

Delaware Urban Runoff Management Model

DURMM v2.5

Quick-Start Guide

Introduction

This Quick-Start Guide has been developed as an overview of the basic use of the 2nd version of the Delaware Urban Runoff Management Model (DURMM). It is not intended to serve as a detailed description of each cell in the spreadsheet or the algorithms used in those cells. The Quick-Start Guide first describes the general workflow and data input, then continues with two examples illustrating typical uses of the model to meet the requirements of the 2019 Delaware Sediment & Stormwater Regulations (DSSR).

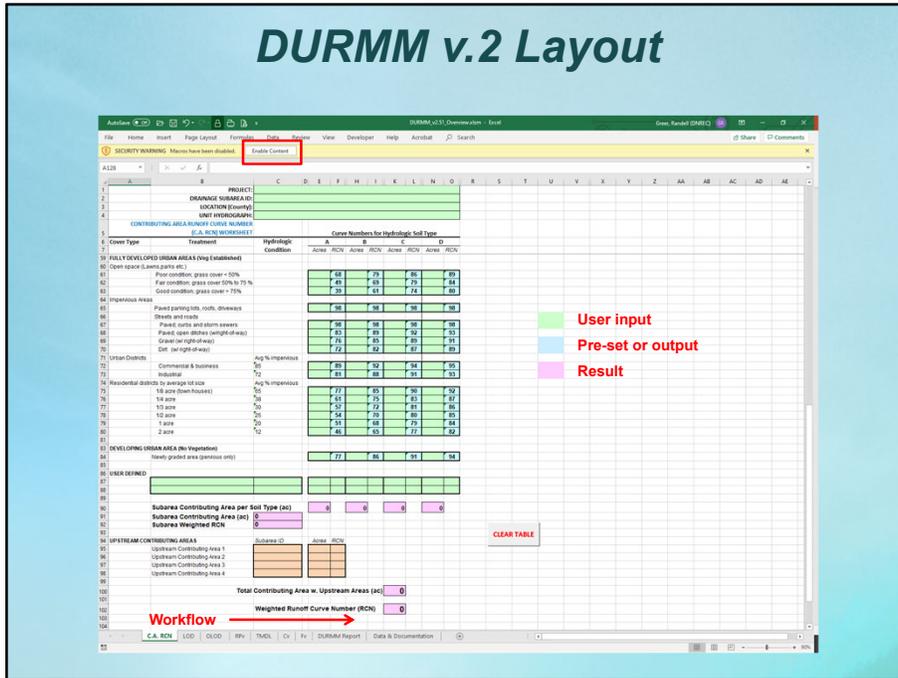
Users should always make sure they're using the latest version of DURMM v2.5, which is available for download from the Sediment & Stormwater Program website under the "Engineering Resources" header:

<http://www.dnrec.delaware.gov/swc/Pages/SedimentStormwater.aspx>

Hovering over the download link will show the version number. This should match the version as shown at the top of the "Report" tab of the downloaded Excel spreadsheet. This Quick-Start Guide was created using DURMM v2.51.200409.



DURMM v.2 Layout



Layout

DURMM v.2.5 was developed using Microsoft's Excel 2016 spreadsheet program. However, it should be compatible with any version back to Excel 97. There are several macros that allow clearing and resetting some of the user input cells, however these are not absolutely necessary for the model to function properly. Upon initial use of the model, the user will be prompted to allow the use of the macros. Enabling macros varies depending on the version of Excel being used.

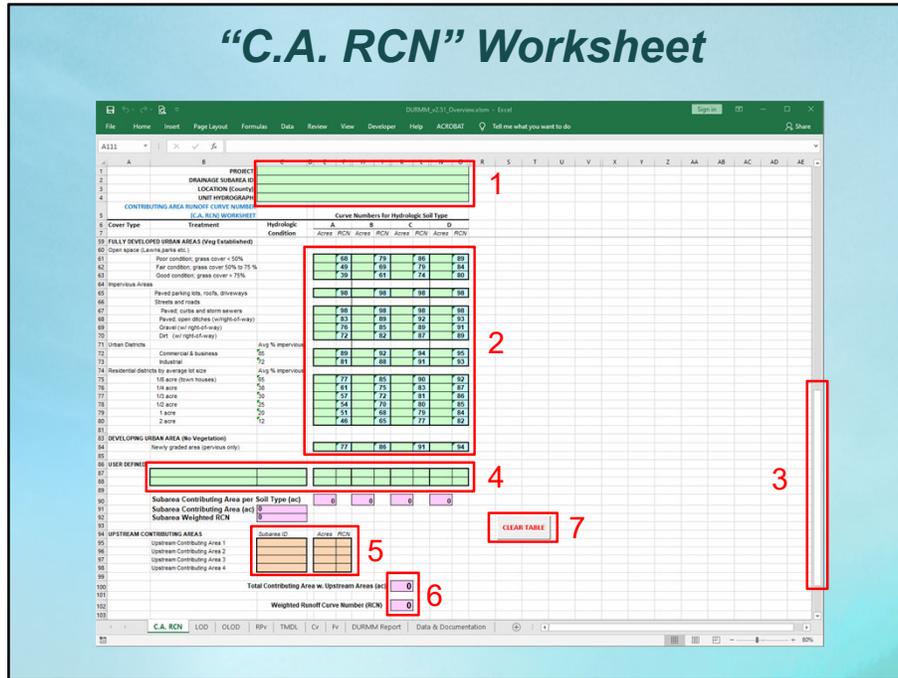
The model itself consists of 8 worksheets. The general workflow proceeds from one worksheet to the next in a left-to-right direction. The cells within each worksheet are color-coded, as follows:

- Green Cells – cells intended for user input
- Cyan Cells – cells that contain either pre-set values or secondary output
- Magenta Cells - cells that contain calculated results for primary output



The next series of slides describe each of the 8 worksheets included in the model and some of the important elements contained in that sheet.

“C.A. RCN” Worksheet

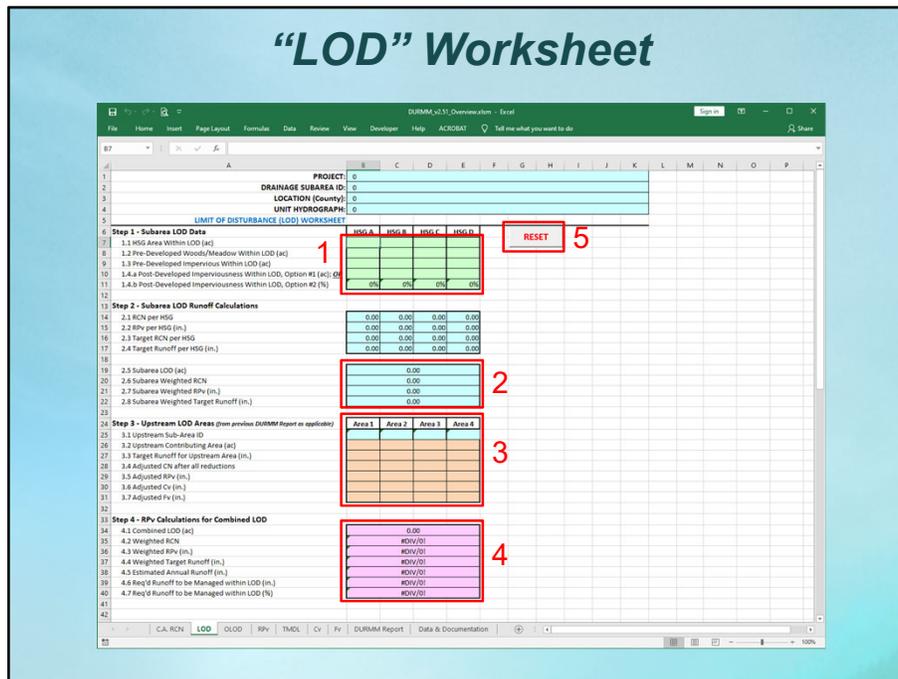


“C. A. RCN” Worksheet

The “C. A. RCN” worksheet is used to determine the weighted Runoff Curve Number (RCN) for the entire contributing area under analysis. Key elements of this worksheet include:

1. Project Data: Project name and subarea ID are entered in the green cells provided. The county location and unit hydrograph are then selected from their respective dropdown lists. This information will be carried over to other worksheets without the need for additional user input.
2. Land Cover Data: Acres of land cover by Hydrologic Soil Group (HSG) and hydrologic condition within the contributing area are entered in the green cells. The table is set up similar to the standard RCN tables in TR-55. The “User defined urban” cells can be used to enter RCN values not included in the standard table, with prior approval.
3. The default setting for this worksheet opens to the urban land cover data. However, the scroll button can be used to scroll up to other land cover descriptions as used in TR-55.
4. User Defined: The spreadsheet includes two (2) lines for user defined land cover, hydrologic condition, acreage and RCN.
5. Upstream Contributing Areas: The ID, acreage and RCN for up to four (4) previously analyzed upstream areas within the total contributing area can be entered by the user.
6. Total acreage and weighted RCN of the total contributing area are computed and reported in their respective fields.
7. The “Clear Table” button can be used to clear all user supplied data from the worksheet and reset any user-defined values.

NOTE: Acreage values should be entered to no more than two (2) decimal places. A popup warning to this effect will appear if a user tries to enter values greater than 2 decimal places.



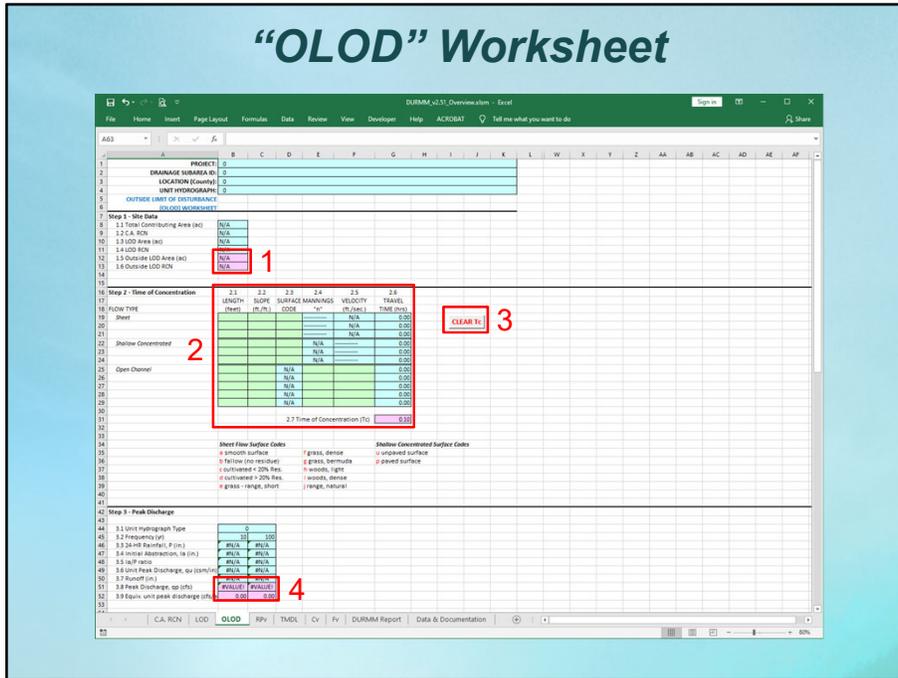
“LOD” Worksheet

This worksheet is used to determine the runoff reduction requirement within the proposed limit of disturbance of the drainage subarea. Since the DSSR only require management of disturbed areas, this may or may not coincide with the total contributing area that drains to the BMPs within that subarea. Key elements of this worksheet include:

1. Total LOD acreage by HSG is entered in the first row of green cells. Acreage of any pre-developed woods/meadow within the LOD is entered in the next row. Post-developed imperviousness is then entered as either an acreage or as a percentage in the respective cells provided. **(NOTE: Entering imperviousness as a percentage will over-write a formula in those cells. See #5 below.)**
2. The subarea Rpv runoff and target runoff is calculated in this section.
3. Data from up to four (4) previously analyzed upstream subareas are entered in this section. Data is taken from the appropriate DURMM reports for those subareas.
4. A weighted runoff volume for the Resource Protection Event is calculated based on the data entered above along with an estimate of the annual runoff volume. The required runoff reduction based on a “0% Effective Imperviousness” criterion is then calculated in watershed inches and percent reduction.
5. The “RESET” button clears any user input data and resets the formulas used in the imperviousness cells.

NOTE: Acreage values should be entered to no more than two (2) decimal places. A popup warning to this effect will appear if a user tries to enter values greater than 2 decimal places.

“OLOD” Worksheet



“OLOD” Worksheet

This worksheet is used to account for runoff that is outside the LOD, but within the total contributing area of the BMP drainage subarea. If the total contributing area and the LOD coincide, this worksheet may be skipped. Key elements on this sheet include:

1. Data entered previously for the “C.A. RCN” and “LOD” worksheets are used to calculate the area outside the LOD and the RCN for that area.
2. Data used to determine the time of concentration for the area outside the LOD is entered in the green cells. There are allowances for 3 sheet flow, 3 shallow concentrated flow and 5 open channel flow segments. (NOTE: The user must supply an estimated velocity for the channel flow segments; it is not calculated within the model.) The total time of concentration for the area outside the LOD is calculated in the magenta cell.
3. The “Clear Tc” button can be used to clear any user input for the Time of Concentration calculation.
4. The peak discharge for the Conveyance Event and the Flooding Event are calculated in their respective magenta cells.

“RPV” Worksheet

“RPV” Worksheet

This worksheet is used to calculate the runoff reduction for the selected BMP suite and check for compliance for the Resource Protection Event. Key elements on this sheet include:

1. User selects a BMP from the dropdown list. BMP 1 would represent the most upstream BMP if a treatment train is proposed. Numbering then proceeds downstream for subsequent BMPs.
2. The model adjusts the runoff reduction requirement for the LOD to the total contributing area. It also checks to ensure any weighted adjustment is no less than the requirement for the LOD itself. The required reduction is calculated in both watershed inches and as a percentage.
3. If the BMP selected has a retention storage component, the available storage in cubic feet is entered in the green cell.
4. If the BMP selected has an annual runoff reduction component, the proportion of the BMP footprint in soils in HSG A/B is entered in the green cell and the appropriate runoff reduction value is entered by the model.
5. The model calculates the retention reduction and/or the annual runoff reduction and checks to see if the required reduction has been met.
6. If the required runoff reduction is not met, the model calculates the residual runoff volume that must be managed using detention or other means, such as an on-site credit or off-site offset.
7. If the residual volume will be managed using a detention practice, these cells contain the calculated average and maximum discharge rates to be used for design and compliance.
8. The “RESET” button can be used to clear user input data from the worksheet to model a different BMP suite.

“TMDL” Worksheet

“TMDL” Worksheet

This worksheet is used to calculate the Total Maximum Daily Load (TMDL). Although compliance is not currently based specific TMDL targets, the Department is collecting this data to assess attainment of overall watershed TMDL goals. The BMP suite selected on the Rpv worksheet is carried over to this sheet, precluding the need to input any BMP data. Key elements on this sheet include:

1. The user selects the appropriate TMDL watershed from the dropdown list.
2. The model calculates the total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) annual pollutant load in milligrams and pounds based on the runoff volume calculated previously and the Event Mean Concentrations (EMCs) provided in the model.
3. The adjusted runoff volume is carried over from the Rpv worksheet.
4. Load reduction is calculated based on the input loads and adjusted runoff reduction. Additional adjustment is calculated for removal efficiency.
5. The model checks to determine if the pollutant reduction goal for the TMDL watershed has been met and calculates a final adjusted annual load for TN, TP and TSS for reporting purposes.

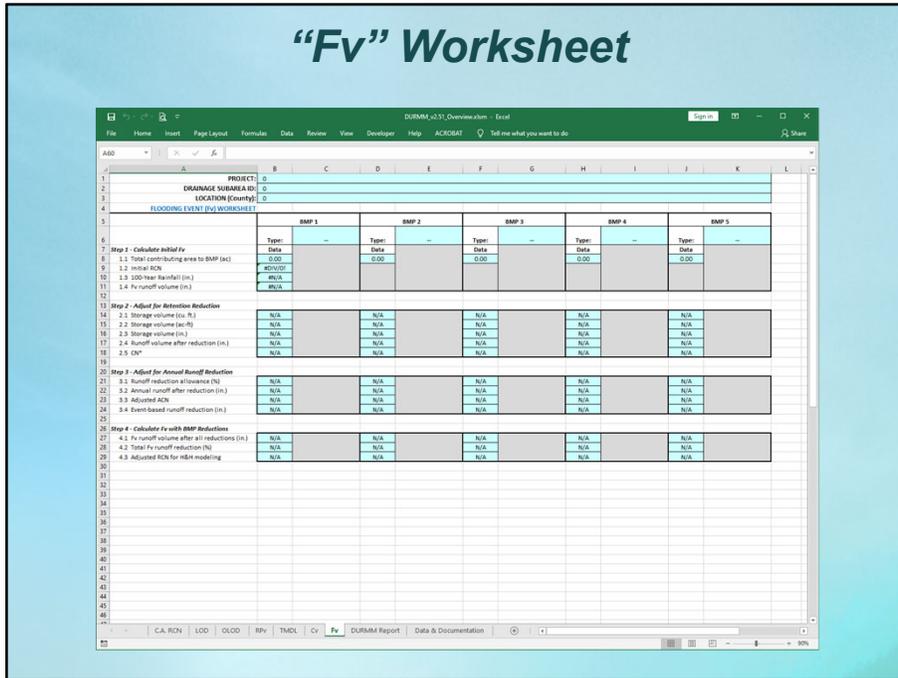
“Cv” Worksheet

CONVEYANCE EVENT (Cv) WORKSHEET		BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
Step 1 - Calculate initial Cv						
1.1	Total contributing area to BMP (ac)	0.00	0.00	0.00	0.00	0.00
1.2	Initial CN	N/A	N/A	N/A	N/A	N/A
1.3	10-Year Rainfall (in.)	N/A	N/A	N/A	N/A	N/A
1.4	Cv runoff volume (in.)	N/A	N/A	N/A	N/A	N/A
Step 2 - Adjust for Retention Reduction						
2.1	Storage volume (cu ft)	N/A	N/A	N/A	N/A	N/A
2.2	Storage volume (ac-ft)	N/A	N/A	N/A	N/A	N/A
2.3	Storage volume (in.)	N/A	N/A	N/A	N/A	N/A
2.4	Runoff volume after reduction (in.)	N/A	N/A	N/A	N/A	N/A
2.5	CN*	N/A	N/A	N/A	N/A	N/A
Step 3 - Adjust for Annual Runoff Reduction						
3.1	Runoff reduction efficiency (%)	N/A	N/A	N/A	N/A	N/A
3.2	Annual runoff after reduction (in.)	N/A	N/A	N/A	N/A	N/A
3.3	Adjusted ACN	N/A	N/A	N/A	N/A	N/A
3.4	Event-based runoff reduction (in.)	N/A	N/A	N/A	N/A	N/A
Step 4 - Calculate Cv with BMP reductions						
4.1	Cv runoff volume after all reductions (in.)	N/A	N/A	N/A	N/A	N/A
4.2	Total Cv runoff reduction (%)	N/A	N/A	N/A	N/A	N/A
4.3	Adjusted RCR for RCR modeling	N/A	N/A	N/A	N/A	N/A

“Cv” Worksheet

This worksheet calculates the effect of runoff reduction practices for the Conveyance (10-YR) Event. The BMP suite selected on the Rpv worksheet is carried over to this sheet, precluding the need to input any BMP data. All other cells are calculated based on data entry and results from previous worksheets. Reductions based on available storage are given full credit. However, the adjustments for runoff reduction BMPs are lower than those for the Resource Protection Event since they are less able to mitigate runoff from a storm of this magnitude.

“Fv” Worksheet



“Fv” Worksheet

This worksheet calculates the effect of runoff reduction practices for the Flooding (100-YR) Event. The BMP suite selected on the Rpv worksheet is carried over to this sheet, precluding the need to input any BMP data. All other cells are calculated based on data entry and results from previous worksheets. Reductions based on available storage are given full credit. However, the adjustments for runoff reduction BMPs are even lower than those for the Conveyance Event since they have minimal ability to mitigate runoff from a storm of this magnitude.

“DURMM Report” Worksheet

Row	Field	Value
1	PROJECT	
2	DRAINAGE SUBAREA ID	
3	COUNTY	
4	TMDL Watershed	
5	VERSION	DURMM v2.5.yymmdd
7	Contributing Area to BMPs (ac.)	0.00
8	C.A. RCN	0.00
9	Subarea LOD (ac.)	0.00
10	Subarea RCN	0.00
11	Upstream Subarea ID	N/A
12	Upstream Subarea LOD (ac.)	0.00
13	Combined LOD with Upstream Areas (ac.)	0.00
14	Combined RCN with Upstream Areas (ac.)	0.00
15	Watershed TMDL TP (lb/acyr)	N/A
16	Watershed TMDL TP (lb/acyr)	N/A
17	Watershed TMDL TSS (lb/acyr)	N/A
19	BMP Data	
20		
21		
22	Rp runoff volume after all reductions (in.)	N/A
23	Total Rp runoff reduction (in.)	N/A
24	Total Rp runoff reduction (%)	N/A
25	Rp Compliance Met Through Runoff Reduction?	N/A
26	Rp Residual Volume (cu. ft.)	N/A
27	Adjusted pollutant load, TN (lb/acyr)	N/A
28	Adjusted pollutant load, TP (lb/acyr)	N/A
29	Adjusted pollutant load, TSS (lb/acyr)	N/A
30	Cu runoff volume after all reductions (in.)	N/A
31	Fp runoff volume after all reductions (in.)	N/A
34	Resource Protection Event (RPE)	
35	RPE for Contributing Area (in.)	0.00
36	Annual Runoff for Contributing Area (in.)	0.00
37	RPE to be Managed for Contributing Area (in.)	0.00
38	RPE to be Managed for Contributing Area (%)	0.00
39	RPE Management Required (cu. ft.)	0
40	RPE Management Provided (cu. ft.)	0
41	RPE Residual Volume (cu. ft.)	0
42	C.A. RPE avg. discharge rate (cfs)	0.00
43	C.A. RPE max. discharge rate (cfs)	0.00
44	TN Pollutant Load (lb/yr)	0.00
45	TP Pollutant Load (lb/yr)	0.00
46	TSS Pollutant Load (lb/yr)	0

“DURMM Report” Worksheet

This worksheet summarizes the results from the previous worksheets in a format suitable for submission with the project application package. The information is largely self-explanatory. However, some key elements include:

1. Summary of BMP suite selected.
2. Determination of compliance with runoff reduction requirements and any residual volume to be managed with detention or other means.
3. Determination of final annual pollutant loads.
4. Summary of results for the RPE event.

The remaining sections of the DURMM Report worksheet are continued on the next slide.

NOTE: The DURMM version is shown in the header of the report using the format:

DURMM v2.5#.yyymmdd

The most current version of DURMM v2.5 should always be used for submission.

“DURMM Report” Worksheet (cont.)

Row	Label	Value	Annotation
48	Cv runoff volume (in.)	0.00	5
49	Adjusted RCN for nRn Modeling (CN*)	0.00	
52	Fv runoff volume (in.)	0.00	6
53	Equipment RCN for nRn Modeling (CN*)	0.00	
56	Adjusted Subarea Data for Downstream DURMM Modeling		
57	Subarea ID	0.00	
58	Contributing Area (ac)	0.00	
59	Weighted Target Runoff (in.)	0.00	6
60	Adjusted Cv after all reductions	0.00	
61	Adjusted RPN (in.)	0.00	
62	Adjusted Cv (in.)	0.00	
63	Adjusted Fv (in.)	0.00	
64			
65	Adjusted Subarea Data for Nutrient Protocol Modeling		
66	Contributing Area (ac)	0.00	
67	LOD Area (ac)	0.00	
68	TN Pollutant Load (lb/yr)	0.00	6
69	TP Pollutant Load (lb/yr)	0.00	
70	TSS Pollutant Load (lb/yr)	0.00	
71	Percent impervious cover	0.00	
72			
73	Adjusted Subarea Data for the Summary Table for Sub-Areas Subject to a Common Point of Interest		
74	Subarea ID	0.00	
75	Contributing Area (ac)	0.00	
76	RPN Residual Volume (in.)	0.00	
77	Adjusted Cv after all reductions	0.00	6
78	Cv RCN for nRn Modeling	0.00	
79	Fv RCN for nRn Modeling	0.00	
80	TN Pollutant Load (lb/yr)	0.00	
81	TP Pollutant Load (lb/yr)	0.00	
82	TSS Pollutant Load (lb/yr)	0.00	

“DURMM Report” Worksheet (cont.)

The information in the remaining sections is largely self-explanatory. However, some key elements include:

1. Summary of BMP suite selected.
2. Determination of compliance with runoff reduction requirements.
3. Determination of compliance with pollutant reduction requirements.
4. Offset requirements.
5. Runoff reduction adjustments to the RCN for the Resource Protection, Conveyance, and Flooding events that can be used for hydrologic and hydraulic modeling for more complex situations.

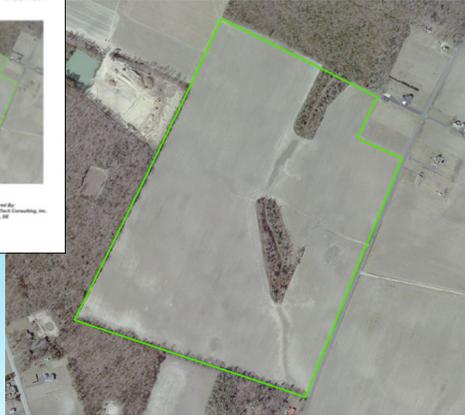
The report allows a reviewer to quickly determine if the runoff reduction and pollutant reduction requirements have been met. If these requirements could not be satisfied due to site constraints or other justifiable technical reasons, the site would be subject to the offset provisions of the DSSR.



Example #1: Concept Level Analysis

The procedures outlined in the previous section will now be used to perform a typical concept level analysis for a fictional land development project named “Broadkill Estates”. For the purposes of this example, a concept level analysis assumes an artificial watershed boundary that coincides with the parcel boundary.

