Shrub
- Palustrine Scrub/shrub
- Palustrine Tidal Emergent
- Palustrine Tidal Forested
- Palustrine Tidal Scrub/Shrub
- Riverine Non-vegetated
- Riverine Vegetated

FirstMap 2016

Wilmington I-95 North Wetlands

DNREC Stormwater
2017

FIGURE 2: CSO COMBINED SEWER DRAINAGE AREA



PROJECT:	I-95 Corridor Improvements_T201407404
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		**77**		**86**		**91**		**94**
	Crop residue (CR)	poor		**76**		**85**		**90**		**93**
	Crop residue (CR)	good		**74**		**83**		**88**		**90**
Row Crops	Straight row (SR)	poor		**72**		**81**		**88**		**91**
	Straight row (SR)	good		**67**		**78**		**85**		**89**
	SR + Crop residue	poor		**71**		**80**		**87**		**90**
	SR + Crop residue	good		**64**		**75**		**82**		**85**
	Contoured (C)	poor		**70**		**79**		**84**		**88**
	Contoured (C)	good		**65**		**75**		**82**		**86**
	C + Crop residue	poor		**69**		**78**		**83**		**87**
	C + Crop residue	good		**64**		**74**		**81**		**85**
	Cont & terraced(C&T)	poor		**66**		**74**		**80**		**82**
	Cont & terraced(C&T)	good		**62**		**71**		**78**		**81**
	C&T + Crop residue	poor		**65**		**73**		**79**		**81**
	C&T + Crop residue	good		**61**		**70**		**77**		**80**
Small Grain	Straight row (SR)	poor		**65**		**76**		**84**		**88**
	Straight row (SR)	good		**63**		**75**		**83**		**87**
	SR + Crop residue	poor		**64**		**75**		**83**		**86**
	SR + Crop residue	good		**60**		**72**		**80**		**84**
	Contoured (C)	poor		**63**		**74**		**82**		**85**
	Contoured (C)	good		**61**		**73**		**81**		**84**
	C + Crop residue	poor		**62**		**73**		**81**		**84**
	C + Crop residue	good		**60**		**72**		**80**		**83**
	Cont & terraced(C&T)	poor		**61**		**72**		**79**		**82**
	Cont & terraces(C&T)	good		**59**		**70**		**78**		**81**
	C&T + Crop residue	poor		**60**		**71**		**78**		**81**
	C&T + Crop residue	good		**58**		**69**		**77**		**80**
Close-seeded	Straight row	poor		**66**		**77**		**85**		**89**
or broadcast	Straight row	good		**58**		**72**		**81**		**85**
legumes or	Contoured	poor		**64**		**75**		**83**		**85**
rotation	Contoured	good		**55**		**69**		**78**		**83**
meadow	Cont & terraced	poor		**63**		**73**		**80**		**83**
	Cont & terraced	good		**51**		**67**		**76**		**80**
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		**68**		**79**		**86**		**89**
		fair		**49**		**69**		**79**		**84**
		good		**39**		**61**		**74**		**80**
	Meadow -cont. grass (non grazed)	----		**30**		**58**		**71**		**78**
	Brush - brush, weed, grass mix	poor		**48**		**67**		**77**		**83**
		fair		**35**		**56**		**70**		**77**
		good		**30**		**48**		**65**		**73**
	Woods - grass combination	poor		**57**		**73**		**82**		**86**
		fair		**43**		**65**		**76**		**82**
		good		**32**		**58**		**72**		**79**
	Woods	poor		**45**		**66**		**77**		**83**
		fair		**36**		**60**		**73**		**79**
		good		**30**		**55**		**70**		**77**
	Farmsteads	----		**59**		**74**		**82**		**86**
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			**68**		**79**		**86**		**89**
	Fair condition; grass cover 50% to 75 %			**49**		**69**		**79**		**84**
	Good condition; grass cover > 75%			**39**	0	**61**	1.68	**74**		**80**
Impervious Areas										
	Paved parking lots, roofs, driveways			**98**	0	**98**	1.11	**98**		**98**
	Streets and roads									
	Paved; curbs and storm sewers			**98**		**98**		**98**		**98**
	Paved; open ditches (w/right-of-way)			**83**		**89**		**92**		**93**
	Gravel (w/ right-of-way)			**76**		**85**		**89**		**91**
	Dirt (w/ right-of-way)			**72**		**82**		**87**		**89**
Urban Districts		Avg % impervious								
	Commercial & business	85		**89**		**92**		**94**		**95**
	Industrial	72		**81**		**88**		**91**		**93**
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		**77**		**85**		**90**		**92**
	1/4 acre	38		**61**		**75**		**83**		**87**
	1/3 acre	30		**57**		**72**		**81**		**86**
	1/2 acre	25		**54**		**70**		**80**		**85**
	1 acre	20		**51**		**68**		**79**		**84**
	2 acre	12		**46**		**65**		**77**		**82**
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			**77**		**86**		**91**		**94**
USER DEFINED										

