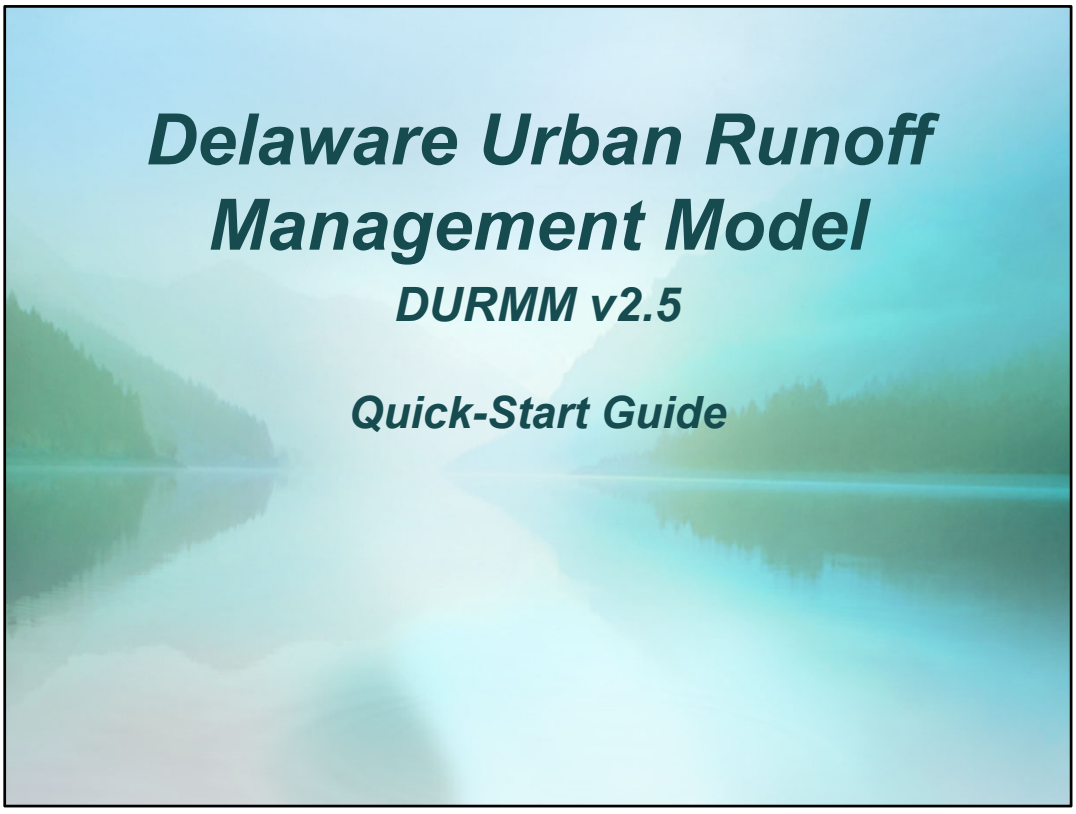


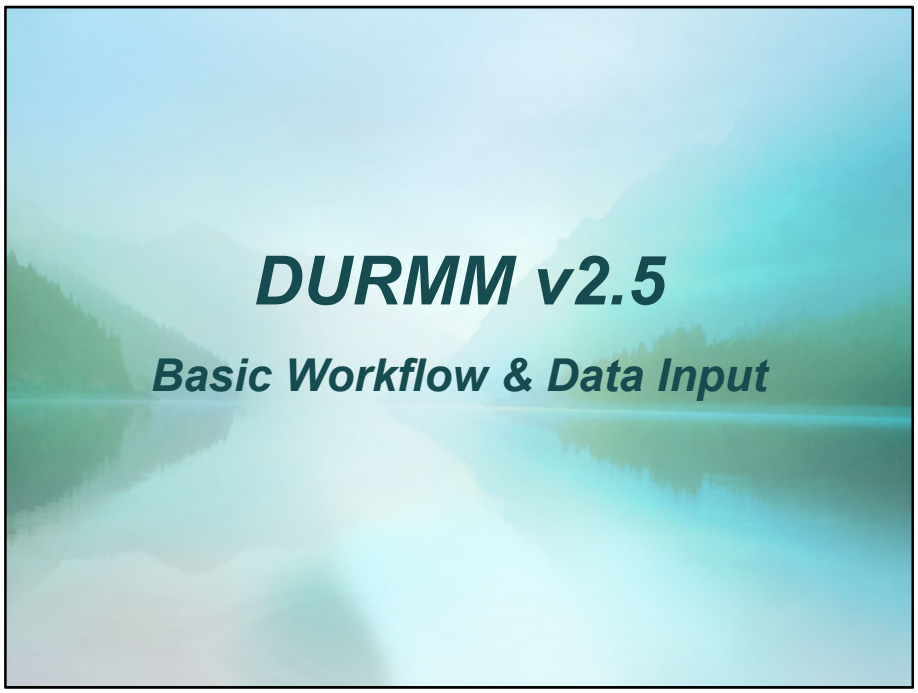
Introduction

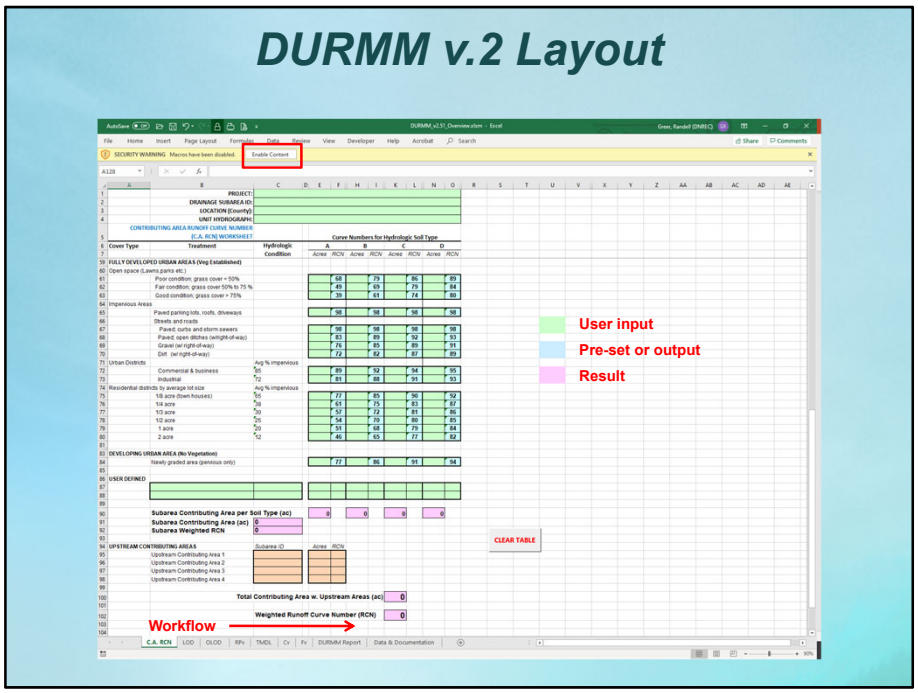
This Quick-Start Guide has been developed as an overview of the basic use of the 2nd version of the Delaware Urban Runoff Management Model (DURMM). It is not intended to serve as a detailed description of each cell in the spreadsheet or the algorithms used in those cells. The Quick-Start Guide first 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 v2.5
Basic Workflow & Data Input

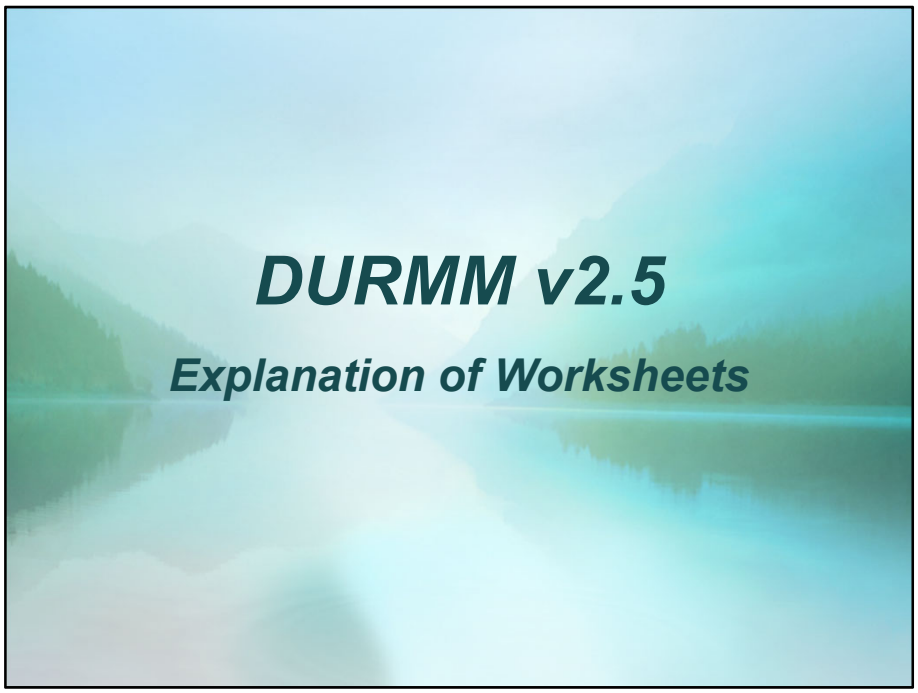


Layout

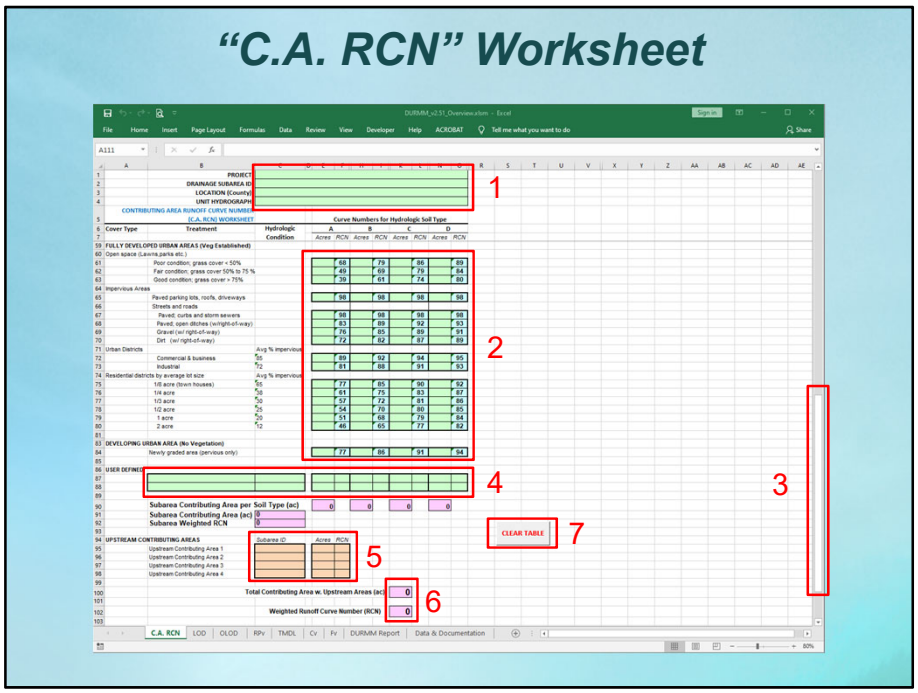
DURMM v.2.5 was developed using Microsoft's Excel 2016 spreadsheet program. However, it should be compatible with any version back to Excel 97. There are several macros that allow clearing and resetting some of the user input cells, however these are not absolutely necessary for the model to function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

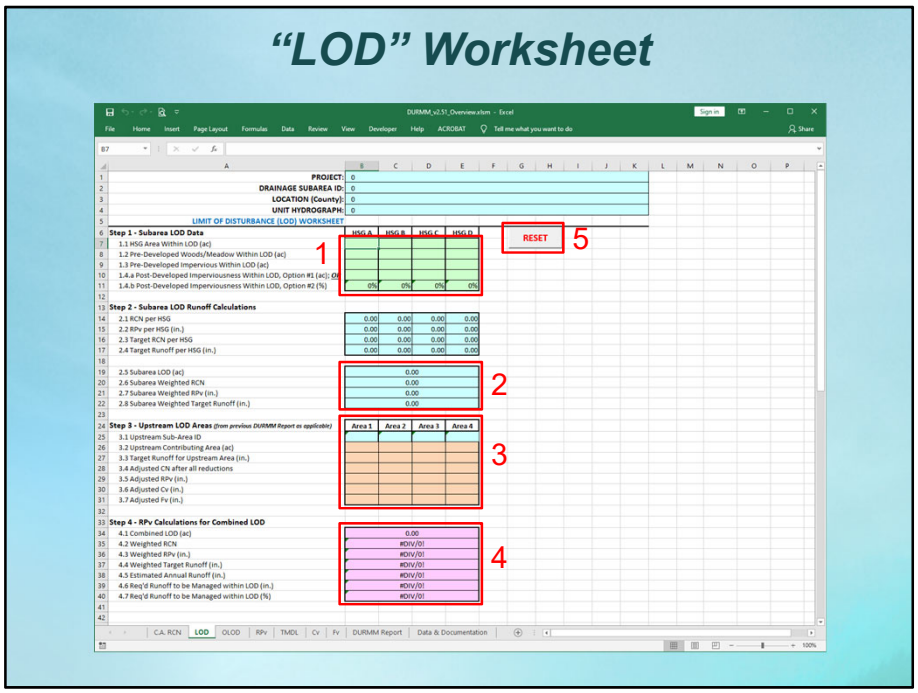


"C. A. RCN" Worksheet

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.

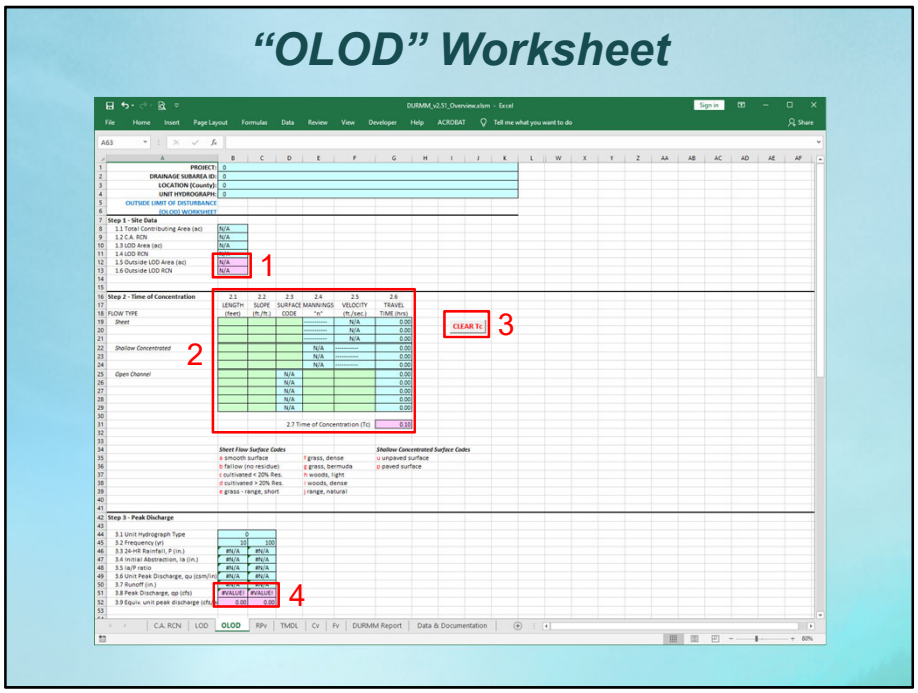


"LOD" Worksheet

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.

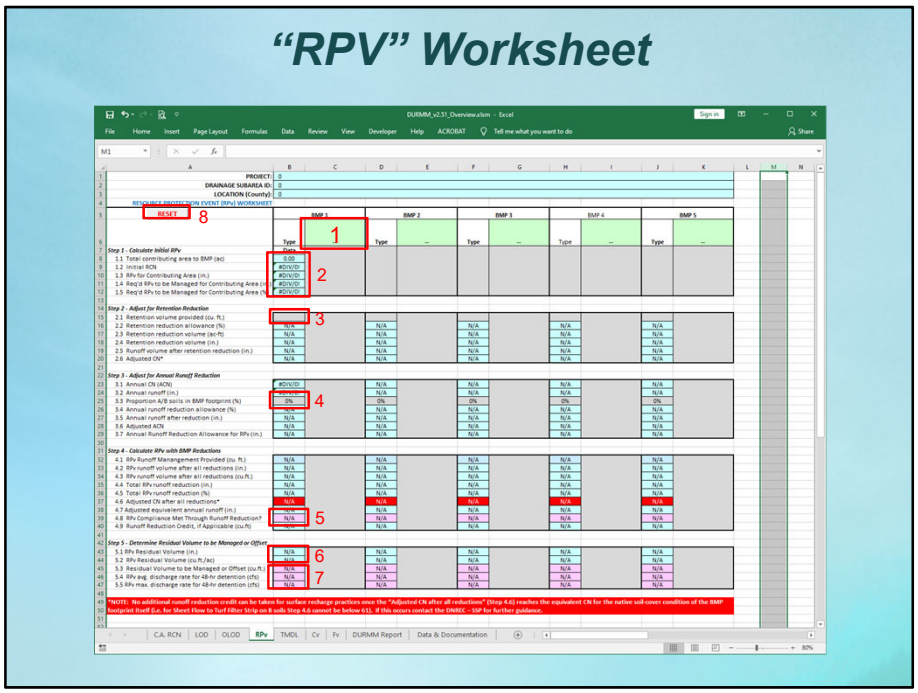
NOTE: Acreage values should be entered to no more than two (2) decimal places. A popup warning to this effect will appear if a user tries to enter values greater than 2 decimal places.



"***OLOD" Worksheet***

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:

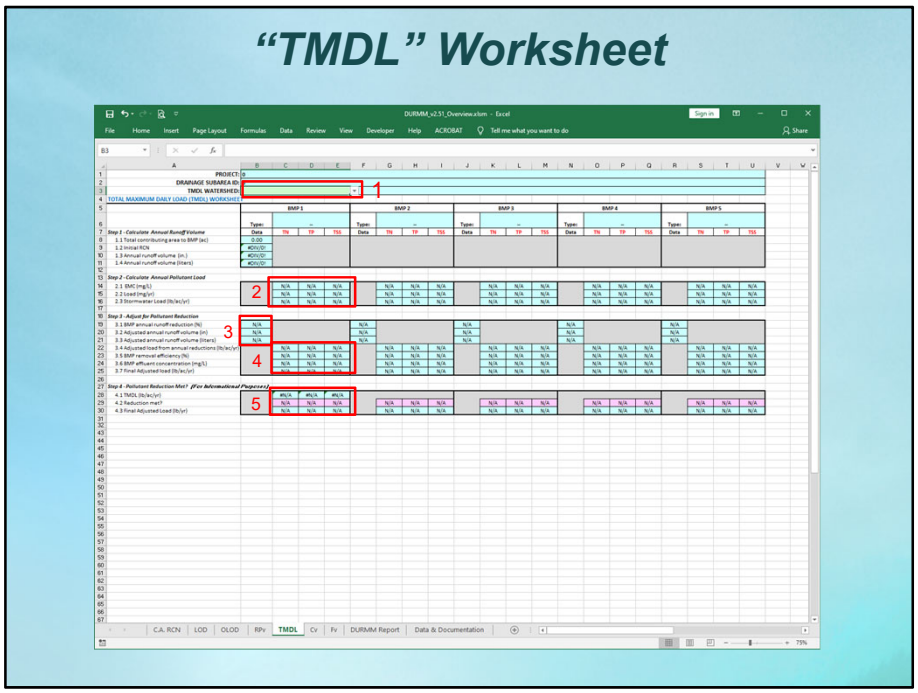
1. Data entered previously for the "C.A. RCN" and "LOD" worksheets are used to calculate the area outside the LOD and the RCN for that area.
2. Data used to determine the time of concentration for the area outside the LOD is entered in the green cells. There are allowances for 3 sheet flow, 3 shallow 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

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:

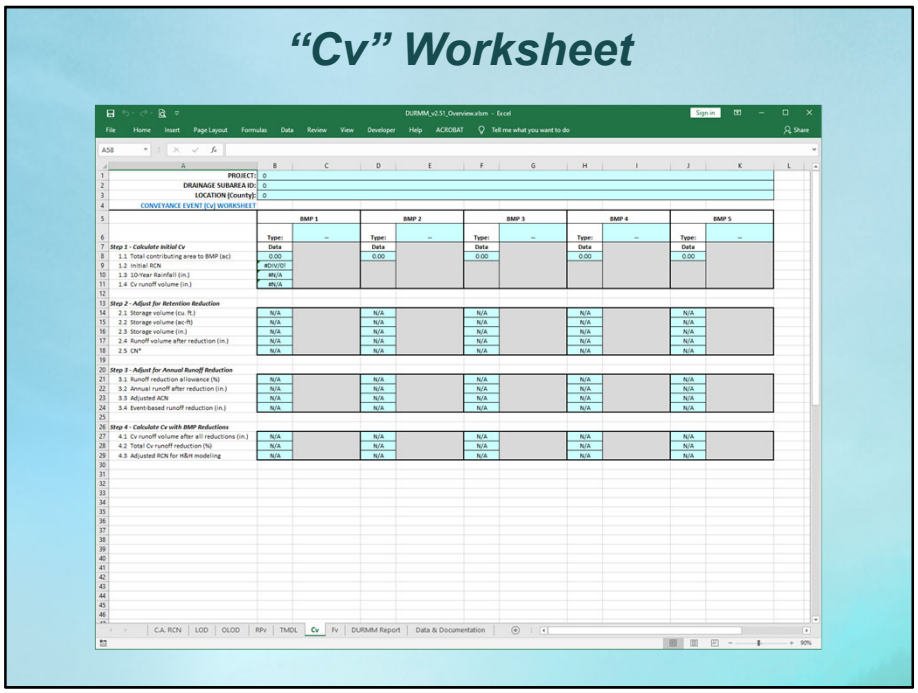
1. User selects a BMP from the dropdown list. BMP 1 would represent the most upstream BMP if a treatment train is proposed. Numbering then proceeds downstream for subsequent BMPs.
2. The model adjusts the runoff reduction requirement for the LOD to the total contributing area. It also checks to ensure 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

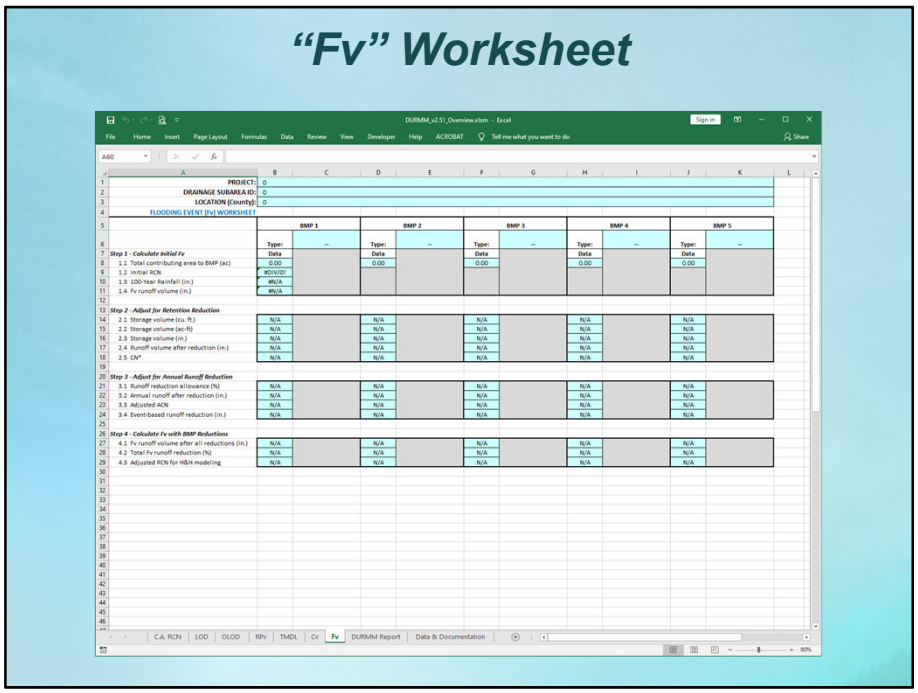
This worksheet is used to calculate the Total Maximum Daily Load (TMDL). Although compliance is not currently based specific TMDL targets, the Department is collecting this data to assess attainment of overall watershed TMDL goals. The BMP suite selected on the RPv worksheet is carried over to this sheet,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



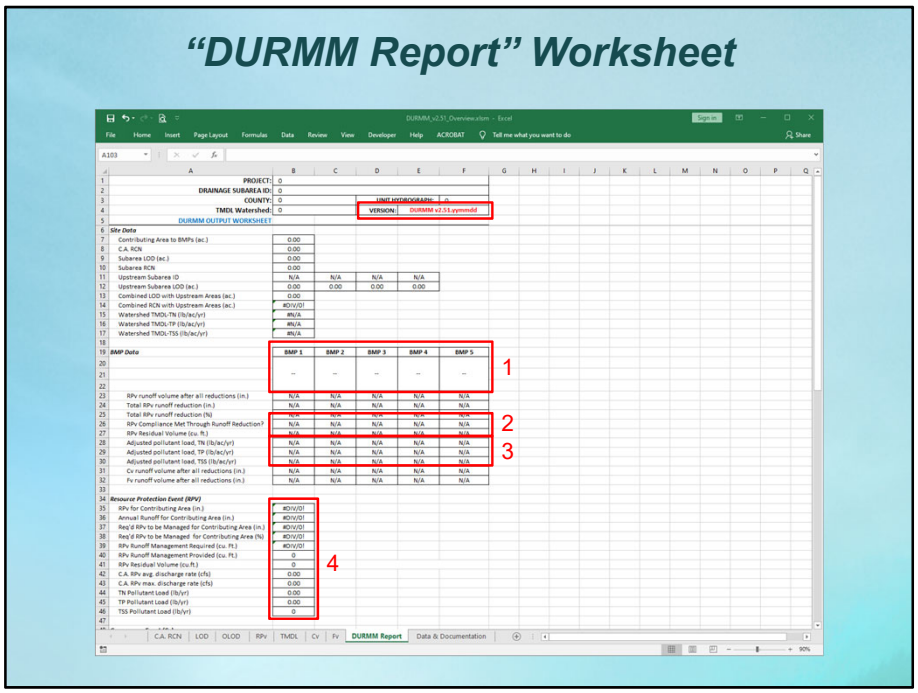
"Cv" Worksheet

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

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

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:

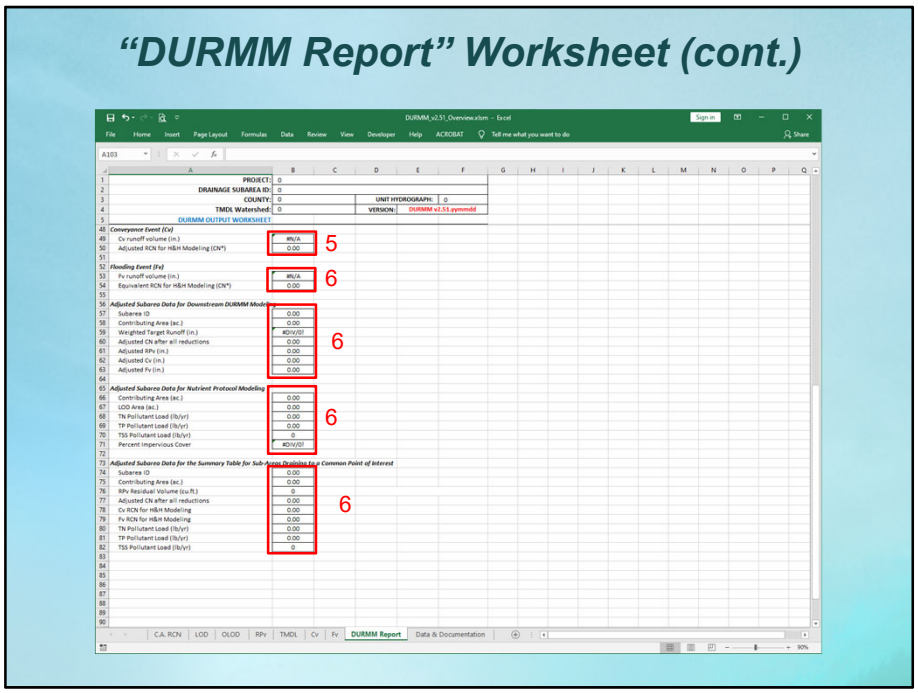
1. Summary of BMP suite selected.
2. Determination of compliance with runoff reduction requirements and any residual volume to be managed with detention or other means.
3. Determination of final annual pollutant loads.
4. Summary of results for the RPv event.