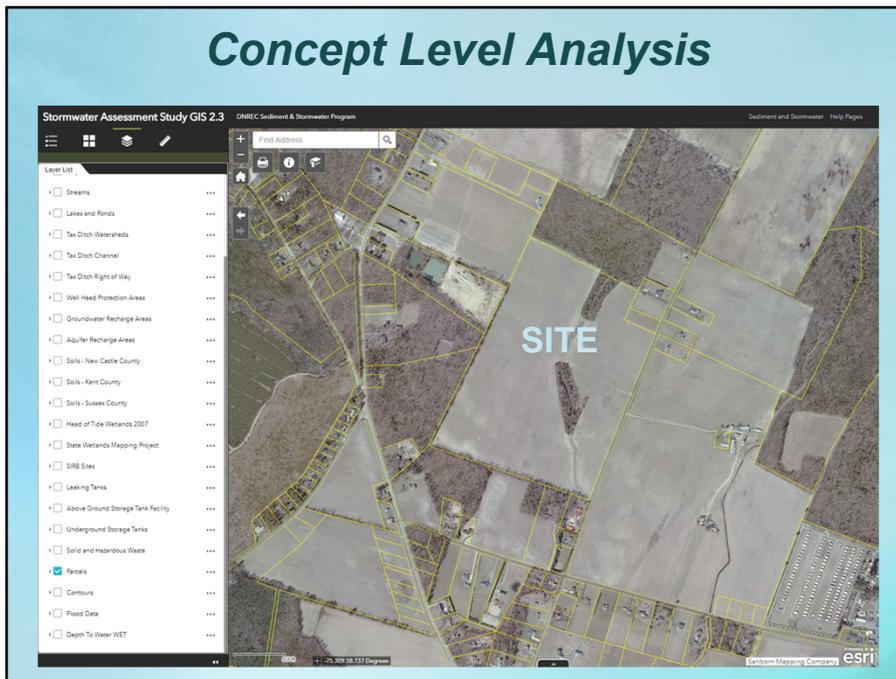
Concept Level Analysis



Data Sources

The information compiled for the Stormwater Assessment Study (SAS) will provide the necessary data inputs for the analysis.

Concept Level Analysis

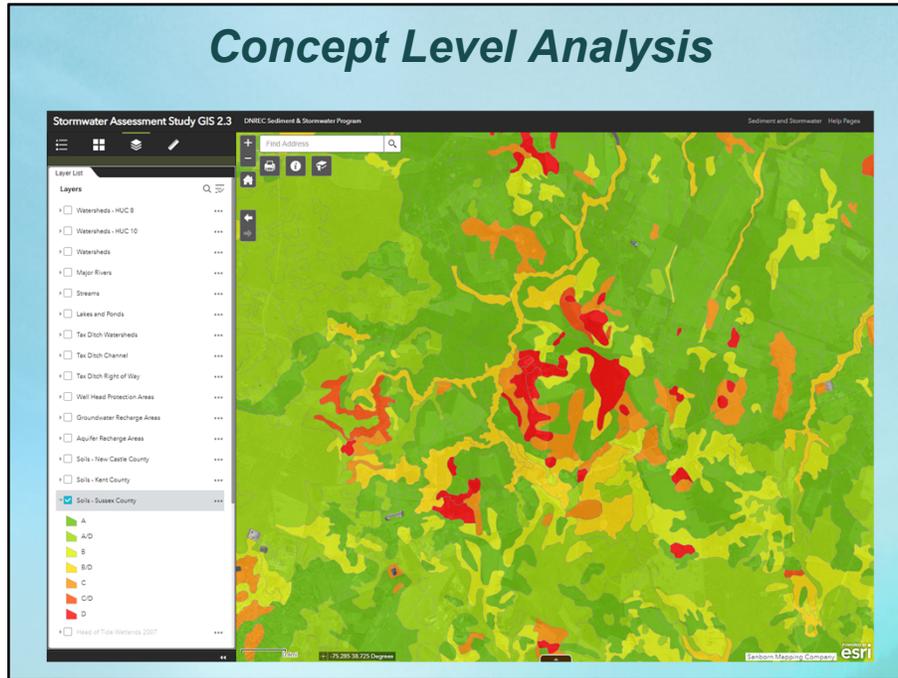


Site GIS Data

The Stormwater Assessment Study GIS App is an on-line GIS tool that can be used for collecting data necessary to perform the DURMM analysis. The SAS GIS App is available at the following link:

<https://firstmap.delaware.gov/sasgis>

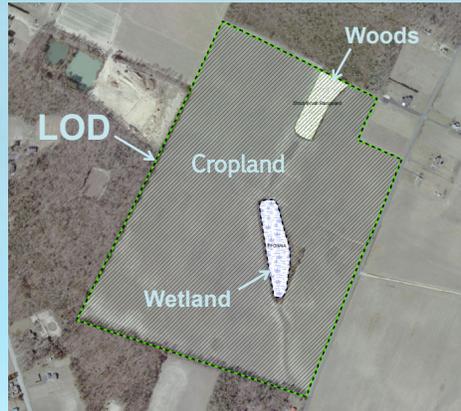
Concept Level Analysis



Soils Data

The Soils layer contains information on Hydrologic Soil Group (HSG) of the various soils on the site that is used by the model to determine runoff volume.

Concept Level Analysis



Proposed LU: Residential, 1 ac. lots

Existing and Proposed Conditions

The majority of the site consists of existing cropland. A small tributary bisects the site into two major drainage subareas. Although the tributary has been partially piped to facilitate cultivation, a small wetland area is located near the center of the site. There is also a small area of scrub/shrub forest at the downstream discharge point of the site.

“Broadkill Estates” has been proposed as a single-family residential site with an average lot size of 1 acre. For purposes of the concept level analysis, the Limit of Disturbance (LOD) has been assumed to coincide with the parcel boundary, except for the wetland area which will remain undisturbed.

Concept Level Analysis Site Data



- C.A. RCN Tab
 - Residential, 1-ac. (20% imperv.)
 - HSG A: 70.07 ac.
 - HSG B: 17.10 ac.
 - HSG C: 15.56 ac.

Data Inputs – “C.A. RCN” Worksheet

The slide above summarizes the data that will be input to the “C.A. RCN” worksheet.

Concept Level Analysis Site Data



- LOD Tab
 - HSG A
 - LOD Area: 70.07 ac.
 - Pre-Dev. Woods: 1.55 ac.
 - Post-Dev. Impervious: 20%
 - HSG B
 - LOD area: 17.10 ac.
 - Pre-Dev. Woods: 0.80 ac.
 - Post-Dev. Impervious: 20%
 - HSG C
 - LOD Area: 15.56 ac.
 - Pre-Dev. Woods: 0 ac.
 - Post-Dev. Impervious: 20%

Data Inputs – “LOD” Worksheet

The slide above summarizes the data that will be input to the “LOD” worksheet. Since the analysis assumes an artificial watershed boundary that coincides with the parcel boundary and LOD, the “OLOD” worksheet is not needed in this case.

“C.A. RCN” Worksheet

The screenshot shows an Excel spreadsheet with the following data sections:

- Project Information:** PROJECT: Estates, DRAINAGE SUBAREA: 01, LOCATION (county): Sussex, DIST HYDROGRAPH: 0155.
- Contributing Area Runoff Curve Number:** A table with columns for Cover Type, Treatment, Hydrologic Condition, and Curve Numbers for Hydrologic Soil Type (A, B, C, D).
- Fully Developed Urban Areas (Veg Established):** Includes categories like Open space (Lawns, parks, etc.), Roof conditions (grass cover < 50%, Fair condition, grass cover 50% to 75 %, Good condition, grass cover > 75 %), Impervious Areas (Paved parking lots, roofs, driveways, Streets and roads, Paved, sidewalks and storm sewers, Paved, open ditches (right-of-way), Ditches (on right-of-way), Det. (w/ right-of-way)), and Urban Districts (Commercial & business, Industrial, Residential districts by average lot size).
- Developing Urban Area (No Vegetation):** Newly graded area (pervious only).
- User Defined:** A section for user-defined areas.
- Summary Totals:**
 - Subarea Contributing Area per Soil Type (ac): 79.87, 17.1, 55.56, 0
 - Subarea Contributing Area (ac): 102.73
 - Subarea Weighted RCN: 58
 - Total Contributing Area w. Upstream Areas (ac): 103
 - Weighted Runoff Curve Number (RCN): 58

“C.A. RCN” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. Acreage values should be entered to no more than two (2) decimal places, otherwise a popup error message will appear. The model has calculated the following results:

- Total Acreage: 103
- Weighted RCN: 58

In keeping with NRCS tradition, results for the RCN are reported in rounded whole numbers on this worksheet even though the internal calculations are performed at the standard level of precision used in Excel.

“LOD” Worksheet

LOD Data	HSG A	HSG B	HSG C	HSG D
7 HSG Area Within LOD (ac)	36.07	17.1	33.56	
8 Pre-Developed Impervious/Nonsoil Within LOD (ac)	2.35	0.0		
9 Post-Developed Imperviousness Within LOD				
10 Option K1 (ac) - 0%				
11 Option K2 (%)	20%	20%	20%	0%
13 Runoff Calculations				
14 RCN per HSG	50.80	48.40	36.80	0.00
15 RPV (in.)	0.70	0.80	1.10	0.00
16 Target (in.)	0.00	0.00	1.10	0.00
17 Cv Weighted Unit Discharge (ft/ac)	0.71	0.71	0.75	0.00
18 Pv Weighted Unit Discharge (ft/ac)	2.21	2.20	2.25	0.00
21 Total Subarea LOD (ac)			102.73	
22 Weighted LOD RCN			57.97	
24 RPV Runoff Reduction				0.61
25 Weighted Runoff (in.)				5.93
26 Estimated Annual Runoff (in.)				0.21
27 Required Runoff Reduction within LOD (in.)				0.21
28 Required Runoff Reduction within LOD (%)				34%
30 Cv Unit Discharge				0.70
31 LOD Allowable Unit Discharge (ft/ac)				2.20
33 Pv Unit Discharge				2.20
34 LOD Allowable Unit Discharge (ft/ac)				2.20

“LOD” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. Again, acreage values should be entered to no more than two (2) decimal places to avoid a popup error message. The model has calculated the following results:

- Total LOD Area: 102.73
- Weighted LOD RCN: 57.97
- Weighted RPV runoff volume: 0.61”
- Estimated annual runoff: 5.93”
- Required runoff reduction: 0.21” (34%)

The results on this sheet are carried out to 2 decimal places. In some cases, the user may detect a slight discrepancy between the computed RCN on the “LOD” worksheet and the previous “C.A. RCN” worksheet if the typical TR-55 land use descriptions were used on the “C.A. RCN” worksheet. This is the result of rounding of impervious area when the typical land use descriptions are used. If the user wishes better agreement between these worksheets, impervious and pervious (open space) acreages should be entered directly on the “C.A. RCN” worksheet. In either case, the results from the “LOD” worksheet are used for all subsequent worksheet calculations.

“RPV” Worksheet

	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
Step 1 - Calculator Initial RPV					
1.1 Total contributing area to BMP (sq)	131.72				
1.2 Initial RCV	57.97				
1.3 RPV for Contributing Area (in)	0.61				
1.4 Req'd RPV to be Managed for Contributing Area (in)	0.21				
1.5 Req'd RPV to be Managed for Contributing Area (%)	34%				
Step 2 - Adjust for Retention Reduction					
2.1 Retention volume provided (cu. ft.)	34015				
2.2 Retention reduction allowance (%)	20%				
2.3 Retention reduction volume (cu. ft.)	6803				
2.4 Retention reduction volume (in)	0.00				
2.5 Runoff volume after retention reduction (in)	0.61				
2.6 Adjusted CR*	50.52				
Step 3 - Adjust for Annual Runoff Reduction					
3.1 Annual CR (CU)	57.97	54.87			
3.2 Annual runoff (in)	5.95	4.89			
3.3 Proportion A/R ratio in BMP footprint (%)	29%	29%			
3.4 Annual runoff reduction allowance (%)	28%	28%			
3.5 Annual runoff reduction (in)	1.69	1.37			
3.6 Adjusted CR	54.87	54.87			
3.7 Annual Runoff Reduction Allowance for RPV (in)	0.12	0.21			
Step 4 - Calculator RPV with BMP Reductions					
4.1 RPV Runoff Management Provided (cu. ft.)	43277	77252			
4.2 RPV runoff volume after all reductions (in)	0.50	0.51			
4.3 RPV runoff volume after all reductions (cu. ft.)	59,804	131,792			
4.4 Total RPV runoff reduction (in)	0.12	0.11			
4.5 Total RPV runoff reduction (%)	19%	18%			
4.6 Adjusted to after all reductions	0.39	0.39			
4.7 Adjusted equivalent annual runoff (in)	4.88	1.67			
4.8 RPV compliance met through runoff reduction?	NO	YES			
4.9 Runoff Reduction Credit, if Applicable (cu. ft.)	N/A	0.12			
Step 5 - Determine Residual Volume to be Managed or Offset					
5.1 RPV Residual Volume (in)	0.00	N/A			
5.2 RPV Residual Volume (cu. ft.)	0.00	N/A			
5.3 Residual Volume to be Managed or Offset (cu. ft.)	0.00	N/A			
5.4 RPV mg. discharge rate for 48-hr detention (cfs)	0.007	N/A			
5.5 RPV max. discharge rate for 48-hr detention (cfs)	0.084	N/A			

“RPV” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. The designer has selected a BMP treatment train consisting of grassed channels for all rooftops and roadways draining to infiltrating bioretention. It is estimated approximately 75% of the grass channels will be located in soils with Hydrologic Soil Group (HSG) A or B. The model has calculated the following results:

- RPV for total contributing area: 0.61”
- Reduction after BMP 1: 0.12” (19%)
- Reduction after BMP 2: 0.21” (34%)

Annualized runoff reductions are used for BMPs that do not have a storage component, such as the grassed channels used in this example. Since infiltration BMPs will store and retain all the captured runoff, their reduction values are based on their storage capacity. A “NO” in the magenta cells of Step 4 indicate additional runoff reduction is required in order to comply with the RPV. A “YES” in the magenta cells indicates the required reduction has been met. The reduction allowances for the BMP suite should be considered representative of the subarea as a whole rather than a strict hydraulic routing from one BMP to the next. This will need to be verified by the design level analysis. Any residual runoff subject to additional management or an offset for the RPV is calculated in Step 5 and shown in the magenta cells. Since this example was able to meet the required runoff reduction with two BMPs, the residual volume to be managed after BMP 2 is reported as “N/A”.

“Cv” Worksheet

	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
7 Step 1 - Calculate initial Cv					
8 1.1 Total contributing area to BMP (ac)	102.73	102.73	102.73	102.73	102.73
9 1.2 initial Rcn	0.79				
10 1.3 10 Year Rainfall (in.)	5.5				
11 1.4 Cv runoff volume (in.)	1.34				
13 Step 2 - Adjust for Retention Reduction					
14 2.1 Storage volume (ac-ft)	0.00	0.00	N/A	N/A	N/A
15 2.2 Storage volume (ac-ft)	0.00	0.78	N/A	N/A	N/A
16 2.3 Storage volume (in.)	0.00	0.09	N/A	N/A	N/A
17 2.4 Runoff volume after reduction (in.)	1.34	1.24	N/A	N/A	N/A
18 2.5 CN*	0.79	0.61	N/A	N/A	N/A
20 Step 3 - Adjust for Annual Runoff Reduction					
21 3.1 Runoff reduction allowance (%)	0%	0%	N/A	N/A	N/A
22 3.2 Annual runoff after reduction (in.)	1.33	1.23	N/A	N/A	N/A
23 3.3 Adjusted Rcn	0.78	0.60	N/A	N/A	N/A
24 3.4 Event-based runoff reduction (in.)	0.00	0.00	N/A	N/A	N/A
26 Step 4 - Calculate Cv with BMP Reductions					
27 4.1 Cv runoff volume after all reductions (in.)	1.33	1.24	N/A	N/A	N/A
28 4.2 Total Cv runoff reduction (%)	0%	7%	N/A	N/A	N/A
29 4.3 Adjusted Rcn for H&E modeling	0.78	0.61	N/A	N/A	N/A

“Cv” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. There are no user-input cells on the “Cv” worksheet. The model has calculated the following results:

- Cv runoff volume: 1.34”
- Cv runoff volume after BMP 1: 1.33” (0% reduction)
- Cv runoff volume after BMP 2: 1.24” (7% reduction)

The runoff reduction values for the Cv event are adjusted downward, as discussed in the Cv Worksheet overview section.

“Fv” Worksheet

PROJECT:		Brownsville Estates				
DRAINAGE SUBAREA ID:		Site - Concept Level Analysis				
LOCATION (County):		Scurry				
FLOODING EVENT (Fv WORKSHEET):						
	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5	
	Type:	Type:	Type:	Type:	Type:	
7	B-6 Grassed Channel	2-A Traditional Streetclosures	-	-	-	
8	Data	Data	Data	Data	Data	
9	102.75	102.75	102.75	102.75	102.75	
10	57.97					
11	0.2					
12	4.00					
13	Step 2 - Adjust for Retention Reduction					
14	2.1 Storage volume (cu ft)	34053.00	N/A	N/A	N/A	
15	2.2 Storage volume (ac-ft)	0.78	N/A	N/A	N/A	
16	2.3 Storage volume (in.)	0.00	N/A	N/A	N/A	
17	2.4 Runoff volume after reduction (in.)	4.00	3.91	N/A	N/A	
18	2.5 CN*	87.97	87.24	N/A	N/A	
19						
20	Step 3 - Adjust for Annual Runoff Reduction					
21	3.1 Runoff reduction efficiency (%)	0%	0%	N/A	N/A	
22	3.2 Annual runoff after reduction (in.)	4.00	N/A	N/A	N/A	
23	3.3 Adjusted ACR	57.97	N/A	N/A	N/A	
24	3.4 Event-based runoff reduction (in.)	0.00	0.00	N/A	N/A	
25						
26	Step 4 - Calculate Fv with BMP Reductions					
27	4.1 Fv runoff volume after all reductions (in.)	4.00	3.91	N/A	N/A	
28	4.2 Total Fv runoff reduction (%)	0%	0%	N/A	N/A	
29	4.3 Adjusted ACR for H&B modeling	57.97	57.24	N/A	N/A	
30						
31						
32						
33						
34						
35						
36						
37						
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55						

“Fv” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. There are no user-input cells on the “Fv” worksheet. The model has calculated the following results:

- Fv runoff volume: 4.00”
- Fv runoff volume after BMP 1: 4.00” (0% reduction)
- Fv runoff volume after BMP 2: 3.91” (2% reduction)

The runoff reduction values for the Fv event are adjusted downward, as discussed in the Fv Worksheet overview section.

“DURMM Report” Worksheet

Site Data	BMP Data				
Contributing Area to BMPs (ac)	100.73				
C.A. RCN	56.07				
Subarea LOD (in.)	100.73				
Subarea TMDL	0.00				
Upstream Subarea ID	N/A				
Upstream Subarea LOD (in.)	0.00				
Combined LOD with Upstream Areas (in.)	100.73				
Combined TMDL with Upstream Areas (lb/cy)	0.00				
Watershed TMDL TP (lb/cy)	11.50				
Watershed TMDL TP (lb/acre/cy)	0.00				
Watershed TMDL TP (lb/acre/cy)	N/A				
BMP Data	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
B-B Guaranteed Channel	0.4	Traditional	---	---	---
BMP abatement	0.50	0.41	N/A	N/A	N/A
Total RP runoff reduction (in.)	0.11	0.11	N/A	N/A	N/A
Total RP runoff reduction (lb)	100	98	N/A	N/A	N/A
RP Compliance Met Through Runoff Reduction?	NO	YES	N/A	N/A	N/A
RP Runoff Volume (cu ft)	34264	34264	N/A	N/A	N/A
Adjusted pollutant load, TP (lb/cy)	3.11	3.38	N/A	N/A	N/A
Adjusted pollutant load, TP (lb/acre/cy)	0.04	0.04	N/A	N/A	N/A
Adjusted pollutant load, TP (lb/acre/cy)	99.88	114.80	N/A	N/A	N/A
Compliance Met Through Runoff Reduction?	YES	YES	N/A	N/A	N/A
Runoff volume after all reductions (in.)	4.00	3.92	N/A	N/A	N/A
Resource Protection Event (RPE)					
RP to be managed for contributing area (in.)	0.01				
Annual runoff for contributing area (in.)	5.93				
RP to be managed for contributing area (lb)	0.11				
RP to be managed for contributing area (lb)	100				
RP Runoff Management Required (in.)	7710				
RP Runoff Management Required (lb)	7710				
RP Runoff Volume (cu ft)	0				
C.A. RP max. discharge rate (in.)	0.00				
C.A. RP max. discharge rate (lb)	0.00				
TP Pollutant Load (lb/cy)	11.54				
TP Pollutant Load (lb/cy)	784				
Compliance Met?					
Cv runoff volume (in.)	3.99				
Adjusted RCN for contributing area (in.)	56.04				
Flowing Head (ft)	4.00				
Fv runoff volume (in.)	0.14				

“DURMM Report” Worksheet

The “DURMM Report” worksheet summarizes the results from the other worksheets. Information is filled into the cells automatically as the user progresses from worksheet to worksheet. The report includes the runoff volumes for the RPv, Cv and Fv, as well as the reductions for the various BMPs selected to manage the subarea. It also summarizes whether the site meets the required runoff reduction for the RPv and the required TMDL pollutant load reductions.

The next section of the report summarizes the adjustments to the RCN for the Cv and Fv that can be used for more detailed hydrologic and hydraulic modeling in more complex situations. These adjustments account for the equivalent lower RCN that results from using runoff reduction techniques.

In this example, the designer was able to show at the concept level that the use of runoff reduction practices could meet both the runoff reduction requirements of the 2019 DSSR and the TMDL goals in the watershed. The results of the Concept Level Analysis will need to be verified through the more detailed Design Level Analysis to show the site complies with the requirements of the 2019 DSSR.



Example #2: Design Level Analysis

The procedures outlined in the previous section will now be used to perform a more detailed design level analysis for the fictional land development project “Broadkill Estates”.

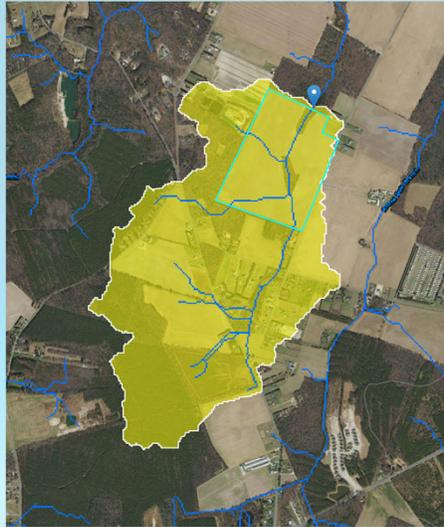
Design Level Analysis



Site Layout

At the design level, the lot and road layout have typically been determined, as well as the general proposed grading and drainage patterns.

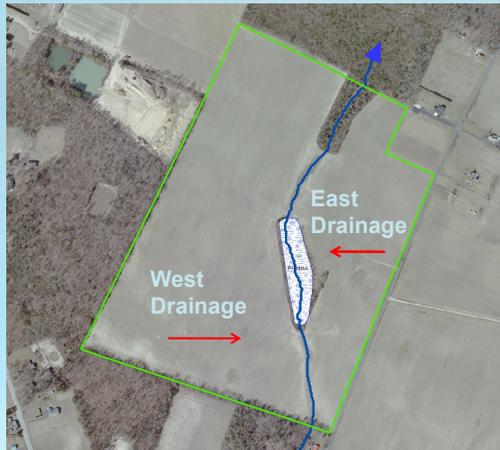
Design Level Analysis



Hydrologic Analysis

The concept level analysis assumed an artificial drainage boundary that coincided with the parcel boundary. This is rarely the case in practice. The more typical situation is illustrated by the “Broadkill Estates” example site in which significant offsite areas drain through the site. In addition, there are incidental areas which drain onto the site around the site boundary. Both these situations must ultimately be considered in the final design. For the purposes of this example, it will be assumed that the larger upstream area will be allowed to pass through the site relatively unmanaged. This will require that the site runoff be managed prior to discharge into the tributary stream. Although incidental offsite areas that would be captured by the selected BMP suite do not need to be managed to the same level as the area within the site LOD, they will still need to be accounted for in the design of the BMPs. The following slides illustrate how DURMM v2.5 is used to perform the analysis and check for compliance with the requirements of the DSSR.

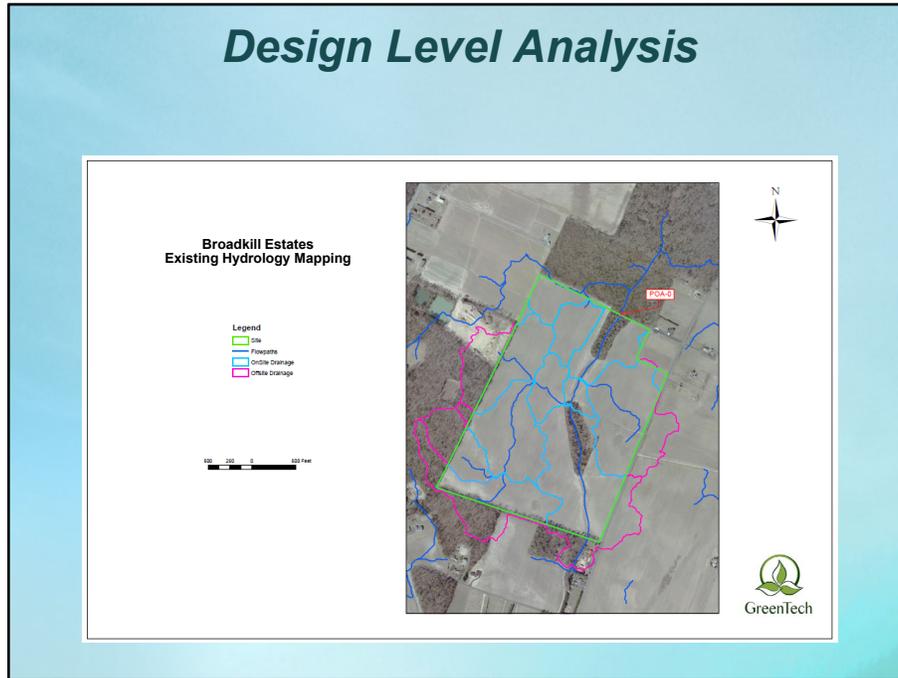
Design Level Analysis



Onsite Drainage

As described in the concept level analysis, the site is bisected by a tributary stream that runs from south to north. This site drainage is therefore characterized by a west drainage subarea and an east drainage subarea.

Design Level Analysis



Offsite Drainage

The “Existing Hydrology” map included in the Project Application Package is helpful to determine any offsite drainage areas that must be accounted for in the final BMP design for the site.