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	0	2.79	0

Subarea Contributing Area (ac) 2.79

Subarea Weighted RCN 84

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 2.79

Weighted Runoff Curve Number (RCN) 84

PROJECT:	I-95 Corridor Improvements_T201407404
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		0	2.77	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)			1.11	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***			1.5	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	54%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	0.00	87.00	0.00
2.2 RPv per HSG (in.)	0.00	0.00	1.77	0.00
2.3 Target Runoff per HSG (in.)	0.00	0.00	1.42	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.00	2.25	0.00

2.6 Subarea LOD (ac)	2.77
2.7 Subarea Weighted RCN	87.00
2.8 Subarea Weighted RPv (in.)	1.77
2.9 Subarea Weighted Target Runoff (in.)	1.42

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	2.77
4.2 Weighted RCN	87.00
4.3 Weighted RPv (in.)	1.77
4.4 Weighted Target Runoff (in.)	1.42
4.5 Estimated Annual Runoff (in.)	24.56
4.6 Req'd Runoff Reduction within LOD (in.)	0.35
4.7 Req'd Runoff Reduction within LOD (%)	20%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements_T201407404
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	2.79
1.2 C.A. RCN	84
1.3 LOD Area (ac)	2.77
1.4 LOD RCN	87
1.5 Outside LOD Area (ac)	0.02
1.6 Outside LOD RCN	-394

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet	83	0.015	d	0.17	N/A	0.17
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated	436	0.0125	u	N/A	1.8	0.07
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel	426		N/A		2.0	0.06
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.30

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	#N/A	#N/A
3.5 Ia/P ratio	#N/A	#N/A
3.6 Unit Peak Discharge, qu (csm/in)	#N/A	#N/A
3.7 Runoff (in.)	-10.21	-54.38
3.8 Peak Discharge, qp (cfs)	#N/A	#N/A
3.9 Equiv. unit peak discharge (cfs/ac)	#N/A	#N/A

PROJECT: I-95 Corridor Improvements_T201407404

DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)

LOCATION (County): New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type	0-No BMP	Type	--	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	2.79		2.79		2.79		2.79		2.79	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	90.56		N/A		N/A		N/A		N/A	
1.3 Initial RCN	83.55									
1.4 RPv for Contributing Area (in.)	1.76									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.35									
1.6 Req'd RPv Reduction for Contributing Area (%)	20%									
1.7 RPv allowable discharge rate (cfs)	0.21									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	1.76		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	86.78		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	83.55		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	21.32		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	21.32		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	83.55		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	1.76		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	17,794		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	83.55		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	21.32		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	90.56		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.35		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	1,253		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	3,497		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements_T201407404 (CSO)
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
			Curve Numbers for Hydrologic Soil Type							
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good		64		75		82		85
	Contoured (C)	poor		70		79		84		88
	Contoured (C)	good		65		75		82		86
	C + Crop residue	poor		69		78		83		87
	C + Crop residue	good		64		74		81		85
	Cont & terraced(C&T)	poor		66		74		80		82
	Cont & terraced(C&T)	good		62		71		78		81
	C&T + Crop residue	poor		65		73		79		81
	C&T + Crop residue	good		61		70		77		80
Small Grain	Straight row (SR)	poor		65		76		84		88
	Straight row (SR)	good		63		75		83		87
	SR + Crop residue	poor		64		75		83		86
	SR + Crop residue	good		60		72		80		84
	Contoured (C)	poor		63		74		82		85
	Contoured (C)	good		61		73		81		84
	C + Crop residue	poor		62		73		81		84
	C + Crop residue	good		60		72		80		83
	Cont & terraced(C&T)	poor		61		72		79		82
	Cont & terraces(C&T)	good		59		70		78		81
	C&T + Crop residue	poor		60		71		78		81
	C&T + Crop residue	good		58		69		77		80
Close-seeded	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79
	Woods	poor		45		66		77		83
		fair		36		60		73		79
		good		30		55		70		77
	Farmsteads	----		59		74		82		86
FULLY DEVELOPED URBAN AREAS (Veg Established)										
Open space (Lawns,parks etc.)										
	Poor condition; grass cover < 50%			68		79		86		89
	Fair condition; grass cover 50% to 75 %			49		69		79		84
	Good condition; grass cover > 75%			39	3.98	61	1.38	74		80
Impervious Areas										
	Paved parking lots, roofs, driveways			98	10.19	98	3.8	98		98
	Streets and roads									
	Paved; curbs and storm sewers			98		98		98		98
	Paved; open ditches (w/right-of-way)			83		89		92		93
	Gravel (w/ right-of-way)			76		85		89		91
	Dirt (w/ right-of-way)			72		82		87		89
Urban Districts		Avg % impervious								
	Commercial & business	85		89		92		94		95
	Industrial	72		81		88		91		93
Residential districts by average lot size		Avg % impervious								
	1/8 acre (town houses)	65		77		85		90		92
	1/4 acre	38		61		75		83		87
	1/3 acre	30		57		72		81		86
	1/2 acre	25		54		70		80		85
	1 acre	20		51		68		79		84
	2 acre	12		46		65		77		82
DEVELOPING URBAN AREA (No Vegetation)										
	Newly graded area (pervious only)			77		86		91		94
USER DEFINED										