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#.yymmdd

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

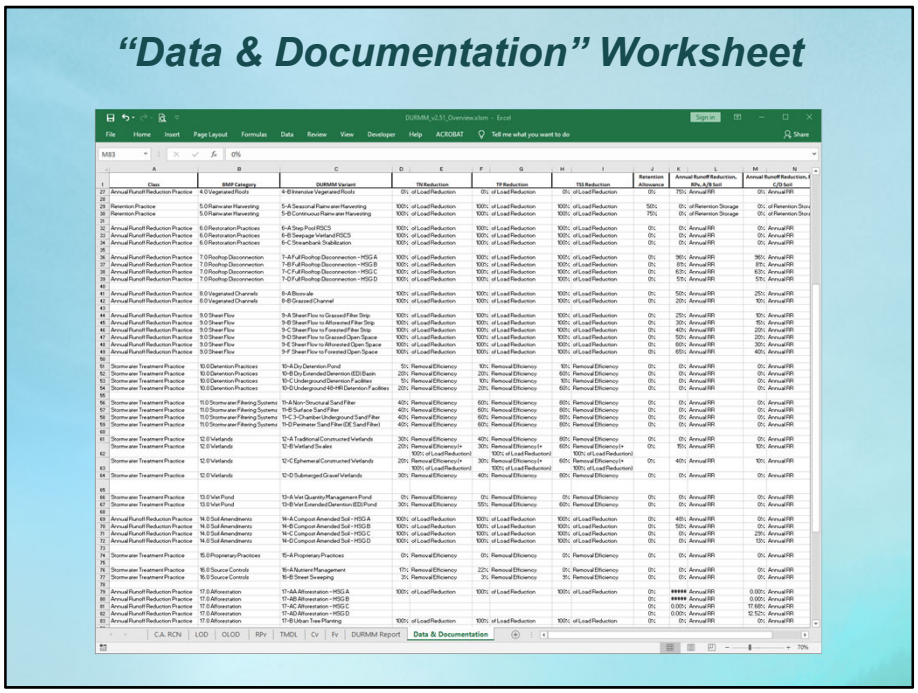


"DURMM Report" Worksheet (cont.)

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.



"DURMM Report" Worksheet

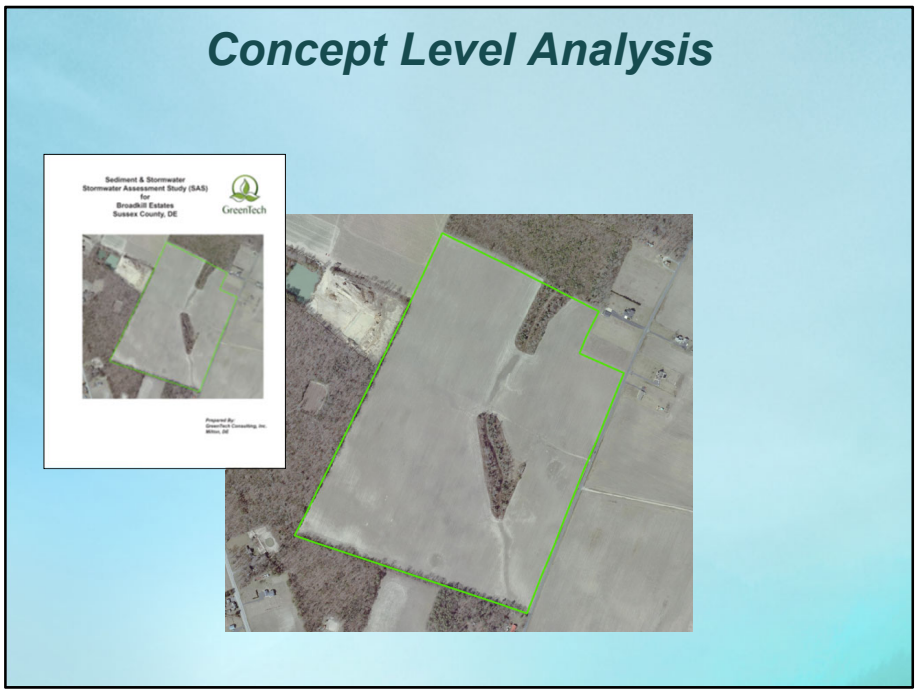
This worksheet summarizes the results from the previous worksheets in a format suitable for submission with the project application package. The information is largely self-explanatory. However, some key elements include:

1. Summary of BMP suite selected.
2. Determination of compliance with runoff reduction requirements.
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.

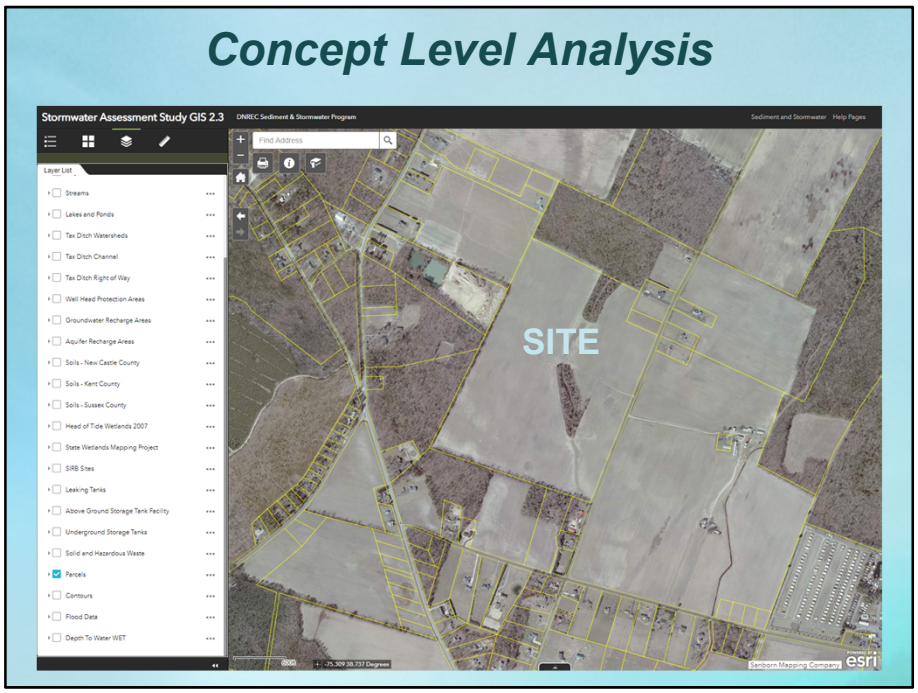
Example #1: Concept Level Analysis

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.



Data Sources

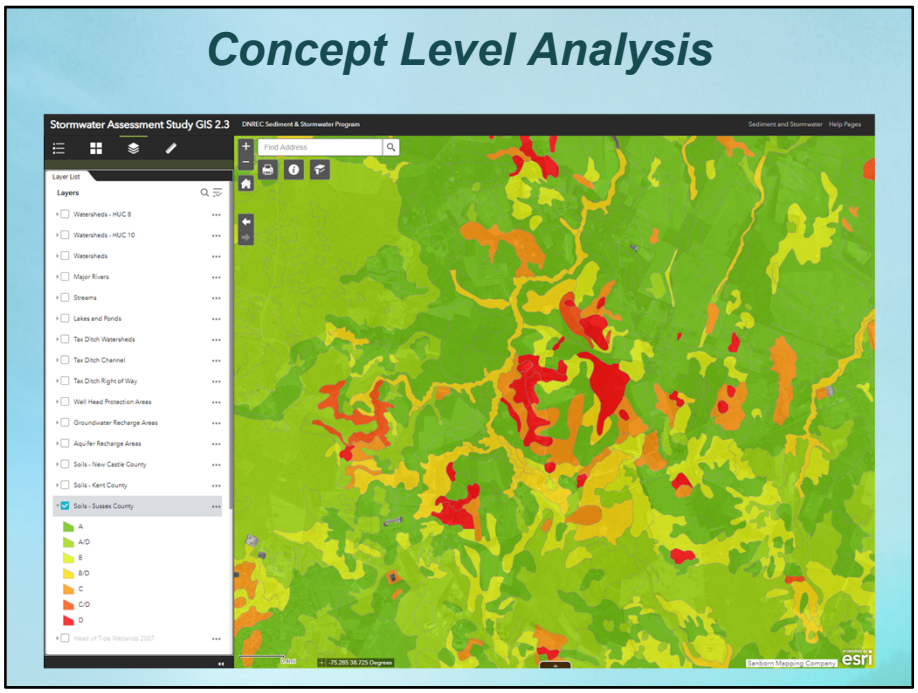
The information compiled for the Stormwater Assessment Study (SAS) will provide the necessary data inputs for the analysis.



Site GIS Data

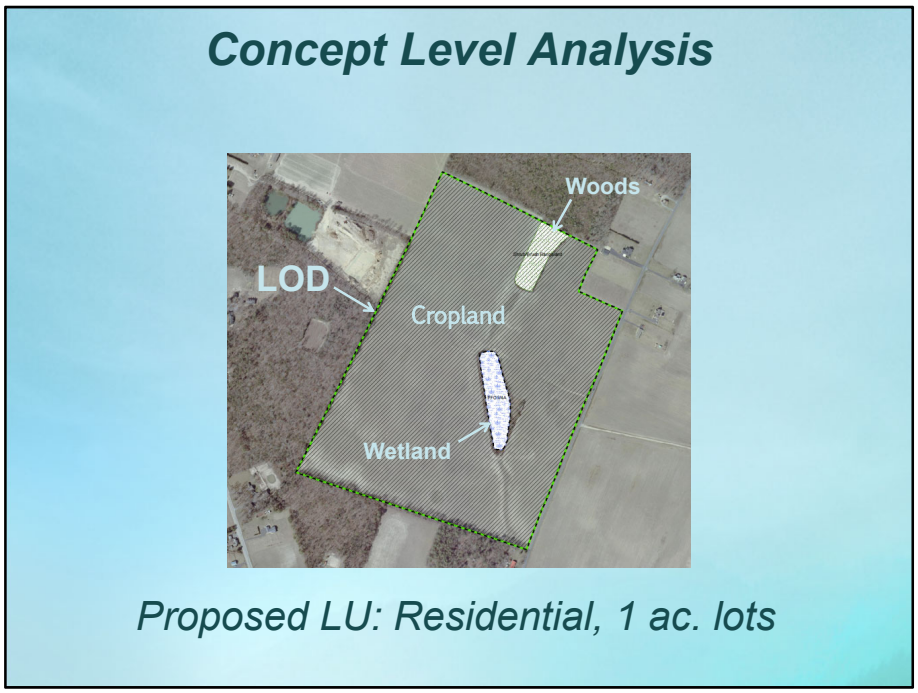
The Stormwater Assessment Study GIS App is an on-line GIS tool that can be used for collecting data necessary to perform the DURMM analysis. The SAS GIS App is available at the following link:

https://firstmap.delaware.gov/sasgis



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.



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

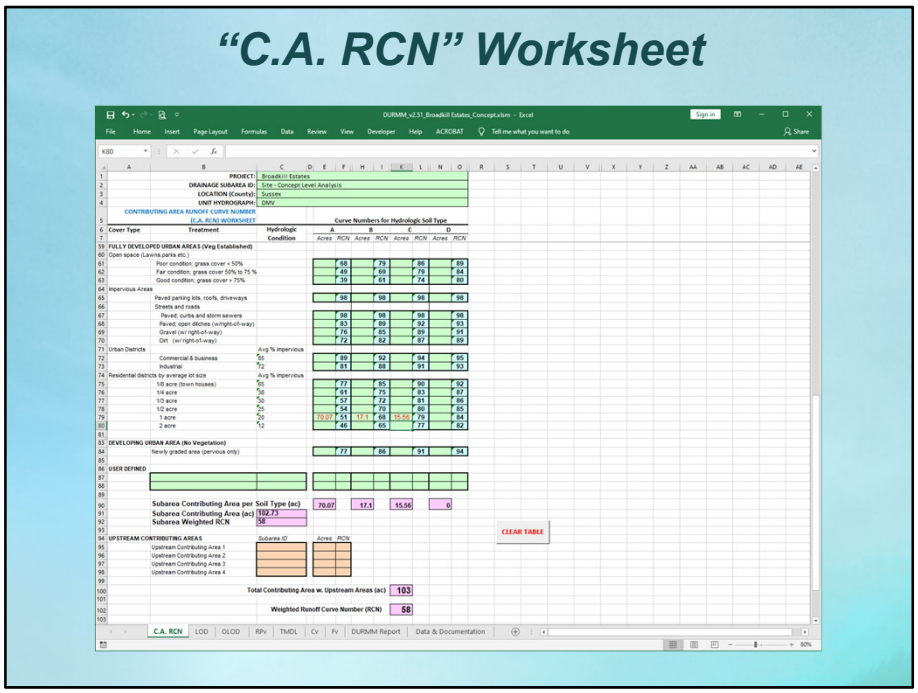
The slide above summarizes the data that will be input to the "C.A. RCN" worksheet.

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.

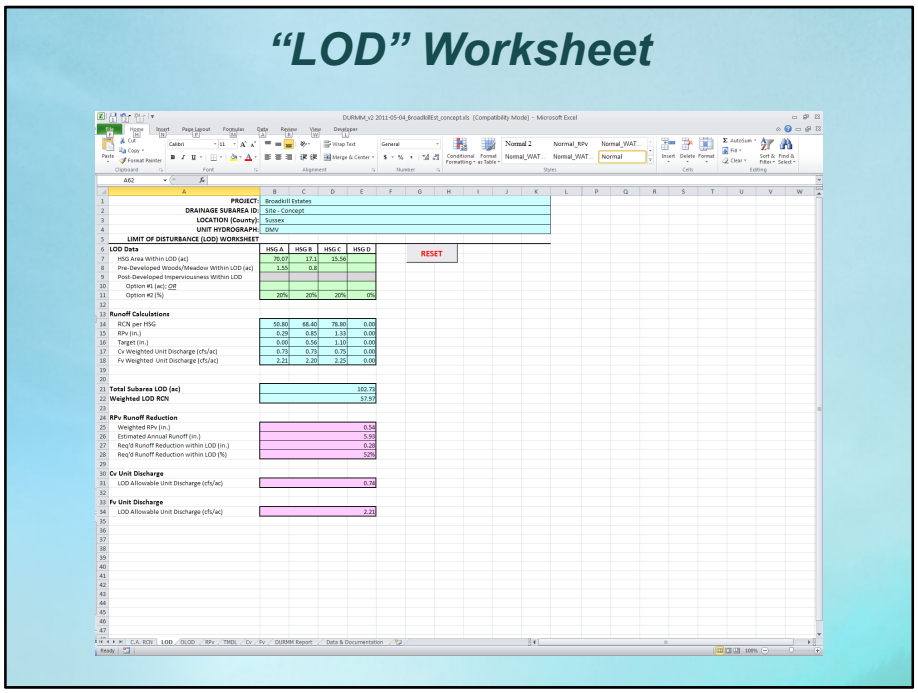


"C.A. RCN" Worksheet

The 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.

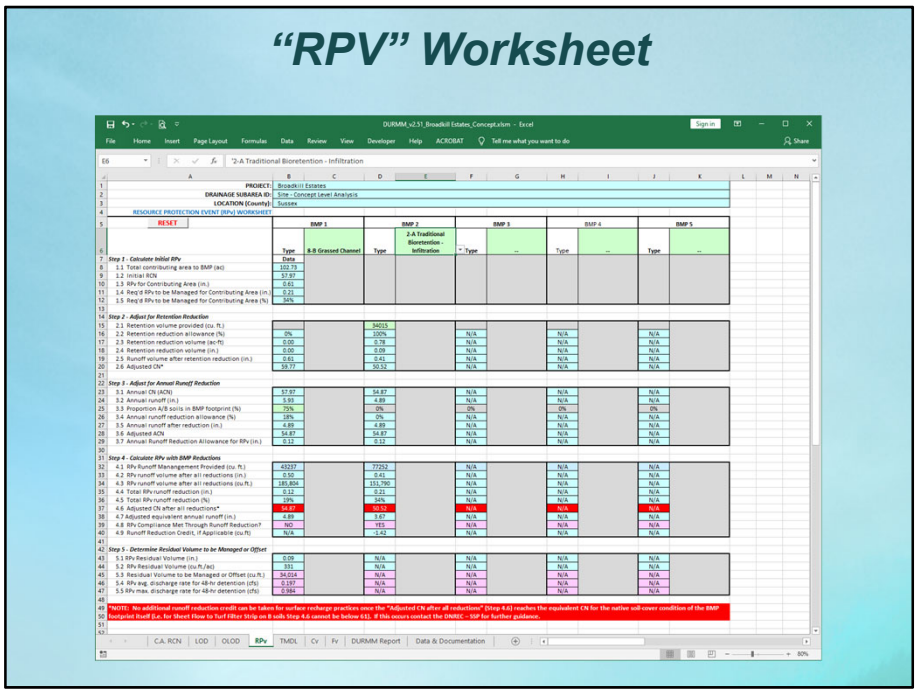


"LOD" Worksheet

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.

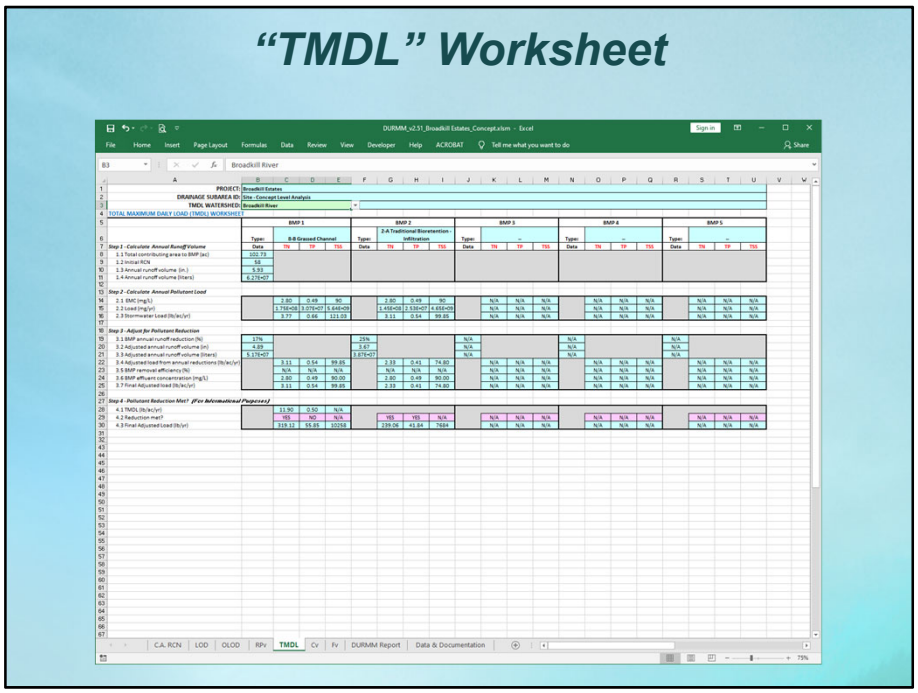


"RPV" Worksheet

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".

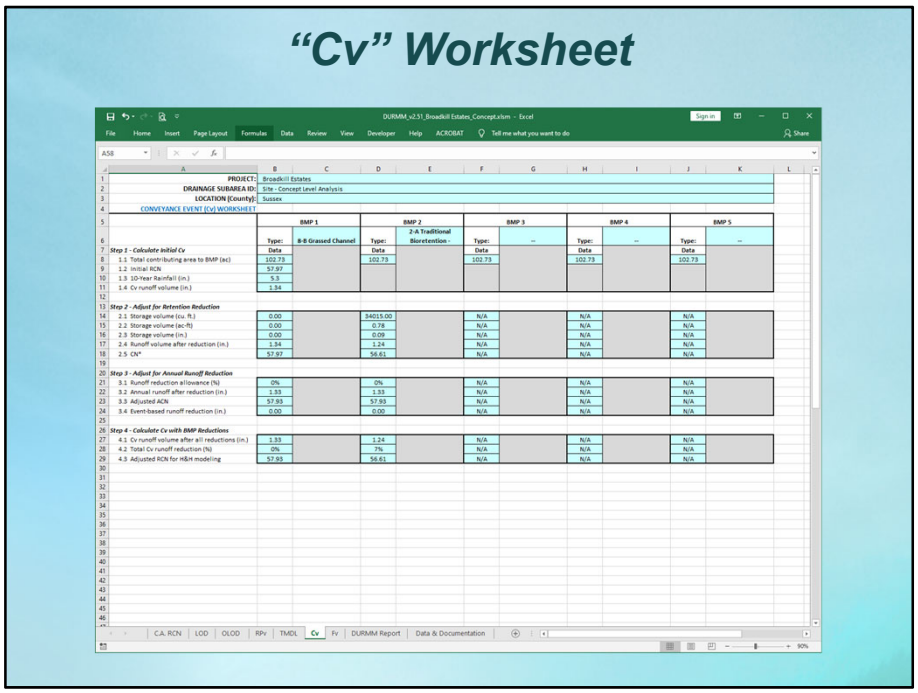


"TMDL" Worksheet

The data inputs/outputs for this worksheet are illustrated in the slide above. Once the user selects the appropriate TMDL watershed from the dropdown list, the model calculates the total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) loads for the subarea, as well as the reductions from the BMP suite selected on the "RPv" worksheet. The model has calculated the following results:

- Pollutant Load: 3.77 lb/ac/yr-TN; 0.66 lb/ac/yr-TP; 121 lb/ac/yr-TSS
- Pollutant load after BMP 1: 3.11 lb/ac/yr-TN; 0.54 lb/ac/yr-TP; 90 lb/ac/yr-TSS
- Pollutant load after BMP 2: 2.33 lb/ac/yr-TN; 0.41 lb/ac/yr-TP; 74.8 lb/ac/yr-TSS

Pollutant load is calculated using the RPv runoff volume and the Event Mean Concentration (EMC) values for the various pollutants that are integrated into the model. The model checks to determine whether the required pollutant reduction has been met. Since the Broadkill River does not have a regulatory TMDL for TSS, these cells are shown as "N/A". A "YES" in the magenta cells indicates that the load reduction has been met. In this example, the TN load reduction has been met as a result of meeting the RPv runoff reduction attributed to BMP 1. The TP reduction was only met with the addition of BMP 2. There is currently no regulatory requirement under the 2019 DSSR to meet a specific TMDL target. However, DNREC requires the TMDL Worksheet to be completed for all projects in order to provide data for tracking TMDL progress.

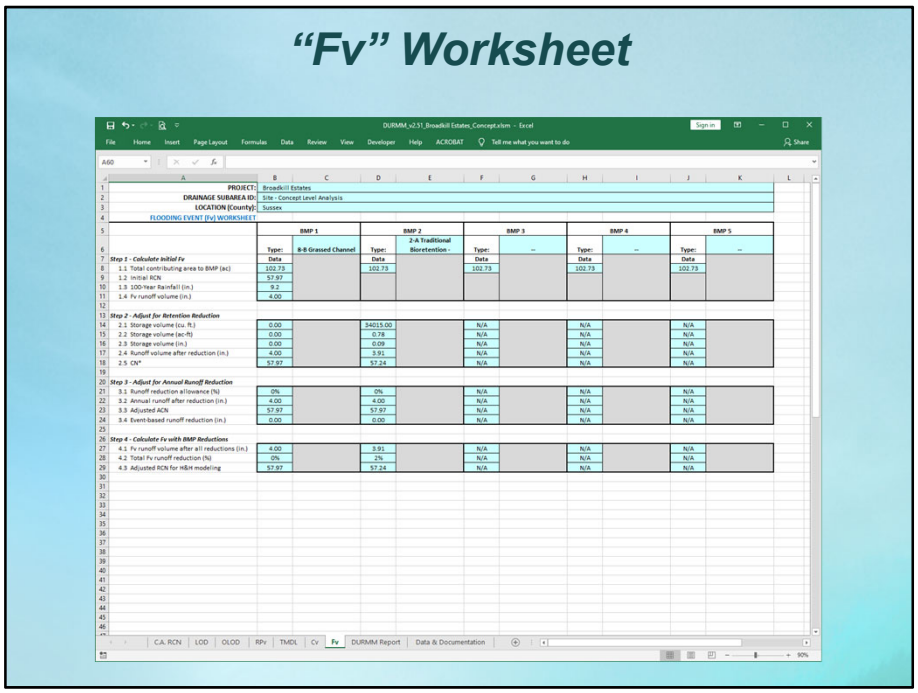


"Cv" Worksheet

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.

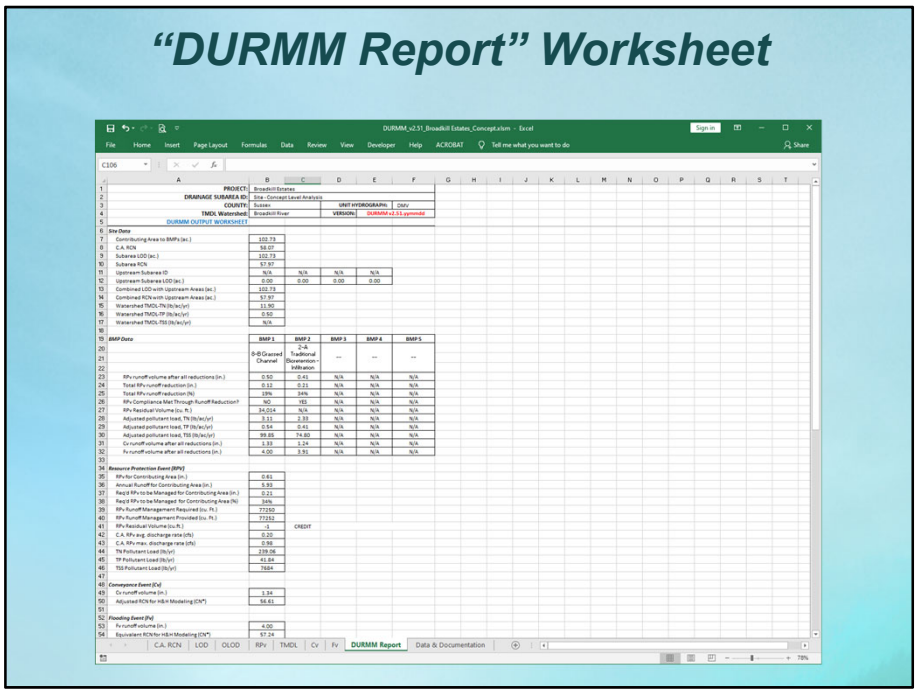


"Fv" Worksheet

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

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.