Design Level Analysis



Site Design

For the purposes of this example, the proposed lot and road layout for the east drainage subarea will be analyzed. The area outside the lots will be designated as common open space.

Design Level Analysis



LOD vs. OLOD

The 2019 DSSR require that only those areas that are disturbed during the construction of the project must be managed. When designing BMPs to manage those areas, however, it is likely that undisturbed areas may contribute drainage to them. These undisturbed areas which are outside the limit of disturbance may be either onsite or offsite. DURMM v2.5 can account for this situation by calculating a weighted RPv runoff volume that reflects the LOD runoff as well as the OLOD runoff. The runoff reduction requirement for the LOD is then adjusted for the total contributing area.

For the purposes of this example, the LOD for the east drainage subarea is bounded by the tributary stream and parcel boundary, excluding the wetland area. The OLOD consists of an area to the east of the property boundary that is currently in cropland.

Design Level Analysis



Soils Data - LOD

The LOD area consists mainly of soils in HSG A, with a small area of soils in HSG B adjacent to the stream.

Design Level Analysis



Soils Data – OLOD

The area outside the LOD consists entirely of soils in HSG A.

Design Level Analysis



OLOD – Time of Concentration

DURMM v2.5 is capable of determining a peak discharge for OLOD areas if they will be managed by BMPs that are discharge-based, such as grassed channels and bioswales. This requires the user to enter an estimate of the time of concentration (T_c) for the area outside the LOD. Since the OLOD areas are often irregular in shape, it is adequate for the user to designate a single representative T_c path for the entire OLOD area for any particular subarea under analysis. The T_c path should be carried through to the final onsite stormwater management BMP in the flowpath.

Design Level Analysis Site Data



- C.A. RCN Tab
 - Row Crops, SR + Crop Residue
 - HSG A: 9.68 ac.
 - Open space
 - HSG A: 8.06 ac.
 - HSG B: 2.26 ac
 - 1-ac. residential (20 % imperv.)
 - HSG A: 21.16 ac.
 - HSG B: 0.73 ac

Data Inputs – “C.A. RCN” Worksheet

The slide above summarizes the data that will be input to the “C.A. RCN” worksheet. It includes both LOD and OLOD areas.

Design Level Analysis Site Data (cont.)



- LOD Tab
 - HSG A
 - LOD area: 29.22 ac.
 - Pre-Dev. Woods: 1.55 ac.
 - Post-Dev. Impervious: 4.23 ac.
 - HSG B
 - LOD area: 2.99 ac.
 - Pre-Dev. Woods: 0 ac.
 - Post-Dev. Impervious: 0.15 ac.
- OLOD Tab
 - Sheet Flow, 100 ft, 0.001 ft/ft, "d"
 - Shallow Conc., 300 ft, 0.002 ft/ft, "u"
 - Channel Flow, 1000 ft, 0.01 ft/ft, 1 fps

Data Inputs – “LOD” and “OLOD” Worksheets

The slide above summarizes the data that will be input to the “LOD” and “OLOD” worksheets.

"C.A. RCN" Worksheet

The screenshot shows an Excel spreadsheet with the following structure:

- Project Information:** PROJECT: BROADBENT Estates, Design Level Analysis; DRAINAGE SUBAREA NO: East Drainage - Design Level Analysis; LOCATION (County): Sussex; SWEET HYDROLOGICAL: C05.
- Contributing Area Runoff Curve Numbers:** A table with 4 columns (A, B, C, D) and 4 rows (Acres, RCN, Acres, RCN).
- C.A. RCN Worksheet:** A table with columns: Treatment, Hydrologic Condition, and Curve Numbers for Hydrologic Soil Type (A, B, C, D). Each Curve Number column has sub-columns for Acres and RCN.

Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type							
		A	B	C	D				
		Acres	RCN	Acres	RCN	Acres	RCN	Acres	RCN
CULTIVATED AGRICULTURAL LANDS									
9	Fallow	Bare soil	---	---	---	---	---	---	---
10		Crop residue (CR)	poor	77	85	91	84	76	83
11		Crop residue (CR)	good	78	85	90	83	76	80
12	Row Crop	Straight row (SR)	poor	74	83	88	80	74	81
13		Straight row (SR)	good	72	81	86	79	72	79
14		SR + Crop residue	poor	47	78	85	80	47	80
15		SR + Crop residue	good	71	80	87	80	71	80
16		Contoured (C)	poor	54	75	82	85	54	80
17		Contoured (C)	good	70	79	84	80	70	80
18		C + Crop residue	poor	45	75	82	80	45	80
19		C + Crop residue	good	70	79	87	87	70	87
20		Cont & terrace(C&T)	poor	54	74	81	85	54	80
21		Cont & terrace(C&T)	good	54	74	80	83	54	80
22		C&T + Crop residue	poor	42	71	78	81	42	80
23		C&T + Crop residue	good	61	70	77	80	61	80
24	Small Grain	Straight row (SR)	poor	65	75	84	80	65	80
25		Straight row (SR)	good	63	75	83	87	63	87
26		SR + Crop residue	poor	44	75	83	80	44	80
27		SR + Crop residue	good	60	72	80	85	60	85
28		Contoured (C)	poor	63	74	82	85	63	85
29		Contoured (C)	good	61	73	81	84	61	84
30		C + Crop residue	poor	62	73	81	84	62	84
31		C + Crop residue	good	60	72	80	83	60	83
32		Cont & terrace(C&T)	poor	51	72	79	82	51	82
33		Cont & terrace(C&T)	good	50	70	78	81	50	81
34		C&T + Crop residue	poor	60	71	79	81	60	81
35		C&T + Crop residue	good	58	69	77	80	58	80
36	Cross seeded	Straight row	poor	66	77	85	89	66	89
37	or broadcast	Straight row	good	64	72	81	85	64	85
38	legume or	Contoured	poor	44	75	83	85	44	85
39	inset	Contoured	good	50	69	78	83	50	83
40	meadow	Cont & terrace	poor	53	73	80	83	53	83
41		Cont & terrace	good	51	67	76	80	51	80
OTHER AGRICULTURAL LANDS									
42									
43	Pasture, grassland or range	poor	48	73	80	83	48	83	
44		bar	---	---	---	---	---	---	
45		bar	---	---	---	---	---	---	
46		bar	---	---	---	---	---	---	
47	meadow with grass (not grazed)	---	---	---	---	---	---	---	
48		bar	---	---	---	---	---	---	
49	brush, shrub, weed, grass, etc.	poor	48	67	77	83	48	83	
50		bar	---	---	---	---	---	---	
51		bar	---	---	---	---	---	---	
52	Woods - grass combination	poor	30	56	70	77	30	77	
53		good	30	48	60	65	30	65	
54		bar	---	---	---	---	---	---	
55		bar	---	---	---	---	---	---	
56		bar	---	---	---	---	---	---	
57		bar	---	---	---	---	---	---	
58		bar	---	---	---	---	---	---	
59		bar	---	---	---	---	---	---	
60		bar	---	---	---	---	---	---	
61		bar	---	---	---	---	---	---	
62		bar	---	---	---	---	---	---	
63		bar	---	---	---	---	---	---	
64		bar	---	---	---	---	---	---	
65		bar	---	---	---	---	---	---	
66		bar	---	---	---	---	---	---	
67		bar	---	---	---	---	---	---	
68		bar	---	---	---	---	---	---	
69		bar	---	---	---	---	---	---	
70		bar	---	---	---	---	---	---	
71		bar	---	---	---	---	---	---	
72		bar	---	---	---	---	---	---	
73		bar	---	---	---	---	---	---	
74		bar	---	---	---	---	---	---	
75		bar	---	---	---	---	---	---	
76		bar	---	---	---	---	---	---	
77		bar	---	---	---	---	---	---	
78		bar	---	---	---	---	---	---	
79		bar	---	---	---	---	---	---	
80		bar	---	---	---	---	---	---	
81		bar	---	---	---	---	---	---	
82		bar	---	---	---	---	---	---	
83		bar	---	---	---	---	---	---	
84		bar	---	---	---	---	---	---	
85		bar	---	---	---	---	---	---	
86		bar	---	---	---	---	---	---	
87		bar	---	---	---	---	---	---	
88		bar	---	---	---	---	---	---	
89		bar	---	---	---	---	---	---	
90		bar	---	---	---	---	---	---	
91		bar	---	---	---	---	---	---	
92		bar	---	---	---	---	---	---	
93		bar	---	---	---	---	---	---	
94		bar	---	---	---	---	---	---	
95		bar	---	---	---	---	---	---	
96		bar	---	---	---	---	---	---	
97		bar	---	---	---	---	---	---	
98		bar	---	---	---	---	---	---	
99		bar	---	---	---	---	---	---	
100		bar	---	---	---	---	---	---	

"C.A. RCN" Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above for the OLOD area. Note that the user must scroll up to the input cells associated with agricultural land uses. RCN data for the urban land uses within the LOD area are shown on the next slide.

“C.A. RCN” Worksheet (cont.)

Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type						
			A	B	C	D			
			Acre	RCN	Acre	RCN	Acre	RCN	
FULLY DEVELOPED URBAN AREAS (Weg Establishment)									
60	Open lot (Lawn, parks, etc.)								
61	Fair condition, grass cover = 50%		60	73	60	63			
62	Fair condition, grass cover = 50% to 75%		65	69	73	64			
63	Good condition, grass cover = 75%		70	68	74	63			
64	Impervious Areas								
65	Paved parking lots, roofs, driveways		98	98	98	98			
66	Streets and roads								
67	Paved courts and storm sewers		98	98	98	98			
68	Paved open areas (concrete/asphalt)		83	83	79	81			
69	Drivew (w/ right of way)		78	85	89	81			
70	DOT (w/ right of way)		72	82	87	83			
71	Urban Districts								
72	Commercial & business	Avg % impervious	60	63	64	65			
73	Industrial	%	81	88	81	83			
74	Residential districts by average lot size	Avg % impervious							
75	1/8 acre (town houses)	%	77	85	80	82			
76	1/4 acre	%	81	75	83	87			
77	1/2 acre	%	63	72	81	86			
78	1 acre	%	64	78	86	86			
79	1.5 acres	%	54.58	83	86	85			
80	2 acres	%	46	85	77	82			
81									
82	DEVELOPING URBAN AREA (No Vegetation)								
83	Heavy graded area (pervious only)		77	89	91	84			
84									
85									
86	USER DEFINED								
87									
88									
89									
90	Subarea Contributing Area per Soil Type (ac)		38.9	2.99	0	0			
91	Subarea Contributing Area (ac)		41.89						
92	Subarea Weighted RCN		53						
93									
94	UPSTREAM CONTRIBUTING AREAS								
95	Subarea ID	Acre	RCN						
96	Upstream Contributing Area 1								
97	Upstream Contributing Area 2								
98	Upstream Contributing Area 4								
99									
100	Total Contributing Area w. Upstream Areas (ac)		41.9						
101									
102	Weighted Runoff Curve Number (RCN)		53						
103									
104									

“C.A. RCN” Worksheet (cont.)

The remaining data inputs/outputs for this worksheet are illustrated in the slide above. The model has calculated the following results:

- Total Acreage: 41.9
- Weighted RCN: 53

“LOD” Worksheet

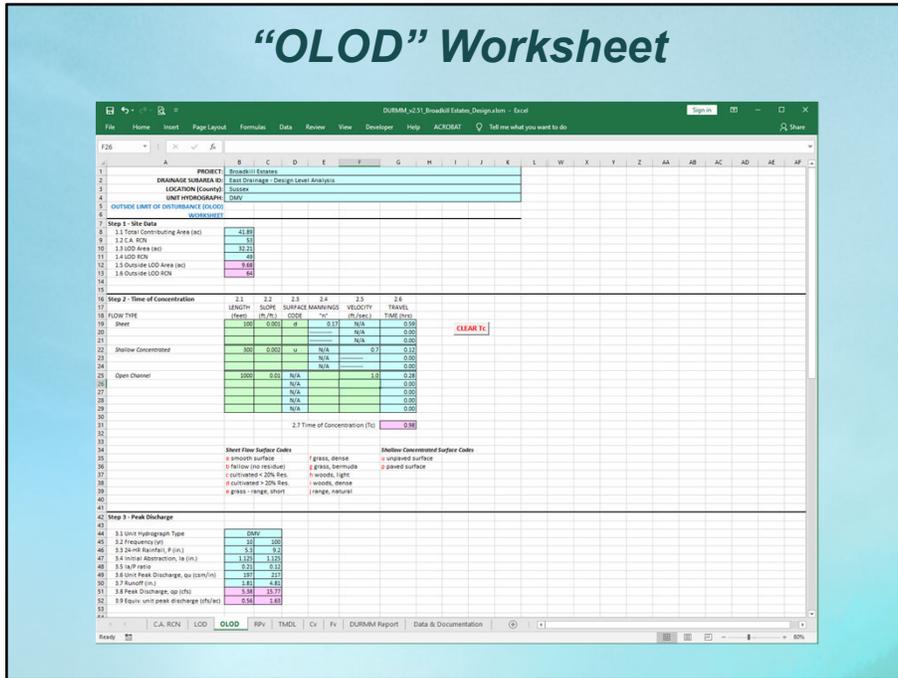
Row	Description	Value
7	1.1 HSG Area Within LOD (ac)	29.22
8	1.2 Post-Developed Woodland/Meadow Within LOD (ac)	3.52
9	1.3 Pre-Developed Impervious Within LOD (ac)	4.24
10	1.4 Post-Developed Imperviousness Within LOD, Option #1 (HSG) (ac)	0.15
11	1.4 Post-Developed Imperviousness Within LOD, Option #2 (HSG) (ac)	0.00
14	2.1 RCN per HSG	47.54
15	2.2 RPV per HSG (in.)	0.35
16	2.3 Target RCN per HSG	38.52
17	2.4 Target Runoff per HSG (in.)	0.26
19	2.5 Subarea LOD (ac)	32.21
20	2.6 Subarea Weighted RCN	48.96
21	2.7 Subarea Weighted RPV (in.)	0.38
22	2.8 Subarea Weighted Target Runoff (in.)	0.24
25	3.1 Upstream Sub-Area ID	
26	3.2 Upstream Contributing Area (ac)	
27	3.3 Target Runoff for Upstream Area (in.)	
28	3.4 Adjusted Cv after all reductions	
29	3.5 Adjusted Rv (in.)	
30	3.6 Adjusted Cv (in.)	
31	3.7 Adjusted Rv (in.)	
34	4.1 Combined LOD (ac)	32.21
35	4.2 Weighted RCN	48.96
36	4.3 Weighted RPV (in.)	0.38
37	4.4 Weighted Target Runoff (in.)	0.24
38	4.5 Estimated Annual Runoff (in.)	3.29
39	4.6 Req'd Runoff to be Managed within LOD (in.)	0.14
40	4.7 Req'd Runoff to be Managed within LOD (%)	36%

“LOD” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. The model has calculated the following results:

- Total LOD Acreage: 32.21
- Weighted LOD RCN: 48.96
- Weighted RPV runoff volume: 0.38”
- Weighted RPV target runoff volume: 0.24”
- Estimated annual runoff: 3.29”
- Required runoff reduction: 0.14” (36%)

"OLOD" Worksheet



"OLOD" Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. The model has calculated the following results:

- OLOD Acreage: 9.68
- OLOD RCN: 64
- OLOD Tc: 0.98 hrs
- OLOD Peak Discharge (Cv): 5.38 cfs
- OLOD Equiv. Unit Discharge (Cv): 0.56 cfs/ac
- OLOD Peak Discharge (Fv): 15.77 cfs
- OLOD Equiv. Unit Discharge (Fv): 1.63 cfs/ac

“RPV” Worksheet

Row	Description	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
7	Calculate Initial Rv					
8	1.1 Total contributing area to BMP (ac)	41.89				
9	1.2 Initial Rv	0.45				
10	1.3 Rv for Contributing Area (in.)	0.45				
11	1.4 Req'd Rv to be Managed for Contributing Area (in.)	0.11				
12	1.5 Req'd Rv to be Managed for Contributing Area (%)	24%				
14	Step 2 - Adjust for Retention Reduction					
15	2.1 Retention volume provided (cu ft)	1505				
16	2.2 Retention reduction allowance (%)	24%				
17	2.3 Retention reduction volume (ac-ft)	0.14				
18	2.4 Retention reduction volume (in.)	0.07				
19	2.5 Runoff volume after retention reduction (in.)	0.38				
20	2.6 Adjusted CV*	0.11				
21	Step 3 - Adjust for Annual Runoff Reduction					
22	3.1 Annual CV (ACT)	0.11	0.07			
23	3.2 Annual runoff (in.)	0.07	0.07			
24	3.3 Proportion A/B soils in BMP footprint (%)	100%	0%			
25	3.4 Annual runoff reduction allowance (%)	24%	0%			
26	3.5 Annual runoff after reduction (in.)	0.38	0.38			
27	3.6 Adjusted CV*	0.07	0.07			
28	3.7 Annual Runoff Reduction Allowance for Rv (in.)	0.07	0.07			
31	Step 4 - Calculate Rv after BMP Reductions					
32	4.1 Rv runoff Management Provided (cu ft)	1505	1505			
33	4.2 Rv runoff volume after all reductions (in.)	0.38	0.38			
34	4.3 Rv runoff volume after all reductions (cu ft)	1505	1505			
35	4.4 Total Rv runoff reduction (in.)	0.11	0.11			
36	4.5 Total Rv runoff reduction (cu ft)	1505	1505			
37	4.6 Adjusted CV after all reductions*	0.11	0.11			
38	4.7 Adjusted equivalent annual runoff (in.)	0.38	0.38			
39	4.8 Rv Compliance Max Through Runoff Reduction?	NO	NO			
40	4.9 Runoff Reduction Credit, if Applicable (cu ft)	N/A	0.05			
42	Step 5 - Determine Residual Volume to be Managed or Offset					
43	5.1 Rv Residual Volume (in.)	0.06	N/A			
44	5.2 Rv Residual Volume (cu ft)	150	N/A			
45	5.3 Residual Volume to be Managed or Offset (cu ft)	0.05	N/A			
46	5.4 Rv Avg. discharge rate for 48-hr detention (cfs)	0.038	N/A			
47	5.5 Rv max. discharge rate for 48-hr detention (cfs)	0.162	N/A			

“RPV” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. The same BMP treatment train consisting of grassed channels for the road drainage and infiltrating bioretention as used in the concept level analysis will be used. For the East Drainage, the grassed channels are completely within HSG A soils. The infiltrating bioretention facility will be sized to store any residual runoff required to be managed after the reduction from the grassed channels. The model has calculated the following results:

- Rpv for total contributing area: 0.45”
- Reduction after BMP 1: 0.07” (15%)
- Reduction after BMP 2: 0.11” (24%)

Note that the required reduction of 0.14” for the 32.21 acre LOD as determined on the “LOD” worksheet has been adjusted to 0.11” for the entire contributing area of 41.89 acres. Similarly, the required 36% reduction requirement has been adjusted to 24% based on the combined LOD and OLOD areas. As with the conceptual design, grassed channels and an infiltrating bioretention facility are adequate to meet the runoff reduction requirements for the Rpv, thus the residual volume to be managed or offset is “N/A”.

“Cv” Worksheet

	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
7 Step 2 - Calculate initial Cv					
8 1.1 Total contributing area to BMP (ac)	21.89	41.89	41.89	41.89	41.89
9 1.2 Initial RCN	51.53				
10 1.3 10-Year Rainfall (in.)	5.2				
11 1.4 Cv runoff volume (in.)	0.97				
12					
13 Step 2 - Adjust for Retention Reduction					
14 2.1 Storage volume (cu. ft.)	0.00	8300.00	N/A	N/A	N/A
15 2.2 Storage volume (ac-ft)	0.00	0.24	N/A	N/A	N/A
16 2.3 Storage volume (in.)	0.00	0.04	N/A	N/A	N/A
17 2.4 Runoff volume after reduction (in.)	0.97	0.93	N/A	N/A	N/A
18 2.5 SW	0.93	51.84	N/A	N/A	N/A
19					
20 Step 3 - Adjust for Annual Runoff Reduction					
21 3.1 Runoff reduction allowance (%)	0%	0%	N/A	N/A	N/A
22 3.2 Annual runoff after reduction (in.)	0.97	0.97	N/A	N/A	N/A
23 3.3 Adjusted RCN	52.50	52.50	N/A	N/A	N/A
24 3.4 Event-based runoff reduction (in.)	0.00	0.00	N/A	N/A	N/A
25					
26 Step 4 - Calculate Cv with BMP Reductions					
27 4.1 Cv runoff volume after all reductions (in.)	0.97	0.93	N/A	N/A	N/A
28 4.2 Total Cv runoff reduction (%)	0%	0%	N/A	N/A	N/A
29 4.3 Adjusted RCN for H&H modeling	52.50	51.84	N/A	N/A	N/A
30					
31					
32					
33					
34					
35					
36					
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53					

“Cv” Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. There are no user-input cells on the “Cv” worksheet. The model has calculated the following results:

- Cv runoff volume: 0.97”
- Cv runoff volume after BMP 1: 0.97” (0% reduction)
- Cv runoff volume after BMP 2: 0.93” (4% reduction)

When the total contributing area consists of both an LOD and an OLOD, the model calculates an adjusted RCN for the combined LOD and OLOD that can be used as input to another DURMM analysis for a downstream subarea or for additional H&H modeling using an external program such as HydroCAD.

"Fv" Worksheet

	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
Step 1 - Calculate initial Fv					
1.1 Total contributing area to BMP (ac)	41.99	41.99	41.99	41.99	41.99
1.2 Initial RCN	52.53	52.53	52.53	52.53	52.53
1.3 100-Year Aberrant (in)	8.2	8.2	8.2	8.2	8.2
1.4 Fv runoff volume (in)	3.33	3.33	3.33	3.33	3.33
Step 2 - Adjust for Retention Reduction					
2.1 Storage volume (cu ft)	0.00	6309.00	N/A	N/A	N/A
2.2 Storage volume (ac-ft)	0.00	0.14	N/A	N/A	N/A
2.3 Storage volume (in)	0.00	0.04	N/A	N/A	N/A
2.4 Runoff volume after reduction (in)	3.33	3.29	N/A	N/A	N/A
2.5 O/R	0.00%	0.00%	N/A	N/A	N/A
Step 3 - Adjust for Annual Runoff Reduction					
3.1 Runoff reduction allowance (%)	0%	0%	N/A	N/A	N/A
3.2 Annual runoff after reduction (in)	3.33	3.33	N/A	N/A	N/A
3.3 Adjusted RCN	52.53	52.53	N/A	N/A	N/A
3.4 Event-based runoff reduction (in)	0.00	0.00	N/A	N/A	N/A
Step 4 - Calculate Fv with BMP Reductions					
4.1 Fv runoff volume after all reductions (in)	3.33	3.29	N/A	N/A	N/A
4.2 Total Fv runoff reduction (%)	0%	1%	N/A	N/A	N/A
4.3 Adjusted RCN for H&H modeling	52.53	52.20	N/A	N/A	N/A

"Fv" Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. There are no user-input cells on the "Cv" worksheet. The model has calculated the following results:

- Fv runoff volume: 3.33"
- Fv runoff volume after BMP 1: 3.33" (0% reduction)
- Fv runoff volume after BMP 2: 3.29" (1% reduction)

As with the Cv, the model calculates an adjusted RCN for the combined LOD and OLOD that can be used as input to another DURMM analysis for a downstream subarea or for additional H&H modeling using an external program such as HydroCAD.

“DURMM Report” Worksheet

Row	Column A	Column B	Column C	Column D	Column E	Column F	Column G	Column H	Column I	Column J	Column K	Column L	Column M	Column N	Column O	Column P	Column Q	Column R	Column S	Column T
1	PROJECT:	Broadkill Estate																		
2	DRAINAGE SUBAREA NO.:	001	Design: Design Load Analysis																	
3	COUNTY:	Sussex	WQRF HYDROGRAPHS	QWR																
4	TMDL WATERSHED:	Broadkill River	WQRF	WQRF																
5	DURMM OUTPUT WORKSHEET:																			
6	Site Data																			
7	Contributing Area to BMP (ac)	48.89																		
8	C.A. RCN	52.53																		
9	Subarea LOD (ac)	22.21																		
10	Subarea NCR	48.94																		
11	Upstream Subarea ID	N/A	N/A	N/A	N/A															
12	Upstream Subarea LOD (ac)	0.00	0.00	0.00	0.00															
13	Combined LOD with Upstream Areas (ac)	22.21																		
14	Combined RCV with Upstream Areas (ac)	48.94																		
15	Watershed TSS ₂₅ (lb/yr)	11.90																		
16	Watershed TSS ₂₅ (lb/acre/yr)	0.24																		
17	Watershed TSS ₂₅ (lb/acre/yr)	N/A																		
18	BMP Data																			
19	BMP ID	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5														
20	Subarea	0.04																		
21	B-B Covered	Traditional																		
22	Runoff Volume after all reductions (in.)	0.39	0.39	N/A	N/A	N/A														
23	Total R _{pv} runoff reduction (in.)	0.07	0.11	N/A	N/A	N/A														
24	Total R _{pv} runoff reduction (%)	20%	24%	N/A	N/A	N/A														
25	R _{pv} Compliance Met Through Runoff Reduction?	NO	YES	N/A	N/A	N/A														
26	R _{pv} Runoff Volume (in.)	0.07	0.07	N/A	N/A	N/A														
27	Adjusted pollutant load, TN (lb/yr)	2.13	1.82	N/A	N/A	N/A														
28	Adjusted pollutant load, TP (lb/yr)	0.07	0.06	N/A	N/A	N/A														
29	Adjusted pollutant load, TSS (lb/yr)	68.58	58.38	N/A	N/A	N/A														
30	Adjusted pollutant load, TSS (lb/acre/yr)	0.07	0.06	N/A	N/A	N/A														
31	Runoff volume after all reductions (in.)	0.39	0.39	N/A	N/A	N/A														
32	Runoff volume after all reductions (%)	1.03	1.03	N/A	N/A	N/A														
33	Resource Protection Event (RPE)																			
34	R _{pv} for Contributing Area (in.)	0.45																		
35	Annual Runoff for Contributing Area (in.)	2.00																		
36	Peak R _{pv} to be Managed for Contributing Area (in.)	0.11																		
37	Peak R _{pv} to be Managed for Contributing Area (%)	28%																		
38	R _{pv} Runoff Management Required (in. Ft.)	18137																		
39	R _{pv} Runoff Management Required (cu. Ft.)	16151																		
40	R _{pv} Runoff Volume (cu. Ft.)	0																		
41	R _{pv} Runoff Volume (cu. Ft.)	0																		
42	C.A. R _{pv} non-attainment rate (lb)	0.04																		
43	C.A. R _{pv} non-attainment rate (lb)	0.18																		
44	TN Runoff Load (lb/yr)	78.08																		
45	TP Runoff Load (lb/yr)	13.33																		
46	TSS Runoff Load (lb/yr)	2485																		
47	Compliance Status																			
48	Compliance Status (in.)	0.07																		
49	Adjusted R _{pv} for non-attainment (in.)	51.04																		
50	Runoff after RPE																			
51	Runoff after RPE (in.)	0.39																		
52	Runoff after RPE (%)	1.03																		
53	Runoff after RPE (in.)	0.39																		
54	Equivalent R _{pv} for non-attainment (in.)	12.09																		
55	Equivalent R _{pv} for non-attainment (%)	33%																		

“DURMM Report” Worksheet

In this example, the designer was able to show that the use of runoff reduction practices complies with the requirements of the 2019 DSSR and TMDL pollutant reduction goals for the watershed. Since DURMM v2.5 does not include a BMP design module, the designer must next use an appropriate methodology to ensure the BMPs selected for analysis are designed in accordance with the Post Construction Stormwater BMP Standards & Specifications in accordance with the 2019 DSSR.