	A	B	C	D
Subarea Contributing Area per Soil Type (ac)	0	14.17	5.18	0

Subarea Contributing Area (ac)	19.35
Subarea Weighted RCN	89

UPSTREAM CONTRIBUTING AREAS

	Subarea ID	*Acres*	*RCN*
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac) 19.4

Weighted Runoff Curve Number (RCN) 89

PROJECT:	I-95 Corridor Improvements_T201407404 (CSO)
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

Step 1 - Subarea LOD Data	**HSG A**	**HSG B**	**HSG C**	**HSG D**
1.1 HSG Area Within LOD (ac)		14.04	5.16	
1.2 Pre-Developed Woods/Meadow Within LOD (ac)			0	
1.3 Pre-Developed Impervious Within LOD (ac)		10.19	3.8	
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		10.25	3.98	
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	73%	77%	0%

Step 2 - Subarea LOD Runoff Calculations

2.1 RCN per HSG	0.00	88.01	92.51	0.00
2.2 RPv per HSG (in.)	0.00	1.83	2.10	0.00
2.3 Target Runoff per HSG (in.)	0.00	1.38	1.73	0.00
2.4 Cv Weighted Unit Discharge per HSG (cfs/ac)	0.00	0.75	0.75	0.00
2.5 Fv Weighted Unit Discharge per HSG (cfs/ac)	0.00	2.25	2.25	0.00

2.6 Subarea LOD (ac)	19.20
2.7 Subarea Weighted RCN	89.22
2.8 Subarea Weighted RPv (in.)	1.90
2.9 Subarea Weighted Target Runoff (in.)	1.47

Step 3 - Upstream LOD Areas ***(from previous DURMM Report as applicable)***	**Area 1**	**Area 2**	**Area 3**	**Area 4**
3.1 Upstream Sub-Area ID				
3.2 Upstream LOD Area (ac)				
3.3 Target Runoff for Upstream Area (in.)				
3.4 Adjusted CN after all reductions				
3.5 Adjusted RPv (in.)				
3.6 Adjusted Cv (in.)				
3.7 Adjusted Fv (in.)				

Step 4 - RPv Calculations for Combined LOD

4.1 Combined LOD (ac)	19.20
4.2 Weighted RCN	89.22
4.3 Weighted RPv (in.)	1.90
4.4 Weighted Target Runoff (in.)	1.47
4.5 Estimated Annual Runoff (in.)	26.83
4.6 Req'd Runoff Reduction within LOD (in.)	0.43
4.7 Req'd Runoff Reduction within LOD (%)	23%

Step 5 - Cv Unit Discharge

5. LOD Allowable Unit Discharge (cfs/ac)	0.75

Step 6 - Fv Unit Discharge

6. LOD Allowable Unit Discharge (cfs/ac)	2.25

PROJECT:	I-95 Corridor Improvements_T201407404 (CSO)
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle
UNIT HYDROGRAPH:	DMV

OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	19.35
1.2 C.A. RCN	89
1.3 LOD Area (ac)	19.2
1.4 LOD RCN	89
1.5 Outside LOD Area (ac)	0.15
1.6 Outside LOD RCN	19

Step 2 - Time of Concentration

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet	83	0.015	d	0.17	N/A	0.17
				-----------	N/A	0.00
				-----------	N/A	0.00
Shallow Concentrated	436	0.0125	u	N/A	1.8	0.07
				N/A	-----------	0.00
				N/A	-----------	0.00
Open Channel	426		N/A		2.0	0.06
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

2.7 Time of Concentration (Tc) 0.30

Sheet Flow Surface Codes

a smooth surface
b fallow (no residue)
c cultivated < 20% Res.
d cultivated > 20% Res.
e grass - range, short
f grass, dense
g grass, bermuda
h woods, light
i woods, dense
j range, natural

Shallow Concentrated Surface Codes

u unpaved surface
p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	4.8	8
3.4 Initial Abstraction, Ia (in.)	#N/A	#N/A
3.5 Ia/P ratio	#N/A	#N/A
3.6 Unit Peak Discharge, qu (csm/in)	#N/A	#N/A
3.7 Runoff (in.)	0.35	0.00
3.8 Peak Discharge, qp (cfs)	#N/A	#N/A
3.9 Equiv. unit peak discharge (cfs/ac)	#N/A	#N/A