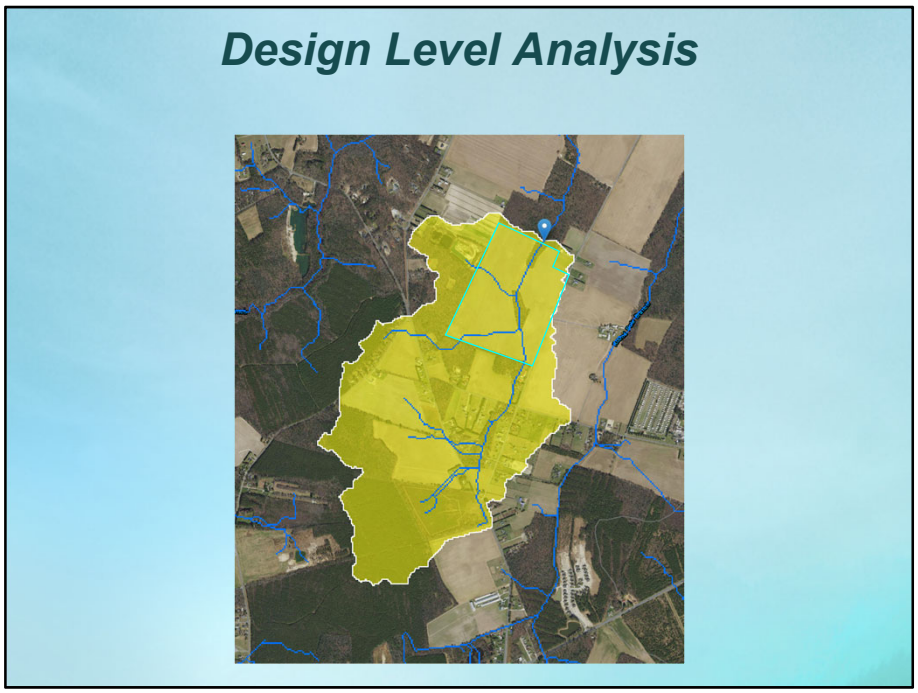
Example #2: Design Level Analysis

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

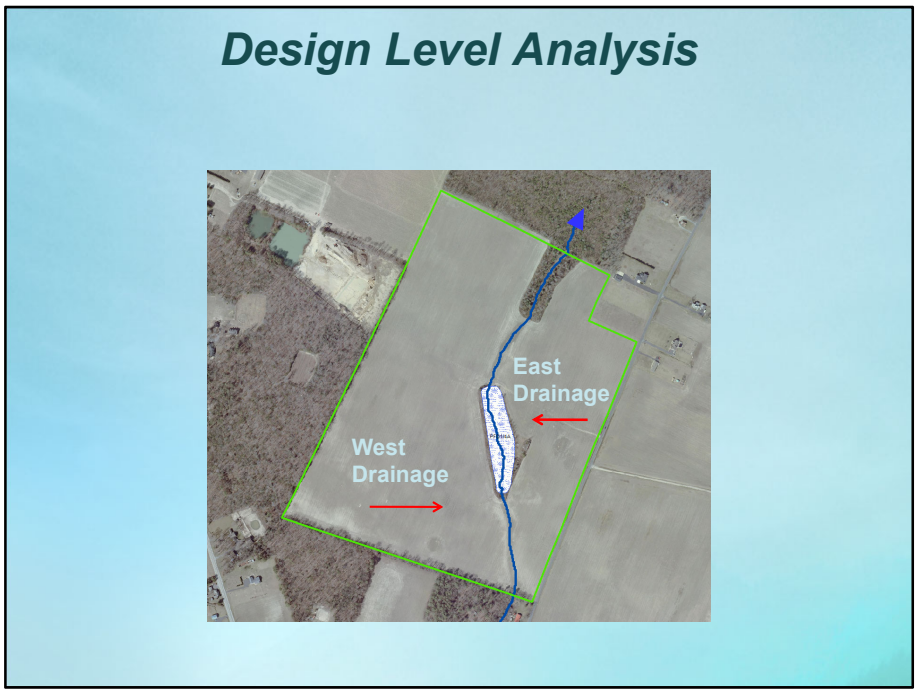
Site Layout

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



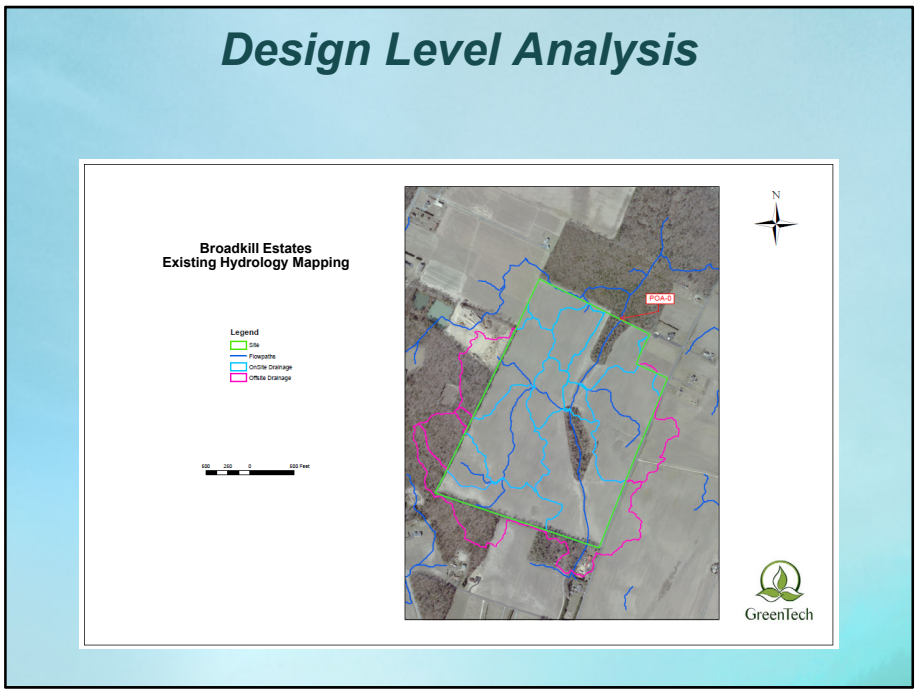
Hydrologic Analysis

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.



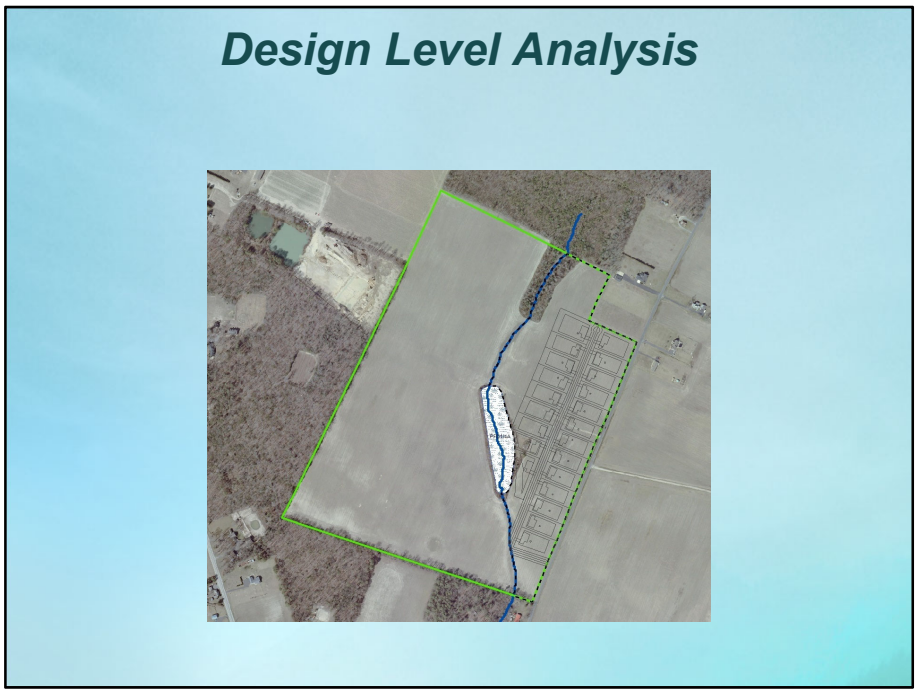
Onsite Drainage

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.



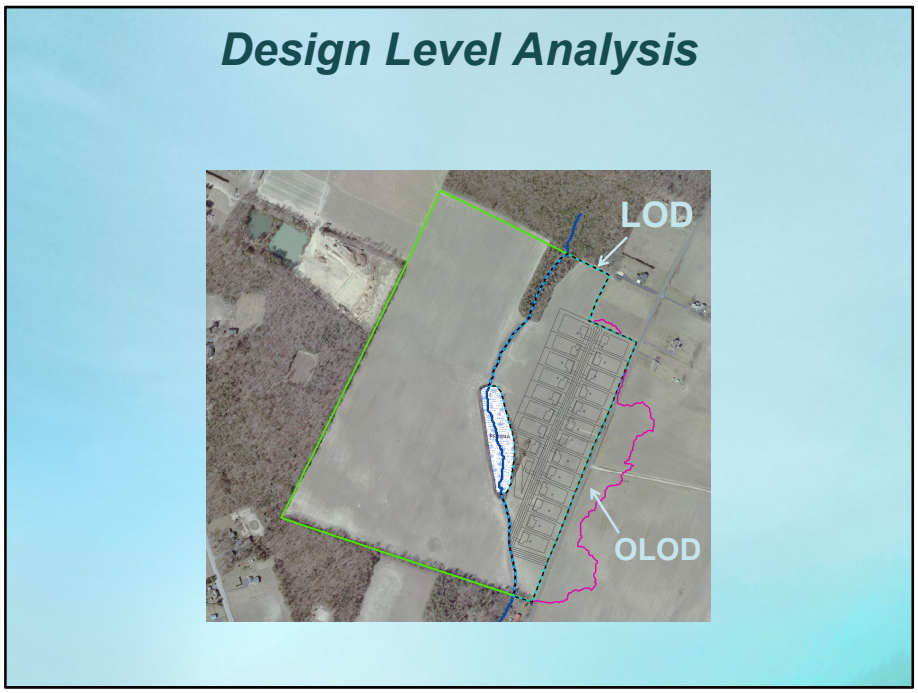
Offsite Drainage

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.



Site Design

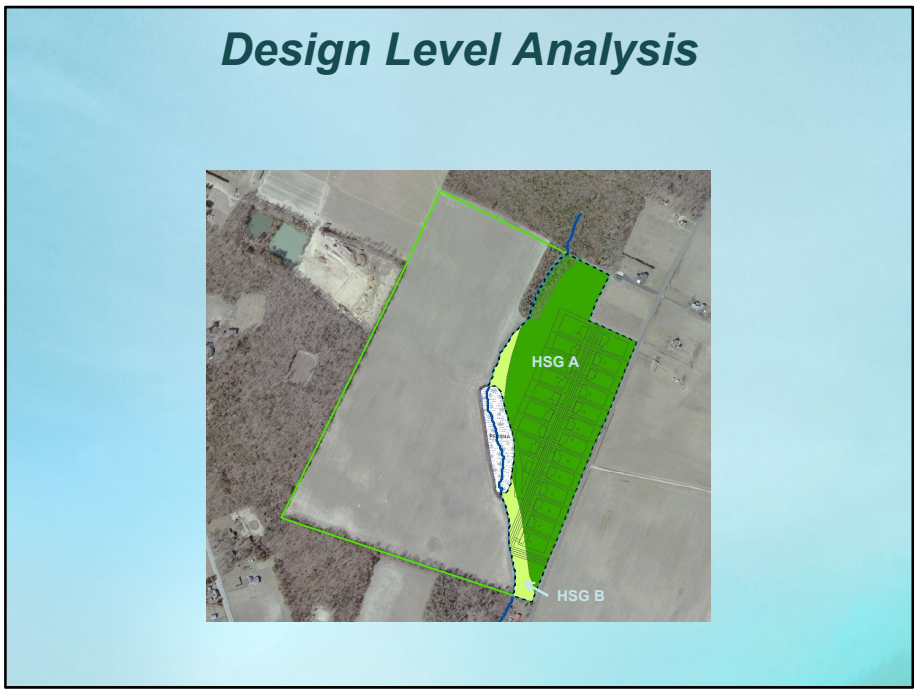
For the purposes of this example, the proposed lot and road layout for the east drainage subarea will be analyzed. The area outside the lots will be designated as common open space.



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.



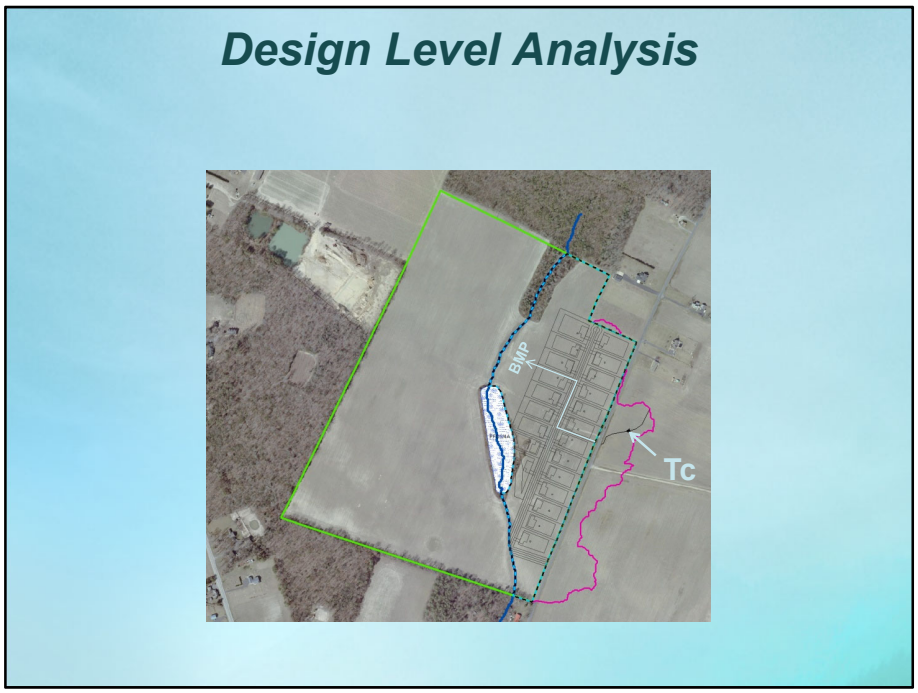
Soils Data - LOD

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.



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 (Tc) 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 Tc path for the entire OLOD area for any particular subarea under analysis. The Tc 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

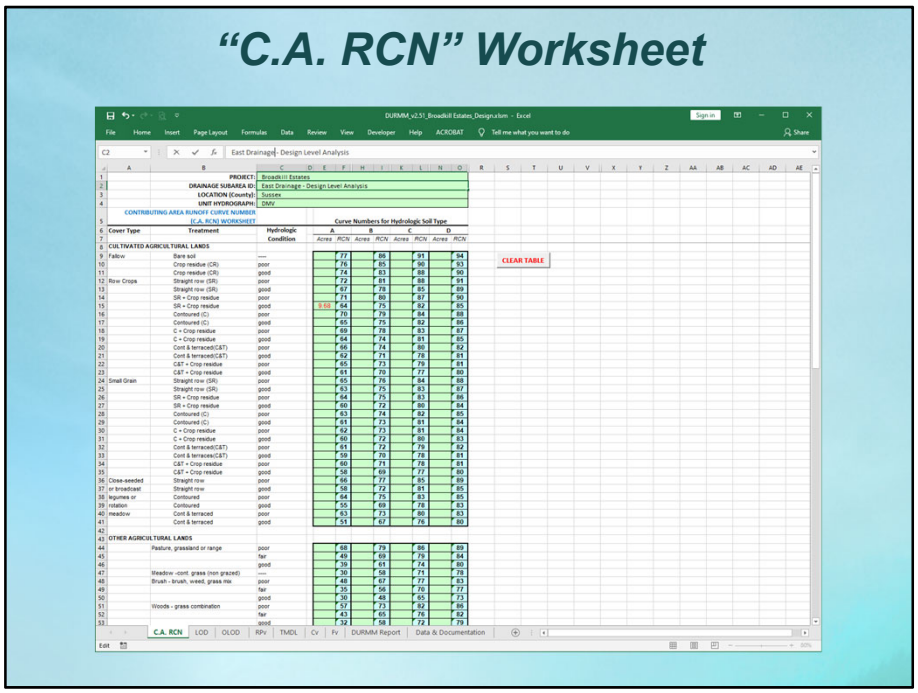
The slide above summarizes the data that will be input to the "C.A. RCN" worksheet. It includes both LOD and OLOD areas.

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

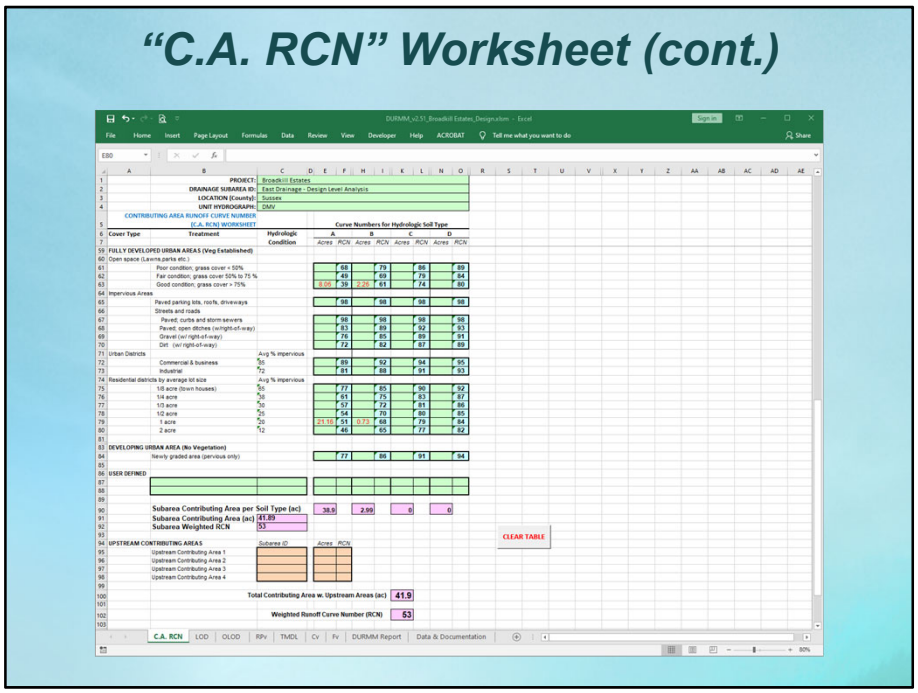
Data Inputs – “LOD” and “OLOD” Worksheets

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



"C.A. RCN" Worksheet

The 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.

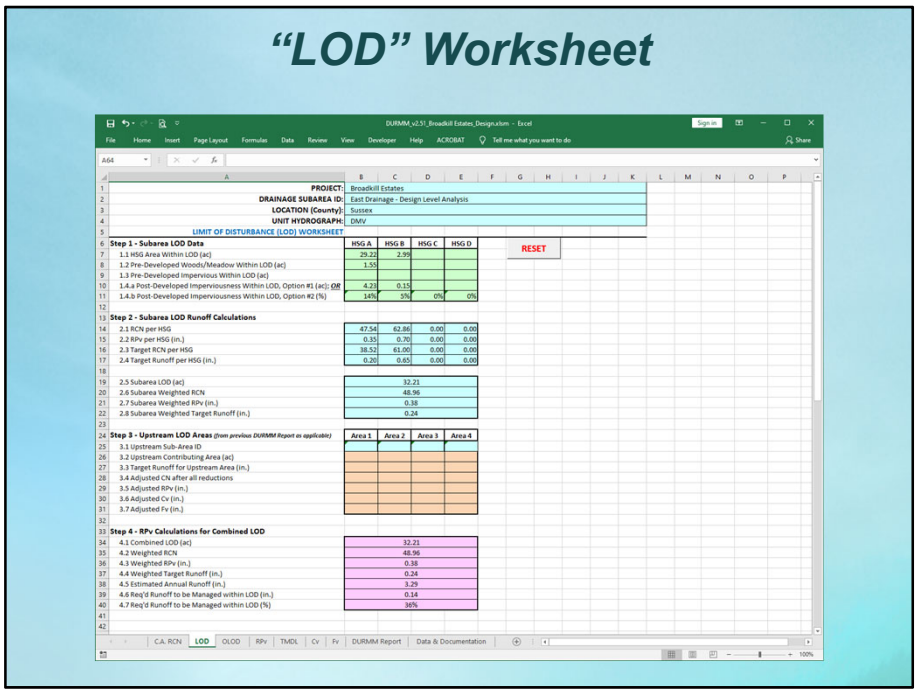


"C.A. RCN" Worksheet (cont.)

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

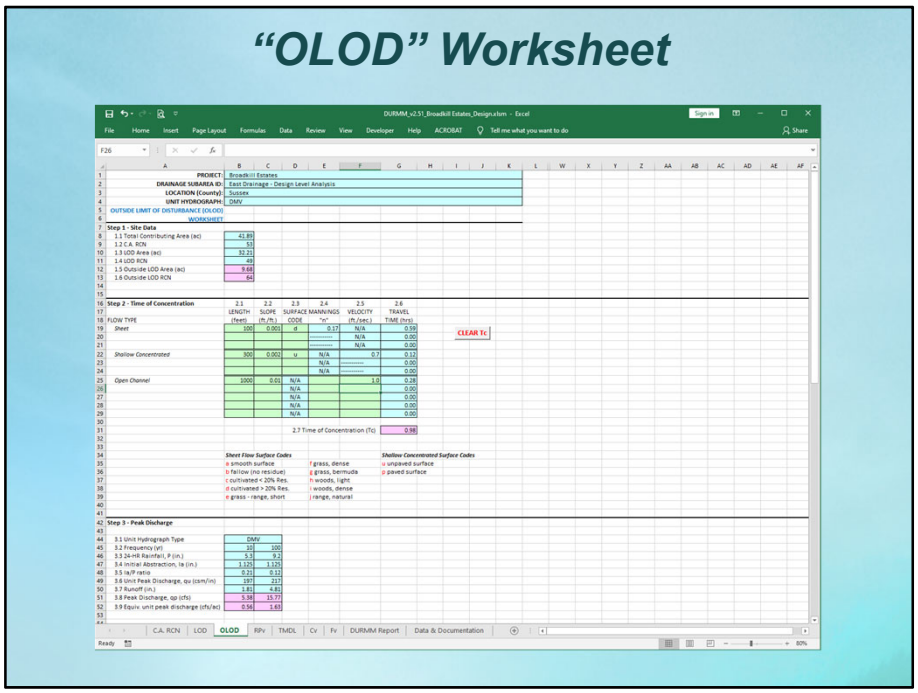


	PROJECT:	Broadkill Estates				
	DRAINAGE SUBAREA ID:	East Drainage - Design Level Analysis				
	LOCATION (County):	Sussex				
	UNIT HYDROGRAPH:	DMV				
	LIMIT OF DISTURBANCE (LOD) WORKSHEET					
	Step 1 - Subarea LOD Data	HSG A	HSG B	HSG C	HSG D	RESET
	1.1 HSG Area Within LOD (ac)	29.22	2.99			
	1.2 Pre-Developed Woods/Meadow Within LOD (ac)	1.55				
	1.3 Pre-Developed Impervious Within LOD (ac)					
	1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac): OR	4.23	0.15			
	1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)	14%	5%	0%	0%	
	Step 2 - Subarea LOD Runoff Calculations					
	2.1 RCN per HSG	47.54	62.86	0.00	0.00	
	2.2 RPv per HSG (in.)	0.35	0.70	0.00	0.00	
	2.3 Target RCN per HSG	38.52	61.00	0.00	0.00	
	2.4 Target Runoff per HSG (in.)	0.20	0.65	0.00	0.00	
	2.5 Subarea LOD (ac)	32.21				
	2.6 Subarea Weighted RCN	48.96				
	2.7 Subarea Weighted RPv (in.)	0.38				
	2.8 Subarea Weighted Target Runoff (in.)	0.24				
	Step 3 - Upstream LOD Areas *(from previous DURMM Report as applicable)*	Area 1	Area 2	Area 3	Area 4	
	3.1 Upstream Sub-Area ID					
	3.2 Upstream Contributing Area (ac)					
	3.3 Target Runoff for Upstream Area (in.)					
	3.4 Adjusted CN after all reductions					
	3.5 Adjusted RPv (in.)					
	3.6 Adjusted Cv (in.)					
	3.7 Adjusted Fv (in.)					
	Step 4 - RPv Calculations for Combined LOD					
	4.1 Combined LOD (ac)	32.21				
	4.2 Weighted RCN	48.96				
	4.3 Weighted RPv (in.)	0.38				
	4.4 Weighted Target Runoff (in.)	0.24				
	4.5 Estimated Annual Runoff (in.)	3.29				
	4.6 Req'd Runoff to be Managed within LOD (in.)	0.14				
	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:

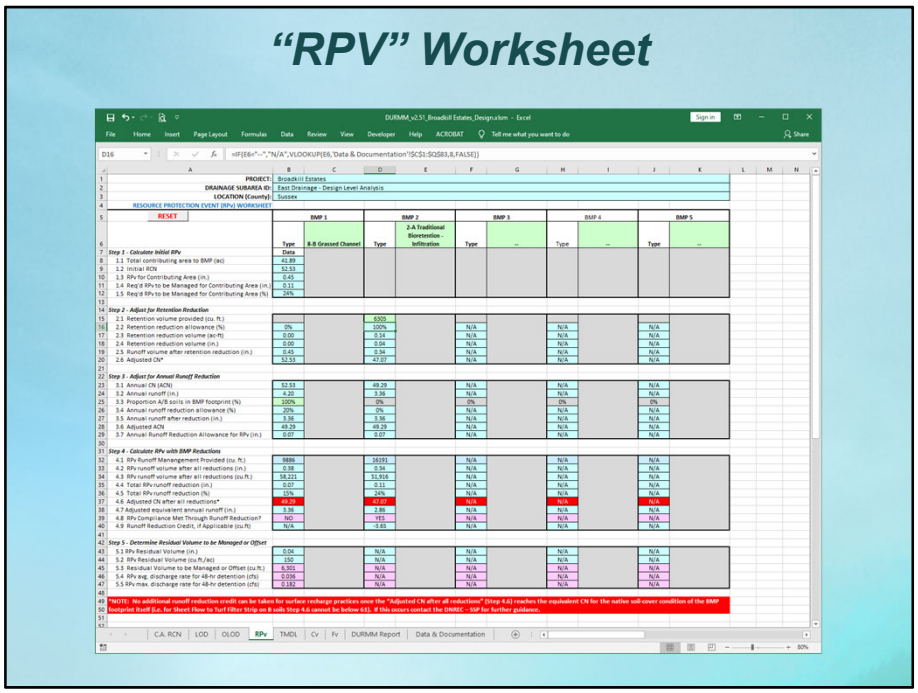
- Total LOD Acreage: 32.21
- Weighted LOD RCN: 48.96
- Weighted RPV runoff volume: 0.38"
- Weighted RPv target runoff volume: 0.24"
- Estimated annual runoff: 3.29"
- Required runoff reduction: 0.14" (36%)



"OLOD" Worksheet

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

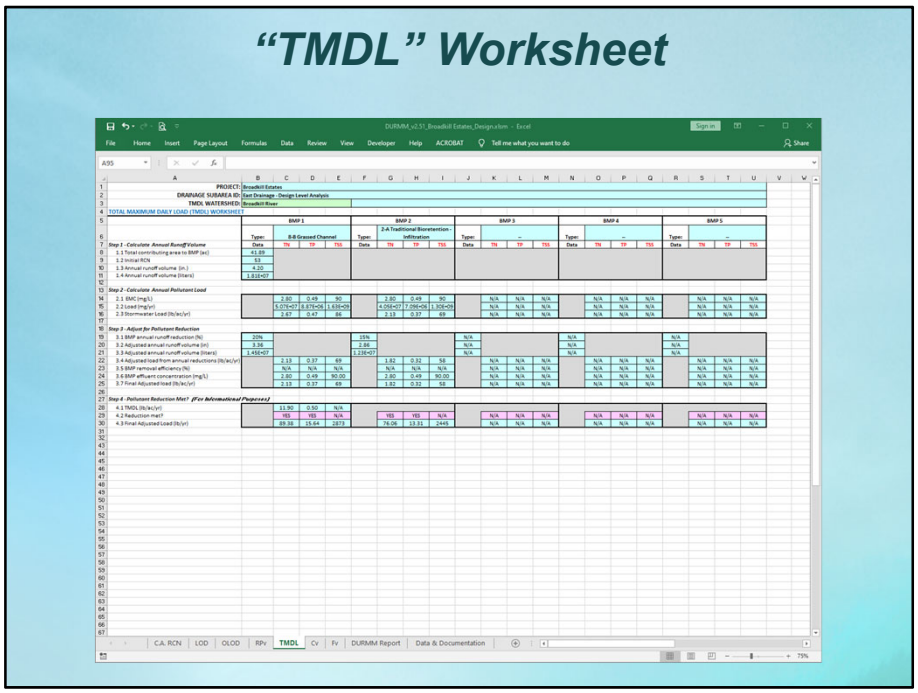


"RPV" Worksheet

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".