Once BMP design has been completed, the user will need to complete the Summary Table for R_{pv} Compliance as shown in the next series of slides.



Summary Table for RPv Compliance

The Summary Table for RPv Compliance is used to demonstrate compliance with the RPv requirements under the 2019 DSSR.

Summary Table for R_Pv Compliance Sheet 1

The screenshot shows an Excel spreadsheet with the following structure:

- Row 3:** Project (green), TMDL WS (cyan), Rel. 1 (red)
- Row 4:** Sub-Area ID⁽¹⁾ (green), Contributing Area⁽²⁾ [ac] (green), Runoff⁽³⁾ [cfs] (green), R_Pv Runoff Management (cyan), T₁₉ Pollutant Load⁽⁴⁾ [lb/yr] (cyan), T₁₇ Pollutant Load⁽⁵⁾ [lb/yr] (cyan), T₁₅ Pollutant Load⁽⁶⁾ [lb/yr] (cyan)
- Row 5:** Required⁽⁷⁾ (magenta), Provided⁽⁸⁾ (magenta)
- Row 6:** Section I - Complete this section for total site LOD management requirement
- Row 7:** Total Site LOD (magenta)
- Row 8:** Section II - Complete this section for BMPs provided for partial LOD management OR sub-area by sub-area management
- Row 9:** 1 (green), 0.0 (magenta)
- Row 10:** 2 (green), 0.0 (magenta)
- Row 11:** 3 (green), 0.0 (magenta)
- Row 12:** 4 (green), 0.0 (magenta)
- Row 13:** 5 (green), 0.0 (magenta)
- Row 14:** 6 (green), 0.0 (magenta)
- Row 15:** 7 (green), 0.0 (magenta)
- Row 16:** 8 (green), 0.0 (magenta)
- Row 17:** 9 (green), 0.0 (magenta)
- Row 18:** 10 (green), 0.0 (magenta)
- Row 19:** 11 (green), 0.0 (magenta)
- Row 20:** 12 (green), 0.0 (magenta)
- Row 21:** 13 (green), 0.0 (magenta)
- Row 22:** 14 (green), 0.0 (magenta)
- Row 23:** 15 (green), 0.0 (magenta)
- Row 24:** 16 (green), 0.0 (magenta)
- Row 25:** 17 (green), 0.0 (magenta)
- Row 26:** 18 (green), 0.0 (magenta)
- Row 27:** 19 (green), 0.0 (magenta)
- Row 28:** 20 (green), 0.0 (magenta)
- Row 29:** Total (magenta), 0.00 lb/yr (magenta), 0.00 lb/yr (magenta), 0 lb/yr (magenta)
- Row 30:** R_Pv Runoff Reduction Goal Met⁽⁹⁾ (magenta), PVALUE1 (magenta)
- Row 31:** Total Credit/Shortfall (magenta), PVALUE1 (magenta), PVALUE1 (magenta)
- Row 32:** Notes:
- Row 33:** 1. All subareas must be within the same HUC-8 watershed.
- Row 34:** 2. Only the most downstream sub-area information should be entered for a series of subareas that drain to each other or for a treatment train.
- Row 35:** 3. From DURMM v2.5 Report, Line 7 OR Approved Hydrologic Software Report
- Row 36:** 4. From DURMM v2.5 Report, Line 25 OR Approved Hydrologic Software Report
- Row 37:** 5. From DURMM v2.5 Report, Line 39 OR Approved Hydrologic Software Report
- Row 38:** 6. From DURMM v2.5 Report, Line 40 OR Approved Hydrologic Software Report
- Row 39:** 7. From DURMM v2.5 Report, Lines 44-48 OR Complete Sheet 2

Sheet 1

The cell coloring scheme used in the Summary Table for R_Pv Compliance is the same as that used in DURMM v2.5:

- Green Cells – cells intended for user input
- Cyan Cells – cells that contain either pre-set values or secondary output
- Magenta Cells - cells that contain calculated results for primary output

Input data for the Summary Table is taken from the DURMM Report worksheet or from an approved hydrologic model. If DURMM v2.5 was used for the BMP analysis, the data from the DURMM Report is entered in the appropriate columns on the Summary Table. A key is included at the bottom of Sheet 1 identifying what cell from the DURMM Report should be entered in which column.

Data entry and results are further coded in accordance with the following coloring scheme:

- Yellow – invalid entry; managed volume entered is greater than runoff volume generated in the subarea
- Dk. Green – the site has an overall credit
- Red – the site has an overall shortfall

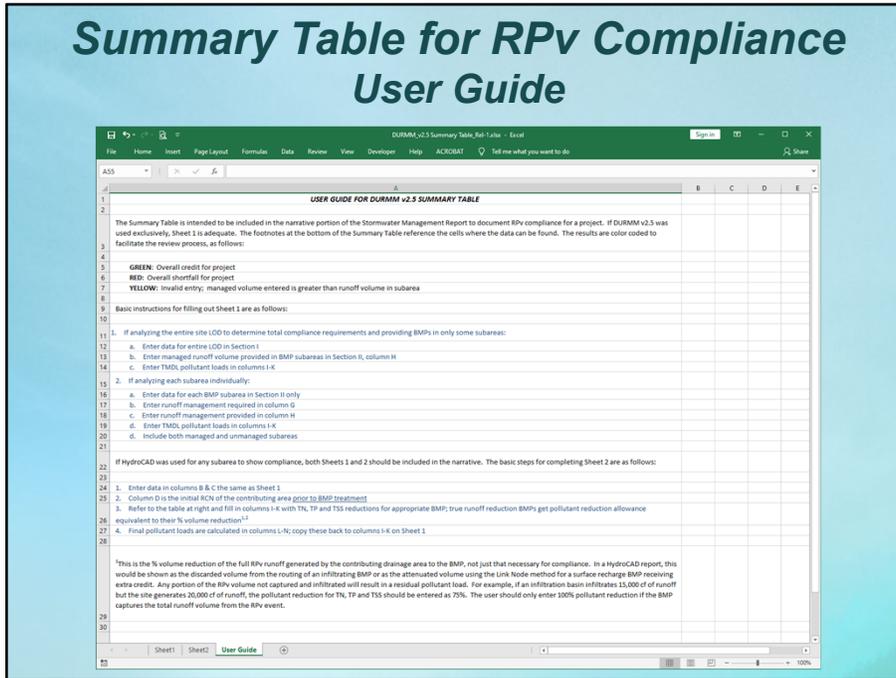
Summary Table for R_{Pv} Compliance Sheet 2

Address ID	Area (ac)	Initial	BMP Pollutant Reduction (%)			Final Pollutant Load (lb/yr)			BMP Type	BMP Pollutant Reduction Abatement*		
			TN	TP	TSS	TN	TP	TSS		TN	TP	TSS
1						0.00	0.00	0	0-No BMP	0%	0%	0%
2						0.00	0.00	0	4-A Extensive Vegetated Roofs	0%	0%	0%
3						0.00	0.00	0	4-B Intensive Vegetated Roofs	0%	0%	0%
4						0.00	0.00	0				
5						0.00	0.00	0	7-A Full Rooftop Disconnection - HSG A	96%	96%	96%
6						0.00	0.00	0	7-B Full Rooftop Disconnection - HSG B	81%	81%	81%
7						0.00	0.00	0	7-C Full Rooftop Disconnection - HSG C	63%	63%	63%
8						0.00	0.00	0	7-D Full Rooftop Disconnection - HSG D	51%	51%	51%
9						0.00	0.00	0				
10						0.00	0.00	0	8-A Bioswale, HSG A/B/Compost C	50%	50%	50%
11						0.00	0.00	0	8-A Bioswale, HSG C/D	25%	25%	25%
12						0.00	0.00	0	8-B Grassed Channel, HSG A/B/Compost C	10%	10%	10%
13						0.00	0.00	0	8-B Grassed Channel, HSG C/D	10%	10%	10%
14						0.00	0.00	0				
15						0.00	0.00	0	9-A Sheet Flow to Grassed FS, HSG A/B/Compost C	25%	25%	25%
16						0.00	0.00	0	9-A Sheet Flow to Grassed FS, HSG C/D	10%	10%	10%
17						0.00	0.00	0	9-B Sheet Flow to Afforest FS, HSG A/B/Compost C	30%	30%	30%
18						0.00	0.00	0	9-B Sheet Flow to Afforest FS, HSG C/D	15%	15%	15%
19						0.00	0.00	0	9-C Sheet Flow to Forest FS, HSG A/B/Compost C	40%	40%	40%
20						0.00	0.00	0	9-C Sheet Flow to Forest FS, HSG C/D	20%	20%	20%
21						0.00	0.00	0	9-D Sheet Flow to Grassed OS, HSG A/B/Compost C	50%	50%	50%
22						0.00	0.00	0	9-D Sheet Flow to Grassed OS, HSG C/D	20%	20%	20%
23						0.00	0.00	0	9-E Sheet Flow to Afforest OS, HSG A/B/Compost C	60%	60%	60%
24						0.00	0.00	0	9-E Sheet Flow to Afforest OS, HSG C/D	30%	30%	30%
25						0.00	0.00	0	9-F Sheet Flow to Forest OS, HSG A/B/Compost C	65%	65%	65%
26						0.00	0.00	0	9-F Sheet Flow to Forest OS, HSG C/D	40%	40%	40%
27						0.00	0.00	0				
28						0.00	0.00	0	10-A Dry Detention Pond	5%	10%	10%
29						0.00	0.00	0	10-B Dry Extended Detention (ED) Basin	20%	20%	60%
30						0.00	0.00	0	10-C Underground Detention Facilities	5%	10%	10%
31						0.00	0.00	0	10-D Underground 48-in Detention Facilities	20%	20%	60%
32						0.00	0.00	0				
33						0.00	0.00	0	11-A Non-Structural Sand Filter	40%	60%	80%
34						0.00	0.00	0	11-B Surface Sand Filter	40%	60%	80%
35						0.00	0.00	0	11-C 3-Chamber Underground Sand Filter	40%	60%	80%
36						0.00	0.00	0	11-D Perimeter Sand Filter (DE Sand Filter)	40%	60%	80%
37						0.00	0.00	0				
38						0.00	0.00	0	12-A Traditional Constructed Wetlands	30%	40%	80%
39						0.00	0.00	0	12-B Wetland Swales	20%	30%	60%
40						0.00	0.00	0	12-C Ephemeral Constructed Wetlands	20%	30%	60%
41						0.00	0.00	0	12-D Submerged Gravel Wetlands	30%	40%	80%
42						0.00	0.00	0				
43						0.00	0.00	0	13-A Wet Quatnths Management Pond	0%	0%	0%
44						0.00	0.00	0	13-B Wet Extended Detention (ED) Pond	30%	50%	60%
45						0.00	0.00	0				
46						0.00	0.00	0				
47						0.00	0.00	0				
48						0.00	0.00	0				
49						0.00	0.00	0				
50						0.00	0.00	0				

Sheet 2

Sheet 2 is only used in those cases where the design-level analysis was done using an external model, such as HydroCAD. Since these external models do not typically model water quality, Sheet 2 is used to determine the pollutant reductions based on the proposed BMPs for the project. The results are then transferred to the appropriate columns on Sheet 1.

Summary Table for R_{Pv} Compliance User Guide



User Guide

The third worksheet in the Summary Table workbook is a basic user guide for completing Sheet 1 and Sheet 2.

Summary Table for R_Pv Compliance Sheet 1 for Broadkill Estates Example

Summary Table for Site R _P v Compliance ⁽¹⁾									
Project: Broadkill Estates				TMDL WS: Broadkill River			Rel. 1		
Ref. #	Sub-Area ID ⁽²⁾	Contributing Area ⁽³⁾ (ac)	Runoff ⁽⁴⁾ (cfs)	R _P v Runoff Management (cfs)		TSS Pollutant Load ⁽⁵⁾ (lb/yr)	TP Pollutant Load ⁽⁶⁾ (lb/yr)	TSS Pollutant Load ⁽⁷⁾ (lb/yr)	
				Required ⁽⁸⁾	Provided ⁽⁹⁾				
Section I - Complete this section for total site LOD management requirement									
Total Site LOD			0.0						
Section II - Complete this section for BMPs provided for partial LOD management OR sub-area by sub-area management									
1	East Drainage	41.89	0.45	68427.3	16187	16191	76.06	13.31	2445
2				0.0					
3				0.0					
4				0.0					
5				0.0					
6				0.0					
7				0.0					
8				0.0					
9				0.0					
10				0.0					
11				0.0					
12				0.0					
13				0.0					
14				0.0					
15				0.0					
16				0.0					
17				0.0					
18				0.0					
19				0.0					
20				0.0					
21				0.0					
22				0.0					
23				0.0					
24				0.0					
25				0.0					
26				0.0					
27				0.0					
28				0.0					
29				0.0					
Total:					16187 cfs	16191 cfs	76.06 lb/yr	13.31 lb/yr	2445 lb/yr
R _P v Runoff Reduction Goal Met?				YES					
Total Credits/Shortfall				4 of Credits					

Notes:
1. All subareas must be within the same HUC-8 watershed.
2. Only the most downstream sub-area information should be entered for a series of subareas that drain to each other or for a treatment train.
3. From DURMM v2.5 Report, Line 7 OR Approved Hydrologic Software Report
4. From DURMM v2.5 Report, Line 25 OR Approved Hydrologic Software Report
5. From DURMM v2.5 Report, Line 39 OR Approved Hydrologic Software Report
6. From DURMM v2.5 Report, Line 40 OR Approved Hydrologic Software Report
7. From DURMM v2.5 Report, Lines 44-48 OR Complete Sheet 3

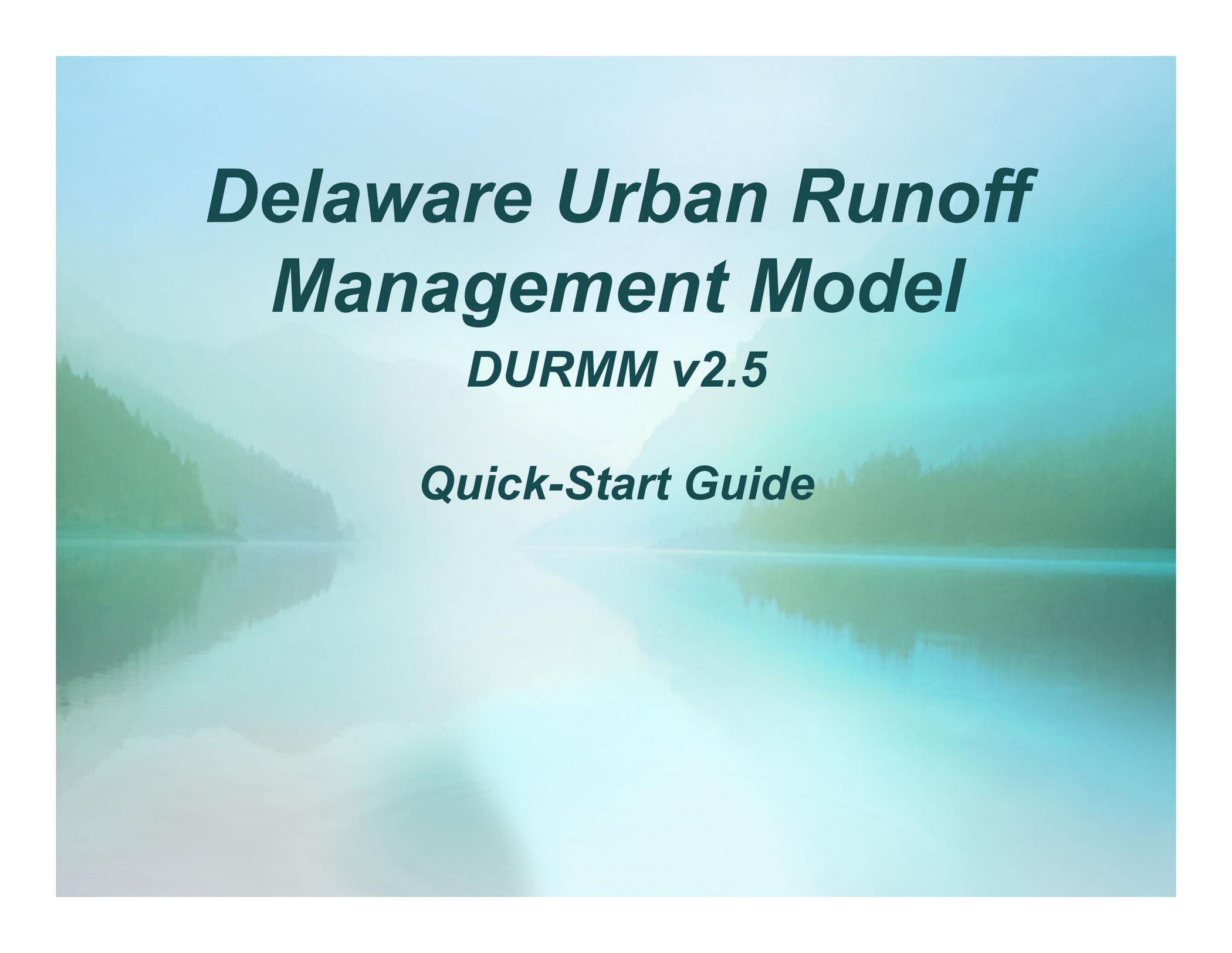
Sheet 1 for Broadkill Estates Example

This slide shows the data for the east drainage from the DURMM v2.5 Report Worksheet for the Broadkill Estates example as it should be entered into the Summary Table for R_Pv Compliance. A similar design level analysis would need to be completed for the west drainage and the resulting data entered into this Summary Table to show R_Pv compliance for the total site.

The DURMM v2.5 worksheets would be included with the other H&H computations in the SWM Report.

The Summary Table for R_Pv Compliance should be included in the narrative summary portion of the SWM Report.

THIS CONCLUDES THE DURMM V2.5 QUICK-START GUIDE. FOR ADDITIONAL INFORMATION CONTACT THE DELAWARE SEDIMENT & STORMWATER PROGRAM.



Delaware Urban Runoff Management Model

DURMM v2.5

Quick-Start Guide



DURMM v2.5

Basic Workflow & Data Input

DURMM v.2 Layout

AutoSave OFF | DURMM_v2.51_Overview.xlsxm - Excel | Greer, Randell (DNREC) | Share | Comments

SECURITY WARNING: Macros have been disabled. **Enable Content**

A128

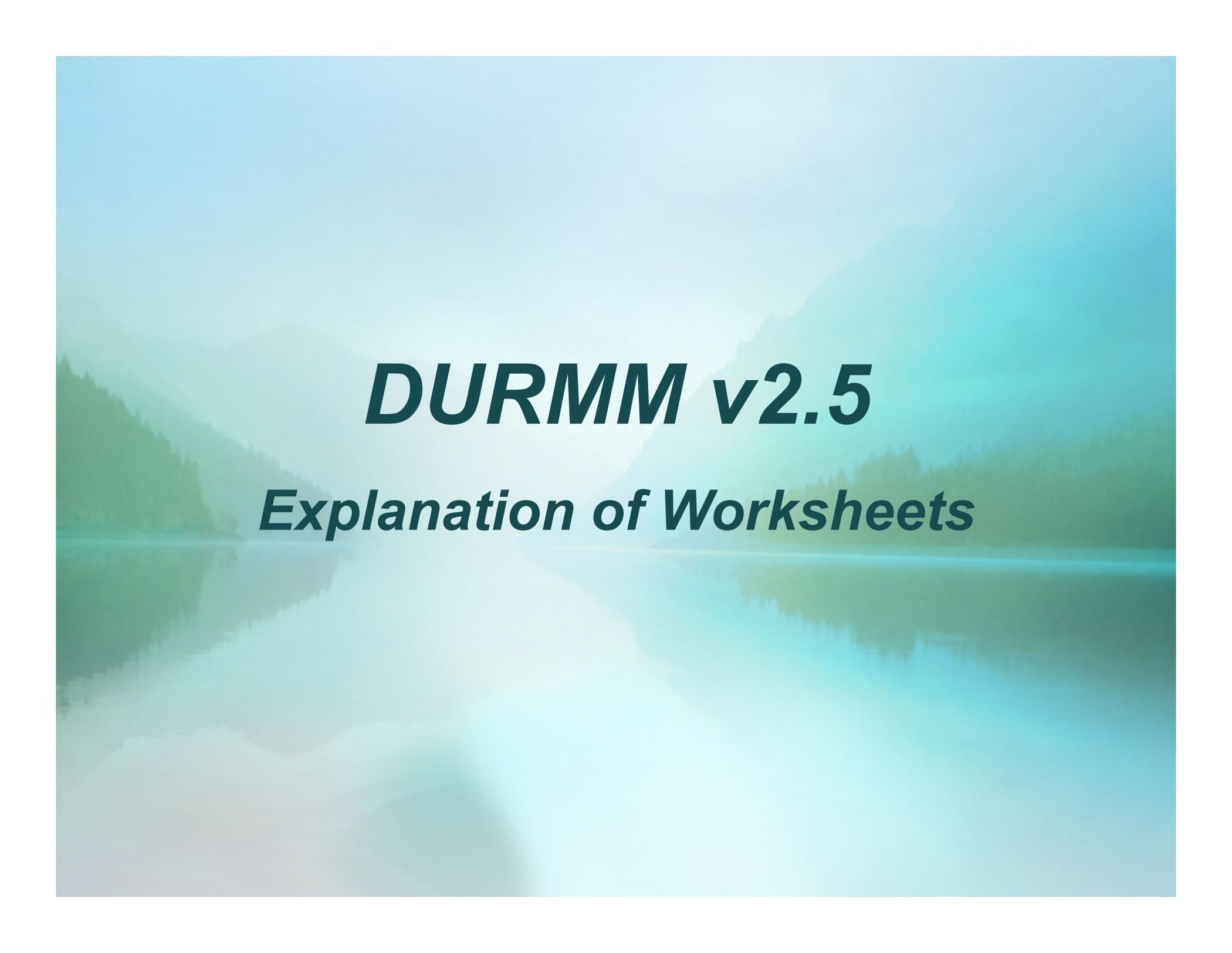
PROJECT:										
DRAINAGE SUBAREA ID:										
LOCATION (County):										
UNIT HYDROGRAPH:										
CONTRIBUTING AREA RUNOFF CURVE NUMBER (C.A. RCN) WORKSHEET										
Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type							
			A		B		C		D	
			Acres	RCN	Acres	RCN	Acres	RCN	Acres	RCN
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	74	80				
Impervious Areas										
Paved parking lots, roofs, driveways			98	98	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	0				
Subarea Contributing Area (ac)			0							
Subarea Weighted RCN			0							
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							
Weighted Runoff Curve Number (RCN)			0							

Legend:
 User input
 Pre-set or output
 Result

Workflow →

CLEAR TABLE

Navigation: C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation | 90%



DURMM v2.5

Explanation of Worksheets

"C.A. RCN" Worksheet

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A111

PROJECT
DRAINAGE SUBAREA ID
LOCATION (County)
UNIT HYDROGRAPH

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

Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type							
			A		B		C		D	
			Acres	RCN	Acres	RCN	Acres	RCN	Acres	RCN
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	74	80				
Impervious Areas										
	Paved parking lots, roofs, driveways		98	98	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										
	Commercial & business	Avg % impervious 85	89	92	94	95				
	Industrial	72	81	88	91	93				
Residential districts by average lot size										
	1/8 acre (town houses)	Avg % impervious 65	77	85	90	92				
	1/4 acre	38	61	75	83	87				
	1/3 acre	50	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	0				
	Subarea Contributing Area (ac)		0							
	Subarea Weighted RCN		0							
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							
	Weighted Runoff Curve Number (RCN)		0							

CLEAR TABLE

80%

“LOD” Worksheet

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B7

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		PROJECT:	0													
2		DRAINAGE SUBAREA ID:	0													
3		LOCATION (County):	0													
4		UNIT HYDROGRAPH:	0													
5		LIMIT OF DISTURBANCE (LOD) WORKSHEET														
6		Step 1 - Subarea LOD Data	HSG A	HSG B	HSG C	HSG D										
7		1.1 HSG Area Within LOD (ac)														
8		1.2 Pre-Developed Woods/Meadow Within LOD (ac)														
9		1.3 Pre-Developed Impervious Within LOD (ac)														
10		1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); OI														
11		1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	0%	0%	0%	0%										
12																
13		Step 2 - Subarea LOD Runoff Calculations														
14		2.1 RCN per HSG	0.00	0.00	0.00	0.00										
15		2.2 RPv per HSG (in.)	0.00	0.00	0.00	0.00										
16		2.3 Target RCN per HSG	0.00	0.00	0.00	0.00										
17		2.4 Target Runoff per HSG (in.)	0.00	0.00	0.00	0.00										
18																
19		2.5 Subarea LOD (ac)	0.00													
20		2.6 Subarea Weighted RCN	0.00													
21		2.7 Subarea Weighted RPv (in.)	0.00													
22		2.8 Subarea Weighted Target Runoff (in.)	0.00													
23																
24		Step 3 - Upstream LOD Areas (from previous DURMM Report as applicable)	Area 1	Area 2	Area 3	Area 4										
25		3.1 Upstream Sub-Area ID														
26		3.2 Upstream Contributing Area (ac)														
27		3.3 Target Runoff for Upstream Area (in.)														
28		3.4 Adjusted CN after all reductions														
29		3.5 Adjusted RPv (in.)														
30		3.6 Adjusted Cv (in.)														
31		3.7 Adjusted Fv (in.)														
32																
33		Step 4 - RPv Calculations for Combined LOD														
34		4.1 Combined LOD (ac)	0.00													
35		4.2 Weighted RCN	#DIV/0!													
36		4.3 Weighted RPv (in.)	#DIV/0!													
37		4.4 Weighted Target Runoff (in.)	#DIV/0!													
38		4.5 Estimated Annual Runoff (in.)	#DIV/0!													
39		4.6 Req'd Runoff to be Managed within LOD (in.)	#DIV/0!													
40		4.7 Req'd Runoff to be Managed within LOD (%)	#DIV/0!													
41																
42																