PROJECT:	I-95 Corridor Improvements_T201407404 (CSO)
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

RESOURCE PROTECTION EVENT (RPv) WORKSHEET

	BMP 1		**BMP 2**		**BMP 3**		**BMP 4**		**BMP 5**	
	Type	**0-No BMP**	**Type**	**--**	**Type**	**--**	**Type**	**--**	**Type**	**--**
Step 1 - Calculate Initial RPv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	19.35		19.35		19.35		19.35		19.35	
1.2 Equivalent TR-55 RCN for H&H modeling **before BMP**	92.10		N/A		N/A		N/A		N/A	
1.3 Initial RCN	88.68									
1.4 RPv for Contributing Area (in.)	1.89									
1.5 Req'd RPv Reduction for Contributing Area (in.)	0.43									
1.6 Req'd RPv Reduction for Contributing Area (%)	23%									
1.7 RPv allowable discharge rate (cfs)	1.53									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0									
2.2 Retention reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
2.3 Retention reduction volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.4 Retention reduction volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.5 Runoff volume after retention reduction (in.)	1.89		N/A		N/A		N/A		N/A	
2.6 Adjusted CN*	89.01		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Annual CN (ACN)	88.68		N/A		N/A		N/A		N/A	
3.2 Annual runoff (in.)	26.27		N/A		N/A		N/A		N/A	
3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
3.4 Annual runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.5 Annual runoff after reduction (in.)	26.27		N/A		N/A		N/A		N/A	
3.6 Adjusted ACN	88.68		N/A		N/A		N/A		N/A	
3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate RPv with BMP Reductions										
4.1 RPv runoff volume after all reductions (in.)	1.89		N/A		N/A		N/A		N/A	
4.2 RPv runoff volume after all reductions (cu.ft.)	132,596		N/A		N/A		N/A		N/A	
4.3 Total RPv runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
4.4 Total RPv runoff reduction (%)	100%		N/A		N/A		N/A		N/A	
4.5 Adjusted CN after all reductions*	88.68		N/A		N/A		N/A		N/A	
4.6 Adjusted equivalent annual runoff (in.)	26.27		N/A		N/A		N/A		N/A	
4.7 Equivalent TR-55 RCN for H&H modeling **after BMP**	92.10		N/A		N/A		N/A		N/A	
4.8 Required reduction met?	NO		N/A		N/A		N/A		N/A	
4.9 If required reduction met, reduction credit (cu.ft)	N/A		N/A		N/A		N/A		N/A	
Step 5 - Determine Runoff Reduction Shortfall										
5.1 Runoff Reduction Shortfall (in.)	0.43		N/A		N/A		N/A		N/A	
5.2 Runoff Reduction Shortfall (cu.ft./ac)	1,545		N/A		N/A		N/A		N/A	
5.3 Total Shortfall Volume (cu.ft.)	29,898		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements_T201407404 (CSO)
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LANDUSE TYPE:	
TMDL WATERSHED:	

TOTAL MAXIMUM DAILY LOAD (TMDL) WORKSHEET

	BMP 1				BMP 2				BMP 3				BMP 4				BMP 5			
	Type:	0-No BMP			Type:	--			Type:	--			Type:	--			Type:	--		
Step 1 - Calculate Annual Runoff Volume	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**	**Data**	**TN**	**TP**	**TSS**
1.1 Total contributing area to BMP (ac)	19.35																			
1.2 Initial RCN	89																			
1.3 Annual runoff volume (in.)	26.27																			
1.4 Annual runoff volume (liters)	5.22E+07																			
Step 2 - Calculate Annual Pollutant Load																				
2.1 EMC (mg/L)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
2.2 Load (mg/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
2.3 Stormwater Load (lb/ac/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
Step 3 - Adjust for Pollutant Reduction																				
3.1 BMP annual runoff reduction (%)	0%				N/A				N/A				N/A				N/A			
3.2 Adjusted annual runoff volume (in)	26.27				N/A				N/A				N/A				N/A			
3.3 Adjusted annual runoff volume (liters)	5.22E+07				N/A				N/A				N/A				N/A			
3.4 Adjusted load from annual reductions (lb/ac/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.5 BMP removal efficiency (%)		0%	0%	0%		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.6 Treatment train removal efficiency (%)		0%	0%	0%		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.7 BMP effluent concentration (mg/L)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.8 Final Adjusted load (lb/ac/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
3.9 Final Adjusted load (lb/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
Step 4 - Pollutant Reduction Met? *(For Informational Purposes)*																				
4.1 TMDL (lb/ac/yr)		#N/A	#N/A	#N/A																
4.2 Reduction met?		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
4.3 Removed Load (lb/yr)		#N/A	#N/A	#N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A

PROJECT:	I-95 Corridor Improvements_T201407404 (CSO)
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)
LOCATION (County):	New Castle