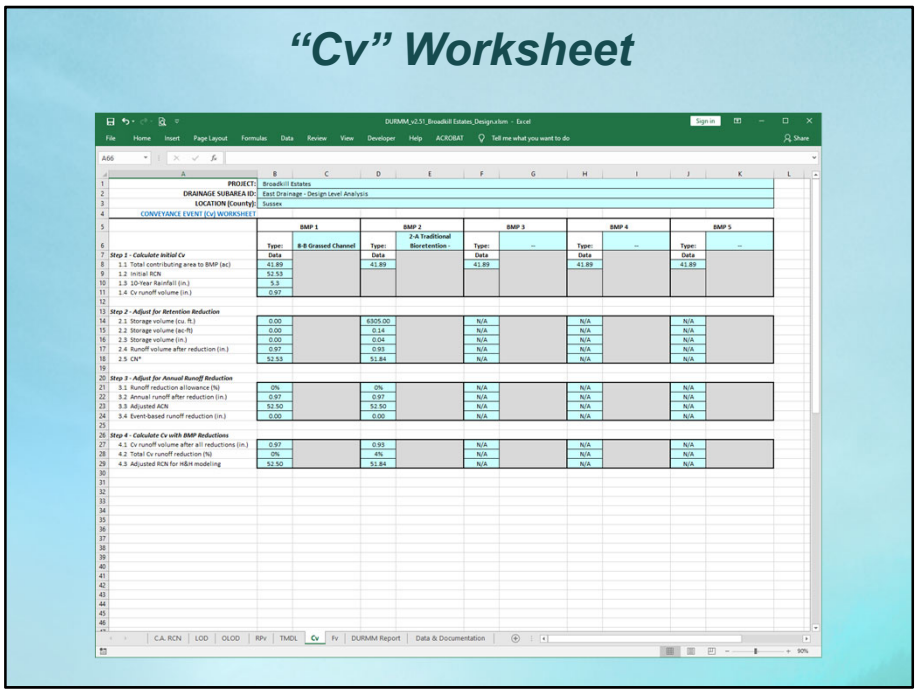


"TMDL" Worksheet

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

- Pollutant Load:
  - 2.67 lb/ac/yr-TN
  - 0.47 lbac/yr-TP
  - 86 lb/ac/yr-TSS
- Pollutant load after BMP 1:
  - 2.13 lb/ac/yr-TN
  - 0.37 lb/ac/yr-TP
  - 69 lb/ac/yr-TSS
- Pollutant load after BMP 2:
  - 1.82 lb/ac/yr-TN
  - 0.0.32 lb/ac/yr-TP
  - 58 lb/ac/yr-TSS

The pollutant loads and reductions are likewise adjusted to account for the total contributing area to the BMPs. For the East Drainage, the grassed channels were adequate to meet both the TN and TP goals for the watershed.

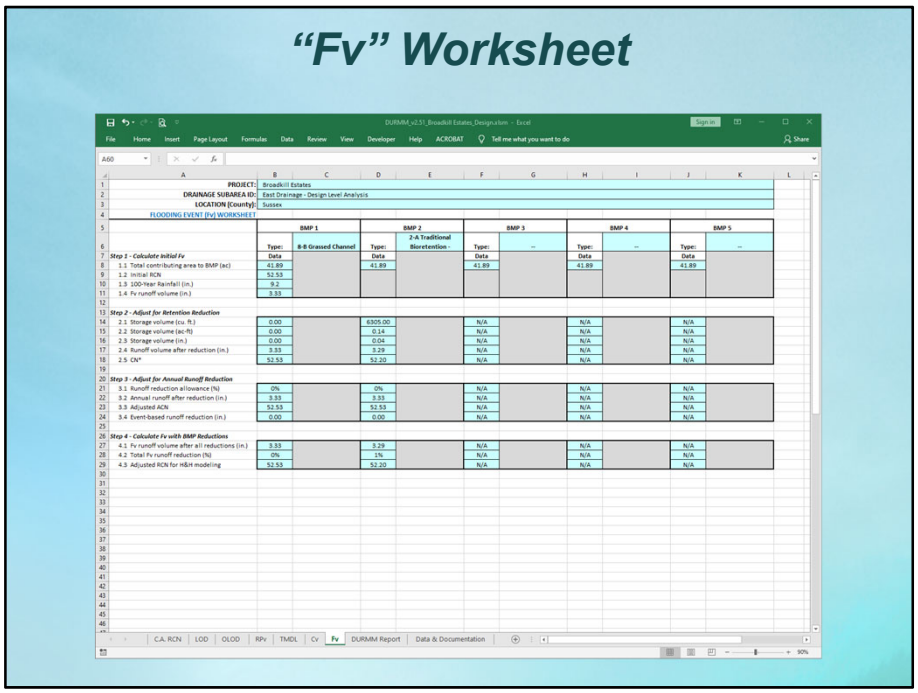


"Cv" Worksheet

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.

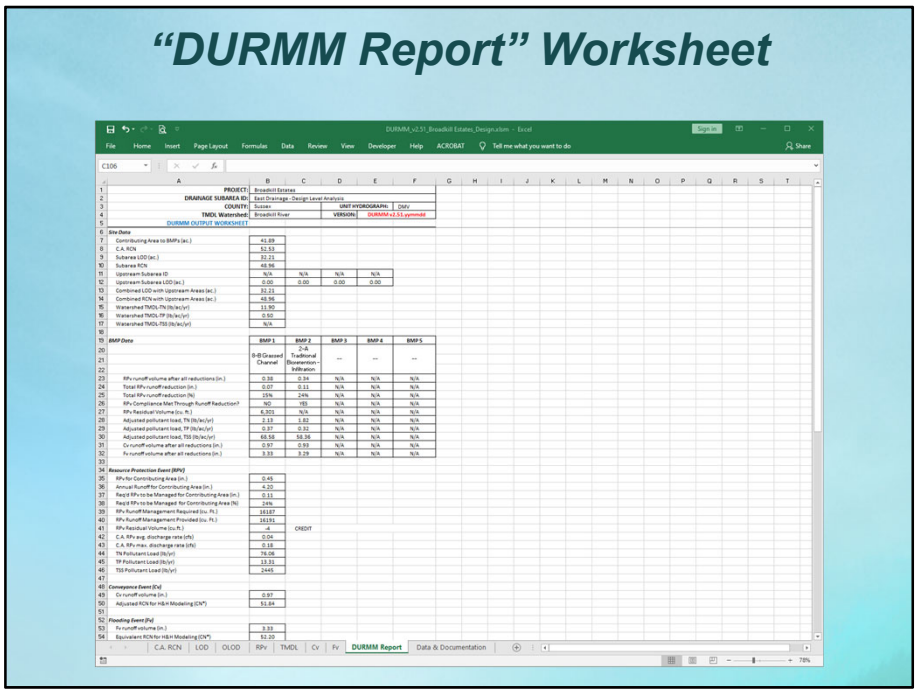


"Fv" Worksheet

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.



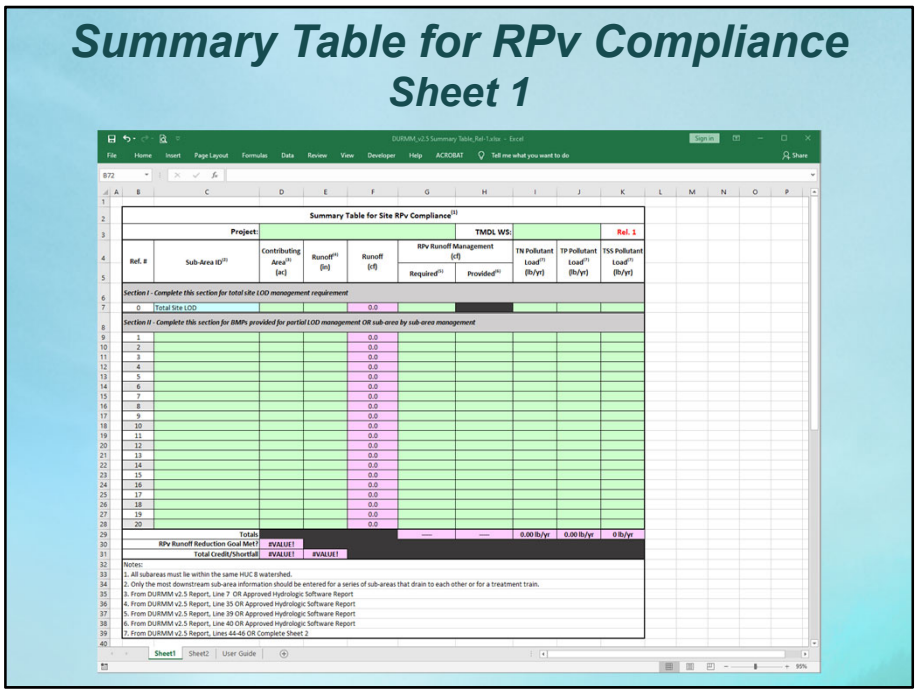
"DURMM Report" Worksheet

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 RPv 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.



Sheet 1

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

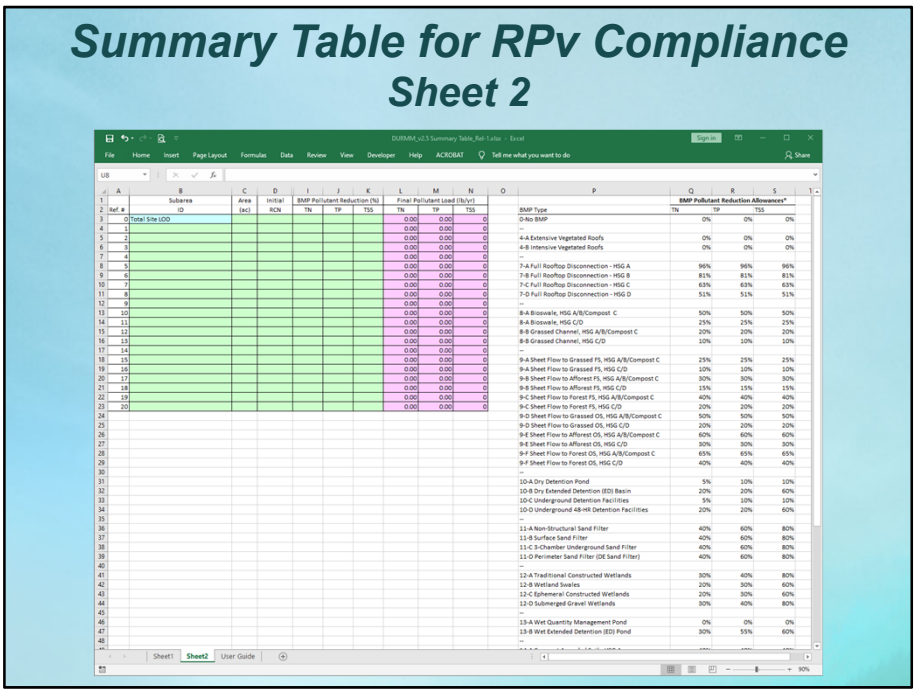
- Green Cells – cells intended for user input
- Cyan Cells – cells that contain either pre-set values or secondary output
- Magenta Cells - cells that contain calculated results for primary output

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

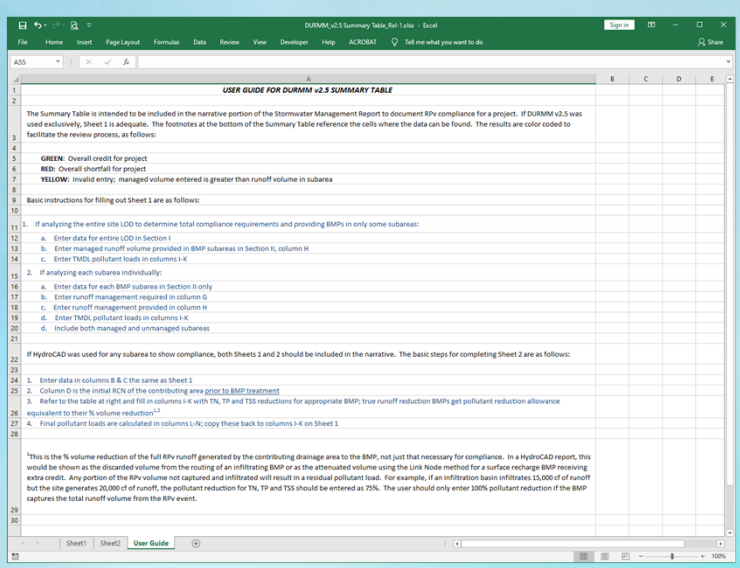
Summary Table for RPv Compliance
Sheet 2



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 RPv 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 RPv 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

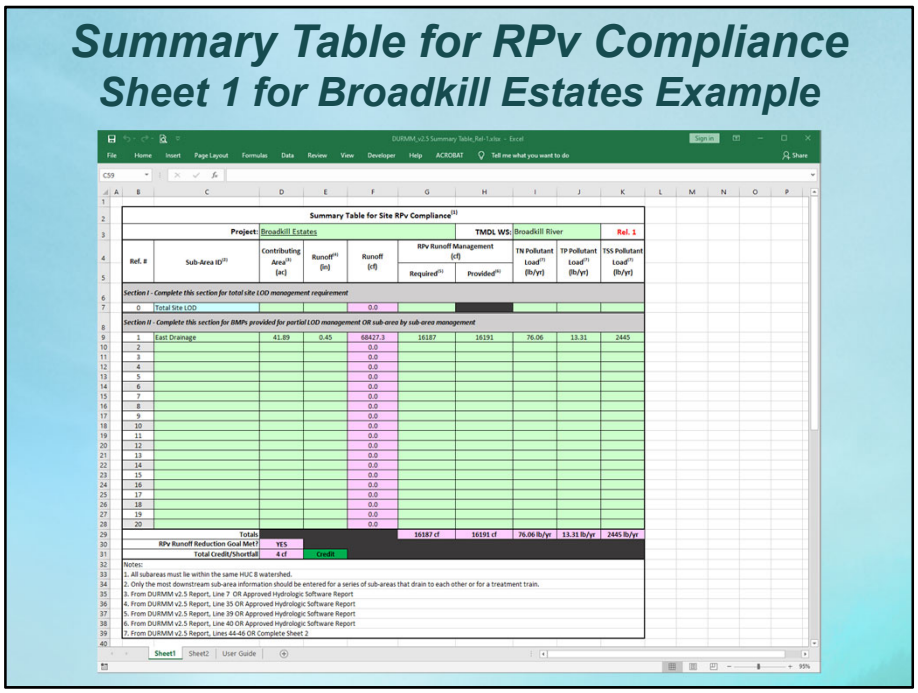
If HydroCAD was used for any subarea to show compliance, both Sheets 1 and 2 should be included in the narrative. The basic steps for completing Sheet 2 are as follows:

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

[1]This is the % volume reduction of the full RPv 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 RPv 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 RPv event.

User Guide

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



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 RPv 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 RPv 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 RPv 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