RESET

1

2

3

4

5

C.A. RCN LOD OLOD RPv TMDL Cv Fv DURMM Report Data & Documentation

100%

"OLOD" Worksheet

DURMM_v2.51_Overview.xlsx - Excel

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A63

1	PROJECT:	0
2	DRAINAGE SUBAREA ID:	0
3	LOCATION (County):	0
4	UNIT HYDROGRAPH:	0
5	OUTSIDE LIMIT OF DISTURBANCE	
6	(OLOD) WORKSHEET	

Step 1 - Site Data

8	1.1 Total Contributing Area (ac)	N/A
9	1.2 C.A. RCN	N/A
10	1.3 LOD Area (ac)	N/A
11	1.4 LOD RCN	N/A
12	1.5 Outside LOD Area (ac)	N/A
13	1.6 Outside LOD RCN	N/A

Step 2 - Time of Concentration

	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)
18	Sheet				N/A	0.00
19					N/A	0.00
20					N/A	0.00
21	Shallow Concentrated			N/A		0.00
22				N/A		0.00
23				N/A		0.00
24	Open Channel		N/A			0.00
25			N/A			0.00
26			N/A			0.00
27			N/A			0.00
28			N/A			0.00
29			N/A			0.00
30			N/A			0.00
31	2.7 Time of Concentration (Tc)					0.10

Sheet Flow Surface Codes

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

Shallow Concentrated Surface Codes

u	unpaved surface
p	paved surface

Step 3 - Peak Discharge

44	3.1 Unit Hydrograph Type	0
45	3.2 Frequency (yr)	10 100
46	3.3 24-HR Rainfall, P (in.)	#N/A #N/A
47	3.4 Initial Abstraction, Ia (in.)	#N/A #N/A
48	3.5 Ia/P ratio	#N/A #N/A
49	3.6 Unit Peak Discharge, qu (csm/in)	#N/A #N/A
50	3.7 Runoff (in.)	#N/A #N/A
51	3.8 Peak Discharge, qp (cfs)	#VALUE! #VALUE!
52	3.9 Equiv. unit peak discharge (cfs/yr)	0.00 0.00

Sheet tabs: C.A. RCN LOD OLOD Rpv TMDL Cv Fv DURMM Report Data & Documentation

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“RPV” Worksheet

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M1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	PROJECT: 0													
2	DRAINAGE SUBAREA ID: 0													
3	LOCATION (County): 0													
4	RESOURCE PROTECTION EVENT (RPv) WORKSHEET													
5	RESET 8	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5				
6		Type	1	Type	--	Type	--	Type	--	Type	--			
7	Step 1 - Calculate Initial RPv													
8	1.1	Total contributing area to BMP (ac)	0.00											
9	1.2	Initial RCN	#DIV/0!											
10	1.3	RPv for Contributing Area (in.)	#DIV/0!											
11	1.4	Req'd RPv to be Managed for Contributing Area (in.)	#DIV/0!											
12	1.5	Req'd RPv to be Managed for Contributing Area (%)	#DIV/0!											
13	Step 2 - Adjust for Retention Reduction													
14	2.1	Retention volume provided (cu. ft.)												
15	2.2	Retention reduction allowance (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
16	2.3	Retention reduction volume (ac-ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
17	2.4	Retention reduction volume (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
18	2.5	Runoff volume after retention reduction (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
19	2.6	Adjusted CN*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
20	Step 3 - Adjust for Annual Runoff Reduction													
21	3.1	Annual CN (ACN)	#DIV/0!	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
22	3.2	Annual runoff (in.)	#DIV/0!	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
23	3.3	Proportion A/B soils in BMP footprint (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%			
24	3.4	Annual runoff reduction allowance (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
25	3.5	Annual runoff after reduction (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
26	3.6	Adjusted ACN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
27	3.7	Annual Runoff Reduction Allowance for RPv (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
28	Step 4 - Calculate RPv with BMP Reductions													
29	4.1	RPv Runoff Management Provided (cu. ft.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
30	4.2	RPv runoff volume after all reductions (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
31	4.3	RPv runoff volume after all reductions (cu.ft.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
32	4.4	Total RPv runoff reduction (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
33	4.5	Total RPv runoff reduction (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
34	4.6	Adjusted CN after all reductions*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
35	4.7	Adjusted equivalent annual runoff (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
36	4.8	RPv Compliance Met Through Runoff Reduction?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
37	4.9	Runoff Reduction Credit, if Applicable (cu.ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
38	Step 5 - Determine Residual Volume to be Managed or Offset													
39	5.1	RPv Residual Volume (in.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
40	5.2	RPv Residual Volume (cu.ft./ac)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
41	5.3	Residual Volume to be Managed or Offset (cu.ft.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
42	5.4	RPv avg. discharge rate for 48-hr detention (cfs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
43	5.5	RPv max. discharge rate for 48-hr detention (cfs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
44	*NOTE: No additional runoff reduction credit can be taken for surface recharge practices once the "Adjusted CN after all reductions" (Step 4.6) reaches the equivalent CN for the native soil-cover condition of the BMP footprint itself (i.e. for Sheet Flow to Turf Filter Strip on B soils Step 4.6 cannot be below 61). If this occurs contact the DNREC - SSP for further guidance.													
45														
46														
47														
48														
49														
50														
51														
52														

C.A. RCN LOD OLOD RPv TMDL Cv Fv DURMM Report Data & Documentation 80%

“TMDL” Worksheet

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B3

PROJECT: 0
 DRAINAGE SUBAREA ID: 1
 TMDL WATERSHED: [Dropdown]

TOTAL MAXIMUM DAILY LOAD (TMDL) WORKSHEET

	BMP 1			BMP 2			BMP 3			BMP 4			BMP 5		
Type:	-			Type:	-			Type:	-			Type:	-		
Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS
1.1 Total contributing area to BMP (ac)	0.00														
1.2 Initial RCN	#DIV/0!														
1.3 Annual runoff volume (in.)	#DIV/0!														
1.4 Annual runoff volume (liters)	#DIV/0!														
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 (%)	N/A			N/A			N/A			N/A			N/A		
3.2 Adjusted annual runoff volume (in)	N/A			N/A			N/A			N/A			N/A		
3.3 Adjusted annual runoff volume (liters)	N/A			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 (%)	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
3.6 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
3.7 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
Step 4 - Pollutant Reduction Met? (For Informational Purposes)															
4.1 TMDL (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
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 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

Navigation: C.A. RCN | LOD | OLOD | RPV | TMDL | Cv | Fv | DURMM Report | Data & Documentation

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“Cv” Worksheet

DURMM_v2.51_Overview.xlsxm - Excel

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A58

	A	B	C	D	E	F	G	H	I	J	K	L
1	PROJECT:	0										
2	DRAINAGE SUBAREA ID:	0										
3	LOCATION (County):	0										
4	CONVEYANCE EVENT (Cv) WORKSHEET											
5		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5		
6		Type:	--	Type:	--	Type:	--	Type:	--	Type:	--	
7	Step 1 - Calculate Initial Cv	Data		Data		Data		Data		Data		
8	1.1 Total contributing area to BMP (ac)	0.00		0.00		0.00		0.00		0.00		
9	1.2 Initial RCN	#DIV/0!										
10	1.3 10-Year Rainfall (in.)	#N/A										
11	1.4 Cv runoff volume (in.)	#N/A										
12												
13	Step 2 - Adjust for Retention Reduction											
14	2.1 Storage volume (cu. ft.)	N/A		N/A		N/A		N/A		N/A		
15	2.2 Storage volume (ac-ft)	N/A		N/A		N/A		N/A		N/A		
16	2.3 Storage volume (in.)	N/A		N/A		N/A		N/A		N/A		
17	2.4 Runoff volume after reduction (in.)	N/A		N/A		N/A		N/A		N/A		
18	2.5 CN*	N/A		N/A		N/A		N/A		N/A		
19												
20	Step 3 - Adjust for Annual Runoff Reduction											
21	3.1 Runoff reduction allowance (%)	N/A		N/A		N/A		N/A		N/A		
22	3.2 Annual runoff after reduction (in.)	N/A		N/A		N/A		N/A		N/A		
23	3.3 Adjusted ACN	N/A		N/A		N/A		N/A		N/A		
24	3.4 Event-based runoff reduction (in.)	N/A		N/A		N/A		N/A		N/A		
25												
26	Step 4 - Calculate Cv with BMP Reductions											
27	4.1 Cv runoff volume after all reductions (in.)	N/A		N/A		N/A		N/A		N/A		
28	4.2 Total Cv runoff reduction (%)	N/A		N/A		N/A		N/A		N/A		
29	4.3 Adjusted RCN for H&H modeling	N/A		N/A		N/A		N/A		N/A		
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												
41												
42												
43												
44												
45												
46												

C.A. RCN | LOD | OLOD | Rpv | TMDL | **Cv** | Fv | DURMM Report | Data & Documentation

90%

"Fv" Worksheet

DURMM_v2.51_Overview.xlsm - Excel

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A60

	A	B	C	D	E	F	G	H	I	J	K	L
1	PROJECT:	0										
2	DRAINAGE SUBAREA ID:	0										
3	LOCATION (County):	0										
4	FLOODING EVENT (Fv) WORKSHEET											
5		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5		
6		Type:	--									
7	Step 1 - Calculate Initial Fv	Data										
8	1.1 Total contributing area to BMP (ac)	0.00		0.00		0.00		0.00		0.00		
9	1.2 Initial RCN	#DIV/0!										
10	1.3 100-Year Rainfall (in.)	#N/A										
11	1.4 Fv runoff volume (in.)	#N/A										
12												
13	Step 2 - Adjust for Retention Reduction											
14	2.1 Storage volume (cu. ft.)	N/A										
15	2.2 Storage volume (ac-ft)	N/A										
16	2.3 Storage volume (in.)	N/A										
17	2.4 Runoff volume after reduction (in.)	N/A										
18	2.5 CN*	N/A										
19												
20	Step 3 - Adjust for Annual Runoff Reduction											
21	3.1 Runoff reduction allowance (%)	N/A										
22	3.2 Annual runoff after reduction (in.)	N/A										
23	3.3 Adjusted ACN	N/A										
24	3.4 Event-based runoff reduction (in.)	N/A										
25												
26	Step 4 - Calculate Fv with BMP Reductions											
27	4.1 Fv runoff volume after all reductions (in.)	N/A										
28	4.2 Total Fv runoff reduction (%)	N/A										
29	4.3 Adjusted RCN for H&H modeling	N/A										
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												
41												
42												
43												
44												
45												
46												
47												

C.A. RCN | LOD | OLOD | Rpv | TMDL | Cv | **Fv** | DURMM Report | Data & Documentation

90%

“DURMM Report” Worksheet

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A103

1	PROJECT:	0																		
2	DRAINAGE SUBAREA ID:	0																		
3	COUNTY:	0																		
4	TMDL Watershed:	0																		
5	DURMM OUTPUT WORKSHEET																			
6	Site Data																			
7	Contributing Area to BMPs (ac.)	0.00																		
8	C.A. RCN	0.00																		
9	Subarea LOD (ac.)	0.00																		
10	Subarea RCN	0.00																		
11	Upstream Subarea ID	N/A	N/A	N/A	N/A															
12	Upstream Subarea LOD (ac.)	0.00	0.00	0.00	0.00															
13	Combined LOD with Upstream Areas (ac.)	0.00																		
14	Combined RCN with Upstream Areas (ac.)	#DIV/0!																		
15	Watershed TMDL-TN (lb/ac/yr)	#N/A																		
16	Watershed TMDL-TP (lb/ac/yr)	#N/A																		
17	Watershed TMDL-TSS (lb/ac/yr)	#N/A																		
18																				
19	BMP Data																			
20		BMP 1	BMP 2	BMP 3	BMP 4	BMP 5														
21		--	--	--	--	--														
22																				
23	RPv runoff volume after all reductions (in.)	N/A	N/A	N/A	N/A	N/A														
24	Total RPv runoff reduction (in.)	N/A	N/A	N/A	N/A	N/A														
25	Total RPv runoff reduction (%)	N/A	N/A	N/A	N/A	N/A														
26	RPv Compliance Met Through Runoff Reduction?	N/A	N/A	N/A	N/A	N/A														
27	RPv Residual Volume (cu. ft.)	N/A	N/A	N/A	N/A	N/A														
28	Adjusted pollutant load, TN (lb/ac/yr)	N/A	N/A	N/A	N/A	N/A														
29	Adjusted pollutant load, TP (lb/ac/yr)	N/A	N/A	N/A	N/A	N/A														
30	Adjusted pollutant load, TSS (lb/ac/yr)	N/A	N/A	N/A	N/A	N/A														
31	Cv runoff volume after all reductions (in.)	N/A	N/A	N/A	N/A	N/A														
32	Fv runoff volume after all reductions (in.)	N/A	N/A	N/A	N/A	N/A														
33																				
34	Resource Protection Event (RPV)																			
35	RPv for Contributing Area (in.)	#DIV/0!																		
36	Annual Runoff for Contributing Area (in.)	#DIV/0!																		
37	Req'd RPv to be Managed for Contributing Area (in.)	#DIV/0!																		
38	Req'd RPv to be Managed for Contributing Area (%)	#DIV/0!																		
39	RPv Runoff Management Required (cu. Ft.)	#DIV/0!																		
40	RPv Runoff Management Provided (cu. Ft.)	0																		
41	RPv Residual Volume (cu.ft.)	0																		
42	C.A. RPv avg. discharge rate (cfs)	0.00																		
43	C.A. RPv max. discharge rate (cfs)	0.00																		
44	TN Pollutant Load (lb/yr)	0.00																		
45	TP Pollutant Load (lb/yr)	0.00																		
46	TSS Pollutant Load (lb/yr)	0																		
47																				

1

2

3

4

C.A. RCN LOD OLOD RPv TMDL Cv Fv DURMM Report Data & Documentation

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“DURMM Report” Worksheet (cont.)

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A103

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	PROJECT:	0															
2	DRAINAGE SUBAREA ID:	0															
3	COUNTY:	0		UNIT HYDROGRAPH:	0												
4	TMDL Watershed:	0		VERSION:	DURMM v2.51.yymmdd												
5	DURMM OUTPUT WORKSHEET																
48	Conveyance Event (Cv)																
49	Cv runoff volume (in.)	#N/A	5														
50	Adjusted RCN for H&H Modeling (CN*)	0.00															
52	Flooding Event (Fv)																
53	Fv runoff volume (in.)	#N/A	6														
54	Equivalent RCN for H&H Modeling (CN*)	0.00															
56	Adjusted Subarea Data for Downstream DURMM Modeling																
57	Subarea ID	0.00															
58	Contributing Area (ac.)	0.00															
59	Weighted Target Runoff (in.)	#DIV/0!	6														
60	Adjusted CN after all reductions	0.00															
61	Adjusted Rpv (in.)	0.00															
62	Adjusted Cv (in.)	0.00															
63	Adjusted Fv (in.)	0.00															
65	Adjusted Subarea Data for Nutrient Protocol Modeling																
66	Contributing Area (ac.)	0.00															
67	LOD Area (ac.)	0.00															
68	TN Pollutant Load (lb/yr)	0.00	6														
69	TP Pollutant Load (lb/yr)	0.00															
70	TSS Pollutant Load (lb/yr)	0															
71	Percent Impervious Cover	#DIV/0!															
73	Adjusted Subarea Data for the Summary Table for Sub-Areas Draining to a Common Point of Interest																
74	Subarea ID	0.00															
75	Contributing Area (ac.)	0.00															
76	RPv Residual Volume (cu.ft.)	0															
77	Adjusted CN after all reductions	0.00	6														
78	Cv RCN for H&H Modeling	0.00															
79	Fv RCN for H&H Modeling	0.00															
80	TN Pollutant Load (lb/yr)	0.00															
81	TP Pollutant Load (lb/yr)	0.00															
82	TSS Pollutant Load (lb/yr)	0															

C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation | 90%

"Data & Documentation" Worksheet

DURMM_v2.51_Overview.xlsm - Excel

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M83 0%

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Class	BMP Category	DURMM Variant	TN Reduction	TP Reduction	TSS Reduction	Retention Allowance	Annual Runoff Reduction, RPv, A/B Soil	Annual Runoff Reduction, C/D Soil					
27	Annual Runoff Reduction Practice	4.0 Vegetated Roofs	4-B Intensive Vegetated Roofs	0% of Load Reduction	0% of Load Reduction	0% of Load Reduction	0%	75% Annual RR	0% Annual RR					
28														
29	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					
30	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					
31														
32	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					
33	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					
34	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					
35														
36	Annual Runoff Reduction Practice	7.0 Rooftop Disconnection	7-A Full Rooftop Disconnection - HSG A	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	96% Annual RR	96% Annual RR					
37	Annual Runoff Reduction Practice	7.0 Rooftop Disconnection	7-B Full Rooftop Disconnection - HSG B	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	81% Annual RR	81% Annual RR					
38	Annual Runoff Reduction Practice	7.0 Rooftop Disconnection	7-C Full Rooftop Disconnection - HSG C	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	63% Annual RR	63% Annual RR					
39	Annual Runoff Reduction Practice	7.0 Rooftop Disconnection	7-D Full Rooftop Disconnection - HSG D	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	51% Annual RR	51% Annual RR					
40														
41	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					
42	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					
43														
44	Annual Runoff Reduction Practice	9.0 Sheet Flow	9-A Sheet Flow to Grassed Filter Strip	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	25% Annual RR	10% Annual RR					
45	Annual Runoff Reduction Practice	9.0 Sheet Flow	9-B Sheet Flow to Afforested Filter Strip	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	30% Annual RR	15% Annual RR					
46	Annual Runoff Reduction Practice	9.0 Sheet Flow	9-C 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					
47	Annual Runoff Reduction Practice	9.0 Sheet Flow	9-D Sheet Flow to Grassed Open Space	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	50% Annual RR	20% Annual RR					
48	Annual Runoff Reduction Practice	9.0 Sheet Flow	9-E Sheet Flow to Afforested Open Space	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	60% Annual RR	30% Annual RR					
49	Annual Runoff Reduction Practice	9.0 Sheet Flow	9-F 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					
50														
51	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					
52	Stormwater Treatment Practice	10.0 Detention Practices	10-B Dry Extended Detention (ED) Basin	20% Removal Efficiency	20% Removal Efficiency	60% Removal Efficiency	0%	0% Annual RR	0% Annual RR					
53	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					
54	Stormwater Treatment Practice	10.0 Detention Practices	10-D Underground 48-HR Detention Facilities	20% Removal Efficiency	20% Removal Efficiency	60% Removal Efficiency	0%	0% Annual RR	0% Annual RR					
55														
56	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					
57	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					
58	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					
59	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					
60														
61	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					
62	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					
63	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					
64	Stormwater Treatment Practice	12.0 Wetlands	12-D Submerged Gravel Wetlands	30% Removal Efficiency	40% Removal Efficiency	80% Removal Efficiency	0%	0% Annual RR	0% Annual RR					
65														
66	Stormwater Treatment Practice	13.0 Wet Pond	13-A Wet Quantity Management Pond	0% Removal Efficiency	0% Removal Efficiency	0% Removal Efficiency	0%	0% Annual RR	0% Annual RR					
67	Stormwater Treatment Practice	13.0 Wet Pond	13-B Wet Extended Detention (ED) Pond	30% Removal Efficiency	55% Removal Efficiency	60% Removal Efficiency	0%	0% Annual RR	0% Annual RR					
68														
69	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%	48% Annual RR	0% Annual RR					
70	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					
71	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	23% Annual RR					
72	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					
73														
74	Stormwater Treatment Practice	15.0 Proprietary Practices	15-A Proprietary Practices	0% Removal Efficiency	0% Removal Efficiency	0% Removal Efficiency	0%	0% Annual RR	0% Annual RR					
75														
76	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					
77	Stormwater Treatment Practice	16.0 Source Controls	16-B Street Sweeping	3% Removal Efficiency	3% Removal Efficiency	0% Removal Efficiency	0%	0% Annual RR	0% Annual RR					
78														
79	Annual Runoff Reduction Practice	17.0 Afforestation	17-AA Afforestation - HSG A	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	##### Annual RR	0.00% Annual RR					
80	Annual Runoff Reduction Practice	17.0 Afforestation	17-AB Afforestation - HSG B				0%	##### Annual RR	0.00% Annual RR					
81	Annual Runoff Reduction Practice	17.0 Afforestation	17-AC Afforestation - HSG C				0%	0.00% Annual RR	17.68% Annual RR					
82	Annual Runoff Reduction Practice	17.0 Afforestation	17-AD Afforestation - HSG D				0%	0.00% Annual RR	12.52% Annual RR					
83	Annual Runoff Reduction Practice	17.0 Afforestation	17-B Urban Tree Planting	100% of Load Reduction	100% of Load Reduction	100% of Load Reduction	0%	0% Annual RR	0% Annual RR					

C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation | 70%



DURMM v2.5

“Broadkill Estates” Example Site

Ex. #1: Concept Level Analysis

Concept Level Analysis

Sediment & Stormwater
Assessment Study (SAS)
for
Broadkill Estates
Sussex County, DE



Prepared By:
GreenTech Consulting, Inc.
Milton, DE



Concept Level Analysis

Stormwater Assessment Study GIS 2.3 DNREC Sediment & Stormwater Program Sediment and Stormwater Help Pages

Find Address

Layer List

- Streams
- Lakes and Ponds
- Tax Ditch Watersheds
- Tax Ditch Channel
- Tax Ditch Right of Way
- Well Head Protection Areas
- Groundwater Recharge Areas
- Aquifer Recharge Areas
- Soils - New Castle County
- Soils - Kent County
- Soils - Sussex County
- Head of Tide Wetlands 2007
- State Wetlands Mapping Project
- SIRB Sites
- Leaking Tanks
- Above Ground Storage Tank Facility
- Underground Storage Tanks
- Solid and Hazardous Waste
- Parcels
- Contours
- Flood Data
- Depth To Water WET

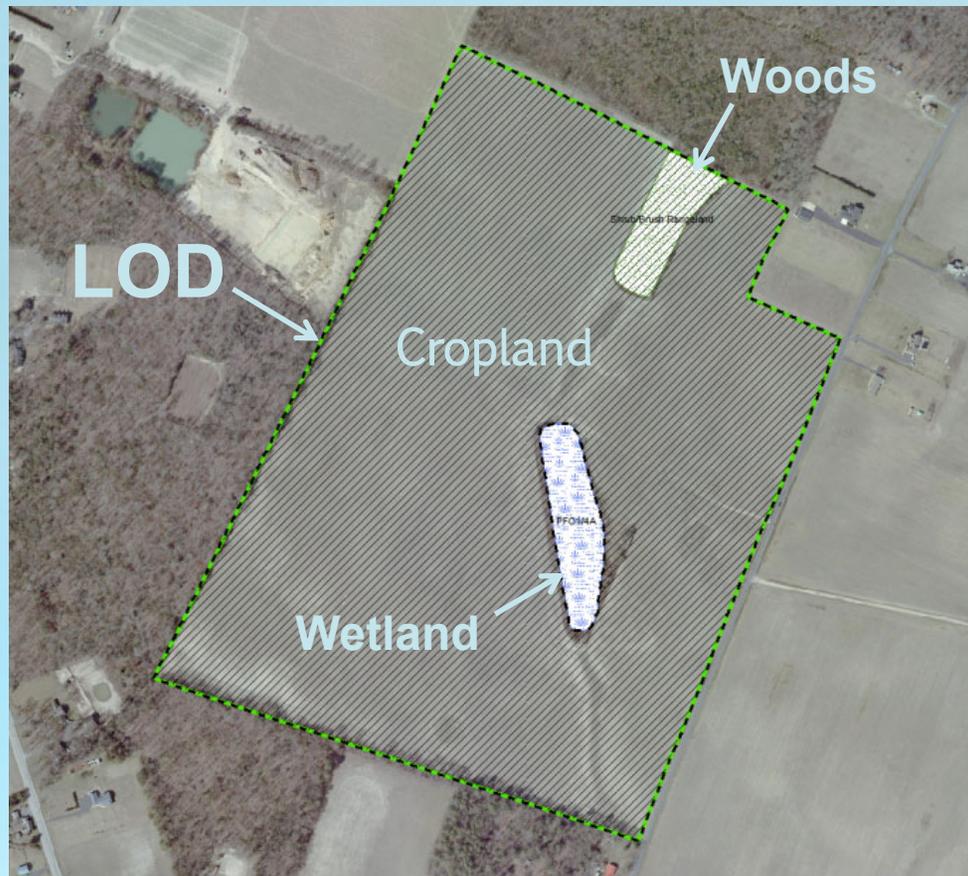
600ft -75.309 38.737 Degrees

Sanborn Mapping Company POWERED BY esri

Concept Level Analysis

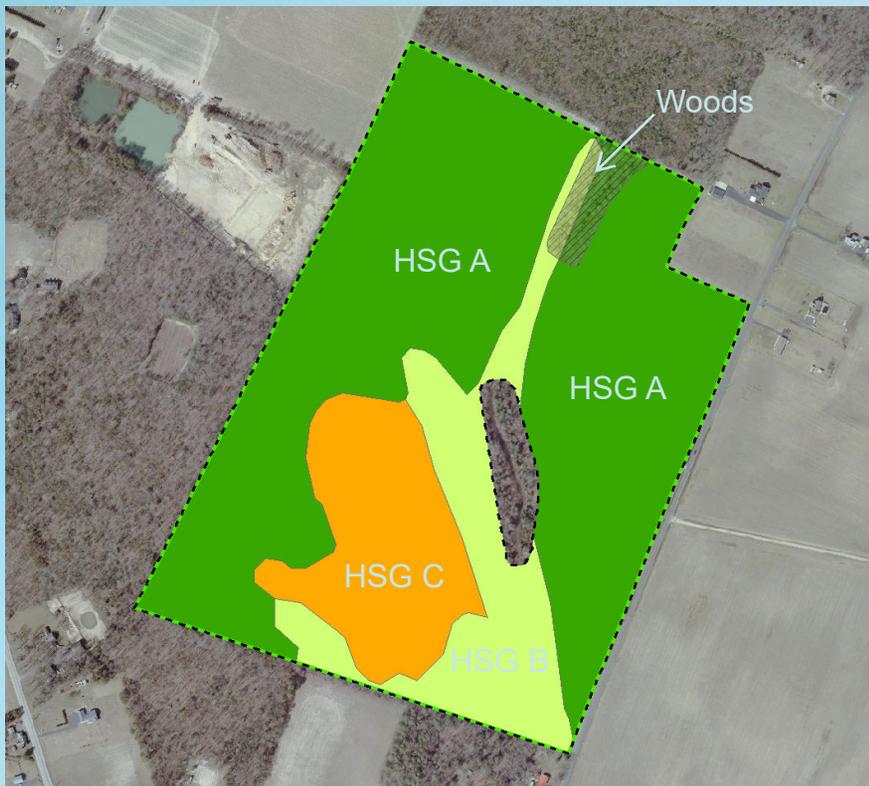


Concept Level Analysis



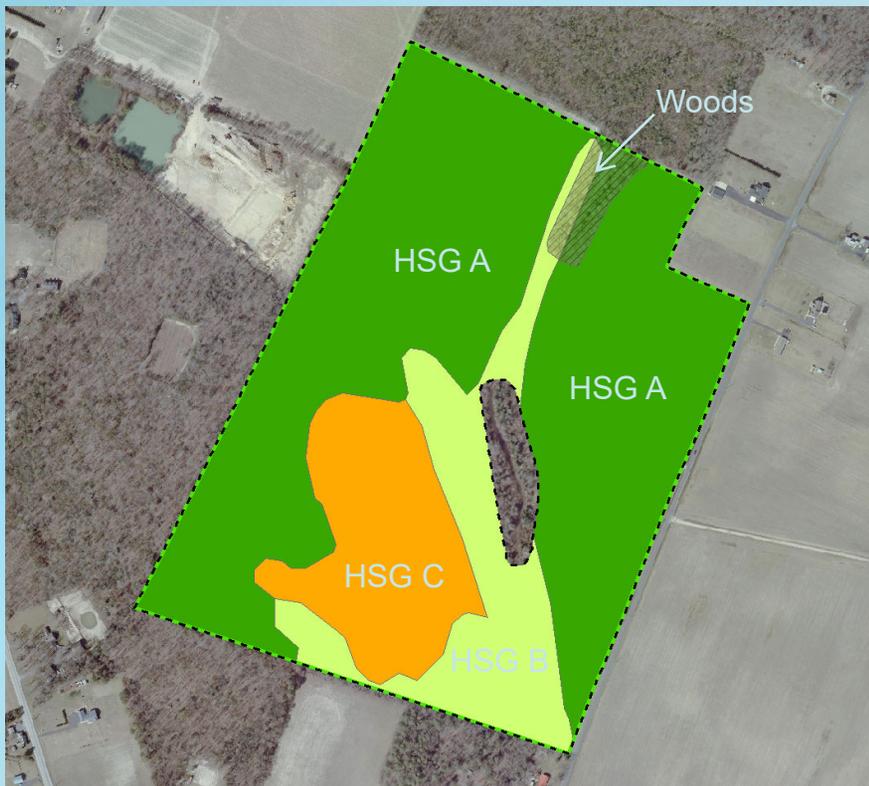
Proposed LU: Residential, 1 ac. lots

Concept Level Analysis Site Data



- C.A. RCN Tab
 - Residential, 1-ac. (20% imperv.)
 - HSG A: 70.07 ac.
 - HSG B: 17.10 ac.
 - HSG C: 15.56 ac.