CONVEYANCE EVENT (Cv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type:	**0-No BMP**	**Type:**	--	**Type:**	--	**Type:**	--	**Type:**	--
Step 1 - Calculate Initial Cv	**Data**		**Data**		**Data**		**Data**		**Data**	
1.1 Total contributing area to BMP (ac)	19.35		19.35		19.35		19.35		19.35	
1.2 Initial RCN	88.68									
1.3 10-Year Rainfall (in.)	4.8									
1.4 Cv runoff volume (in.)	3.55									
1.5 LOD allowable unit discharge (cfs/ac)	0.75									
1.6 Equiv. unit discharge outside LOD (cfs/ac)	#N/A									
1.7 Cv allowable discharge rate (cfs)	#N/A									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0.00		N/A		N/A		N/A		N/A	
2.2 Storage volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.3 Storage volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.4 Runoff volume after reduction (in.)	3.55		N/A		N/A		N/A		N/A	
2.5 CN*	88.68		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.2 Annual runoff after reduction (in.)	3.55		N/A		N/A		N/A		N/A	
3.3 Adjusted ACN	88.68		N/A		N/A		N/A		N/A	
3.4 Event-based runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate Cv with BMP Reductions										
4.1 Cv runoff volume after all reductions (in.)	3.55		N/A		N/A		N/A		N/A	
4.2 Total Cv runoff reduction (%)	0%		N/A		N/A		N/A		N/A	
4.3 Adjusted RCN for H&H modeling	88.68		N/A		N/A		N/A		N/A	

PROJECT: I-95 Corridor Improvements_T201407404 (CSO)
DRAINAGE SUBAREA ID: Brandywine-Christina (02040205)
LOCATION (County): New Castle

FLOODING EVENT (Fv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type:	0-No BMP	Type:	--	Type:	--	Type:	--	Type:	--
Step 1 - Calculate Initial Fv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	19.35		19.35		19.35		19.35		19.35	
1.2 Initial RCN	88.68									
1.3 100-Year Rainfall (in.)	8.0									
1.4 Fv runoff volume (in.)	6.65									
1.5 LOD allowable unit discharge (cfs/ac)	2.25									
1.6 Equiv. unit discharge outside LOD (cfs/ac)	#N/A									
1.7 Fv allowable discharge rate (cfs)	#N/A									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0.00		N/A		N/A		N/A		N/A	
2.2 Storage volume (ac-ft)	0.00		N/A		N/A		N/A		N/A	
2.3 Storage volume (in.)	0.00		N/A		N/A		N/A		N/A	
2.4 Runoff volume after reduction (in.)	6.65		N/A		N/A		N/A		N/A	
2.5 CN*	88.68		N/A		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Runoff reduction allowance (%)	0%		N/A		N/A		N/A		N/A	
3.2 Annual runoff after reduction (in.)	6.65		N/A		N/A		N/A		N/A	
3.3 Adjusted ACN	88.68		N/A		N/A		N/A		N/A	
3.4 Event-based runoff reduction (in.)	0.00		N/A		N/A		N/A		N/A	
Step 4 - Calculate Fv with BMP Reductions										
4.1 Fv runoff volume after all reductions (in.)	6.65		N/A		N/A		N/A		N/A	
4.2 Total Fv runoff reduction (%)	0%		N/A		N/A		N/A		N/A	
4.3 Adjusted RCN for H&H modeling	88.68		N/A		N/A		N/A		N/A	

PROJECT:	I-95 Corridor Improvements_T201407404 (CSO)		
DRAINAGE SUBAREA ID:	Brandywine-Christina (02040205)		
COUNTY:	New Castle	**UNIT HYDROGRAPH:**	DMV
TMDL Watershed:	0	**LANDUSE:**	0

DURMM OUTPUT WORKSHEET **DURMM v2.00.150802**

Site Data

Contributing Area to BMPs (ac.)	19.35			
C.A. RCN	88.68			
Subarea LOD (ac.)	19.20			
Subarea RCN	89.22			
Upstream Subarea ID				
Upstream Subarea LOD (ac.)	0.00	0.00	0.00	0.00
Combined LOD with Upstream Areas (ac.)	19.20			
Combined RCN with Upstream Areas (ac.)	89.22			
Watershed TMDL-TN (lb/ac/yr)	#N/A			
Watershed TMDL-TP (lb/ac/yr)	#N/A			
Watershed TMDL-TSS (lb/ac/yr)	#N/A			