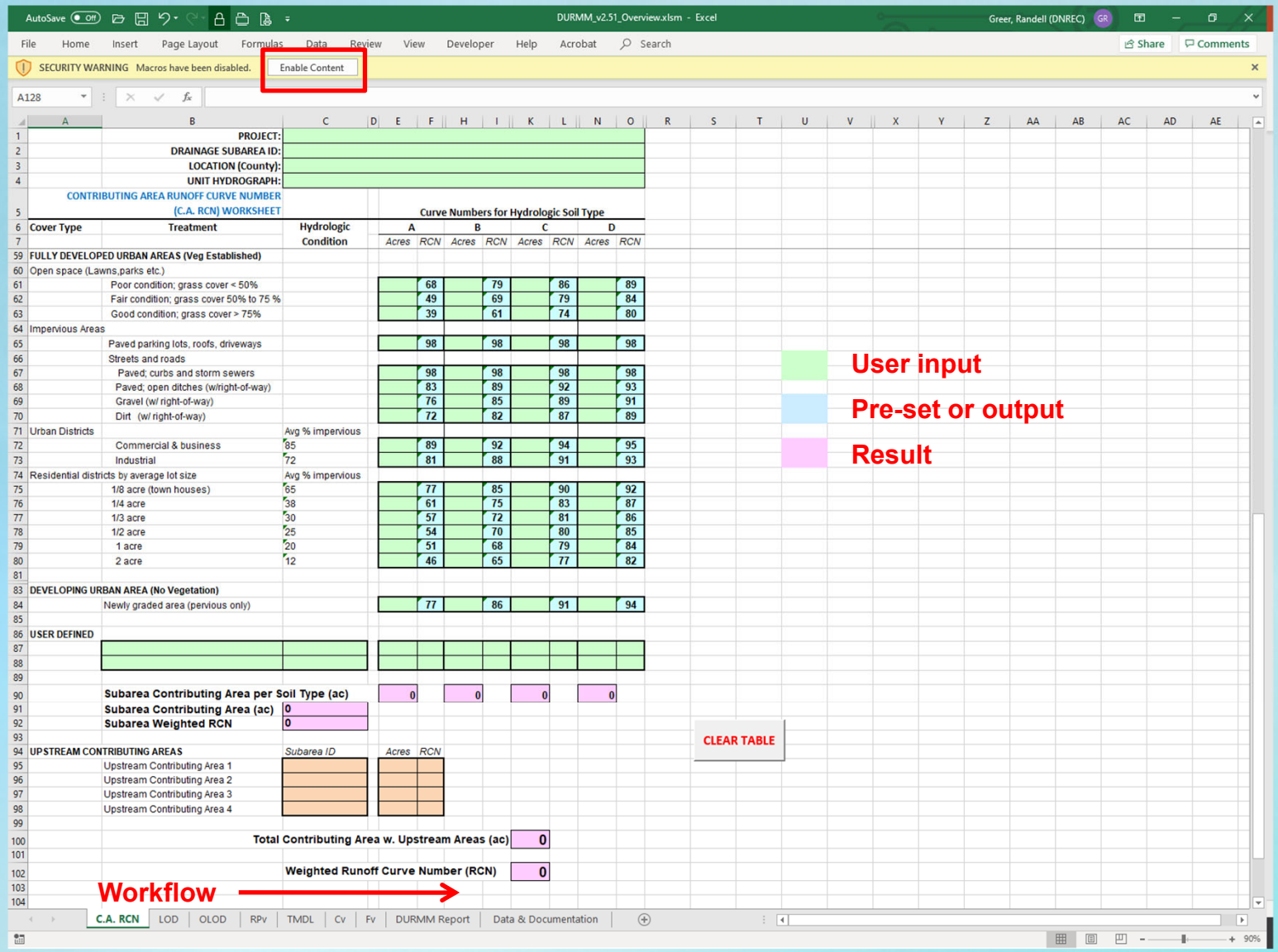
DURMM v2.5

Quick-Start Guide

DURMM v2.5

Basic Workflow & Data Input

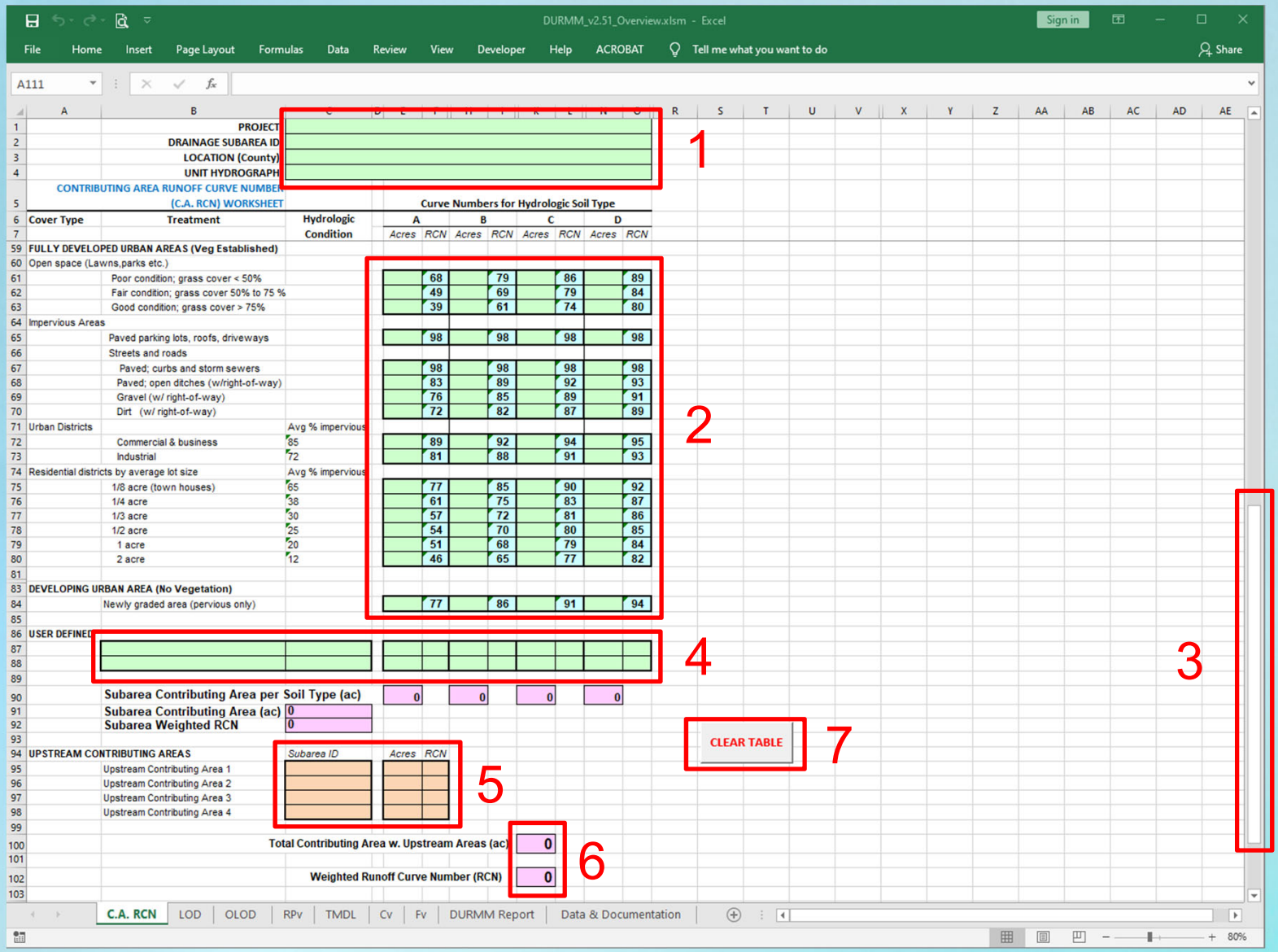
DURMM v.2 Layout



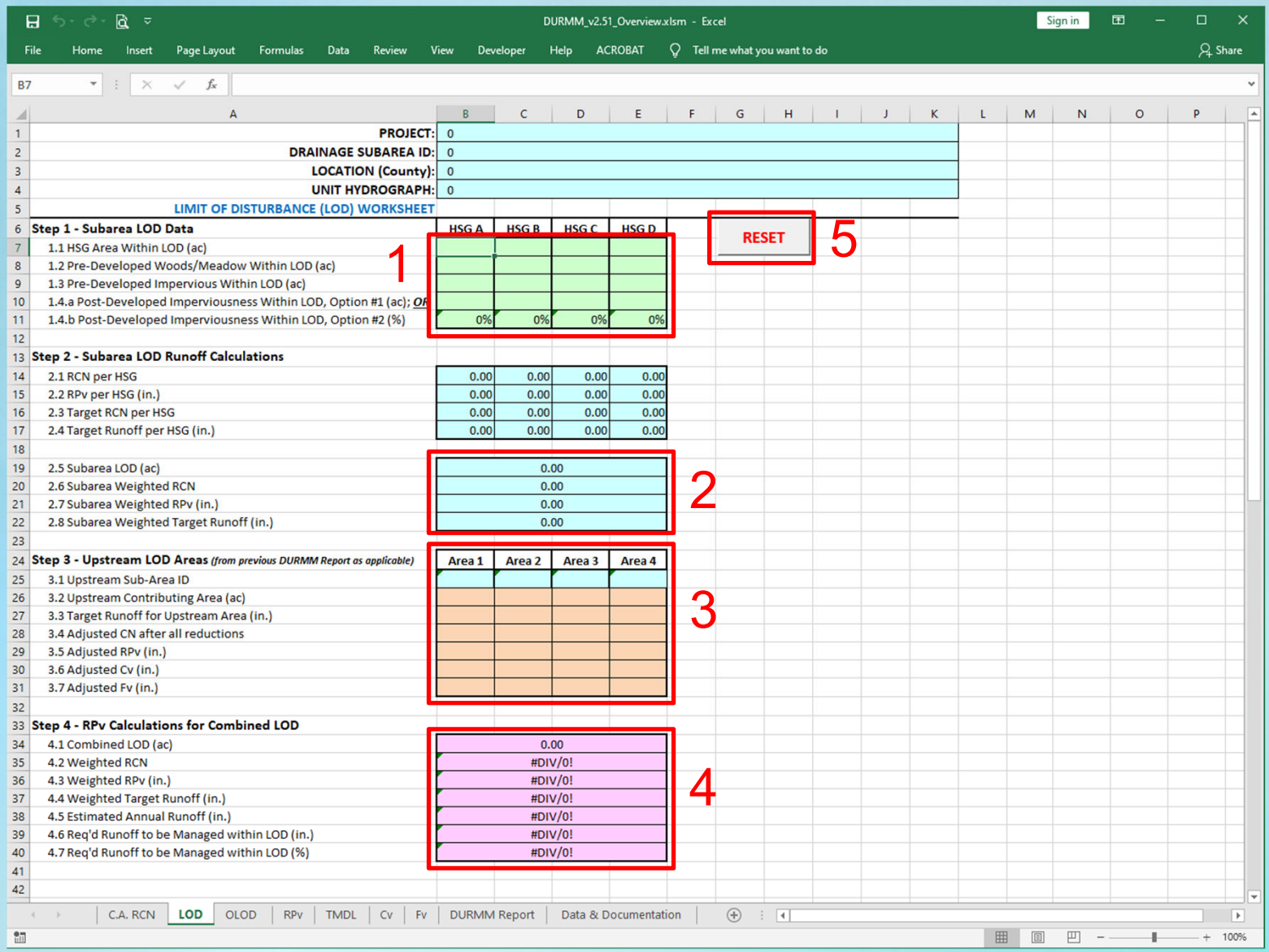
DURMM v2.5

Explanation of Worksheets

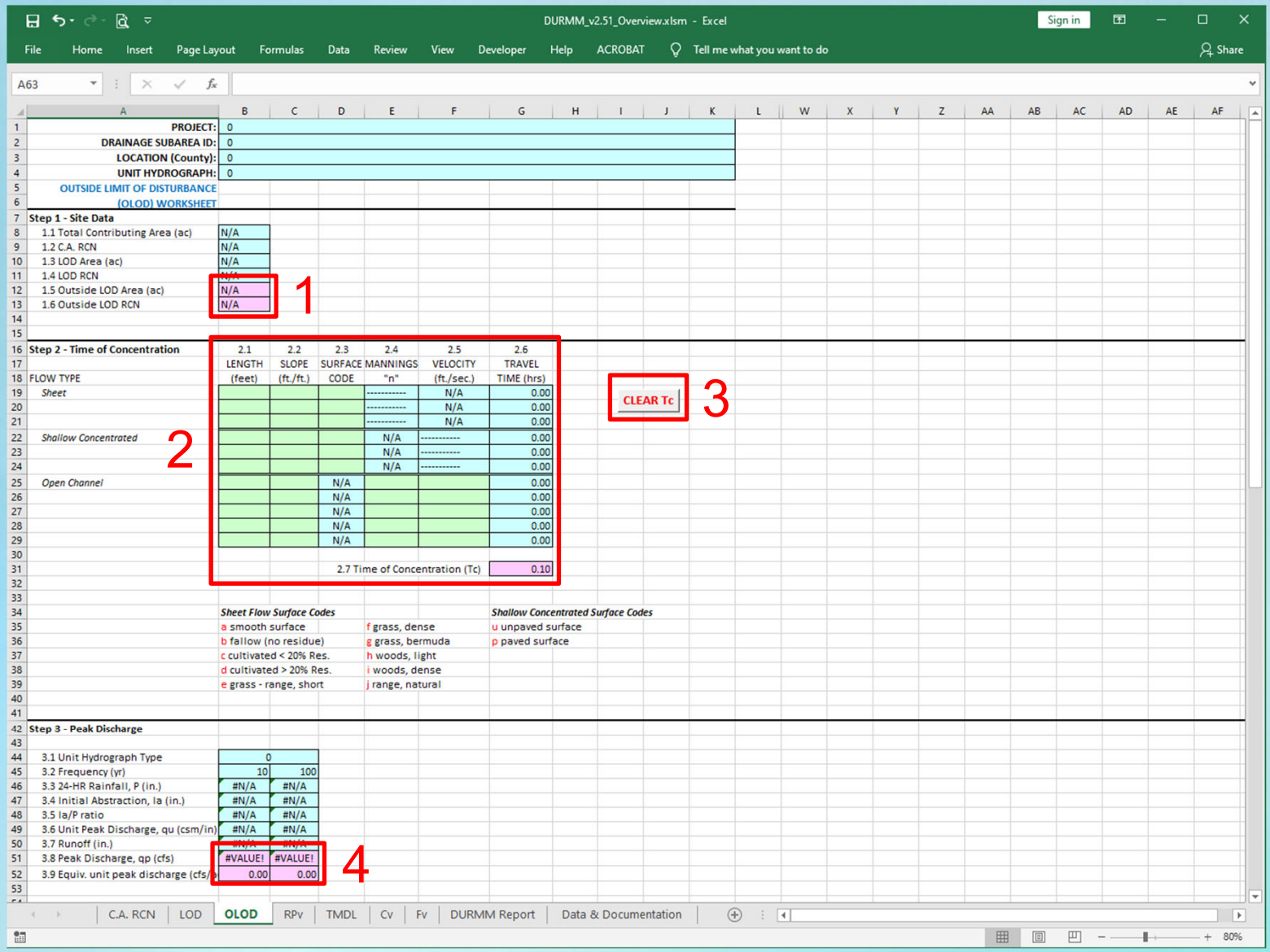
“C.A. RCN” Worksheet



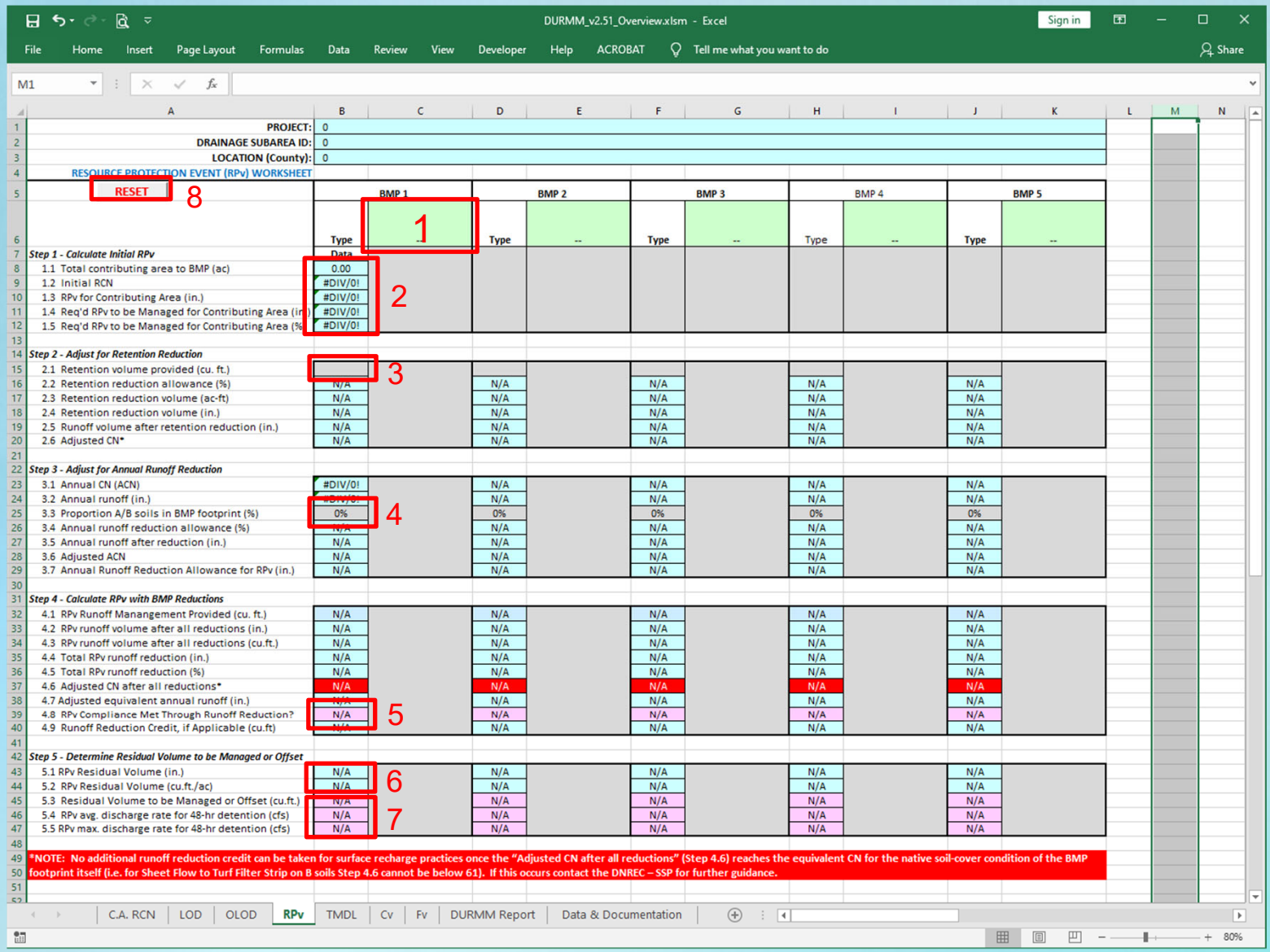
"LOD" Worksheet



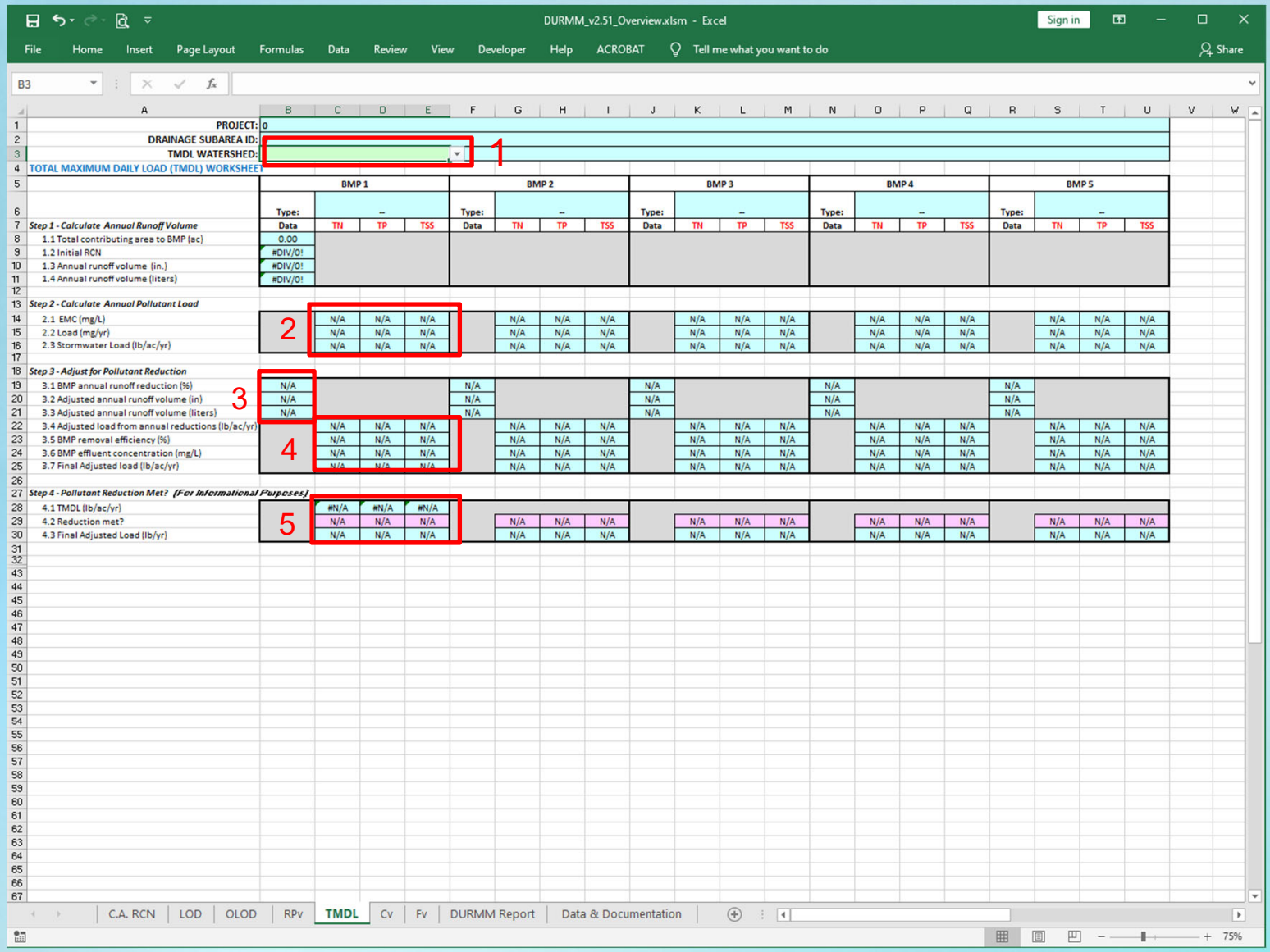
"OLOD" Worksheet



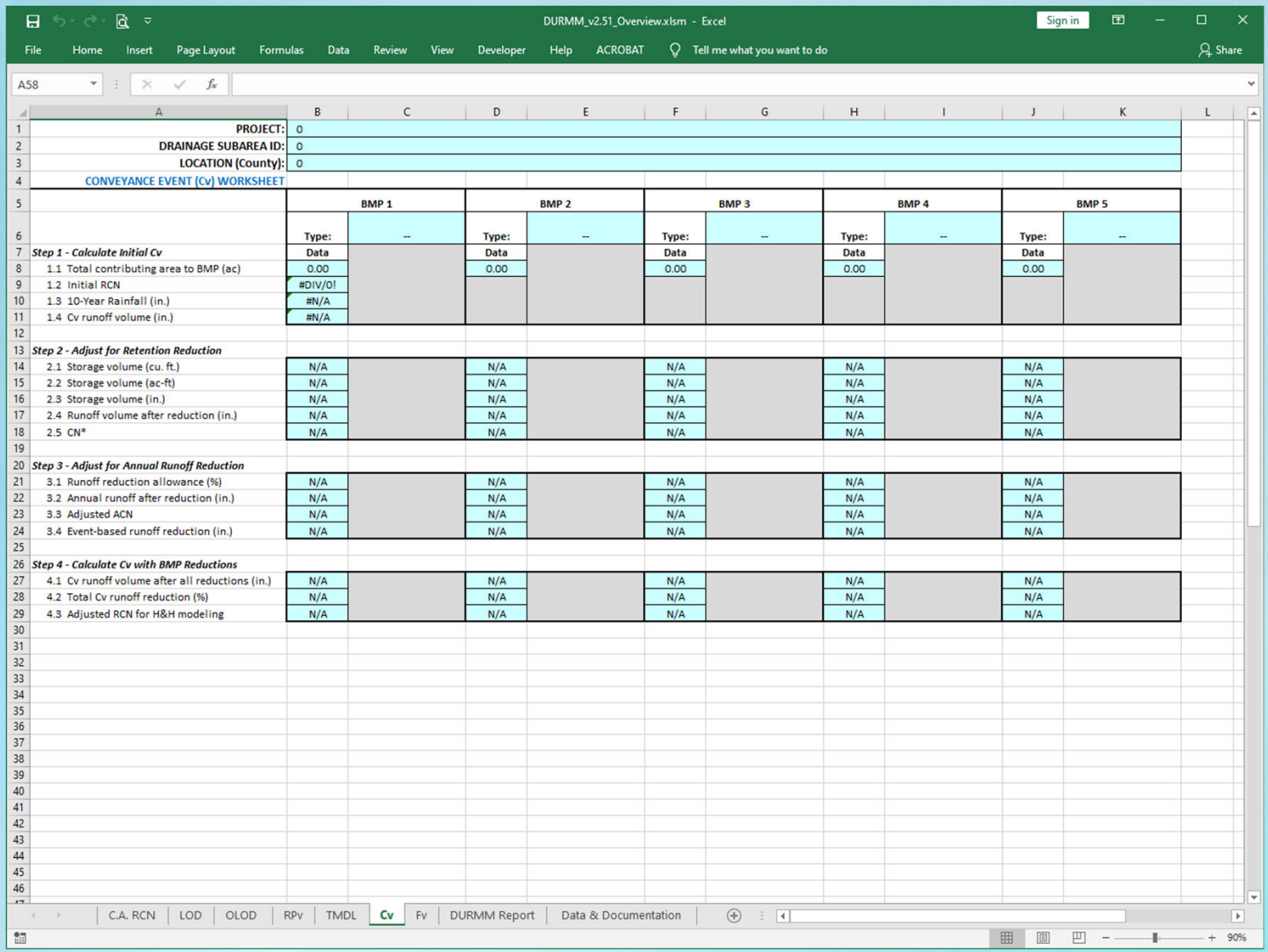
"RPV" Worksheet



"TMDL" Worksheet



“Cv” Worksheet



DURMM_v2.51_Overview.xlsm - Excel

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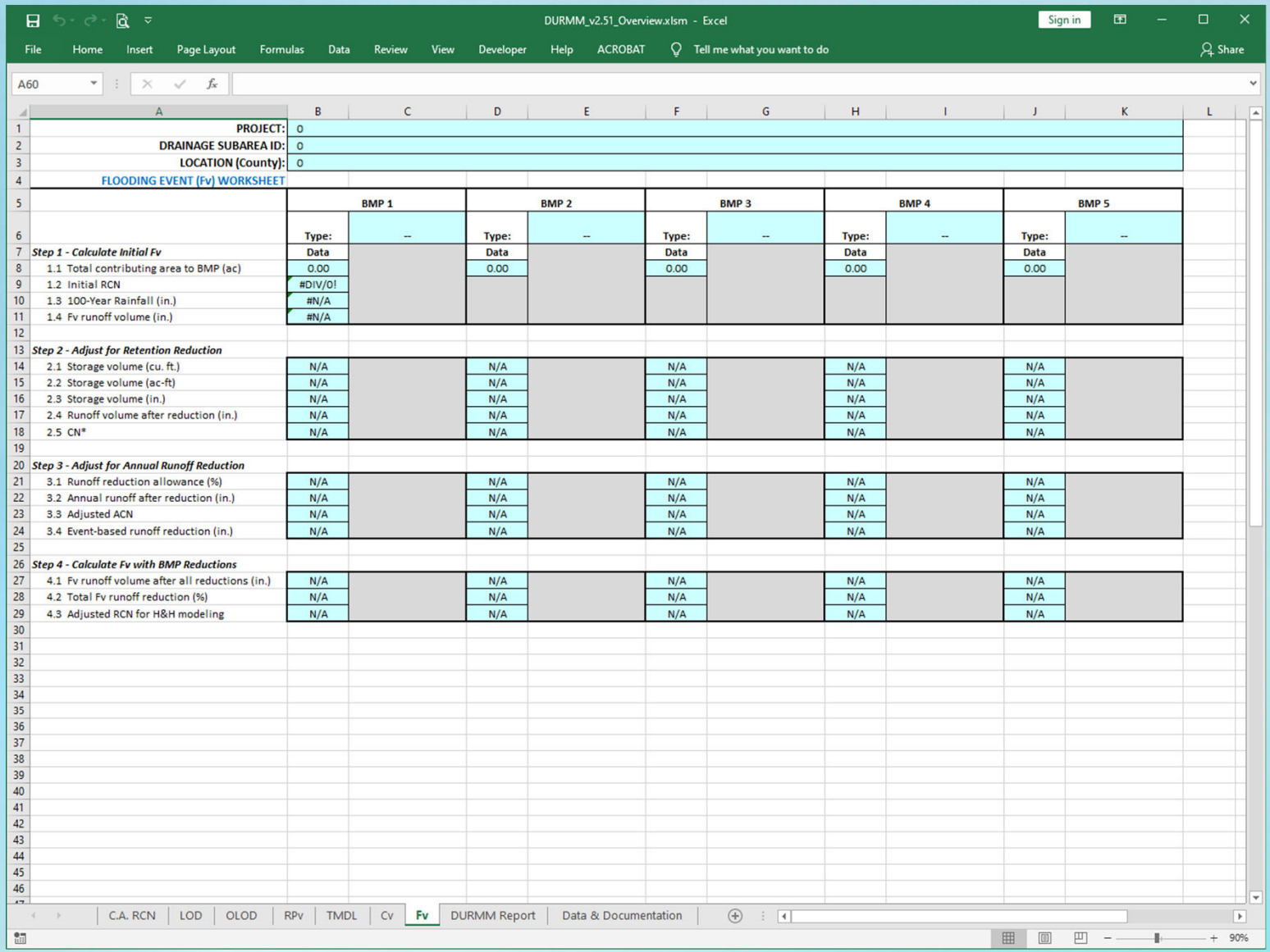
1	PROJECT:	0										
2	DRAINAGE SUBAREA ID:	0										
3	LOCATION (County):	0										
4	CONVEYANCE EVENT (Cv) WORKSHEET											
5		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5		
6		Type:	--	Type:	--	Type:	--	Type:	--	Type:	--	
7	***Step 1 - Calculate Initial Cv***	Data		Data		Data		Data		Data		
8	1.1 Total 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		

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

“Fv” Worksheet



DURMM_v2.51_Overview.xlsm - Excel

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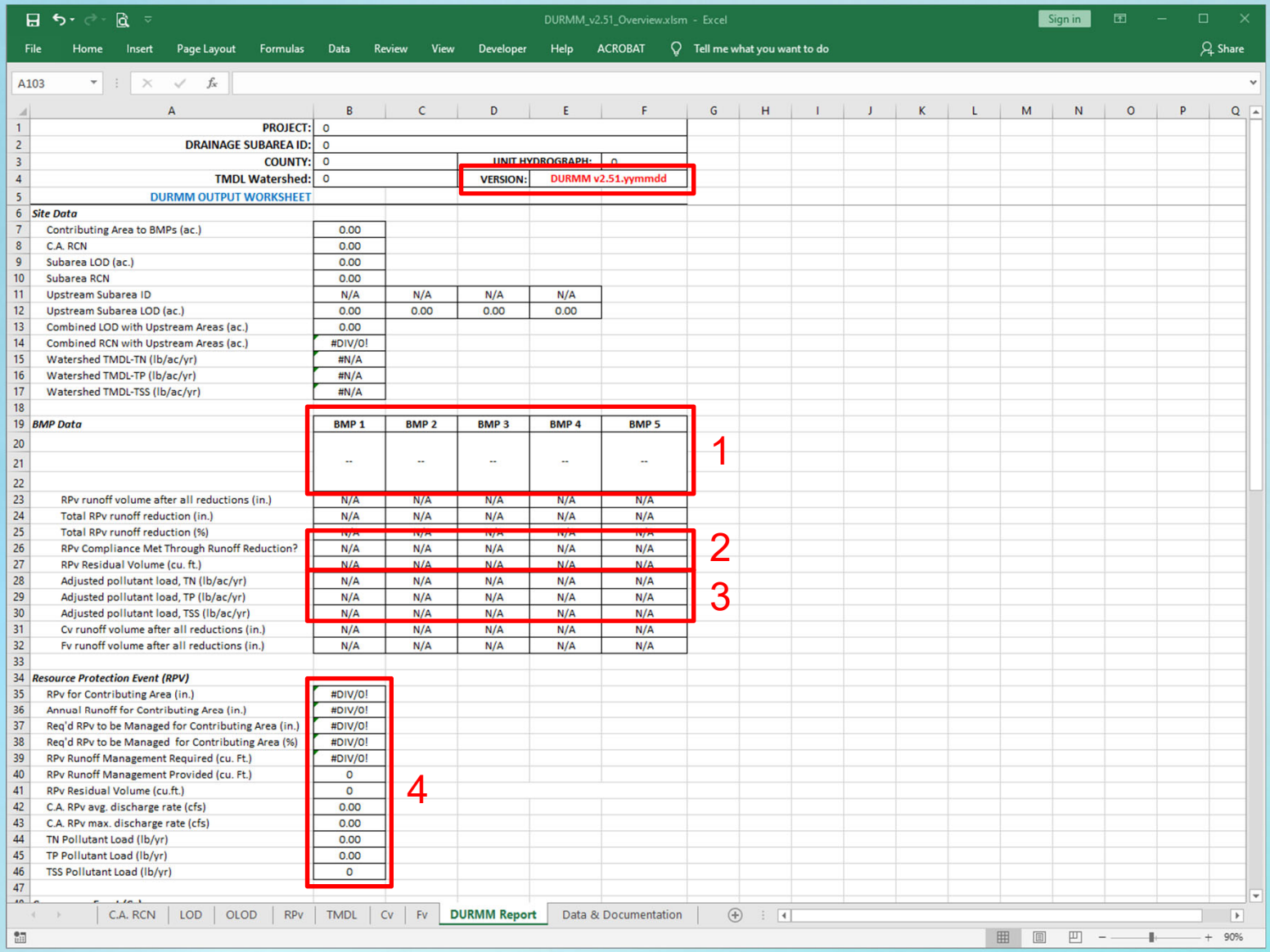
1	PROJECT:	0										
2	DRAINAGE SUBAREA ID:	0										
3	LOCATION (County):	0										
4	FLOODING EVENT (Fv) WORKSHEET											
5		BMP 1		BMP 2		BMP 3		BMP 4		BMP 5		
6		Type:	--	Type:	--	Type:	--	Type:	--	Type:	--	
7	***Step 1 - Calculate Initial Fv***	Data		Data		Data		Data		Data		
8	1.1 Total contributing area to BMP (ac)	0.00		0.00		0.00		0.00		0.00		
9	1.2 Initial RCN	#DIV/0!										
10	1.3 100-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		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 Fv with BMP Reductions***											
27	4.1 Fv runoff volume after all reductions (in.)	N/A		N/A		N/A		N/A		N/A		
28	4.2 Total Fv 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		

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

90%

"DURMM Report" Worksheet



DURMM_v2.51_Overview.xlsm - Excel

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2	DRAINAGE SUBAREA ID:	0				
3	COUNTY:	0		UNIT HYDROGRAPH:	0	
4	TMDL Watershed:	0		VERSION:	DURMM v2.51.yymmdd	
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***	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
20						
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

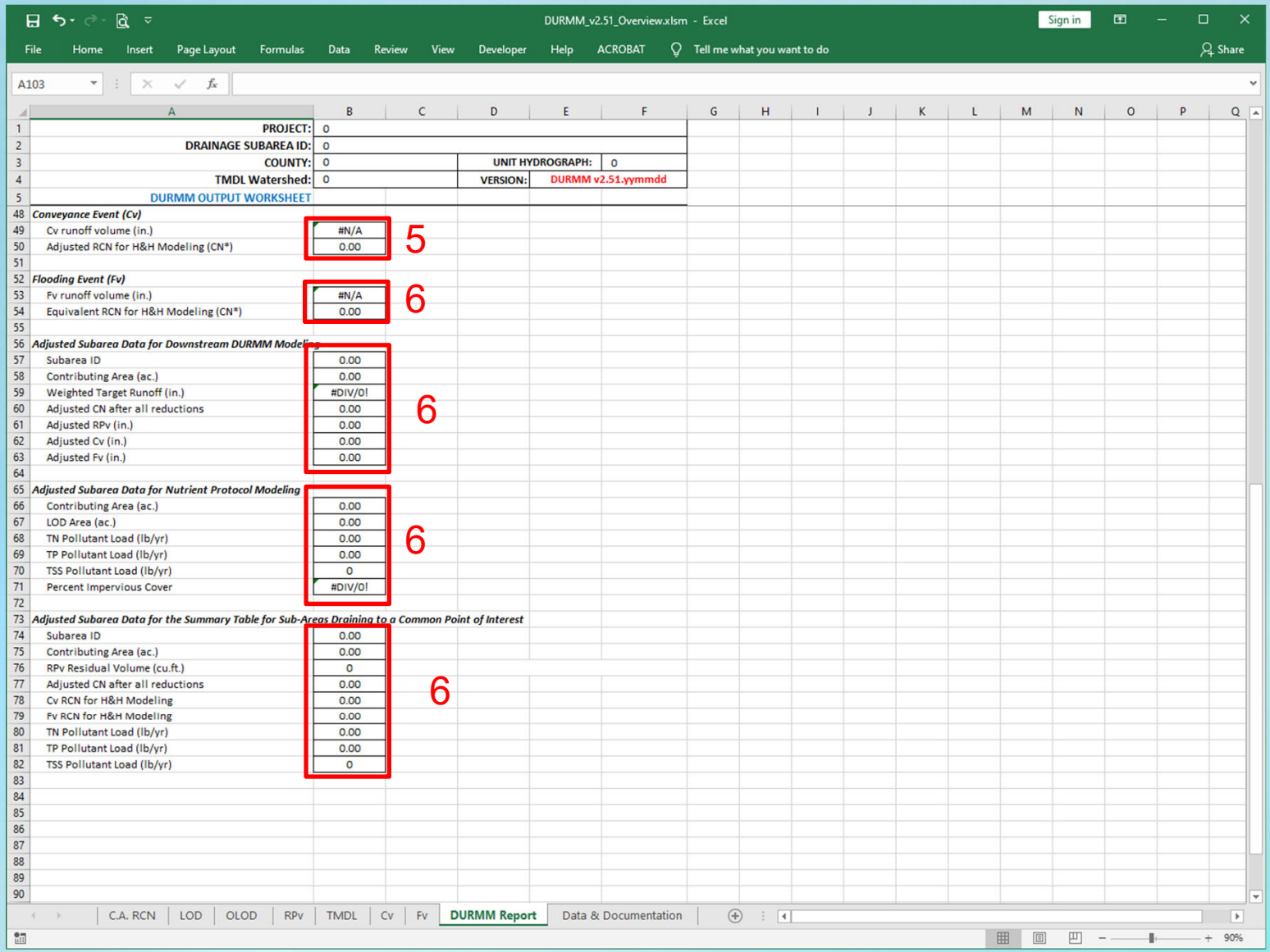
2

3

4

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

"DURMM Report" Worksheet (cont.)