Concept Level Analysis Site Data



- LOD Tab
 - HSG A
 - LOD Area: 70.07 ac.
 - Pre-Dev. Woods: 1.55 ac.
 - Post-Dev. Impervious: 20%
 - HSG B
 - LOD area: 17.10 ac.
 - Pre-Dev. Woods: 0.80 ac.
 - Post-Dev. Impervious: 20%
 - HSG C
 - LOD Area: 15.56 ac.
 - Pre-Dev. Woods: 0 ac.
 - Post-Dev. Impervious: 20%

“LOD” Worksheet

DURMM_v2 2011-05-04_BroadkillEst_concept.xls [Compatibility Mode] - Microsoft Excel

PROJECT: Broadkill Estates
 DRAINAGE SUBAREA ID: Site - Concept
 LOCATION (County): Sussex
 UNIT HYDROGRAPH: DMV

LIMIT OF DISTURBANCE (LOD) WORKSHEET

LOD Data	HSG A	HSG B	HSG C	HSG D	
HSG Area Within LOD (ac)	70.07	17.1	15.56		RESET
Pre-Developed Woods/Meadow Within LOD (ac)	1.55	0.8			
Post-Developed Imperviousness Within LOD					
Option #1 (ac); OR					
Option #2 (%)	20%	20%	20%	0%	
Runoff Calculations					
RCN per HSG	50.80	68.40	78.80	0.00	
RPv (in.)	0.29	0.85	1.33	0.00	
Target (in.)	0.00	0.56	1.10	0.00	
Cv Weighted Unit Discharge (cfs/ac)	0.73	0.73	0.75	0.00	
Fv Weighted Unit Discharge (cfs/ac)	2.21	2.20	2.25	0.00	
Total Subarea LOD (ac)					
				102.73	
Weighted LOD RCN					
				57.97	
RPv Runoff Reduction					
Weighted RPv (in.)				0.54	
Estimated Annual Runoff (in.)				5.93	
Req'd Runoff Reduction within LOD (in.)				0.28	
Req'd Runoff Reduction within LOD (%)				52%	
Cv Unit Discharge					
LOD Allowable Unit Discharge (cfs/ac)				0.74	
Fv Unit Discharge					
LOD Allowable Unit Discharge (cfs/ac)				2.21	

Ready

"RPV" Worksheet

DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

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E6 : X ✓ fx '2-A Traditional Bioretention - Infiltration

		B	C	D	E	F	G	H	I	J	K	L	M	N
1	PROJECT:	Broadkill Estates												
2	DRAINAGE SUBAREA ID:	Site - Concept Level Analysis												
3	LOCATION (County):	Sussex												
4	RESOURCE PROTECTION EVENT (RPV) WORKSHEET													
5	RESET	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5				
6		Type	8-B Grassed Channel	Type	2-A Traditional Bioretention - Infiltration	Type	--	Type	--	Type	--			
7	Step 1 - Calculate Initial RPv													
8	1.1 Total contributing area to BMP (ac)	102.73												
9	1.2 Initial RCN	57.97												
10	1.3 RPv for Contributing Area (in.)	0.61												
11	1.4 Req'd RPv to be Managed for Contributing Area (in.)	0.21												
12	1.5 Req'd RPv to be Managed for Contributing Area (%)	34%												
13	Step 2 - Adjust for Retention Reduction													
15	2.1 Retention volume provided (cu. ft.)			34015										
16	2.2 Retention reduction allowance (%)	0%		100%		N/A		N/A		N/A		N/A		
17	2.3 Retention reduction volume (ac-ft)	0.00		0.78		N/A		N/A		N/A		N/A		
18	2.4 Retention reduction volume (in.)	0.00		0.09		N/A		N/A		N/A		N/A		
19	2.5 Runoff volume after retention reduction (in.)	0.61		0.41		N/A		N/A		N/A		N/A		
20	2.6 Adjusted CN*	59.77		50.52		N/A		N/A		N/A		N/A		
21	Step 3 - Adjust for Annual Runoff Reduction													
23	3.1 Annual CN (ACN)	57.97		54.87		N/A		N/A		N/A		N/A		
24	3.2 Annual runoff (in.)	5.93		4.89		N/A		N/A		N/A		N/A		
25	3.3 Proportion A/B soils in BMP footprint (%)	75%		0%		0%		0%		0%		0%		
26	3.4 Annual runoff reduction allowance (%)	18%		0%		N/A		N/A		N/A		N/A		
27	3.5 Annual runoff after reduction (in.)	4.89		4.89		N/A		N/A		N/A		N/A		
28	3.6 Adjusted ACN	54.87		54.87		N/A		N/A		N/A		N/A		
29	3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.12		0.12		N/A		N/A		N/A		N/A		
30	Step 4 - Calculate RPv with BMP Reductions													
32	4.1 RPv Runoff Management Provided (cu. ft.)	43237		77252		N/A		N/A		N/A		N/A		
33	4.2 RPv runoff volume after all reductions (in.)	0.50		0.41		N/A		N/A		N/A		N/A		
34	4.3 RPv runoff volume after all reductions (cu.ft.)	185,804		151,790		N/A		N/A		N/A		N/A		
35	4.4 Total RPv runoff reduction (in.)	0.12		0.21		N/A		N/A		N/A		N/A		
36	4.5 Total RPv runoff reduction (%)	19%		34%		N/A		N/A		N/A		N/A		
37	4.6 Adjusted CN after all reductions*	54.87		50.52		N/A		N/A		N/A		N/A		
38	4.7 Adjusted equivalent annual runoff (in.)	4.89		3.67		N/A		N/A		N/A		N/A		
39	4.8 RPv Compliance Met Through Runoff Reduction?	NO		YES		N/A		N/A		N/A		N/A		
40	4.9 Runoff Reduction Credit, if Applicable (cu.ft)	N/A		-1.42		N/A		N/A		N/A		N/A		
41	Step 5 - Determine Residual Volume to be Managed or Offset													
43	5.1 RPv Residual Volume (in.)	0.09		N/A		N/A		N/A		N/A		N/A		
44	5.2 RPv Residual Volume (cu.ft./ac)	331		N/A		N/A		N/A		N/A		N/A		
45	5.3 Residual Volume to be Managed or Offset (cu.ft.)	34,014		N/A		N/A		N/A		N/A		N/A		
46	5.4 RPv avg. discharge rate for 48-hr detention (cfs)	0.197		N/A		N/A		N/A		N/A		N/A		
47	5.5 RPv max. discharge rate for 48-hr detention (cfs)	0.984		N/A		N/A		N/A		N/A		N/A		
49	*NOTE: No additional runoff reduction credit can be taken for surface recharge practices once the "Adjusted CN after all reductions" (Step 4.6) reaches the equivalent CN for the native soil-cover condition of the BMP footprint itself [i.e. for Sheet Flow to Turf Filter Strip on B soils Step 4.6 cannot be below 61]. If this occurs contact the DNREC - SSP for further guidance.													
51														
52														

C.A. RCN | LOD | OLOD | **RPv** | TMDL | Cv | Fv | DURMM Report | Data & Documentation

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“TMDL” Worksheet

DURMM_v2.51_Broadkill Estates_Concept.xlsxm - Excel

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B3 Broadkill River

PROJECT: Broadkill Estates																
DRAINAGE SUBAREA ID: Site - Concept Level Analysis																
TMDL WATERSHED: Broadkill River																
TOTAL MAXIMUM DAILY LOAD (TMDL) WORKSHEET																
	BMP 1			BMP 2			BMP 3			BMP 4			BMP 5			
	Type:	8-8 Grassed Channel		Type:	2-A Traditional Bioretention - Infiltration		Type:	-		Type:	-		Type:	-		
	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS
7	Step 1 - Calculate Annual Runoff Volume															
8	1.1 Total contributing area to BMP (ac)	102.73														
9	1.2 Initial RCN	58														
10	1.3 Annual runoff volume (in.)	5.93														
11	1.4 Annual runoff volume (liters)	6.27E+07														
13	Step 2 - Calculate Annual Pollutant Load															
14	2.1 EMC (mg/L)	2.80	0.49	90	2.80	0.49	90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	2.2 Load (mg/yr)	1.75E+08	3.07E+07	5.64E+09	1.45E+08	2.53E+07	4.65E+09	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16	2.3 Stormwater Load (lb/ac/yr)	3.77	0.66	121.03	3.11	0.54	99.85	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18	Step 3 - Adjust for Pollutant Reduction															
19	3.1 BMP annual runoff reduction (%)	17%			25%			N/A				N/A				
20	3.2 Adjusted annual runoff volume (in)	4.89			3.67			N/A				N/A				
21	3.3 Adjusted annual runoff volume (liters)	5.17E+07			3.87E+07			N/A				N/A				
22	3.4 Adjusted load from annual reductions (lb/ac/yr)	3.11	0.54	99.85	2.33	0.41	74.80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	3.5 BMP removal efficiency (%)	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
24	3.6 BMP effluent concentration (mg/L)	2.80	0.49	90.00	2.80	0.49	90.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	3.7 Final Adjusted load (lb/ac/yr)	3.11	0.54	99.85	2.33	0.41	74.80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	Step 4 - Pollutant Reduction Met? (For Informational Purposes)															
28	4.1 TMDL (lb/ac/yr)	11.90	0.50	N/A												
29	4.2 Reduction met?	YES	NO	N/A	YES	YES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30	4.3 Final Adjusted Load (lb/yr)	319.12	55.85	10258	239.06	41.84	7684	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

C.A. RCN LOD OLOD Rpv TMDL Cv Fv DURMM Report Data & Documentation 75%

“Cv” Worksheet

DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

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A58

	A	B	C	D	E	F	G	H	I	J	K	L
1	PROJECT: Broadkill Estates											
2	DRAINAGE SUBAREA ID: Site - Concept Level Analysis											
3	LOCATION (County): Sussex											
4	CONVEYANCE EVENT (Cv) WORKSHEET											
5		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5		
6		Type:	8-B Grassed Channel	Type:	2-A Traditional Bioretention -	Type:	--	Type:	--	Type:	--	
7	Step 1 - Calculate Initial Cv	Data		Data		Data		Data		Data		
8	1.1 Total contributing area to BMP (ac)	102.73		102.73		102.73		102.73		102.73		
9	1.2 Initial RCN	57.97										
10	1.3 10-Year Rainfall (in.)	5.3										
11	1.4 Cv runoff volume (in.)	1.34										
12												
13	Step 2 - Adjust for Retention Reduction											
14	2.1 Storage volume (cu. ft.)	0.00		34015.00		N/A		N/A		N/A		
15	2.2 Storage volume (ac-ft)	0.00		0.78		N/A		N/A		N/A		
16	2.3 Storage volume (in.)	0.00		0.09		N/A		N/A		N/A		
17	2.4 Runoff volume after reduction (in.)	1.34		1.24		N/A		N/A		N/A		
18	2.5 CN*	57.97		56.61		N/A		N/A		N/A		
19												
20	Step 3 - Adjust for Annual Runoff Reduction											
21	3.1 Runoff reduction allowance (%)	0%		0%		N/A		N/A		N/A		
22	3.2 Annual runoff after reduction (in.)	1.33		1.33		N/A		N/A		N/A		
23	3.3 Adjusted ACN	57.93		57.93		N/A		N/A		N/A		
24	3.4 Event-based runoff reduction (in.)	0.00		0.00		N/A		N/A		N/A		
25												
26	Step 4 - Calculate Cv with BMP Reductions											
27	4.1 Cv runoff volume after all reductions (in.)	1.33		1.24		N/A		N/A		N/A		
28	4.2 Total Cv runoff reduction (%)	0%		7%		N/A		N/A		N/A		
29	4.3 Adjusted RCN for H&H modeling	57.93		56.61		N/A		N/A		N/A		
30												
31												
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C.A. RCN | LOD | OLOD | Rpv | TMDL | Cv | Fv | DURMM Report | Data & Documentation | 90%

“Fv” Worksheet

DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

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PROJECT: Broadkill Estates
 DRAINAGE SUBAREA ID: Site - Concept Level Analysis
 LOCATION (County): Sussex

FLOODING EVENT (Fv) WORKSHEET

	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
	Type:	8-B Grassed Channel	Type:	2-A Traditional Bioretention -	Type:	--	Type:	--	Type:	--
Step 1 - Calculate Initial Fv	Data		Data		Data		Data		Data	
1.1 Total contributing area to BMP (ac)	102.73		102.73		102.73		102.73		102.73	
1.2 Initial RCN	57.97									
1.3 100-Year Rainfall (in.)	9.2									
1.4 Fv runoff volume (in.)	4.00									
Step 2 - Adjust for Retention Reduction										
2.1 Storage volume (cu. ft.)	0.00		34015.00		N/A		N/A		N/A	
2.2 Storage volume (ac-ft)	0.00		0.78		N/A		N/A		N/A	
2.3 Storage volume (in.)	0.00		0.09		N/A		N/A		N/A	
2.4 Runoff volume after reduction (in.)	4.00		3.91		N/A		N/A		N/A	
2.5 CN*	57.97		57.24		N/A		N/A		N/A	
Step 3 - Adjust for Annual Runoff Reduction										
3.1 Runoff reduction allowance (%)	0%		0%		N/A		N/A		N/A	
3.2 Annual runoff after reduction (in.)	4.00		4.00		N/A		N/A		N/A	
3.3 Adjusted ACN	57.97		57.97		N/A		N/A		N/A	
3.4 Event-based runoff reduction (in.)	0.00		0.00		N/A		N/A		N/A	
Step 4 - Calculate Fv with BMP Reductions										
4.1 Fv runoff volume after all reductions (in.)	4.00		3.91		N/A		N/A		N/A	
4.2 Total Fv runoff reduction (%)	0%		2%		N/A		N/A		N/A	
4.3 Adjusted RCN for H&H modeling	57.97		57.24		N/A		N/A		N/A	

C.A. RCN | LOD | OLOD | Rpv | TMDL | Cv | **Fv** | DURMM Report | Data & Documentation | 90%

“DURMM Report” Worksheet

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C106

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
1		PROJECT:	Broadkill Estates																		
2		DRAINAGE SUBAREA ID:	Site - Concept Level Analysis																		
3		COUNTY:	Sussex		UNIT HYDROGRAPH:	DMV															
4		TMDL Watershed:	Broadkill River		VERSION:	DURMM v2.51.yymmdd															
5		DURMM OUTPUT WORKSHEET																			
6		Site Data																			
7		Contributing Area to BMPs (ac.)	102.73																		
8		C.A. RCN	58.07																		
9		Subarea LOD (ac.)	102.73																		
10		Subarea RCN	57.97																		
11		Upstream Subarea ID	N/A	N/A	N/A	N/A															
12		Upstream Subarea LOD (ac.)	0.00	0.00	0.00	0.00															
13		Combined LOD with Upstream Areas (ac.)	102.73																		
14		Combined RCN with Upstream Areas (ac.)	57.97																		
15		Watershed TMDL-TN (lb/ac/yr)	11.90																		
16		Watershed TMDL-TP (lb/ac/yr)	0.50																		
17		Watershed TMDL-TSS (lb/ac/yr)	N/A																		
18																					
19		BMP Data																			
20			BMP 1	BMP 2	BMP 3	BMP 4	BMP 5														
21			8-B Grassed Channel	2-A Traditional Bioretention - Infiltration	--	--	--														
22																					
23		RPv runoff volume after all reductions (in.)	0.50	0.41	N/A	N/A	N/A														
24		Total RPv runoff reduction (in.)	0.12	0.21	N/A	N/A	N/A														
25		Total RPv runoff reduction (%)	19%	34%	N/A	N/A	N/A														
26		RPv Compliance Met Through Runoff Reduction?	NO	YES	N/A	N/A	N/A														
27		RPv Residual Volume (cu. ft.)	34,014	N/A	N/A	N/A	N/A														
28		Adjusted pollutant load, TN (lb/ac/yr)	3.11	2.33	N/A	N/A	N/A														
29		Adjusted pollutant load, TP (lb/ac/yr)	0.54	0.41	N/A	N/A	N/A														
30		Adjusted pollutant load, TSS (lb/ac/yr)	99.85	74.80	N/A	N/A	N/A														
31		Cv runoff volume after all reductions (in.)	1.33	1.24	N/A	N/A	N/A														
32		Fv runoff volume after all reductions (in.)	4.00	3.91	N/A	N/A	N/A														
33																					
34		Resource Protection Event (RPV)																			
35		RPv for Contributing Area (in.)	0.61																		
36		Annual Runoff for Contributing Area (in.)	5.93																		
37		Req'd RPv to be Managed for Contributing Area (in.)	0.21																		
38		Req'd RPv to be Managed for Contributing Area (%)	34%																		
39		RPv Runoff Management Required (cu. Ft.)	77250																		
40		RPv Runoff Management Provided (cu. Ft.)	77252																		
41		RPv Residual Volume (cu. ft.)	-1	CREDIT																	
42		C.A. RPv avg. discharge rate (cfs)	0.20																		
43		C.A. RPv max. discharge rate (cfs)	0.98																		
44		TN Pollutant Load (lb/yr)	239.06																		
45		TP Pollutant Load (lb/yr)	41.84																		
46		TSS Pollutant Load (lb/yr)	7684																		
47																					
48		Conveyance Event (Cv)																			
49		Cv runoff volume (in.)	1.34																		
50		Adjusted RCN for H&H Modeling (CN*)	56.61																		
51																					
52		Flooding Event (Fv)																			
53		Fv runoff volume (in.)	4.00																		
54		Equivalent RCN for H&H Modeling (CN*)	57.24																		