BMP Data	**BMP 1**	**BMP 2**	**BMP 3**	**BMP 4**	**BMP 5**
	0-No BMP	--	--	--	--
RPv runoff volume after all reductions (in.)	1.89	N/A	N/A	N/A	N/A
Total RPv runoff reduction (in.)	0.00	N/A	N/A	N/A	N/A
Total RPv runoff reduction (%)	100%	N/A	N/A	N/A	N/A
Req'd runoff reduction met?	NO	N/A	N/A	N/A	N/A
RPv Offset Volume (cu. ft.)	29,898	N/A	N/A	N/A	N/A
Adjusted pollutant load, TN (lb/ac/yr)	#N/A	N/A	N/A	N/A	N/A
Adjusted pollutant load, TP (lb/ac/yr)	#N/A	N/A	N/A	N/A	N/A
Adjusted pollutant load, TSS (lb/ac/yr)	#N/A	N/A	N/A	N/A	N/A
Cv runoff volume after all reductions (in.)	3.55	N/A	N/A	N/A	N/A
Fv runoff volume after all reductions (in.)	6.65	N/A	N/A	N/A	N/A

Resource Protection Event (RPV)

RPv for Contributing Area (in.)	1.89	
Annual Runoff for Contributing Area (in.)	26.27	
Req'd RPv Reduction for Contributing Area (in.)	0.43	
Req'd RPv Reduction for Contributing Area (%)	23%	
RPv Runoff Reduction Shortfall or Credit (cu.ft.)	29897.61	SHORTFALL
C.A. allowable discharge rate (cfs)	1.53	
Adjusted CN after all reductions	88.68	
Equivalent RCN for H&H Modeling	92.10	

Conveyance Event (Cv)

Cv runoff volume (in.)	3.55
Stds-based allowable discharge (cfs)	#N/A
Equivalent RCN for H&H Modeling	88.68

Flooding Event (Fv)

Fv runoff volume (in.)	6.65
Stds-based allowable discharge (cfs)	#N/A
Equivalent RCN for H&H Modeling	88.68

Adjusted Subarea Data for Downstream DURMM Modeling

Subarea ID	ne-Christina (02040205)
Contributing Area (ac.)	19.35
C.A. RCN	88.68
LOD Area (ac.)	19.20
Weighted Target Runoff (in.)	1.47
Adjusted CN after all reductions	88.68
Adjusted RPv (in.)	1.89
Adjusted Cv (in.)	3.55
Adjusted Fv (in.)	6.65

Adjusted Subarea Data for Nutrient Protocol Modeling

Contributing Area (ac.)	19.35
LOD Area (ac.)	19.20
TN Pollutant Load (lb/yr)	#N/A
TP Pollutant Load (lb/yr)	#N/A
TSS Pollutant Load (lb/yr)	#N/A
Percent Impervious Cover	74%

Adjusted Subarea Data for the Summary Table for Sub-Areas Draining to a Common Point of Interest

Subarea ID	ne-Christina (02040205)	
Contributing Area (ac.)	19.35	
Runoff Reduction Shortfall or Credit (cu.ft.)	29897.61	SHORTFALL
Adjusted CN after all reductions	88.68	
Cv RCN for H&H Modeling	88.68	
Fv RCN for H&H Modeling	88.68	
TN Pollutant Load (lb/yr)	#N/A	
TP Pollutant Load (lb/yr)	#N/A	
TSS Pollutant Load (lb/yr)	#N/A	