DURMM_v2.51_Overview.xlsm - Excel

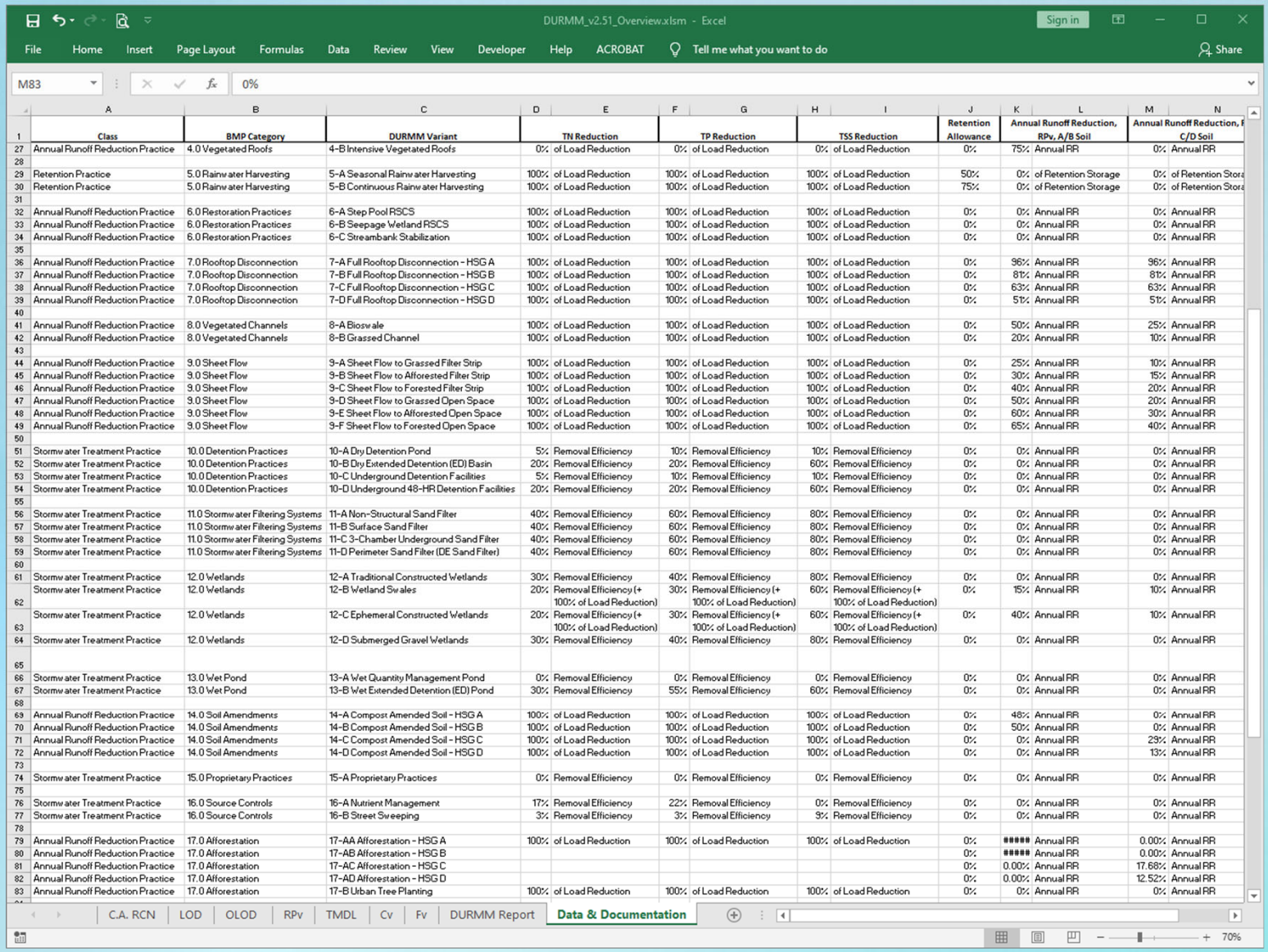
PROJECT:	0				
DRAINAGE SUBAREA ID:	0				
COUNTY:	0		UNIT HYDROGRAPH:	0	
TMDL Watershed:	0		VERSION:	DURMM v2.51.yymmdd	

DURMM OUTPUT WORKSHEET

Conveyance Event (Cv)		
Cv runoff volume (in.)	#N/A	5
Adjusted RCN for H&H Modeling (CN*)	0.00	
Flooding Event (Fv)		
Fv runoff volume (in.)	#N/A	6
Equivalent RCN for H&H Modeling (CN*)	0.00	
Adjusted Subarea Data for Downstream DURMM Modeling		
Subarea ID	0.00	6
Contributing Area (ac.)	0.00	
Weighted Target Runoff (in.)	#DIV/0!	
Adjusted CN after all reductions	0.00	
Adjusted RPv (in.)	0.00	
Adjusted Cv (in.)	0.00	
Adjusted Fv (in.)	0.00	
Adjusted Subarea Data for Nutrient Protocol Modeling		
Contributing Area (ac.)	0.00	6
LOD Area (ac.)	0.00	
TN Pollutant Load (lb/yr)	0.00	
TP Pollutant Load (lb/yr)	0.00	
TSS Pollutant Load (lb/yr)	0	
Percent Impervious Cover	#DIV/0!	
Adjusted Subarea Data for the Summary Table for Sub-Areas Draining to a Common Point of Interest		
Subarea ID	0.00	6
Contributing Area (ac.)	0.00	
RPv Residual Volume (cu.ft.)	0	
Adjusted CN after all reductions	0.00	
Cv RCN for H&H Modeling	0.00	
Fv RCN for H&H Modeling	0.00	
TN Pollutant Load (lb/yr)	0.00	
TP Pollutant Load (lb/yr)	0.00	
TSS Pollutant Load (lb/yr)	0	

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

“Data & Documentation” Worksheet



DURMM_v2.51_Overview.xlsm - Excel

File Home Insert Page Layout Formulas Data Review View Developer Help ACROBAT Tell me what you want to do

M83 | 0%

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	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 Stora
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 Stora
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	29%	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	3%	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

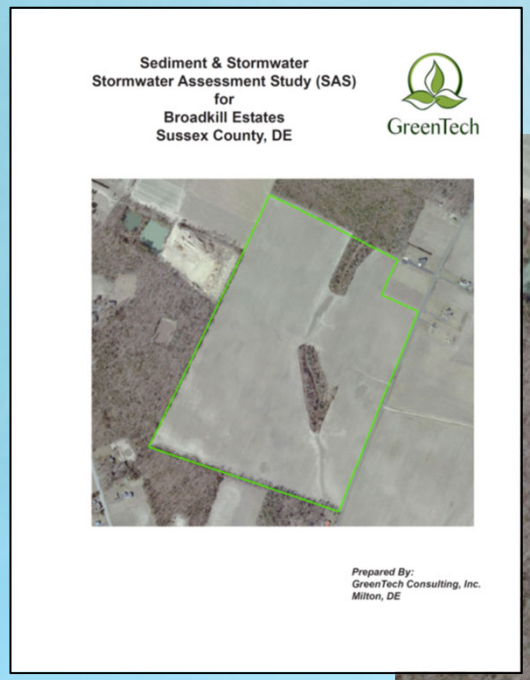
C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation

70%

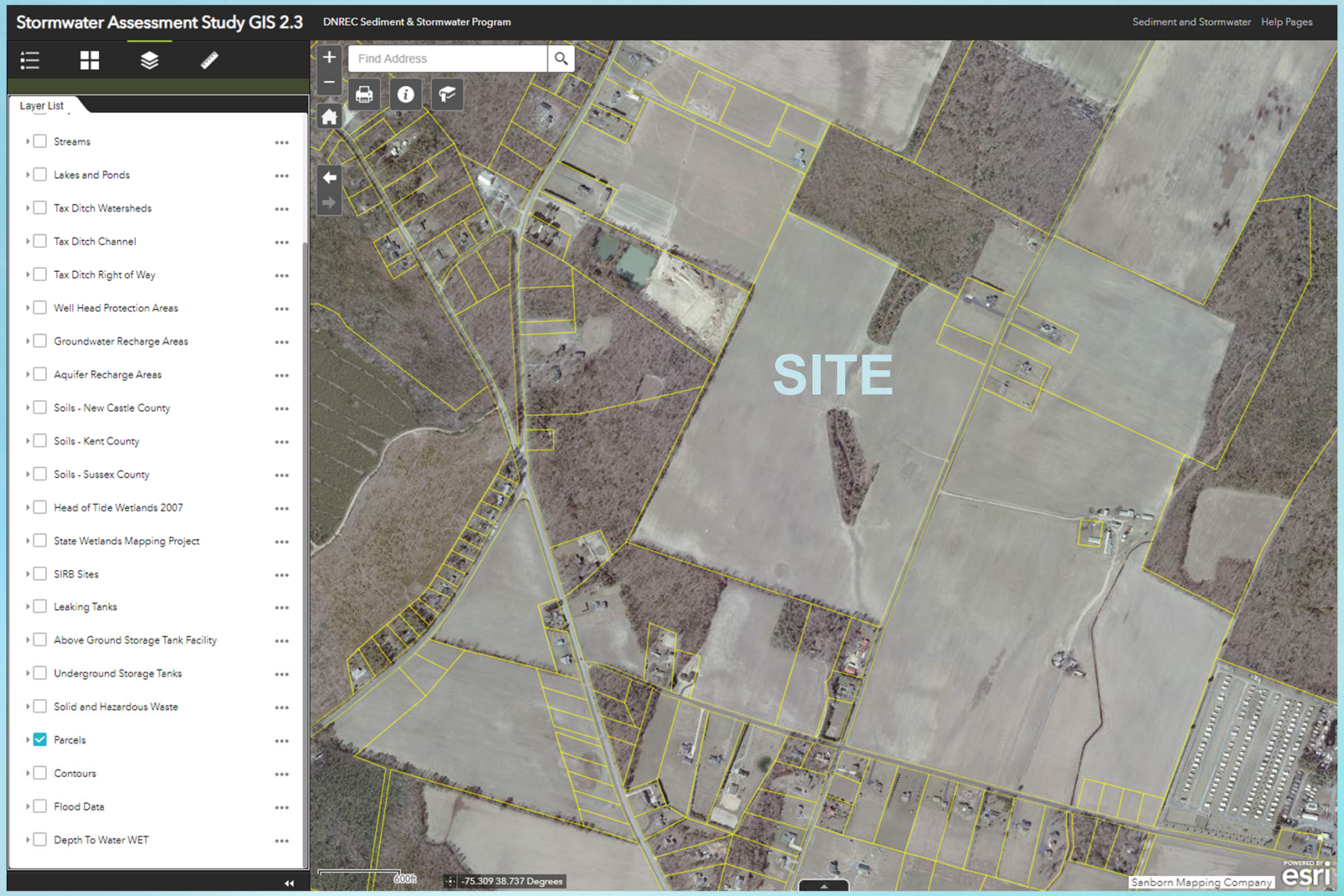
DURMM v2.5

“Broadkill Estates” Example Site
Ex. #1: Concept Level Analysis

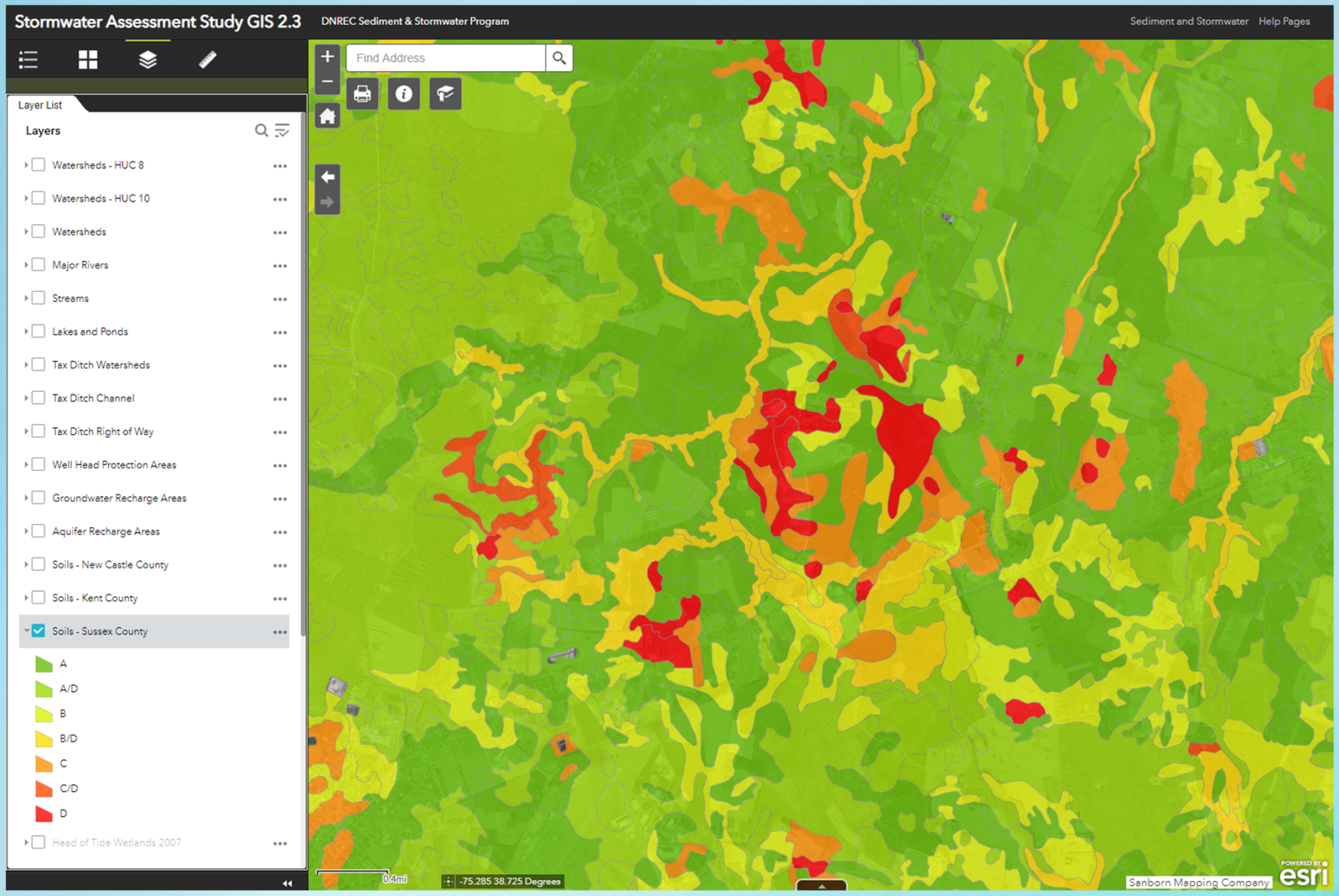
Concept Level Analysis



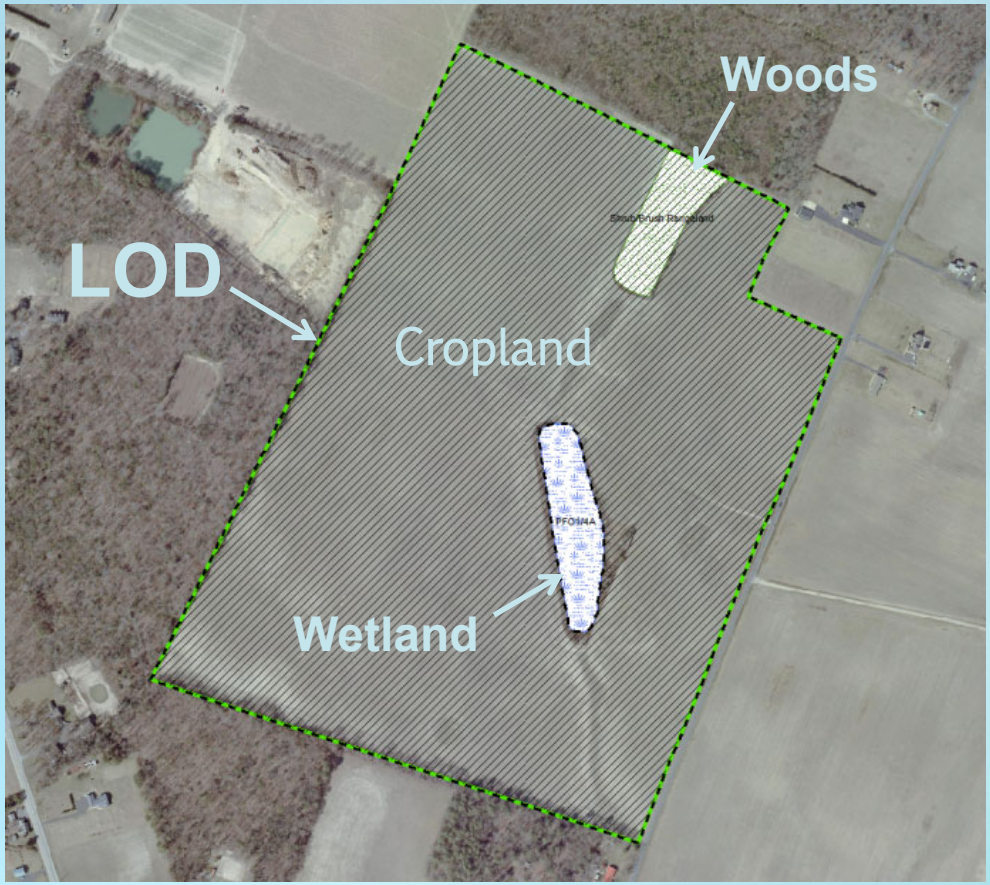
Concept Level Analysis



Concept Level Analysis



Concept Level Analysis



Proposed LU: Residential, 1 ac. lots

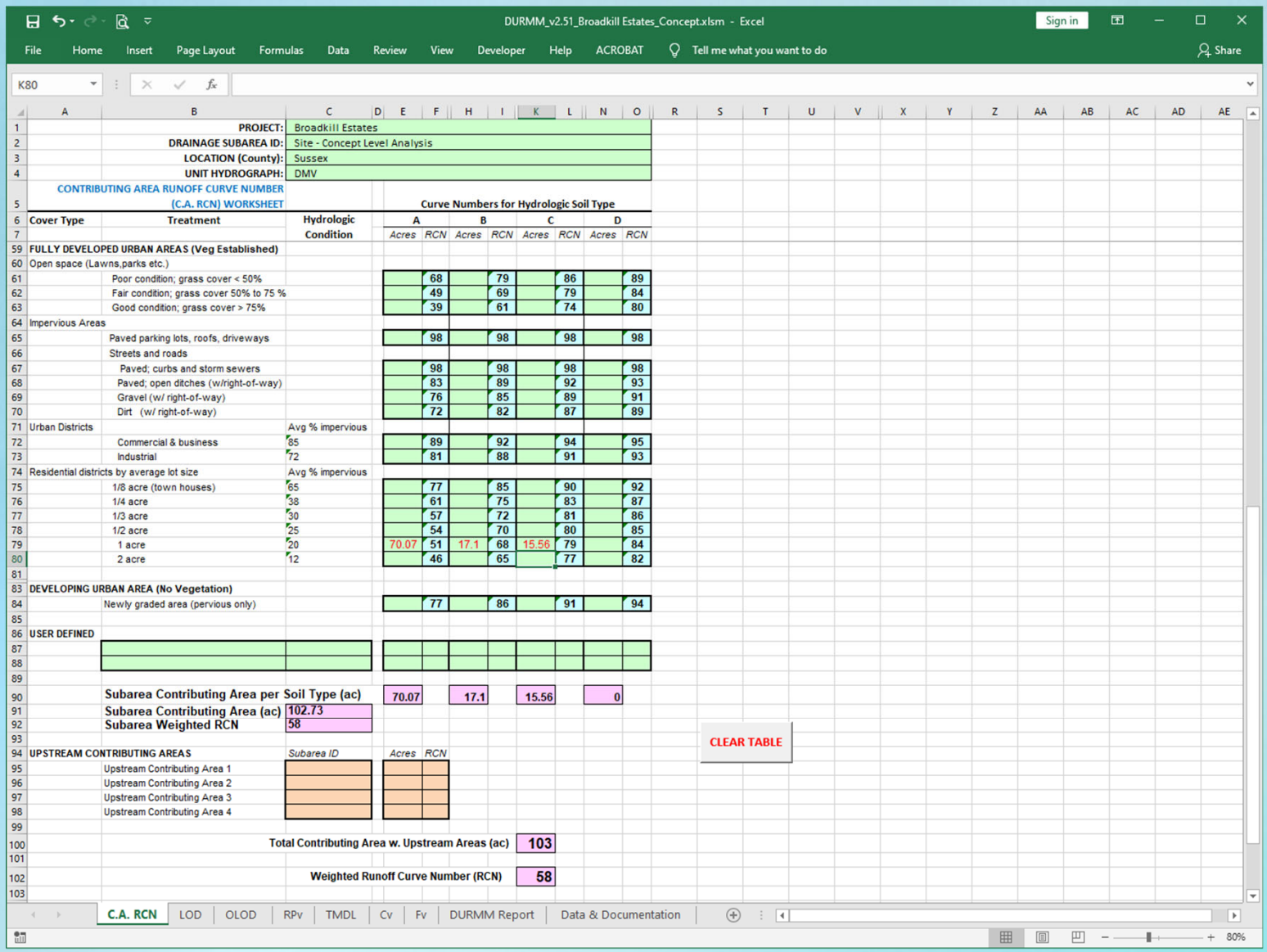
Concept Level Analysis
Site Data

- 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%

“C.A. RCN” Worksheet



DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

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K80

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

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

Cover Type	Treatment	Hydrologic Condition	A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
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	70.07	51	17.1	68	15.56	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)		70.07		17.1		15.56		0	

Subarea Contributing Area (ac)	102.73
Subarea Weighted RCN	58

CLEAR TABLE

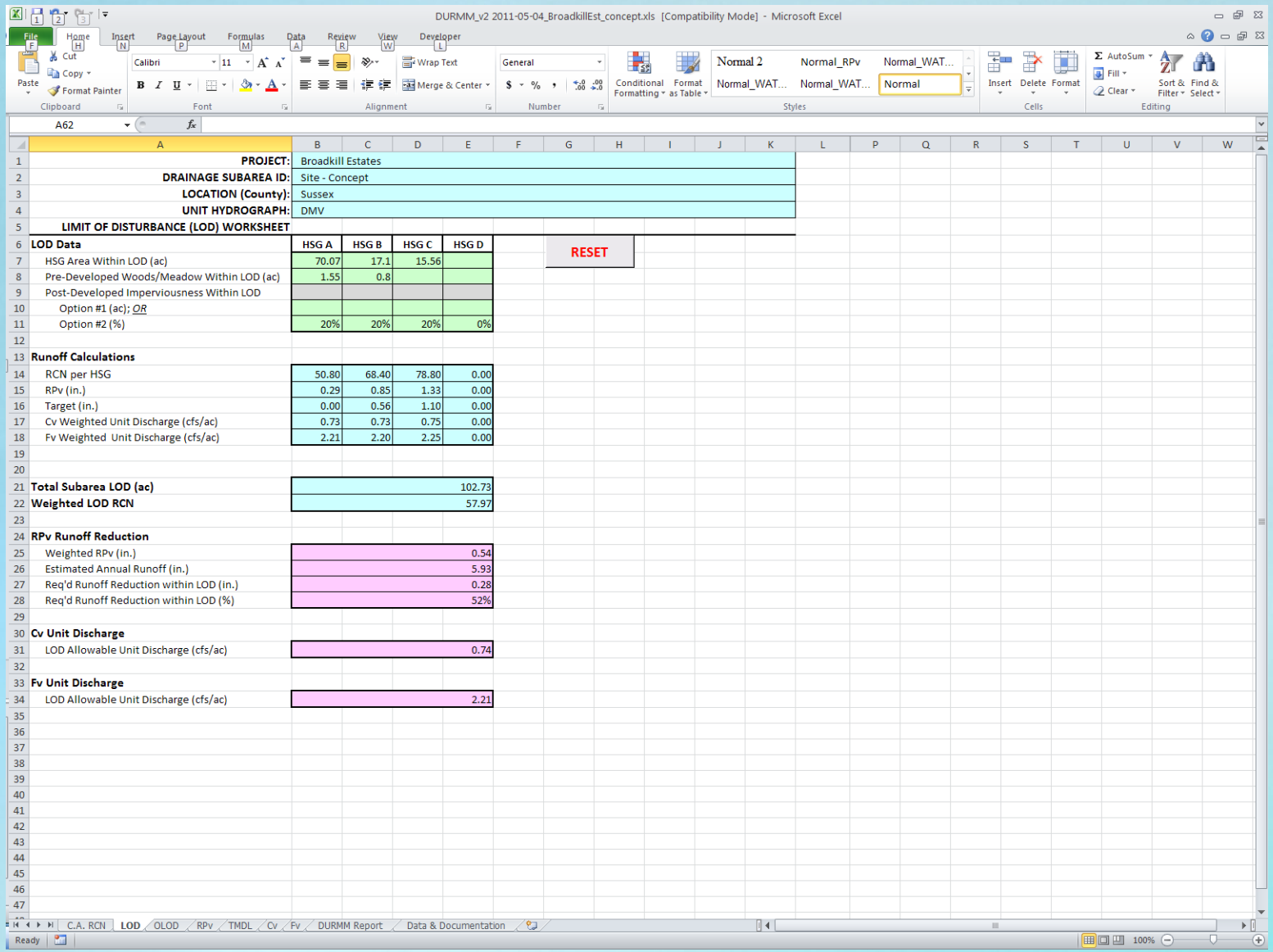
UPSTREAM CONTRIBUTING AREAS	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac)	103
Weighted Runoff Curve Number (RCN)	58

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

80%

"LOD" Worksheet



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

1	**PROJECT:**	Broadkill Estates			
2	**DRAINAGE SUBAREA ID:**	Site - Concept			
3	**LOCATION (County):**	Sussex			
4	**UNIT HYDROGRAPH:**	DMV			
5	**LIMIT OF DISTURBANCE (LOD) WORKSHEET**				