Navigation: C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation

Scale: 78%



DURMM v2.5

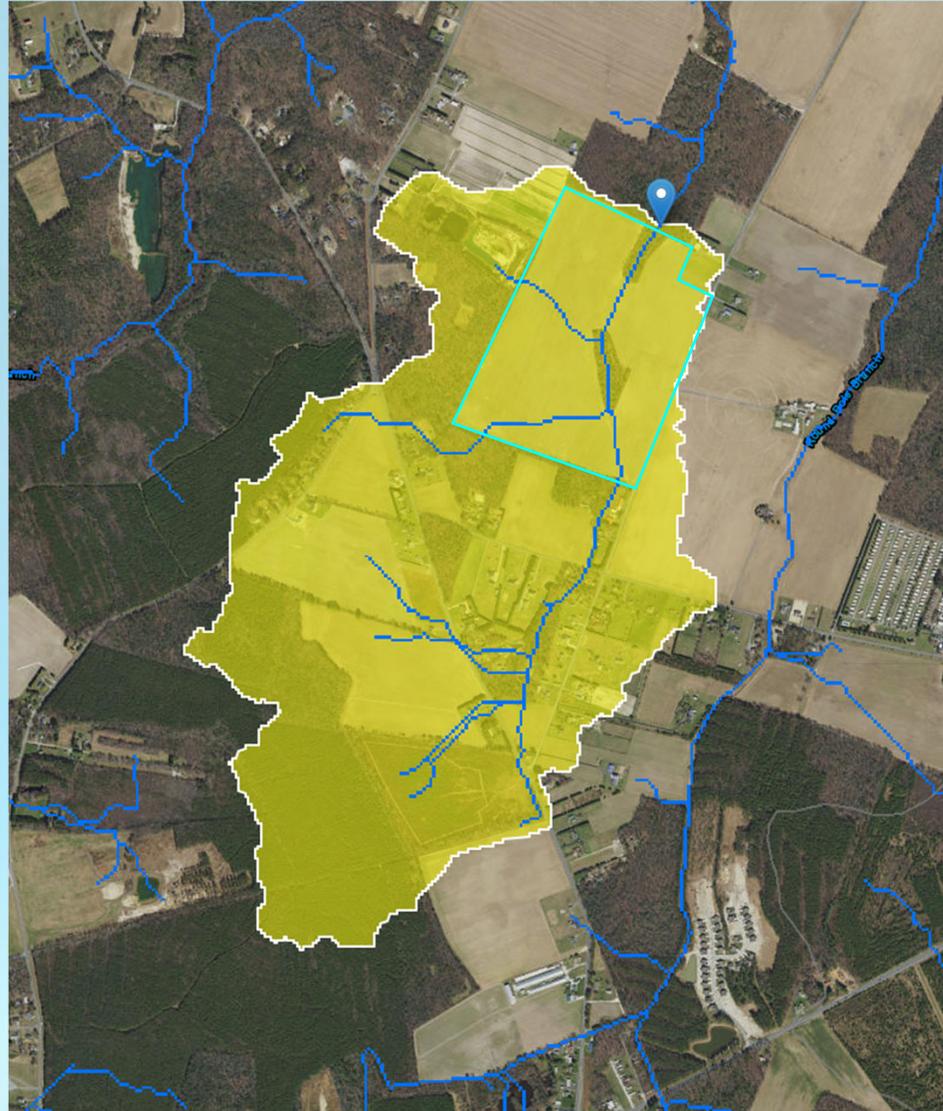
“Broadkill Estates” Example Site

Ex. #2: Design Level Analysis

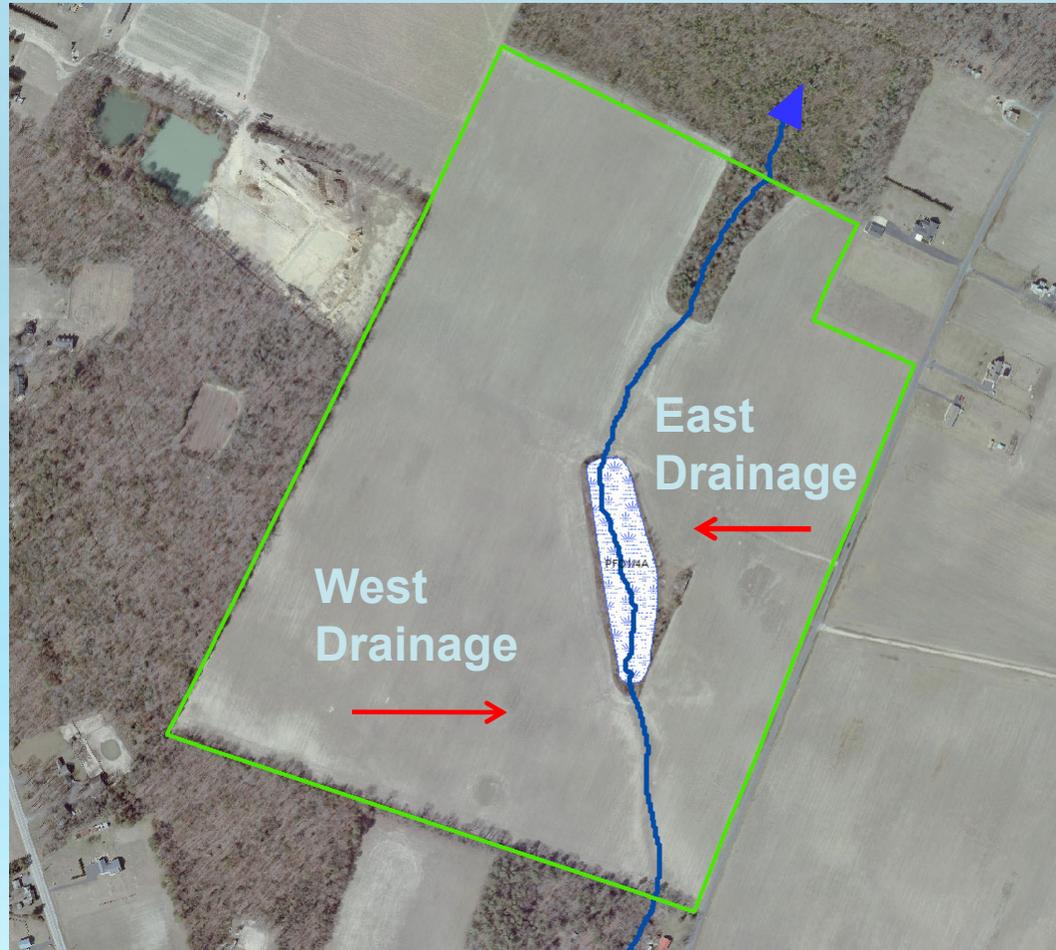
Design Level Analysis



Design Level Analysis



Design Level Analysis



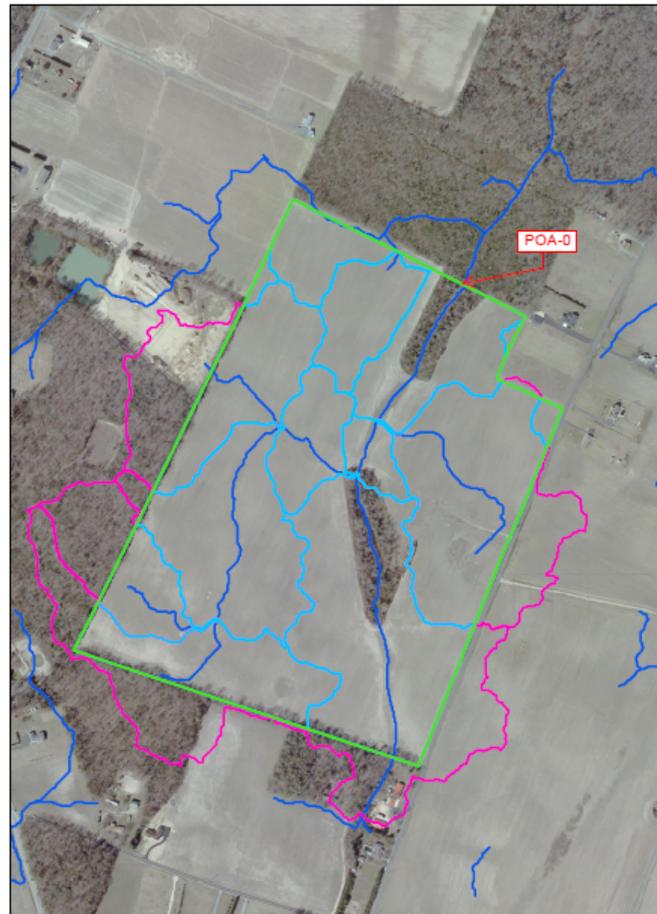
Design Level Analysis

Broadkill Estates Existing Hydrology Mapping

Legend

- Site
- Flowpaths
- OnSite Drainage
- Offsite Drainage

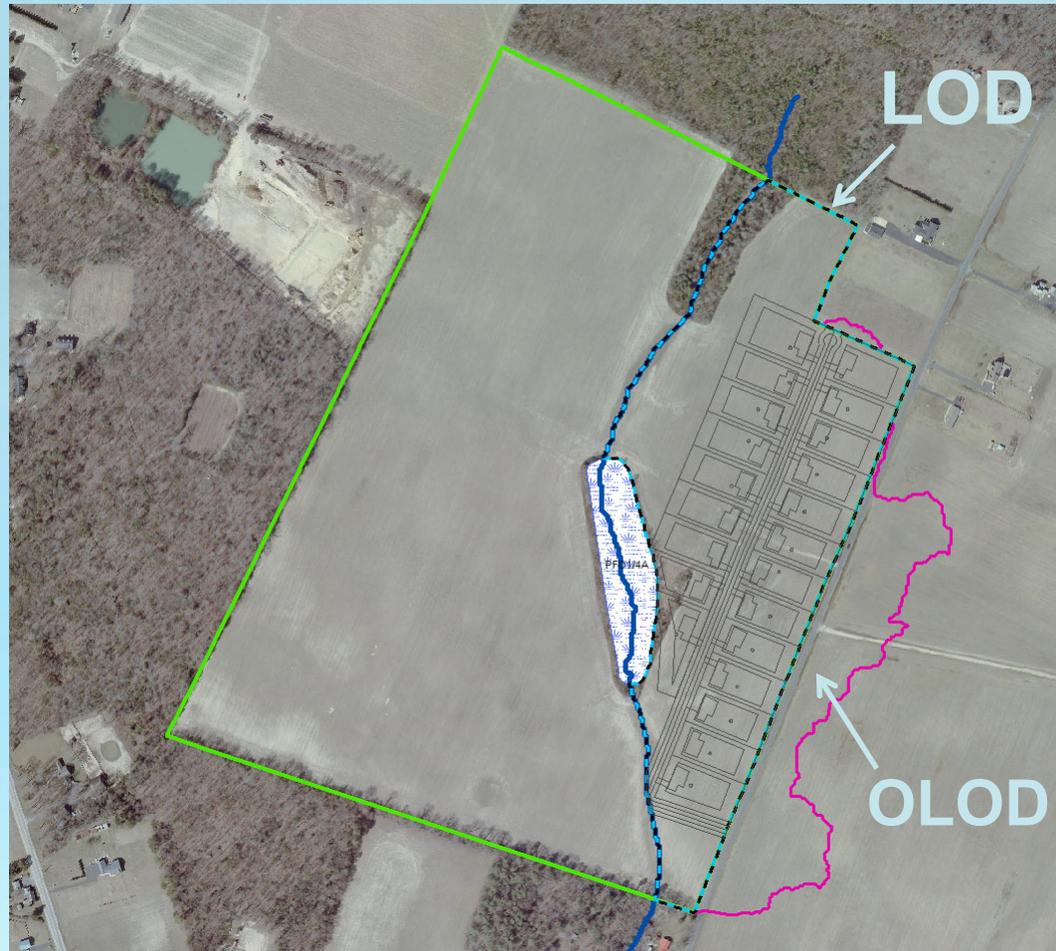
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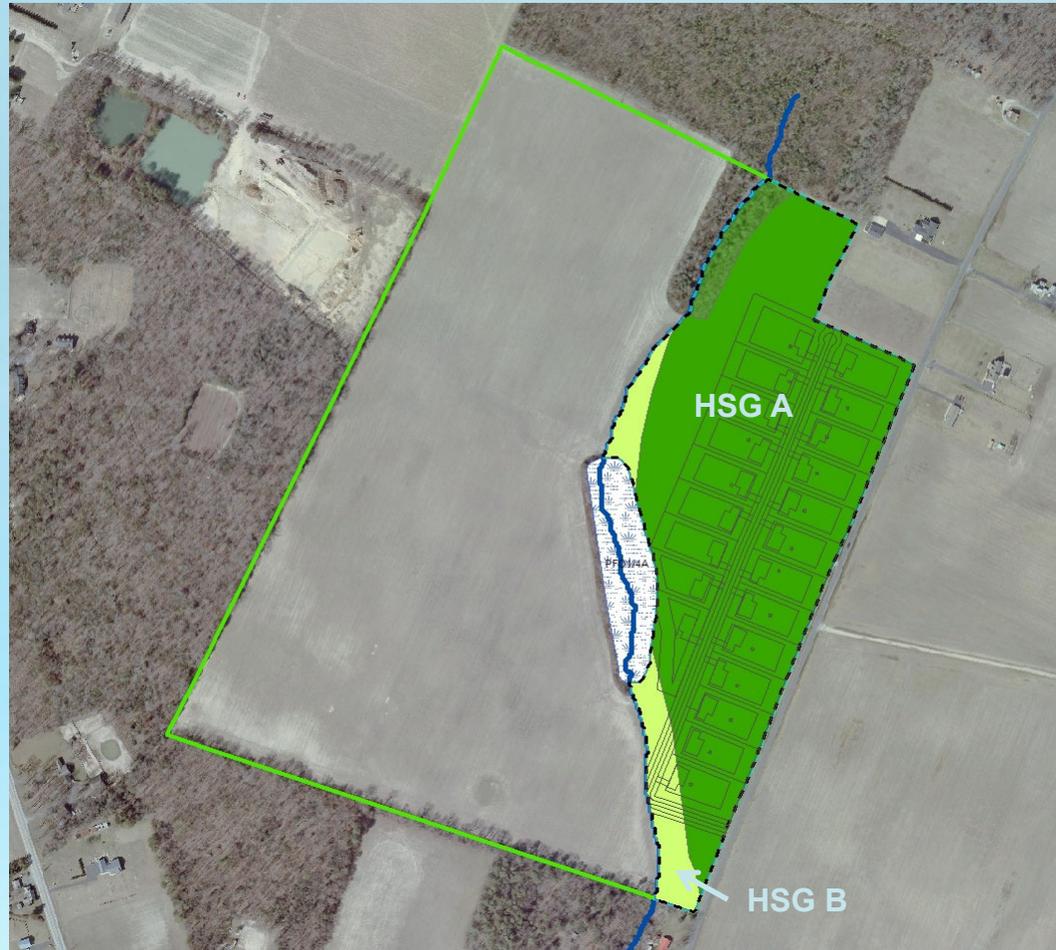
Design Level Analysis



Design Level Analysis



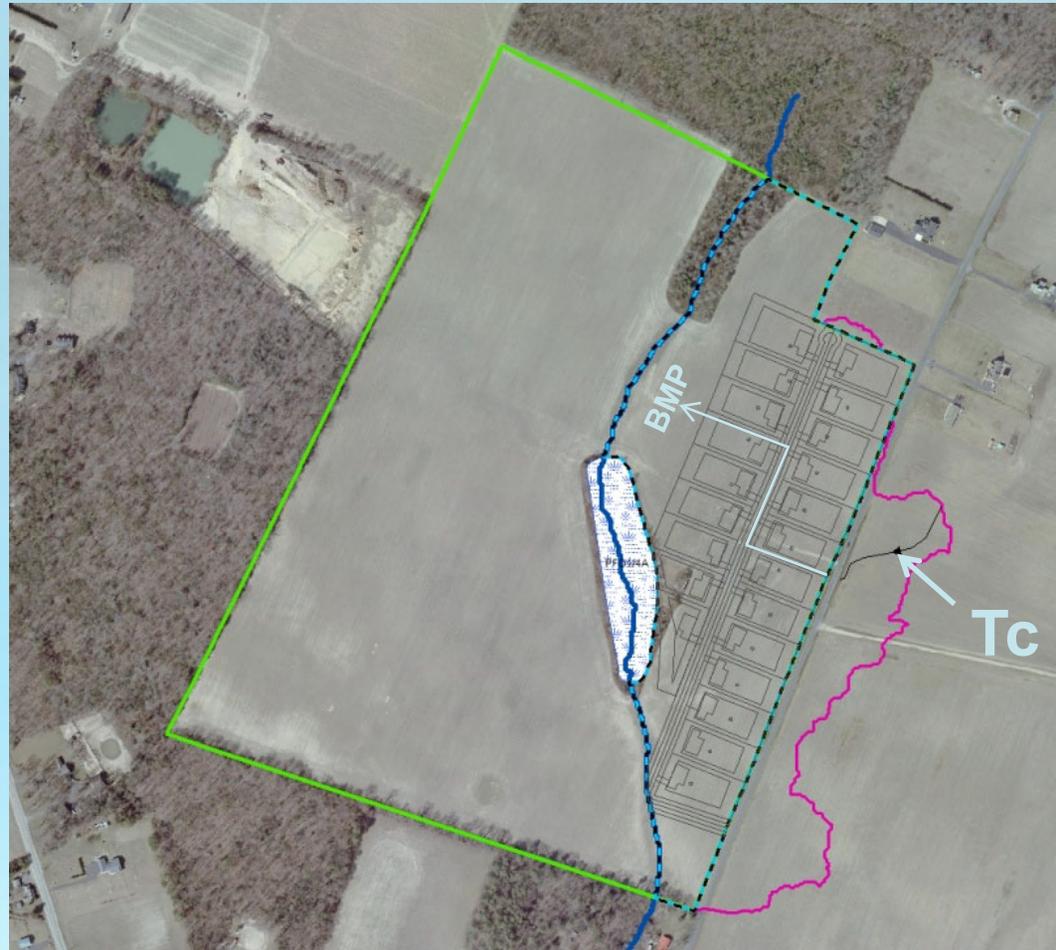
Design Level Analysis



Design Level Analysis

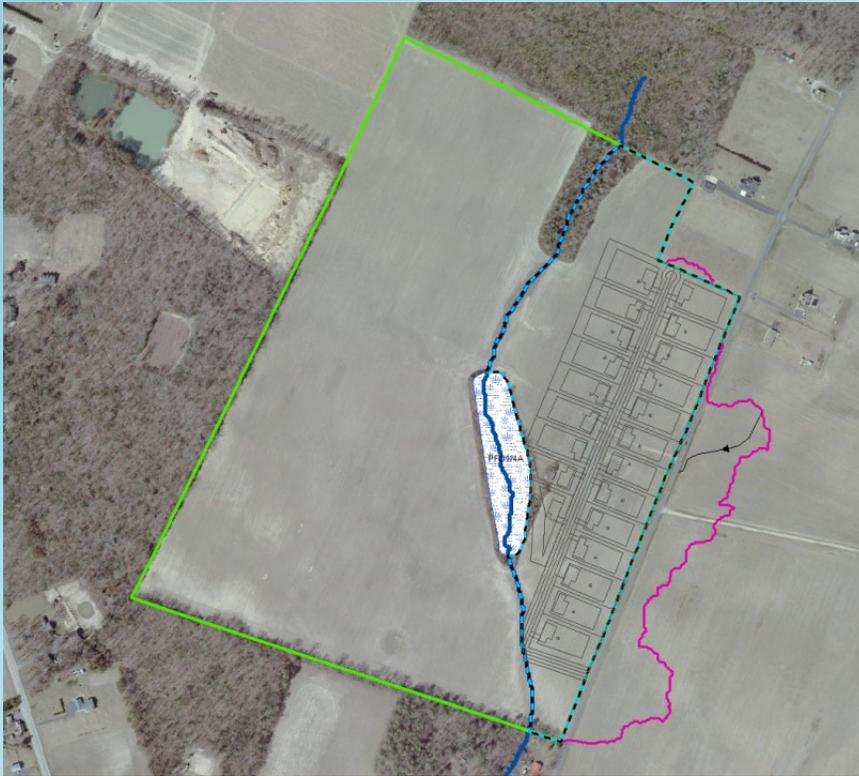


Design Level Analysis



Design Level Analysis

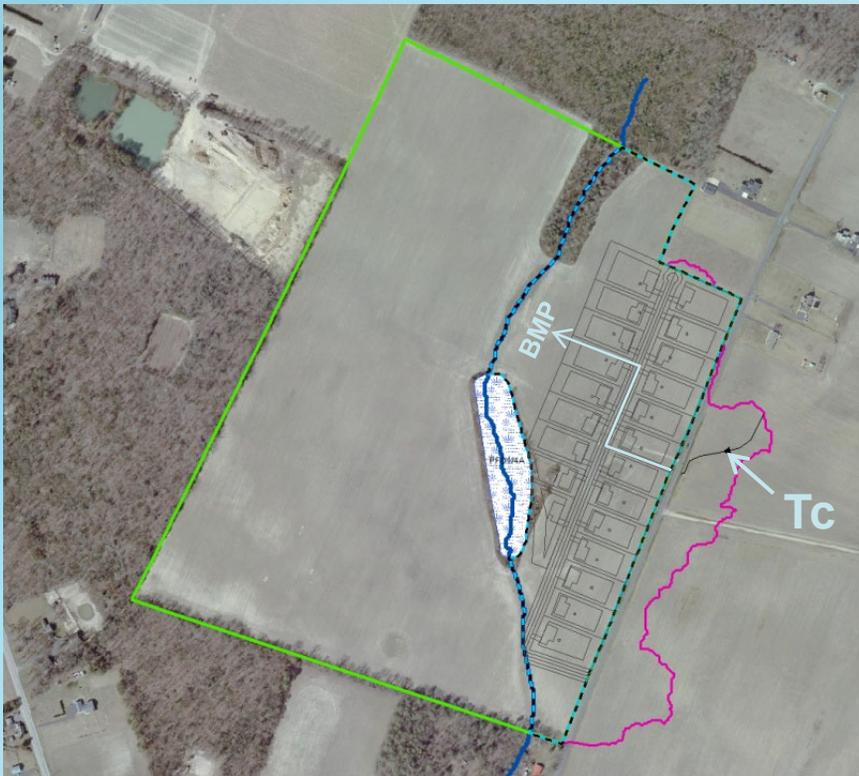
Site Data



- C.A. RCN Tab
 - Row Crops, SR + Crop Residue
 - HSG A: 9.68 ac.
 - Open space
 - HSG A: 8.06 ac.
 - HSG B: 2.26 ac
 - 1-ac. residential (20 % imperv.)
 - HSG A: 21.16 ac.
 - HSG B: 0.73 ac

Design Level Analysis

Site Data (cont.)



- LOD Tab
 - HSG A
 - LOD area: 29.22 ac.
 - Pre-Dev. Woods: 1.55 ac.
 - Post-Dev. Impervious: 4.23 ac.
 - HSG B
 - LOD area: 2.99 ac.
 - Pre-Dev. Woods: 0 ac.
 - Post-Dev. Impervious: 0.15 ac.
- OLOD Tab
 - Sheet Flow, 100 ft, 0.001 ft/ft, "d"
 - Shallow Conc., 300 ft, 0.002 ft/ft, "u"
 - Channel Flow, 1000 ft, 0.01 ft/ft, 1 fps

"C.A. RCN" Worksheet

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East Drainage - Design Level Analysis

PROJECT: Broadkill Estates
 DRAINAGE SUBAREA ID: East Drainage - Design Level Analysis
 LOCATION (County): Sussex
 UNIT HYDROGRAPH: DMV

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

Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type							
			A		B		C		D	
			A	B	A	B	A	B	A	B
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	9.68	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 or broadcast	Straight row	poor	66	77	85	89				
	Straight row	good	58	72	81	85				
legumes or rotation	Contoured	poor	64	75	83	85				
	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				

CLEAR TABLE

C.A. RCN LOD OLOD Rpv TMDL Cv Fv DURMM Report Data & Documentation

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“LOD” Worksheet

DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

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A64

1	PROJECT: Broadkill Estates				
2	DRAINAGE SUBAREA ID: East Drainage - Design Level Analysis				
3	LOCATION (County): Sussex				
4	UNIT HYDROGRAPH: DMV				
5	LIMIT OF DISTURBANCE (LOD) WORKSHEET				
6	Step 1 - Subarea LOD Data	HSG A	HSG B	HSG C	HSG D
7	1.1 HSG Area Within LOD (ac)	29.22	2.99		
8	1.2 Pre-Developed Woods/Meadow Within LOD (ac)	1.55			
9	1.3 Pre-Developed Impervious Within LOD (ac)				
10	1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); OR	4.23	0.15		
11	1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	14%	5%	0%	0%
12					
13	Step 2 - Subarea LOD Runoff Calculations				
14	2.1 RCN per HSG	47.54	62.86	0.00	0.00
15	2.2 RPv per HSG (in.)	0.35	0.70	0.00	0.00
16	2.3 Target RCN per HSG	38.52	61.00	0.00	0.00
17	2.4 Target Runoff per HSG (in.)	0.20	0.65	0.00	0.00
18					
19	2.5 Subarea LOD (ac)	32.21			
20	2.6 Subarea Weighted RCN	48.96			
21	2.7 Subarea Weighted RPv (in.)	0.38			
22	2.8 Subarea Weighted Target Runoff (in.)	0.24			
23					
24	Step 3 - Upstream LOD Areas (from previous DURMM Report as applicable)	Area 1	Area 2	Area 3	Area 4
25	3.1 Upstream Sub-Area ID				
26	3.2 Upstream Contributing Area (ac)				
27	3.3 Target Runoff for Upstream Area (in.)				
28	3.4 Adjusted CN after all reductions				
29	3.5 Adjusted RPv (in.)				
30	3.6 Adjusted Cv (in.)				
31	3.7 Adjusted Fv (in.)				
32					
33	Step 4 - RPv Calculations for Combined LOD				
34	4.1 Combined LOD (ac)	32.21			
35	4.2 Weighted RCN	48.96			
36	4.3 Weighted RPv (in.)	0.38			
37	4.4 Weighted Target Runoff (in.)	0.24			
38	4.5 Estimated Annual Runoff (in.)	3.29			
39	4.6 Req'd Runoff to be Managed within LOD (in.)	0.14			
40	4.7 Req'd Runoff to be Managed within LOD (%)	36%			
41					
42					

C.A. RCN LOD OLOD RPv TMDL Cv Fv DURMM Report Data & Documentation

100%

"OLOD" Worksheet

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F26

PROJECT: Broadkill Estates
 DRAINAGE SUBAREA ID: East Drainage - Design Level Analysis
 LOCATION (County): Sussex
 UNIT HYDROGRAPH: DMV
 OUTSIDE LIMIT OF DISTURBANCE (OLOD) WORKSHEET

Step 1 - Site Data

1.1 Total Contributing Area (ac)	41.89
1.2 C.A. RCN	53
1.3 LOD Area (ac)	32.21
1.4 LOD RCN	49
1.5 Outside LOD Area (ac)	9.68
1.6 Outside LOD RCN	64

Step 2 - Time of Concentration

	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	100	0.001	d	0.17	N/A	0.59
Shallow Concentrated	300	0.002	u	N/A	0.7	0.12
Open Channel	1000	0.01	N/A	N/A	1.0	0.28

2.7 Time of Concentration (Tc) 0.98

Sheet Flow Surface Codes
 a smooth surface
 b fallow (no residue)
 c cultivated < 20% Res.
 d cultivated > 20% Res.
 e grass - range, short

Shallow Concentrated Surface Codes
 f grass, dense
 g grass, bermuda
 h woods, light
 i woods, dense
 j range, natural

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV
3.2 Frequency (yr)	10 100
3.3 24-HR Rainfall, P (in.)	5.3 9.2
3.4 Initial Abstraction, Ia (in.)	1.125 1.125
3.5 Ia/P ratio	0.21 0.12
3.6 Unit Peak Discharge, qu (csm/in)	197 217
3.7 Runoff (in.)	1.81 4.81
3.8 Peak Discharge, qp (cfs)	5.38 15.77
3.9 Equiv. unit peak discharge (cfs/ac)	0.56 1.63

CLEAR Tc

Ready | C.A. RCN | LOD | OLOD | Rpv | TMDL | Cv | Fv | DURMM Report | Data & Documentation | 80%

"RPV" Worksheet

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D16 =IF(E6="--", "N/A", VLOOKUP(E6, "Data & Documentation"!\$C\$1:\$Q\$83, 8, FALSE))

PROJECT:		Broadkill Estates									
DRAINAGE SUBAREA ID:		East Drainage - Design Level Analysis									
LOCATION (County):		Sussex									
RESOURCE PROTECTION EVENT (RPV) WORKSHEET											
RESET		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
		Type	8-B Grassed Channel	Type	2-A Traditional Bioretention - Infiltration	Type	--	Type	--	Type	--
Step 1 - Calculate Initial RPv		Data									
8	1.1 Total contributing area to BMP (ac)	41.89									
9	1.2 Initial RCN	52.53									
10	1.3 RPv for Contributing Area (in.)	0.45									
11	1.4 Req'd RPv to be Managed for Contributing Area (in.)	0.11									
12	1.5 Req'd RPv to be Managed for Contributing Area (%)	24%									
Step 2 - Adjust for Retention Reduction											
15	2.1 Retention volume provided (cu. ft.)		6305								
16	2.2 Retention reduction allowance (%)	0%	100%		N/A		N/A		N/A		N/A
17	2.3 Retention reduction volume (ac-ft)	0.00	0.14		N/A		N/A		N/A		N/A
18	2.4 Retention reduction volume (in.)	0.00	0.04		N/A		N/A		N/A		N/A
19	2.5 Runoff volume after retention reduction (in.)	0.45	0.34		N/A		N/A		N/A		N/A
20	2.6 Adjusted CN*	52.53	47.07		N/A		N/A		N/A		N/A
Step 3 - Adjust for Annual Runoff Reduction											
23	3.1 Annual CN (ACN)	52.53	49.29		N/A		N/A		N/A		N/A
24	3.2 Annual runoff (in.)	4.20	3.36		N/A		N/A		N/A		N/A
25	3.3 Proportion A/B soils in BMP footprint (%)	100%	0%		0%		0%		0%		0%
26	3.4 Annual runoff reduction allowance (%)	20%	0%		N/A		N/A		N/A		N/A
27	3.5 Annual runoff after reduction (in.)	3.36	3.36		N/A		N/A		N/A		N/A
28	3.6 Adjusted ACN	49.29	49.29		N/A		N/A		N/A		N/A
29	3.7 Annual Runoff Reduction Allowance for RPv (in.)	0.07	0.07		N/A		N/A		N/A		N/A
Step 4 - Calculate RPv with BMP Reductions											
32	4.1 RPv Runoff Management Provided (cu. ft.)	9886	16191		N/A		N/A		N/A		N/A
33	4.2 RPv runoff volume after all reductions (in.)	0.38	0.34		N/A		N/A		N/A		N/A
34	4.3 RPv runoff volume after all reductions (cu.ft.)	58,221	51,916		N/A		N/A		N/A		N/A
35	4.4 Total RPv runoff reduction (in.)	0.07	0.11		N/A		N/A		N/A		N/A
36	4.5 Total RPv runoff reduction (%)	15%	24%		N/A		N/A		N/A		N/A
37	4.6 Adjusted CN after all reductions*	49.29	47.07		N/A		N/A		N/A		N/A
38	4.7 Adjusted equivalent annual runoff (in.)	3.36	2.86		N/A		N/A		N/A		N/A
39	4.8 RPv Compliance Met Through Runoff Reduction?	NO	YES		N/A		N/A		N/A		N/A
40	4.9 Runoff Reduction Credit, if Applicable (cu.ft.)	N/A	-3.65		N/A		N/A		N/A		N/A
Step 5 - Determine Residual Volume to be Managed or Offset											
43	5.1 RPv Residual Volume (in.)	0.04	N/A		N/A		N/A		N/A		N/A
44	5.2 RPv Residual Volume (cu.ft./ac)	150	N/A		N/A		N/A		N/A		N/A
45	5.3 Residual Volume to be Managed or Offset (cu.ft.)	6,301	N/A		N/A		N/A		N/A		N/A
46	5.4 RPv avg. discharge rate for 48-hr detention (cfs)	0.036	N/A		N/A		N/A		N/A		N/A
47	5.5 RPv max. discharge rate for 48-hr detention (cfs)	0.182	N/A		N/A		N/A		N/A		N/A
<p>*NOTE: No additional runoff reduction credit can be taken for surface recharge practices once the "Adjusted CN after all reductions" (Step 4.6) reaches the equivalent CN for the native soil-cover condition of the BMP footprint itself (i.e. for Sheet Flow to Turf Filter Strip on B soils Step 4.6 cannot be below 61). If this occurs contact the DNREC - SSP for further guidance.</p>											