Class	BMP Category	DURMM Variant	TN Reduction	TP Reduction	TSS Reduction	Retention Allowable	Annual Runoff Reduction, RPv, A/B Soil	Annual Runoff Reduction, RPv, C/D Soil	Runoff Reduction, Cv	Runoff Reduction, Fv
No BMP	N/A	0-No BMP	0%	0%	0%	0%	0%	0%	0%	0%
Retention Practice	1.0 Infiltration	1-A Infiltration Trench	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	1.0 Infiltration	1-B Infiltration Basin	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	1.0 Infiltration	1-C Underground Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-A Traditional Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-A Traditional Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-B In-Situ Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-B In-Situ Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-C Streetscape Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-C Streetscape Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-D Engineered Tree Pits - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-D Engineered Tree Pits - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-E Stormwater Planters - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-E Stormwater Planters - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-F Advanced Bioretention - Underdrain	30% Removal Efficiency (+ 100% of Load Reduction)	40% Removal Efficiency (+ 100% of Load Reduction)	80% Removal Efficiency (+ 100% of Load Reduction)	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	2.0 Bioretention	2-F Advanced Bioretention - Infiltration	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-A Porous Asphalt (PA)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-B Pervious Concrete (PC)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-C Permeable Concrete Pavers (PP) & (CP)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	3.0 Permeable Pavement	3-D Plastic & Composite Grid Pavers (GP)	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	100%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Annual Runoff Reduction Practice	4.0 Vegetated Roofs	4-A Extensive Vegetated Roofs	100% of Load Reduction	100% of Load Reduction	0% of Load Reduction	0%	50% Annual RR	0% Annual RR	5% Runoff Reduction	1% Runoff Reduction
Annual Runoff Reduction Practice	4.0 Vegetated Roofs	4-B Intensive Vegetated Roofs	100% of Load Reduction	100% of Load Reduction	0% of Load Reduction	0%	75% Annual RR	0% Annual RR	8% Runoff Reduction	2% Runoff Reduction
Retention Practice	5.0 Rainwater Harvesting	5-A Seasonal Rainwater Harvesting	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	50%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Retention Practice	5.0 Rainwater Harvesting	5-B Continuous Rainwater Harvesting	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	75%	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage	0% of Retention Storage
Annual Runoff Reduction Practice	6.0 Restoration Practices	6-A Step Pool RSCS	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	6.0 Restoration Practices	6-B Seepage Wetland RSCS	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	6.0 Restoration Practices	6-C Streambank Stabilization	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	7.0 Rooftop Disconnection	7-A Rooftop Disconnection	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	25% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	8.0 Vegetated Channels	8-A Bioswale	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	50% Annual RR	25% Annual RR	2% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	8.0 Vegetated Channels	8-B Grassed Channel	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	20% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-A Sheet Flow to Turf Filter Strip	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	25% Annual RR	10% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-A Sheet Flow to Forested Filter Strip	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	40% Annual RR	20% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-B Sheet Flow to Turf Open Space	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	50% Annual RR	20% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Annual Runoff Reduction Practice	9.0 Sheet Flow	9-B Sheet Flow to Forested Open Space	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	65% Annual RR	40% Annual RR	10% of RPv Allowance	1% of RPv Allowance
Stormwater Treatment Practice	10.0 Detention Practices	10-A Dry Detention Pond	5% Removal Efficiency	10% Removal Efficiency	10% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	10.0 Detention Practices	10-B Dry Extended Detention (ED) Pond	20% Removal Efficiency	20% Removal Efficiency	60% Removal Efficiency	0%	10% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	10.0 Detention Practices	10-C Underground Detention Facilities	5% Removal Efficiency	10% Removal Efficiency	10% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-A Non-Structural Sand Filter	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-B Surface Sand Filter	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-C 3-Chamber Underground Sand Filter	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	11.0 Stormwater Filtering Systems	11-D Perimeter Sand Filter (DE Sand Filter)	40% Removal Efficiency	60% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-A Traditional Constructed Wetlands	30% Removal Efficiency	40% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-B Wetland Swales	20% Removal Efficiency (+ 100% of Load Reduction)	30% Removal Efficiency (+ 100% of Load Reduction)	60% Removal Efficiency (+ 100% of Load Reduction)	0%	15% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-C Ephemeral Constructed Wetlands	20% Removal Efficiency (+ 100% of Load Reduction)	30% Removal Efficiency (+ 100% of Load Reduction)	60% Removal Efficiency (+ 100% of Load Reduction)	0%	40% Annual RR	10% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	12.0 Wetlands	12-D Submerged Gravel Wetlands	0% Removal Efficiency	0% Removal Efficiency	0% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	13.0 Wet Pond	13-A Wet Pond	20% Removal Efficiency	45% Removal Efficiency	60% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	13.0 Wet Pond	13-B Wet Extended Detention (ED) Pond	20% Removal Efficiency	45% Removal Efficiency	60% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-A Compost Amended Soil - HSG A	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	38% Annual RR	0% Annual RR	4% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-B Compost Amended Soil - HSG B	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	50% Annual RR	0% Annual RR	5% Runoff Reduction	1% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-C Compost Amended Soil - HSG C	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	29% Annual RR	3% Runoff Reduction	0% Runoff Reduction
Annual Runoff Reduction Practice	14.0 Soil Amendments	14-D Compost Amended Soil - HSG D	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	13% Annual RR	1% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	15.0 Proprietary Practices	15-A Hydrodynamic Structures	5% Removal Efficiency	10% Removal Efficiency	10% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	16.0 Source Controls	16-A Nutrient Management	17% Removal Efficiency	22% Removal Efficiency	0% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction
Stormwater Treatment Practice	16.0 Source Controls	16-B Street Sweeping	3% Removal Efficiency	3% Removal Efficiency	9% Removal Efficiency	0%	0% Annual RR	0% Annual RR	0% Runoff Reduction	0% Runoff Reduction

Summary Table for Sub-Areas Draining to a Common Point of Interest (POI)(1)