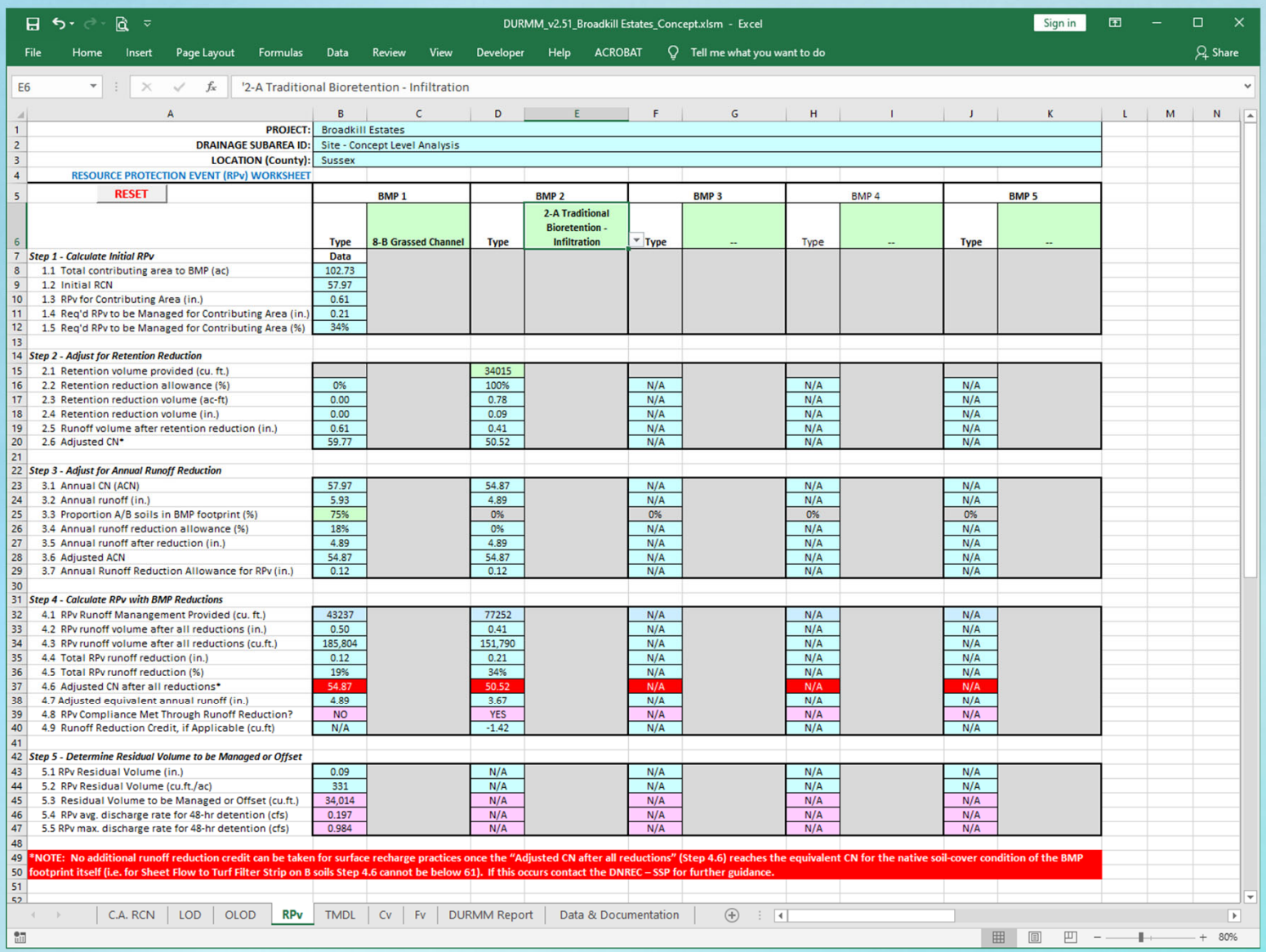
RESET

6	**LOD Data**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
7	HSG Area Within LOD (ac)	70.07	17.1	15.56	
8	Pre-Developed Woods/Meadow Within LOD (ac)	1.55	0.8		
9	Post-Developed Imperviousness Within LOD				
10	Option #1 (ac); *OR*				
11	Option #2 (%)	20%	20%	20%	0%
12					
13	**Runoff Calculations**				
14	RCN per HSG	50.80	68.40	78.80	0.00
15	RPv (in.)	0.29	0.85	1.33	0.00
16	Target (in.)	0.00	0.56	1.10	0.00
17	Cv Weighted Unit Discharge (cfs/ac)	0.73	0.73	0.75	0.00
18	Fv Weighted Unit Discharge (cfs/ac)	2.21	2.20	2.25	0.00
19					
20					
21	**Total Subarea LOD (ac)**				102.73
22	**Weighted LOD RCN**				57.97
23					
24	**RPv Runoff Reduction**				
25	Weighted RPv (in.)				0.54
26	Estimated Annual Runoff (in.)				5.93
27	Req'd Runoff Reduction within LOD (in.)				0.28
28	Req'd Runoff Reduction within LOD (%)				52%
29					
30	**Cv Unit Discharge**				
31	LOD Allowable Unit Discharge (cfs/ac)				0.74
32					
33	**Fv Unit Discharge**				
34	LOD Allowable Unit Discharge (cfs/ac)				2.21

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

Ready

“RPV” Worksheet



DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

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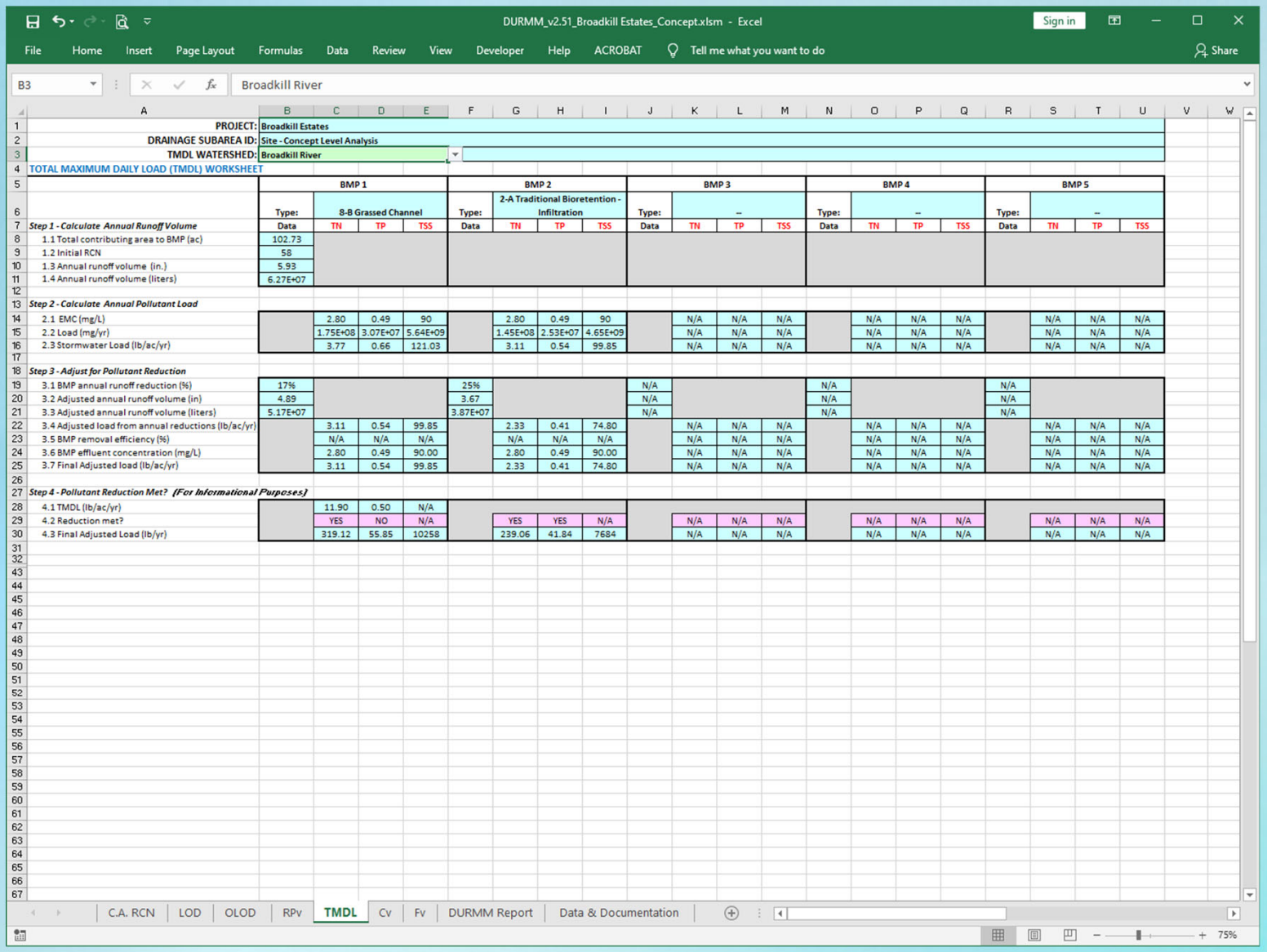
E6: '2-A Traditional Bioretention - Infiltration

	A	B	C	D	E	F	G	H	I	J	K
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*	Data									
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											
14	*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	
17	2.3 Retention reduction volume (ac-ft)	0.00		0.78		N/A		N/A		N/A	
18	2.4 Retention reduction volume (in.)	0.00		0.09		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	
20	2.6 Adjusted CN*	59.77		50.52		N/A		N/A		N/A	
21											
22	*Step 3 - Adjust for Annual Runoff Reduction*										
23	3.1 Annual CN (ACN)	57.97		54.87		N/A		N/A		N/A	
24	3.2 Annual runoff (in.)	5.93		4.89		N/A		N/A		N/A	
25	3.3 Proportion A/B soils in BMP footprint (%)	75%		0%		0%		0%		0%	
26	3.4 Annual runoff reduction allowance (%)	18%		0%		N/A		N/A		N/A	
27	3.5 Annual runoff after reduction (in.)	4.89		4.89		N/A		N/A		N/A	
28	3.6 Adjusted ACN	54.87		54.87		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	
30											
31	*Step 4 - Calculate RPv with BMP Reductions*										
32	4.1 RPv Runoff Manangement Provided (cu. ft.)	43237		77252		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	
34	4.3 RPv runoff volume after all reductions (cu.ft.)	185,804		151,790		N/A		N/A		N/A	
35	4.4 Total RPv runoff reduction (in.)	0.12		0.21		N/A		N/A		N/A	
36	4.5 Total RPv runoff reduction (%)	19%		34%		N/A		N/A		N/A	
37	4.6 Adjusted CN after all reductions*	54.87		50.52		N/A		N/A		N/A	
38	4.7 Adjusted equivalent annual runoff (in.)	4.89		3.67		N/A		N/A		N/A	
39	4.8 RPv Compliance Met Through Runoff Reduction?	NO		YES		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	
41											
42	*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	
44	5.2 RPv Residual Volume (cu.ft./ac)	331		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	
46	5.4 RPv avg. discharge rate for 48-hr detention (cfs)	0.197		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	
48											
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										
50	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											

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

80%

"TMDL" Worksheet



DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

B3: Broadkill River

1	PROJECT:	Broadkill Estates																				
2	DRAINAGE SUBAREA ID:	Site - Concept Level Analysis																				
3	TMDL WATERSHED:	Broadkill River																				
4	TOTAL MAXIMUM DAILY LOAD (TMDL) WORKSHEET																					
5		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 Annual Runoff Volume*	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	
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																				
12																						
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	
17																						
18	*Step 3 - Adjust for Pollutant Reduction*																					
19	3.1 BMP annual runoff reduction (%)	17%				25%				N/A				N/A				N/A				
20	3.2 Adjusted annual runoff volume (in)	4.89				3.67				N/A				N/A				N/A				
21	3.3 Adjusted annual runoff volume (liters)	5.17E+07				3.87E+07				N/A				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	
26																						
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	
31																						
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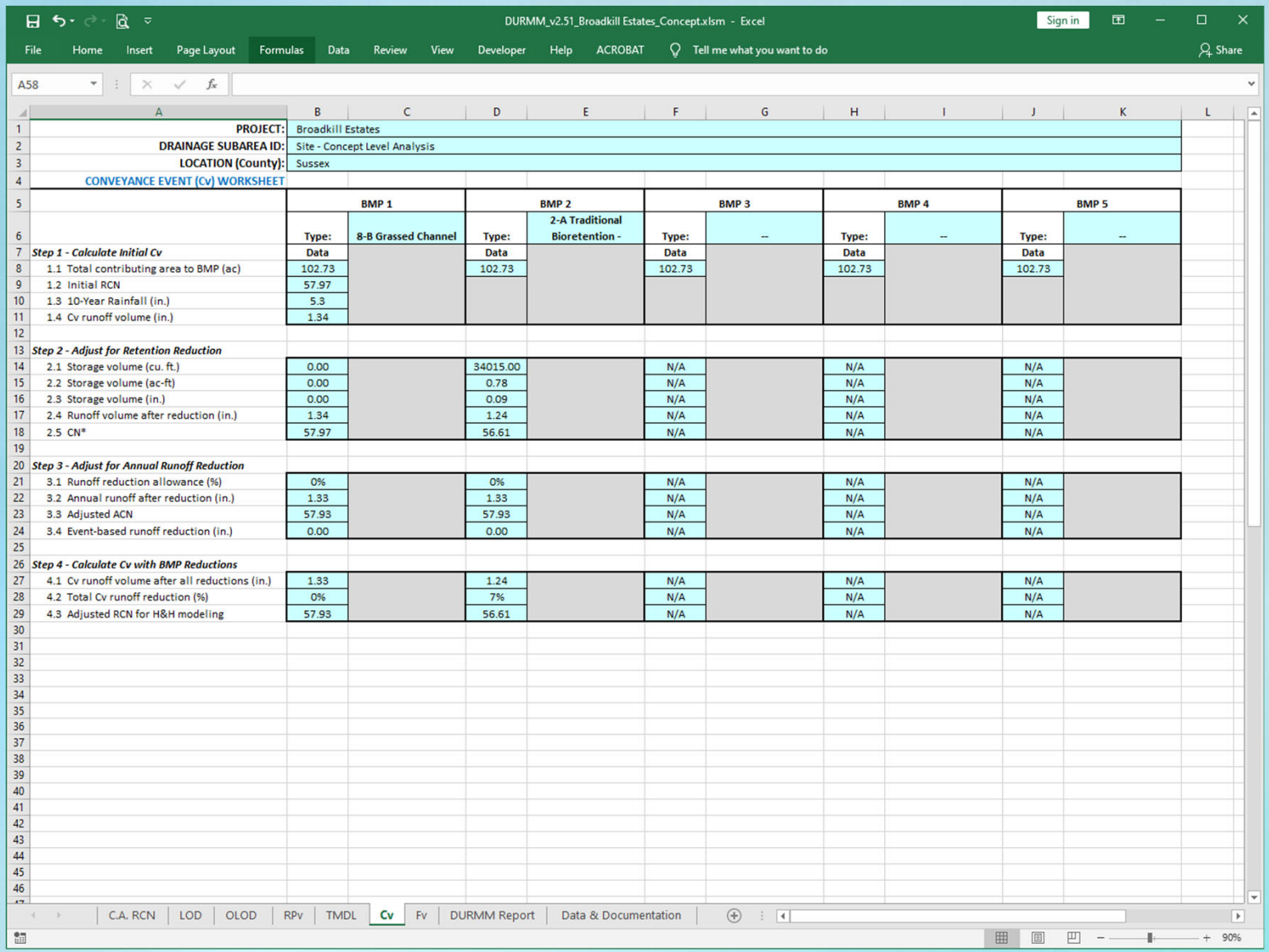
C.A. RCN | LOD | OLOD | RPv | **TMDL** | Cv | Fv | DURMM Report | Data & Documentation

75%

“Cv” Worksheet

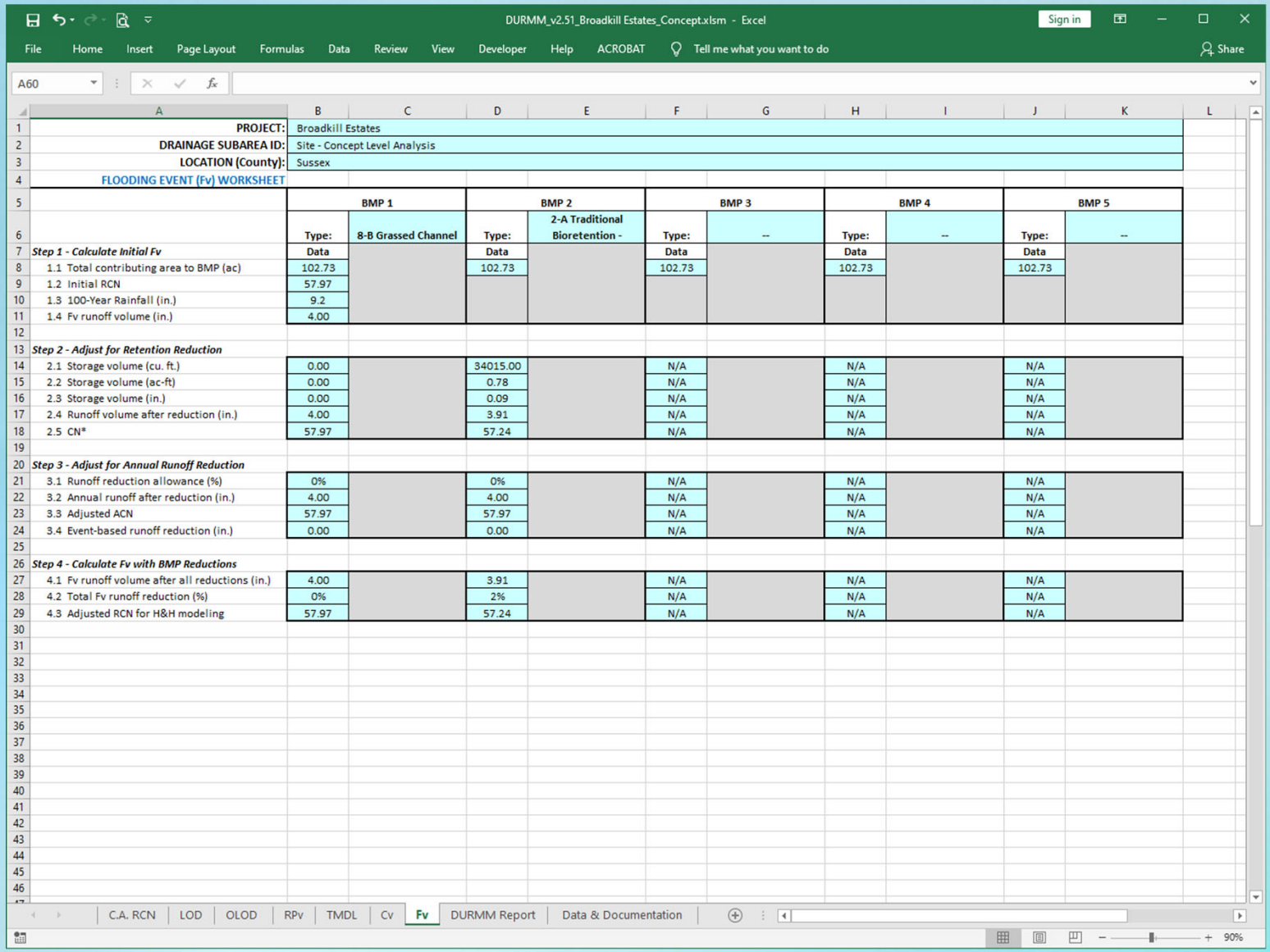


DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

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	

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

“Fv” Worksheet

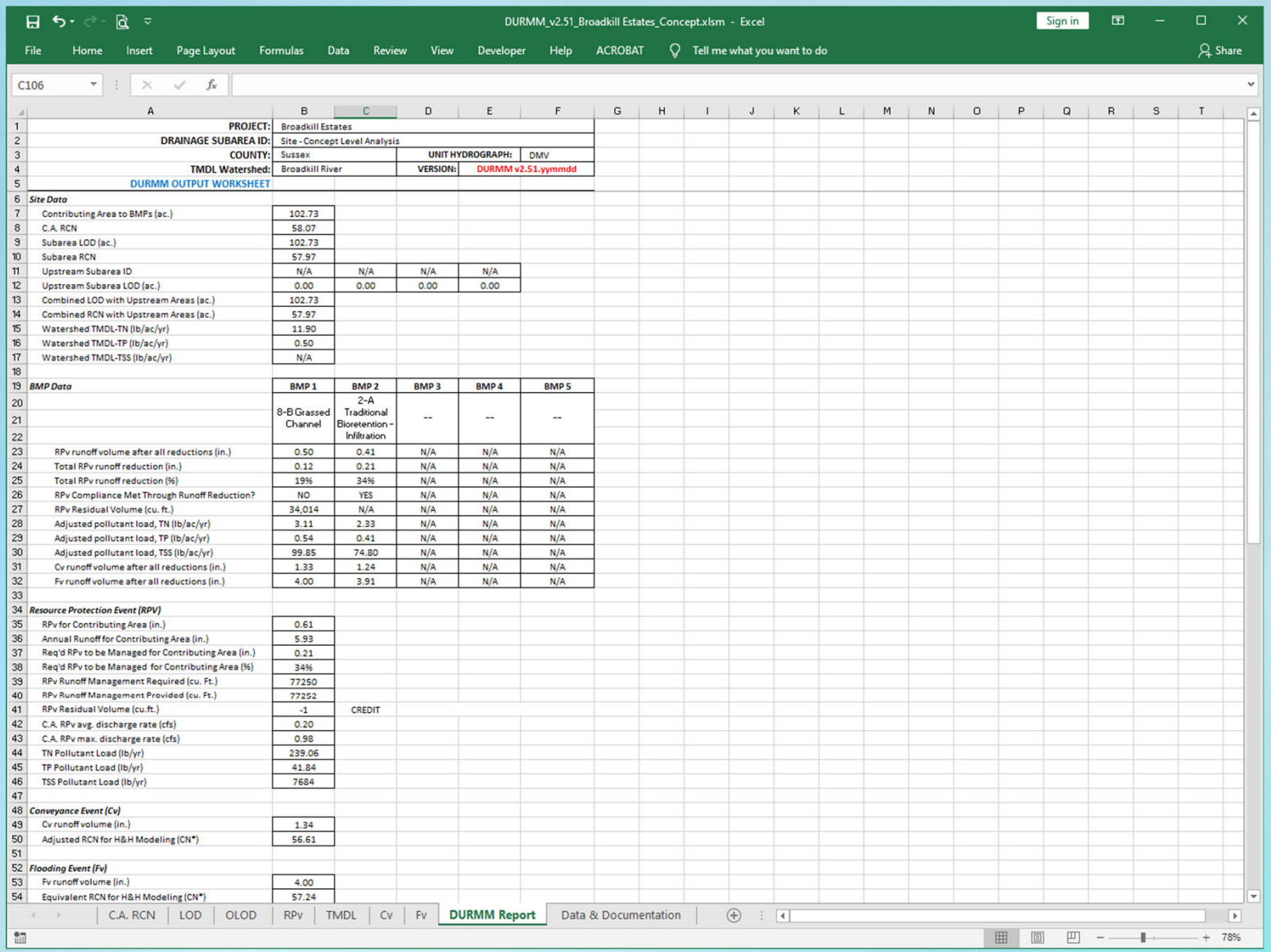


DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

1	PROJECT:	Broadkill Estates									
2	DRAINAGE SUBAREA ID:	Site - Concept 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)	102.73		102.73		102.73		102.73		102.73	
9	1.2 Initial RCN	57.97									
10	1.3 100-Year Rainfall (in.)	9.2									
11	1.4 Fv runoff volume (in.)	4.00									
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.)	4.00		3.91		N/A		N/A		N/A	
18	2.5 CN*	57.97		57.24		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.)	4.00		4.00		N/A		N/A		N/A	
23	3.3 Adjusted ACN	57.97		57.97		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.)	4.00		3.91		N/A		N/A		N/A	
28	4.2 Total Fv runoff reduction (%)	0%		2%		N/A		N/A		N/A	
29	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

“DURMM Report” Worksheet



DURMM_v2.51_Broadkill Estates_Concept.xlsm - Excel

PROJECT:	Broadkill Estates				
DRAINAGE SUBAREA ID:	Site - Concept Level Analysis				
COUNTY:	Sussex		UNIT HYDROGRAPH:	DMV	
TMDL Watershed:	Broadkill River		VERSION:	DURMM v2.51.yymmdd	
DURMM OUTPUT WORKSHEET					

Site Data					
Contributing Area to BMPs (ac.)	102.73				
C.A. RCN	58.07				
Subarea LOD (ac.)	102.73				
Subarea RCN	57.97				
Upstream Subarea ID	N/A	N/A	N/A	N/A	
Upstream Subarea LOD (ac.)	0.00	0.00	0.00	0.00	
Combined LOD with Upstream Areas (ac.)	102.73				
Combined RCN with Upstream Areas (ac.)	57.97				
Watershed TMDL-TN (lb/ac/yr)	11.90				
Watershed TMDL-TP (lb/ac/yr)	0.50				
Watershed TMDL-TSS (lb/ac/yr)	N/A				

BMP Data	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5
	8-B Grassed Channel	2-A Traditional Bioretention - Infiltration	--	--	--
RPv runoff volume after all reductions (in.)	0.50	0.41	N/A	N/A	N/A
Total RPv runoff reduction (in.)	0.12	0.21	N/A	N/A	N/A
Total RPv runoff reduction (%)	19%	34%	N/A	N/A	N/A
RPv Compliance Met Through Runoff Reduction?	NO	YES	N/A	N/A	N/A
RPv Residual Volume (cu. ft.)	34,014	N/A	N/A	N/A	N/A
Adjusted pollutant load, TN (lb/ac/yr)	3.11	2.33	N/A	N/A	N/A
Adjusted pollutant load, TP (lb/ac/yr)	0.54	0.41	N/A	N/A	N/A
Adjusted pollutant load, TSS (lb/ac/yr)	99.85	74.80	N/A	N/A	N/A
Cv runoff volume after all reductions (in.)	1.33	1.24	N/A	N/A	N/A
Fv runoff volume after all reductions (in.)	4.00	3.91	N/A	N/A	N/A

Resource Protection Event (RPV)			
RPv for Contributing Area (in.)	0.61		
Annual Runoff for Contributing Area (in.)	5.93		
Req'd RPv to be Managed for Contributing Area (in.)	0.21		
Req'd RPv to be Managed for Contributing Area (%)	34%		
RPv Runoff Management Required (cu. Ft.)	77250		
RPv Runoff Management Provided (cu. Ft.)	77252		
RPv Residual Volume (cu.ft.)	-1	CREDIT	
C.A. RPv avg. discharge rate (cfs)	0.20		
C.A. RPv max. discharge rate (cfs)	0.98		
TN Pollutant Load (lb/yr)	239.06		
TP Pollutant Load (lb/yr)	41.84		
TSS Pollutant Load (lb/yr)	7684		
Conveyance Event (Cv)			
Cv runoff volume (in.)	1.34		
Adjusted RCN for H&H Modeling (CN*)	56.61		
Flooding Event (Fv)			
Fv runoff volume (in.)	4.00		
Equivalent RCN for H&H Modeling (CN*)	57.24		