C.A. RCN LOD OLOD RPv TMDL Cv Fv DURMM Report Data & Documentation

80%

“TMDL” Worksheet

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A95

PROJECT: Broadkill Estates																
DRAINAGE SUBAREA ID: East Drainage - Design Level Analysis																
TMDL WATERSHED: Broadkill River																
TOTAL MAXIMUM DAILY LOAD (TMDL) WORKSHEET																
	BMP 1			BMP 2			BMP 3			BMP 4			BMP 5			
	Type:	8-8 Grassed Channel			Type:	2-A Traditional Bioretention - Infiltration			Type:	-			Type:	-		
	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS
7	Step 1 - Calculate Annual Runoff Volume															
8	1.1 Total contributing area to BMP (ac)	41.89														
9	1.2 Initial RCN	53														
10	1.3 Annual runoff volume (in.)	4.20														
11	1.4 Annual runoff volume (liters)	1.81E+07														
13	Step 2 - Calculate Annual Pollutant Load															
14	2.1 EMC (mg/L)	2.80	0.49	90	2.80	0.49	90		N/A	N/A	N/A		N/A	N/A	N/A	
15	2.2 Load (mg/yr)	5.07E+07	8.87E+06	1.63E+09	4.05E+07	7.09E+06	1.30E+09		N/A	N/A	N/A		N/A	N/A	N/A	
16	2.3 Stormwater Load (lb/ac/yr)	2.67	0.47	86	2.13	0.37	69		N/A	N/A	N/A		N/A	N/A	N/A	
18	Step 3 - Adjust for Pollutant Reduction															
19	3.1 BMP annual runoff reduction (%)	20%			15%				N/A				N/A			
20	3.2 Adjusted annual runoff volume (in)	3.36			2.86				N/A				N/A			
21	3.3 Adjusted annual runoff volume (liters)	1.45E+07			1.23E+07				N/A				N/A			
22	3.4 Adjusted load from annual reductions (lb/ac/yr)	2.13	0.37	69	1.82	0.32	58		N/A	N/A	N/A		N/A	N/A	N/A	
23	3.5 BMP removal efficiency (%)	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A	
24	3.6 BMP effluent concentration (mg/L)	2.80	0.49	90.00	2.80	0.49	90.00		N/A	N/A	N/A		N/A	N/A	N/A	
25	3.7 Final Adjusted load (lb/ac/yr)	2.13	0.37	69	1.82	0.32	58		N/A	N/A	N/A		N/A	N/A	N/A	
27	Step 4 - Pollutant Reduction Met? (For Informational Purposes)															
28	4.1 TMDL (lb/ac/yr)	11.90	0.50	N/A					N/A	N/A	N/A		N/A	N/A	N/A	
29	4.2 Reduction met?	YES	YES	N/A	YES	YES	N/A		N/A	N/A	N/A		N/A	N/A	N/A	
30	4.3 Final Adjusted Load (lb/yr)	89.38	15.64	2873	76.06	13.31	2445		N/A	N/A	N/A		N/A	N/A	N/A	

C.A. RCN | LOD | OLOD | RPv | **TMDL** | Cv | Fv | DURMM Report | Data & Documentation | 75%

“Cv” Worksheet

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A66

	A	B	C	D	E	F	G	H	I	J	K	L
1	PROJECT: Broadkill Estates											
2	DRAINAGE SUBAREA ID: East Drainage - Design Level Analysis											
3	LOCATION (County): Sussex											
4	CONVEYANCE EVENT (Cv) WORKSHEET											
5		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5		
6		Type:	8-B Grassed Channel	Type:	2-A Traditional Bioretention -	Type:	--	Type:	--	Type:	--	
7	Step 1 - Calculate Initial Cv	Data		Data		Data		Data		Data		
8	1.1 Total contributing area to BMP (ac)	41.89		41.89		41.89		41.89		41.89		
9	1.2 Initial RCN	52.53										
10	1.3 10-Year Rainfall (in.)	5.3										
11	1.4 Cv runoff volume (in.)	0.97										
12												
13	Step 2 - Adjust for Retention Reduction											
14	2.1 Storage volume (cu. ft.)	0.00		6305.00		N/A		N/A		N/A		
15	2.2 Storage volume (ac-ft)	0.00		0.14		N/A		N/A		N/A		
16	2.3 Storage volume (in.)	0.00		0.04		N/A		N/A		N/A		
17	2.4 Runoff volume after reduction (in.)	0.97		0.93		N/A		N/A		N/A		
18	2.5 CN*	52.53		51.84		N/A		N/A		N/A		
19												
20	Step 3 - Adjust for Annual Runoff Reduction											
21	3.1 Runoff reduction allowance (%)	0%		0%		N/A		N/A		N/A		
22	3.2 Annual runoff after reduction (in.)	0.97		0.97		N/A		N/A		N/A		
23	3.3 Adjusted ACN	52.50		52.50		N/A		N/A		N/A		
24	3.4 Event-based runoff reduction (in.)	0.00		0.00		N/A		N/A		N/A		
25												
26	Step 4 - Calculate Cv with BMP Reductions											
27	4.1 Cv runoff volume after all reductions (in.)	0.97		0.93		N/A		N/A		N/A		
28	4.2 Total Cv runoff reduction (%)	0%		4%		N/A		N/A		N/A		
29	4.3 Adjusted RCN for H&H modeling	52.50		51.84		N/A		N/A		N/A		
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												
41												
42												
43												
44												
45												
46												
47												

C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation

90%

“Fv” Worksheet

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A60

	A	B	C	D	E	F	G	H	I	J	K	L
1	PROJECT: Broadkill Estates											
2	DRAINAGE SUBAREA ID: East Drainage - Design Level Analysis											
3	LOCATION (County): Sussex											
4	FLOODING EVENT (Fv) WORKSHEET											
5		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5		
6		Type:	8-B Grassed Channel	Type:	2-A Traditional Bioretention -	Type:	--	Type:	--	Type:	--	
7	Step 1 - Calculate Initial Fv	Data		Data		Data		Data		Data		
8	1.1 Total contributing area to BMP (ac)	41.89		41.89		41.89		41.89		41.89		
9	1.2 Initial RCN	52.53										
10	1.3 100-Year Rainfall (in.)	9.2										
11	1.4 Fv runoff volume (in.)	3.33										
12												
13	Step 2 - Adjust for Retention Reduction											
14	2.1 Storage volume (cu. ft.)	0.00		6305.00		N/A		N/A		N/A		
15	2.2 Storage volume (ac-ft)	0.00		0.14		N/A		N/A		N/A		
16	2.3 Storage volume (in.)	0.00		0.04		N/A		N/A		N/A		
17	2.4 Runoff volume after reduction (in.)	3.33		3.29		N/A		N/A		N/A		
18	2.5 CN*	52.53		52.20		N/A		N/A		N/A		
19												
20	Step 3 - Adjust for Annual Runoff Reduction											
21	3.1 Runoff reduction allowance (%)	0%		0%		N/A		N/A		N/A		
22	3.2 Annual runoff after reduction (in.)	3.33		3.33		N/A		N/A		N/A		
23	3.3 Adjusted ACN	52.53		52.53		N/A		N/A		N/A		
24	3.4 Event-based runoff reduction (in.)	0.00		0.00		N/A		N/A		N/A		
25												
26	Step 4 - Calculate Fv with BMP Reductions											
27	4.1 Fv runoff volume after all reductions (in.)	3.33		3.29		N/A		N/A		N/A		
28	4.2 Total Fv runoff reduction (%)	0%		1%		N/A		N/A		N/A		
29	4.3 Adjusted RCN for H&H modeling	52.53		52.20		N/A		N/A		N/A		
30												
31												
32												
33												
34												
35												
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43												
44												
45												
46												
47												

C.A. RCN | LOD | OLOD | Rpv | TMDL | Cv | **Fv** | DURMM Report | Data & Documentation | 90%

“DURMM Report” Worksheet

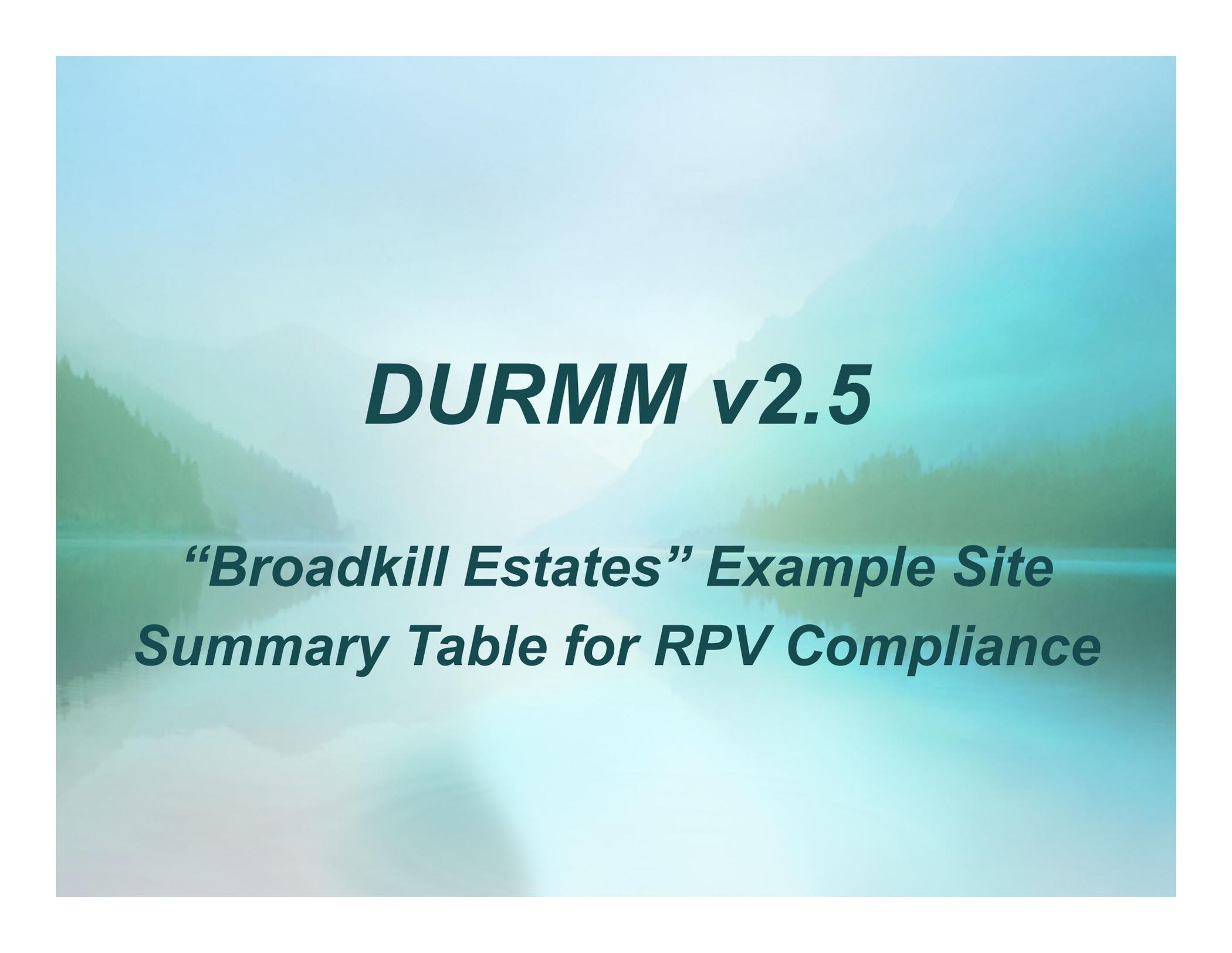
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C106

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
1		PROJECT:	Broadkill Estates																		
2		DRAINAGE SUBAREA ID:	East Drainage - Design Level Analysis																		
3		COUNTY:	Sussex		UNIT HYDROGRAPH:	DMV															
4		TMDL Watershed:	Broadkill River		VERSION:	DURMM v2.51.yymmdd															
5		DURMM OUTPUT WORKSHEET																			
6		Site Data																			
7		Contributing Area to BMPs (ac.)	41.89																		
8		C.A. RCN	52.53																		
9		Subarea LOD (ac.)	32.21																		
10		Subarea RCN	48.96																		
11		Upstream Subarea ID	N/A	N/A	N/A	N/A															
12		Upstream Subarea LOD (ac.)	0.00	0.00	0.00	0.00															
13		Combined LOD with Upstream Areas (ac.)	32.21																		
14		Combined RCN with Upstream Areas (ac.)	48.96																		
15		Watershed TMDL-TN (lb/ac/yr)	11.90																		
16		Watershed TMDL-TP (lb/ac/yr)	0.50																		
17		Watershed TMDL-TSS (lb/ac/yr)	N/A																		
18																					
19		BMP Data																			
20			BMP 1	BMP 2	BMP 3	BMP 4	BMP 5														
21			8-B Grassed Channel	2-A Traditional Bioretention - Infiltration	--	--	--														
22																					
23		RPv runoff volume after all reductions (in.)	0.38	0.34	N/A	N/A	N/A														
24		Total RPv runoff reduction (in.)	0.07	0.11	N/A	N/A	N/A														
25		Total RPv runoff reduction (%)	15%	24%	N/A	N/A	N/A														
26		RPv Compliance Met Through Runoff Reduction?	NO	YES	N/A	N/A	N/A														
27		RPv Residual Volume (cu. ft.)	6,301	N/A	N/A	N/A	N/A														
28		Adjusted pollutant load, TN (lb/ac/yr)	2.13	1.82	N/A	N/A	N/A														
29		Adjusted pollutant load, TP (lb/ac/yr)	0.37	0.32	N/A	N/A	N/A														
30		Adjusted pollutant load, TSS (lb/ac/yr)	68.58	58.36	N/A	N/A	N/A														
31		Cv runoff volume after all reductions (in.)	0.97	0.93	N/A	N/A	N/A														
32		Fv runoff volume after all reductions (in.)	3.33	3.29	N/A	N/A	N/A														
33																					
34		Resource Protection Event (RPV)																			
35		RPv for Contributing Area (in.)	0.45																		
36		Annual Runoff for Contributing Area (in.)	4.20																		
37		Req'd RPv to be Managed for Contributing Area (in.)	0.11																		
38		Req'd RPv to be Managed for Contributing Area (%)	24%																		
39		RPv Runoff Management Required (cu. Ft.)	16187																		
40		RPv Runoff Management Provided (cu. Ft.)	16191																		
41		RPv Residual Volume (cu. ft.)	-4	CREDIT																	
42		C.A. RPv avg. discharge rate (cfs)	0.04																		
43		C.A. RPv max. discharge rate (cfs)	0.18																		
44		TN Pollutant Load (lb/yr)	76.06																		
45		TP Pollutant Load (lb/yr)	13.31																		
46		TSS Pollutant Load (lb/yr)	2445																		
47																					
48		Conveyance Event (Cv)																			
49		Cv runoff volume (in.)	0.97																		
50		Adjusted RCN for H&H Modeling (CN*)	51.84																		
51																					
52		Flooding Event (Fv)																			
53		Fv runoff volume (in.)	3.33																		
54		Equivalent RCN for H&H Modeling (CN*)	52.20																		

Navigation: C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | **DURMM Report** | Data & Documentation | 78%



DURMM v2.5

***“Broadkill Estates” Example Site
Summary Table for RPV Compliance***

Summary Table for R_Pv Compliance Sheet 1

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B72

Summary Table for Site R _P v Compliance ⁽¹⁾									
Project:					TMDL WS:			Rel. 1	
Ref. #	Sub-Area ID ⁽²⁾	Contributing Area ⁽³⁾ (ac)	Runoff ⁽⁴⁾ (in)	Runoff (cf)	R _P v Runoff Management (cf)		TN Pollutant Load ⁽⁷⁾ (lb/yr)	TP Pollutant Load ⁽⁷⁾ (lb/yr)	TSS Pollutant Load ⁽⁷⁾ (lb/yr)
					Required ⁽⁵⁾	Provided ⁽⁶⁾			
Section I - Complete this section for total site LOD management requirement									
0	Total Site LOD			0.0					
Section II - Complete this section for BMPs provided for partial LOD management OR sub-area by sub-area management									
1				0.0					
2				0.0					
3				0.0					
4				0.0					
5				0.0					
6				0.0					
7				0.0					
8				0.0					
9				0.0					
10				0.0					
11				0.0					
12				0.0					
13				0.0					
14				0.0					
15				0.0					
16				0.0					
17				0.0					
18				0.0					
19				0.0					
20				0.0					
Totals					----	----	0.00 lb/yr	0.00 lb/yr	0 lb/yr
R _P v Runoff Reduction Goal Met?		#VALUE!							
Total Credit/Shortfall		#VALUE!	#VALUE!						
Notes:									
1. All subareas must lie within the same HUC 8 watershed.									
2. Only the most downstream sub-area information should be entered for a series of sub-areas that drain to each other or for a treatment train.									
3. From DURMM v2.5 Report, Line 7 OR Approved Hydrologic Software Report									
4. From DURMM v2.5 Report, Line 35 OR Approved Hydrologic Software Report									
5. From DURMM v2.5 Report, Line 39 OR Approved Hydrologic Software Report									
6. From DURMM v2.5 Report, Line 40 OR Approved Hydrologic Software Report									
7. From DURMM v2.5 Report, Lines 44-46 OR Complete Sheet 2									

Sheet1 Sheet2 User Guide

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Summary Table for RPr Compliance Sheet 2

DURMM_v2.5 Summary Table_Rel-1.xlsx - Excel

Ref. #	Subarea ID	Area (ac)	Initial RCN	BMP Pollutant Reduction (%)			Final Pollutant Load (lb/yr)			BMP Type	BMP Pollutant Reduction Allowances*		
				TN	TP	TSS	TN	TP	TSS		TN	TP	TSS
0	Total Site LOD						0.00	0.00	0	0-No BMP	0%	0%	0%
1							0.00	0.00	0	--			
2							0.00	0.00	0	4-A Extensive Vegetated Roofs	0%	0%	0%
3							0.00	0.00	0	4-B Intensive Vegetated Roofs	0%	0%	0%
4							0.00	0.00	0	--			
5							0.00	0.00	0	7-A Full Rooftop Disconnection - HSG A	96%	96%	96%
6							0.00	0.00	0	7-B Full Rooftop Disconnection - HSG B	81%	81%	81%
7							0.00	0.00	0	7-C Full Rooftop Disconnection - HSG C	63%	63%	63%
8							0.00	0.00	0	7-D Full Rooftop Disconnection - HSG D	51%	51%	51%
9							0.00	0.00	0	--			
10							0.00	0.00	0	8-A Bioswale, HSG A/B/Compost C	50%	50%	50%
11							0.00	0.00	0	8-A Bioswale, HSG C/D	25%	25%	25%
12							0.00	0.00	0	8-B Grassed Channel, HSG A/B/Compost C	20%	20%	20%
13							0.00	0.00	0	8-B Grassed Channel, HSG C/D	10%	10%	10%
14							0.00	0.00	0	--			
15							0.00	0.00	0	9-A Sheet Flow to Grassed FS, HSG A/B/Compost C	25%	25%	25%
16							0.00	0.00	0	9-A Sheet Flow to Grassed FS, HSG C/D	10%	10%	10%
17							0.00	0.00	0	9-B Sheet Flow to Afforest FS, HSG A/B/Compost C	30%	30%	30%
18							0.00	0.00	0	9-B Sheet Flow to Afforest FS, HSG C/D	15%	15%	15%
19							0.00	0.00	0	9-C Sheet Flow to Forest FS, HSG A/B/Compost C	40%	40%	40%
20							0.00	0.00	0	9-C Sheet Flow to Forest FS, HSG C/D	20%	20%	20%
										9-D Sheet Flow to Grassed OS, HSG A/B/Compost C	50%	50%	50%
										9-D Sheet Flow to Grassed OS, HSG C/D	20%	20%	20%
										9-E Sheet Flow to Afforest OS, HSG A/B/Compost C	60%	60%	60%
										9-E Sheet Flow to Afforest OS, HSG C/D	30%	30%	30%
										9-F Sheet Flow to Forest OS, HSG A/B/Compost C	65%	65%	65%
										9-F Sheet Flow to Forest OS, HSG C/D	40%	40%	40%
										--			
										10-A Dry Detention Pond	5%	10%	10%
										10-B Dry Extended Detention (ED) Basin	20%	20%	60%
										10-C Underground Detention Facilities	5%	10%	10%
										10-D Underground 48-HR Detention Facilities	20%	20%	60%
										--			
										11-A Non-Structural Sand Filter	40%	60%	80%
										11-B Surface Sand Filter	40%	60%	80%
										11-C 3-Chamber Underground Sand Filter	40%	60%	80%
										11-D Perimeter Sand Filter (DE Sand Filter)	40%	60%	80%
										--			
										12-A Traditional Constructed Wetlands	30%	40%	80%
										12-B Wetland Swales	20%	30%	60%
										12-C Ephemeral Constructed Wetlands	20%	30%	60%
										12-D Submerged Gravel Wetlands	30%	40%	80%
										--			
										13-A Wet Quantity Management Pond	0%	0%	0%
										13-B Wet Extended Detention (ED) Pond	30%	55%	60%
										--			

Summary Table for R_Pv Compliance User Guide

USER GUIDE FOR DURMM v2.5 SUMMARY TABLE

The Summary Table is intended to be included in the narrative portion of the Stormwater Management Report to document R_Pv compliance for a project. If DURMM v2.5 was used exclusively, Sheet 1 is adequate. The footnotes at the bottom of the Summary Table reference the cells where the data can be found. The results are color coded to facilitate the review process, as follows:

- GREEN:** Overall credit for project
- RED:** Overall shortfall for project
- YELLOW:** Invalid entry; managed volume entered is greater than runoff volume in subarea

Basic instructions for filling out Sheet 1 are as follows:

1. If analyzing the entire site LOD to determine total compliance requirements and providing BMPs in only some subareas:
 - a. Enter data for entire LOD in Section I
 - b. Enter managed runoff volume provided in BMP subareas in Section II, column H
 - c. Enter TMDL pollutant loads in columns I-K
2. If analyzing each subarea individually:
 - a. Enter data for each BMP subarea in Section II only
 - b. Enter runoff management required in column G
 - c. Enter runoff management provided in column H
 - d. Enter TMDL pollutant loads in columns I-K
 - d. Include both managed and unmanaged subareas

If HydroCAD was used for any subarea to show compliance, both Sheets 1 and 2 should be included in the narrative. The basic steps for completing Sheet 2 are as follows:

1. Enter data in columns B & C the same as Sheet 1
2. Column D is the initial RCN of the contributing area prior to BMP treatment
3. Refer to the table at right and fill in columns I-K with TN, TP and TSS reductions for appropriate BMP; true runoff reduction BMPs get pollutant reduction allowance equivalent to their % volume reduction^{1,2}
4. Final pollutant loads are calculated in columns L-N; copy these back to columns I-K on Sheet 1

¹This is the % volume reduction of the full R_Pv runoff generated by the contributing drainage area to the BMP, not just that necessary for compliance. In a HydroCAD report, this would be shown as the discarded volume from the routing of an infiltrating BMP or as the attenuated volume using the Link Node method for a surface recharge BMP receiving extra credit. Any portion of the R_Pv volume not captured and infiltrated will result in a residual pollutant load. For example, if an infiltration basin infiltrates 15,000 cf of runoff but the site generates 20,000 cf of runoff, the pollutant reduction for TN, TP and TSS should be entered as 75%. The user should only enter 100% pollutant reduction if the BMP captures the total runoff volume from the R_Pv event.

Summary Table for R_Pv Compliance Sheet 1 for Broadkill Estates Example

DURMM_v2.5 Summary Table_Rel-1.xlsx - Excel

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Summary Table for Site R _P v Compliance ⁽¹⁾									
Project:		Broadkill Estates			TMDL WS:		Broadkill River		Rel. 1
Ref. #	Sub-Area ID ⁽²⁾	Contributing Area ⁽³⁾ (ac)	Runoff ⁽⁴⁾ (in)	Runoff (cf)	R _P v Runoff Management (cf)		TN Pollutant Load ⁽⁷⁾ (lb/yr)	TP Pollutant Load ⁽⁷⁾ (lb/yr)	TSS Pollutant Load ⁽⁷⁾ (lb/yr)
					Required ⁽⁵⁾	Provided ⁽⁶⁾			
Section I - Complete this section for total site LOD management requirement									
0	Total Site LOD			0.0					
Section II - Complete this section for BMPs provided for partial LOD management OR sub-area by sub-area management									
1	East Drainage	41.89	0.45	68427.3	16187	16191	76.06	13.31	2445
2				0.0					
3				0.0					
4				0.0					
5				0.0					
6				0.0					
7				0.0					
8				0.0					
9				0.0					
10				0.0					
11				0.0					
12				0.0					
13				0.0					
14				0.0					
15				0.0					
16				0.0					
17				0.0					
18				0.0					
19				0.0					
20				0.0					
Totals					16187 cf	16191 cf	76.06 lb/yr	13.31 lb/yr	2445 lb/yr
R_Pv Runoff Reduction Goal Met?		YES							
Total Credit/Shortfall		4 cf	Credit						
Notes:									
1. All subareas must lie within the same HUC 8 watershed.									
2. Only the most downstream sub-area information should be entered for a series of sub-areas that drain to each other or for a treatment train.									
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Sheet1 Sheet2 User Guide

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