POI: ______________________________

Ref. #	Sub-Area ID(2)	Contributing Area (ac)	RPv Runoff Reduction Shortfall(+) or Credit(-) (cu.ft.)(3)	Adjusted RPv CN after all reductions(4)	Cv RCN for H&H Modeling(4)	Fv RCN for H&H Modeling(4)	TN Pollutant Load (lb/yr)	TP Pollutant Load (lb/yr)	TSS Pollutant Load (lb/yr)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
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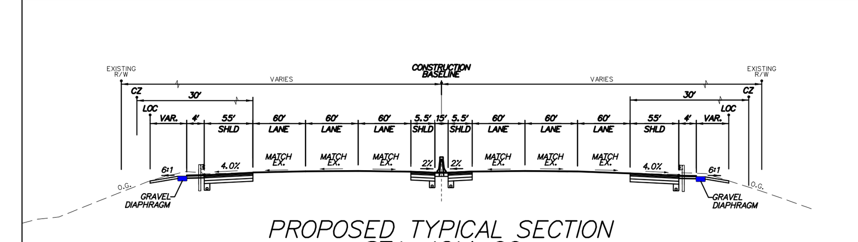
29									
30									
Totals to Common POI		**0.00 ac**	**0 cu.ft.**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**0.00 lb/yr**	**0.00 lb/yr**	**0.00 lb/yr**
RPv Runoff Reduction Goal Met?			**YES**						
If Not, Total Offset Volume Required			**N/A**						

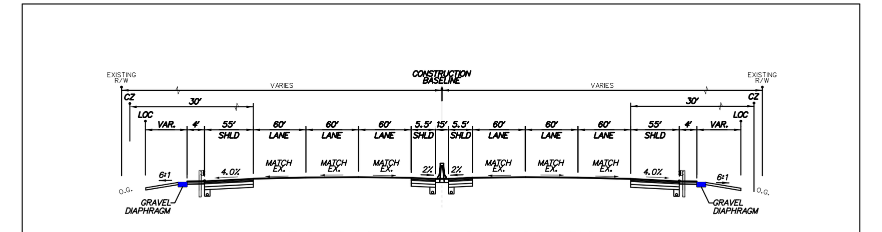
Notes:

1. As long as the site lies within the same watershed, all sub-areas within the site can be tallied to reflect global site conditions; or, the summary table can be used to show conditions to a specific POI.
2. Only the most downstream sub-area information should be entered for a series of sub-areas that drain directly into each other, as the upstream areas will already be accounted for in the DURMM computations.
3. A RPv runoff reduction shortfall should be entered as a positive number, as it is the runoff volume still needed to be reduced. A RPv credit should be entered as a negative number, as it indicates the additional volume that was reduced past the requirement.
4. To portray an accurate total weighted CN value for the RPv, Cv and Fv events, an entry must be made for every defined sub-area. If a sub-area's contributing drainage acreage is entered, but not its corresponding CN value, then the total weighted CN will be skewed.

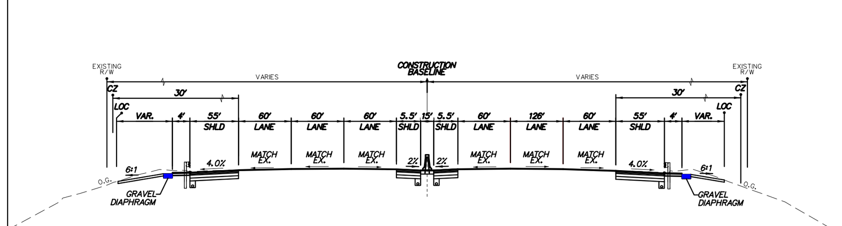
95 Wilmington Corridor Rehabilitation



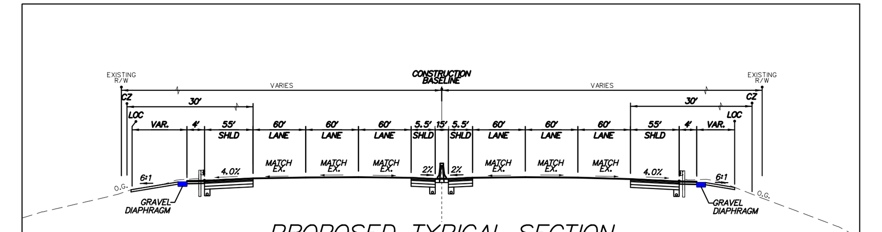
PROPOSED TYPICAL SECTION
STA. 1214+00



PROPOSED TYPICAL SECTION
STA. 1225+00



PROPOSED TYPICAL SECTION
STA. 1235+00



PROPOSED TYPICAL SECTION
STA. 1255+00

PROPOSED TYPICAL SECTION
STA. 1320+00 TO STA. 1360+00

LEGEND	
	WETLANDS
	WATERS OF THE US
--- LOC ---	LIMIT OF CONSTRUCTION
— LOD — LOD	LIMIT OF DISTURBANCE
	PROPOSED CONSTRUCTION
	EXISTING STORMDRAIN SYSTEM
	SOILS BOUNDARY
	POI BOUNDARY
	CONTRACT BREAKLINE

DELAWARE
DEPARTMENT OF TRANSPORTATION

REHABILITATION OF I-95
FROM I-495 TO NORTH OF
BRANDYWINE RIVER BRIDGE

SWM CONCURRENCE
MEETING 1
JULY 11, 2017