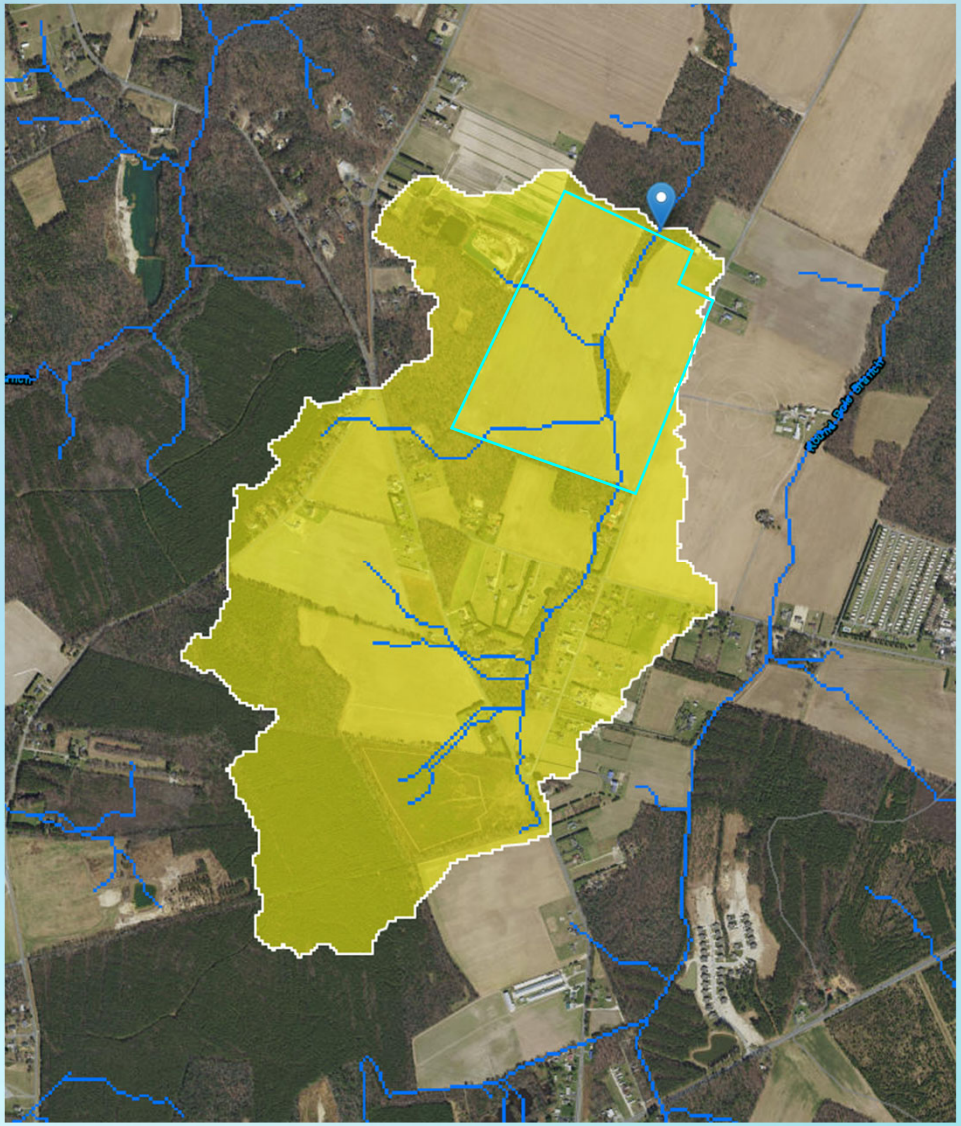
C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation

DURMM v2.5

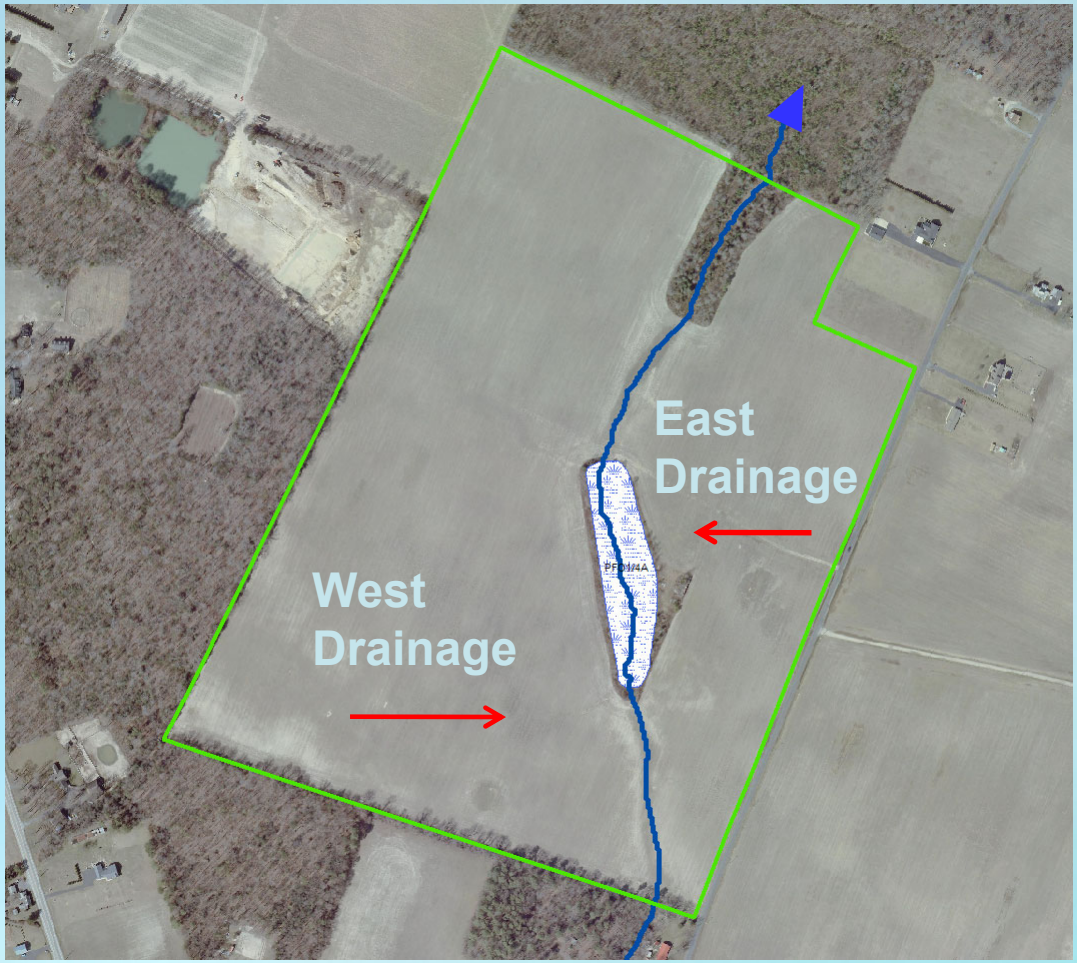
“Broadkill Estates” Example Site
Ex. #2: Design Level Analysis

Design Level Analysis

Design Level Analysis

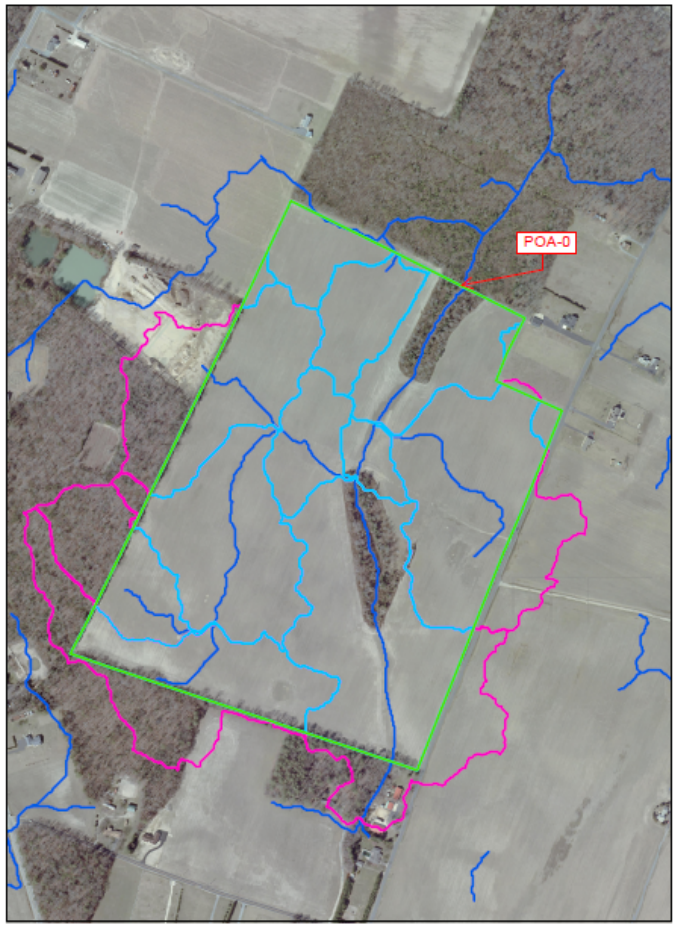


Design Level Analysis



Design Level Analysis

Broadkill Estates
Existing Hydrology Mapping



Legend
- Site
- Flowpaths
- OnSite Drainage
- Offsite Drainage

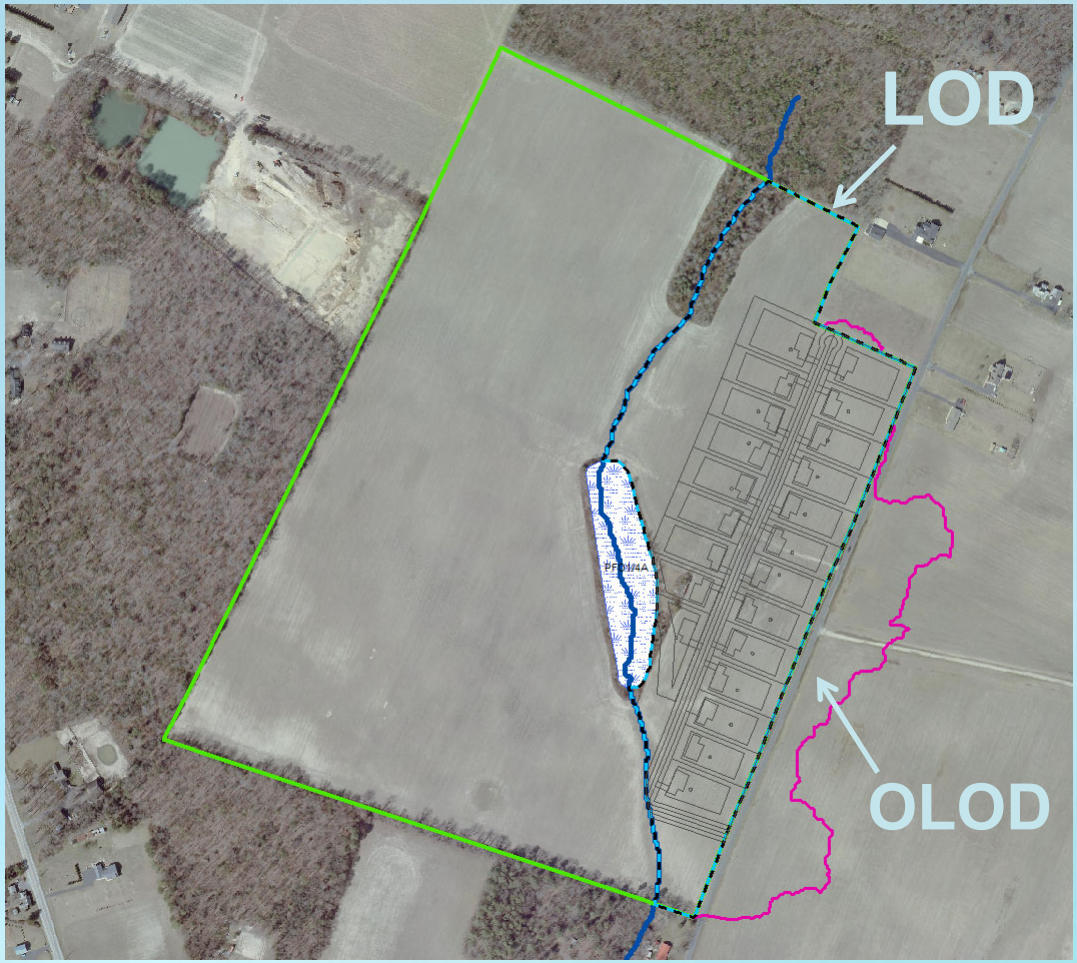
500 250 0 500 Feet

N

GreenTech

Design Level Analysis

Design Level Analysis



Design Level Analysis

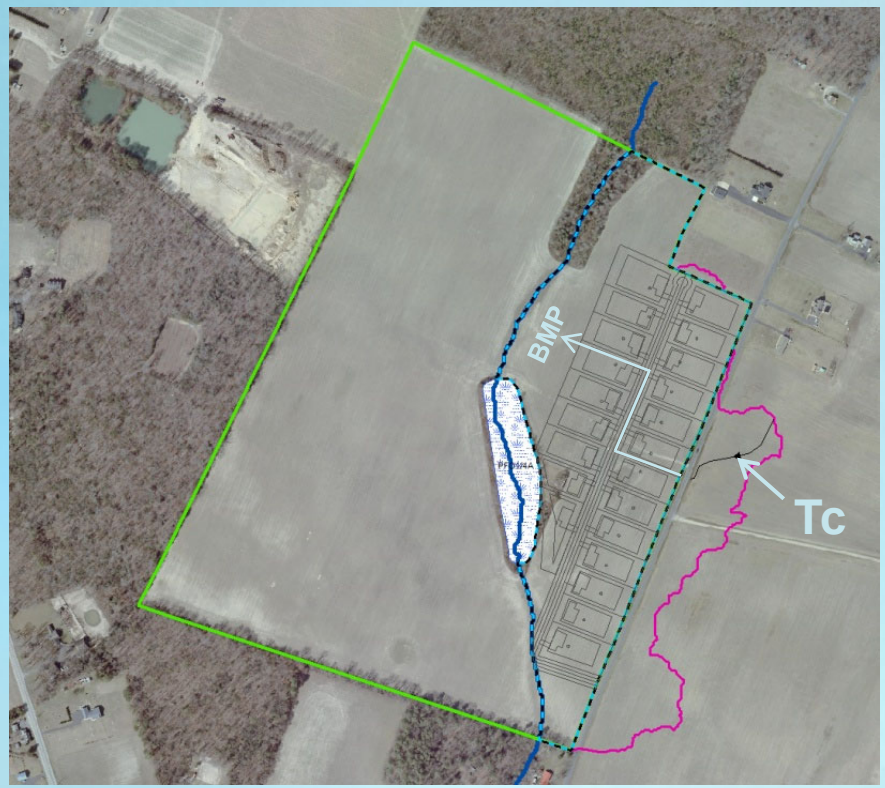
Design Level Analysis

Design Level Analysis

Design Level Analysis
Site Data

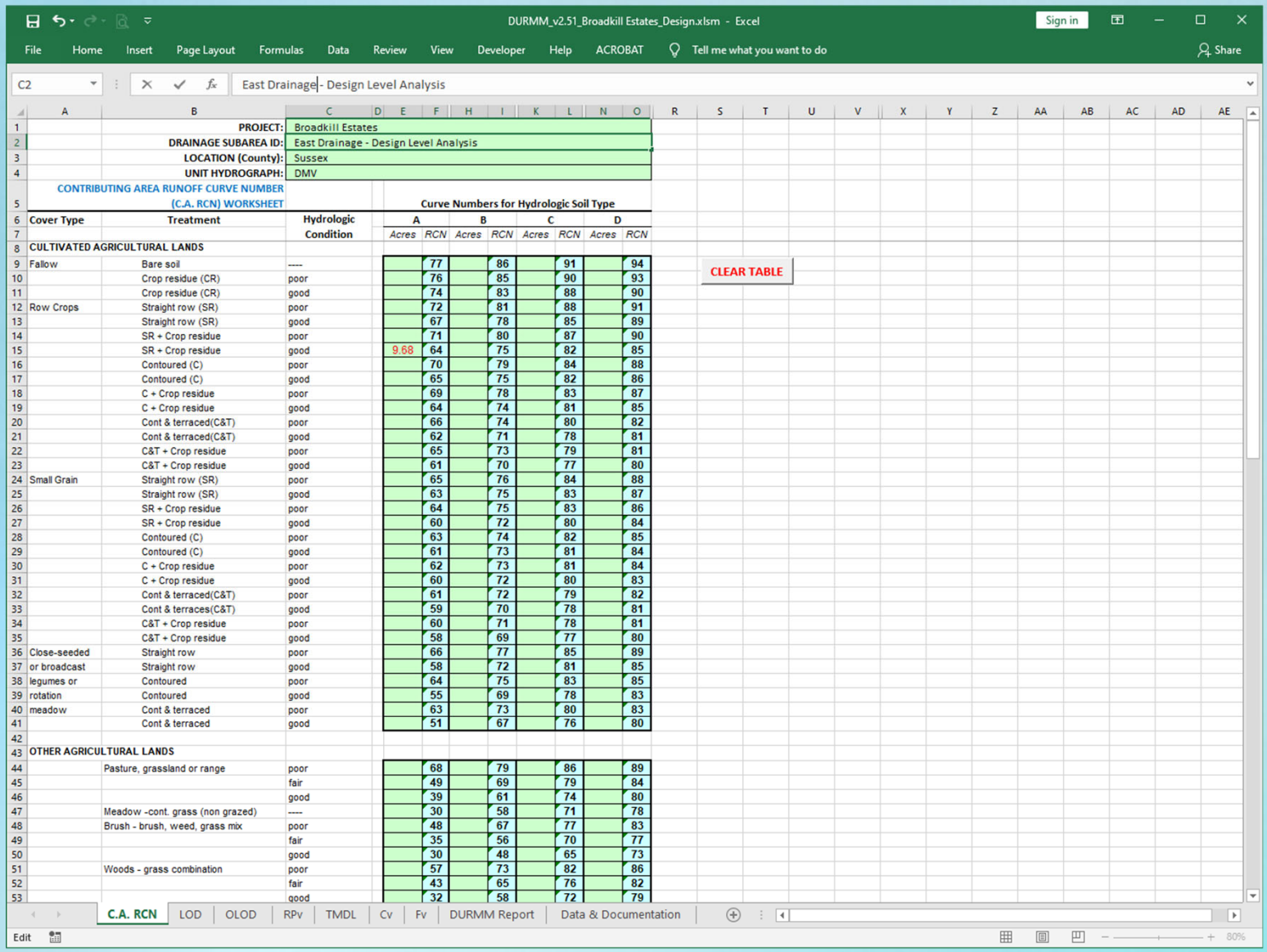
- C.A. RCN Tab
  - Row Crops, SR + Crop Residue
    - HSG A: 9.68 ac.
  - Open space
    - HSG A: 8.06 ac.
    - HSG B: 2.26 ac
  - 1-ac. residential (20 % imperv.)
    - HSG A: 21.16 ac.
    - HSG B: 0.73 ac

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



DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

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C2: 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

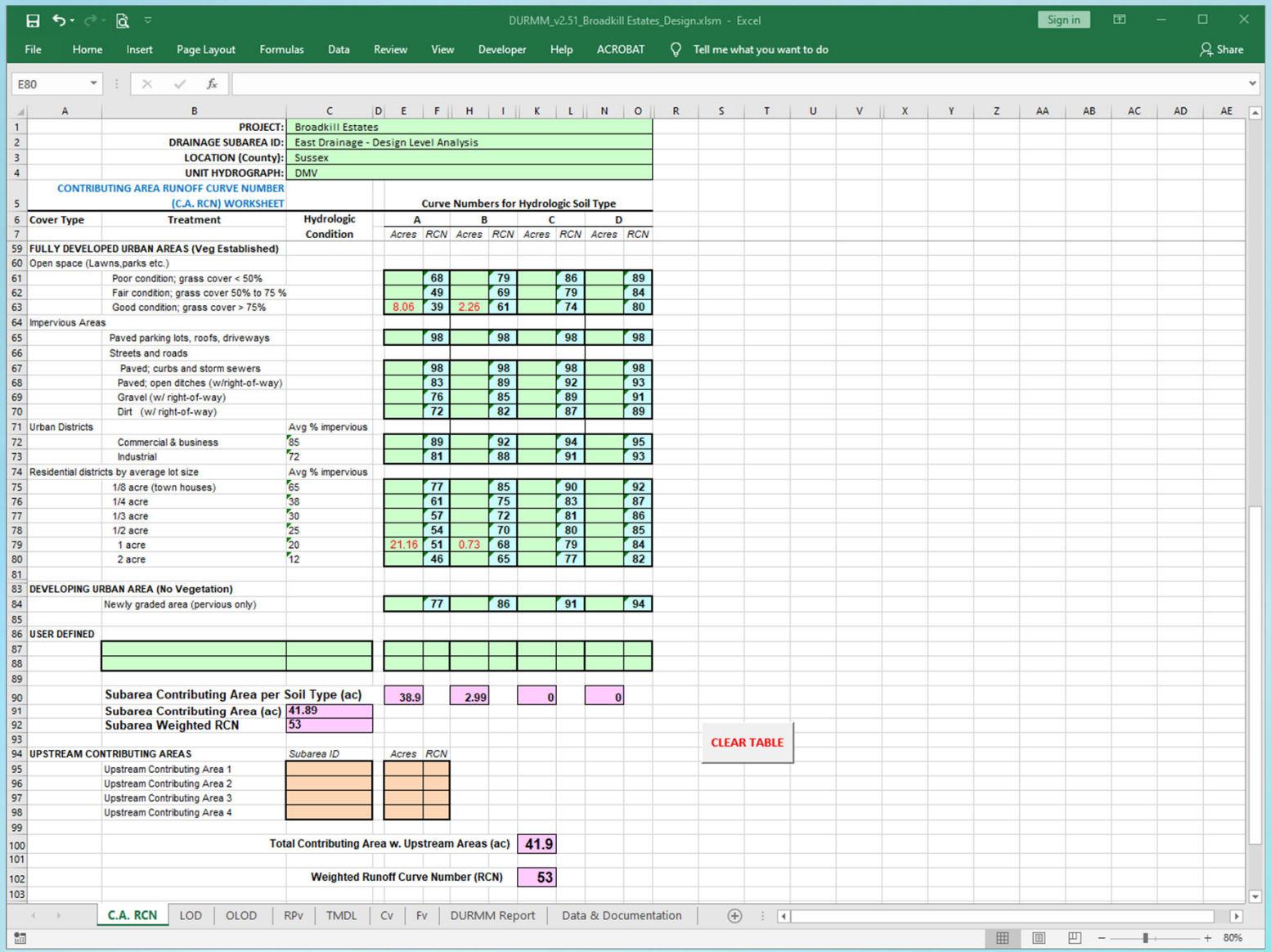
CLEAR TABLE

Cover Type	Treatment	Hydrologic Condition	Curve Numbers for Hydrologic Soil Type A Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D RCN
CULTIVATED AGRICULTURAL LANDS										
Fallow	Bare soil	----		77		86		91		94
	Crop residue (CR)	poor		76		85		90		93
	Crop residue (CR)	good		74		83		88		90
Row Crops	Straight row (SR)	poor		72		81		88		91
	Straight row (SR)	good		67		78		85		89
	SR + Crop residue	poor		71		80		87		90
	SR + Crop residue	good	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	Straight row	poor		66		77		85		89
or broadcast	Straight row	good		58		72		81		85
legumes or	Contoured	poor		64		75		83		85
rotation	Contoured	good		55		69		78		83
meadow	Cont & terraced	poor		63		73		80		83
	Cont & terraced	good		51		67		76		80
OTHER AGRICULTURAL LANDS										
	Pasture, grassland or range	poor		68		79		86		89
		fair		49		69		79		84
		good		39		61		74		80
	Meadow -cont. grass (non grazed)	----		30		58		71		78
	Brush - brush, weed, grass mix	poor		48		67		77		83
		fair		35		56		70		77
		good		30		48		65		73
	Woods - grass combination	poor		57		73		82		86
		fair		43		65		76		82
		good		32		58		72		79

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

Edit

“C.A. RCN” Worksheet (cont.)



DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

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 Acres	A RCN	B Acres	B RCN	C Acres	C RCN	D Acres	D 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%		8.06	39	2.26	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	21.16	51	0.73	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)	38.9	2.99	0	0
Subarea Contributing Area (ac)	41.89			
Subarea Weighted RCN	53			

CLEAR TABLE

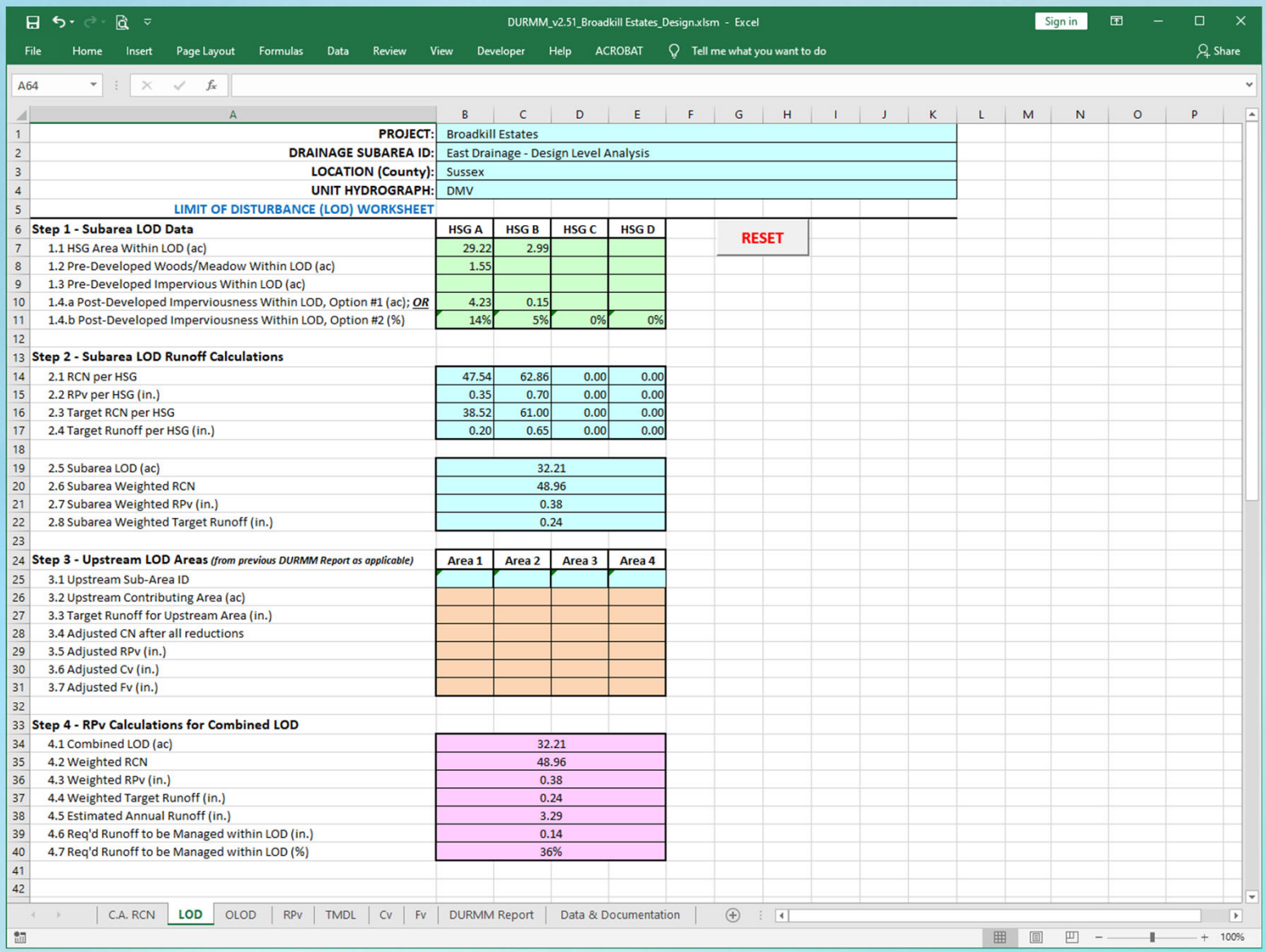
UPSTREAM CONTRIBUTING AREAS	Subarea ID	Acres	RCN
Upstream Contributing Area 1			
Upstream Contributing Area 2			
Upstream Contributing Area 3			
Upstream Contributing Area 4			

Total Contributing Area w. Upstream Areas (ac): 41.9

Weighted Runoff Curve Number (RCN): 53

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

“LOD” Worksheet

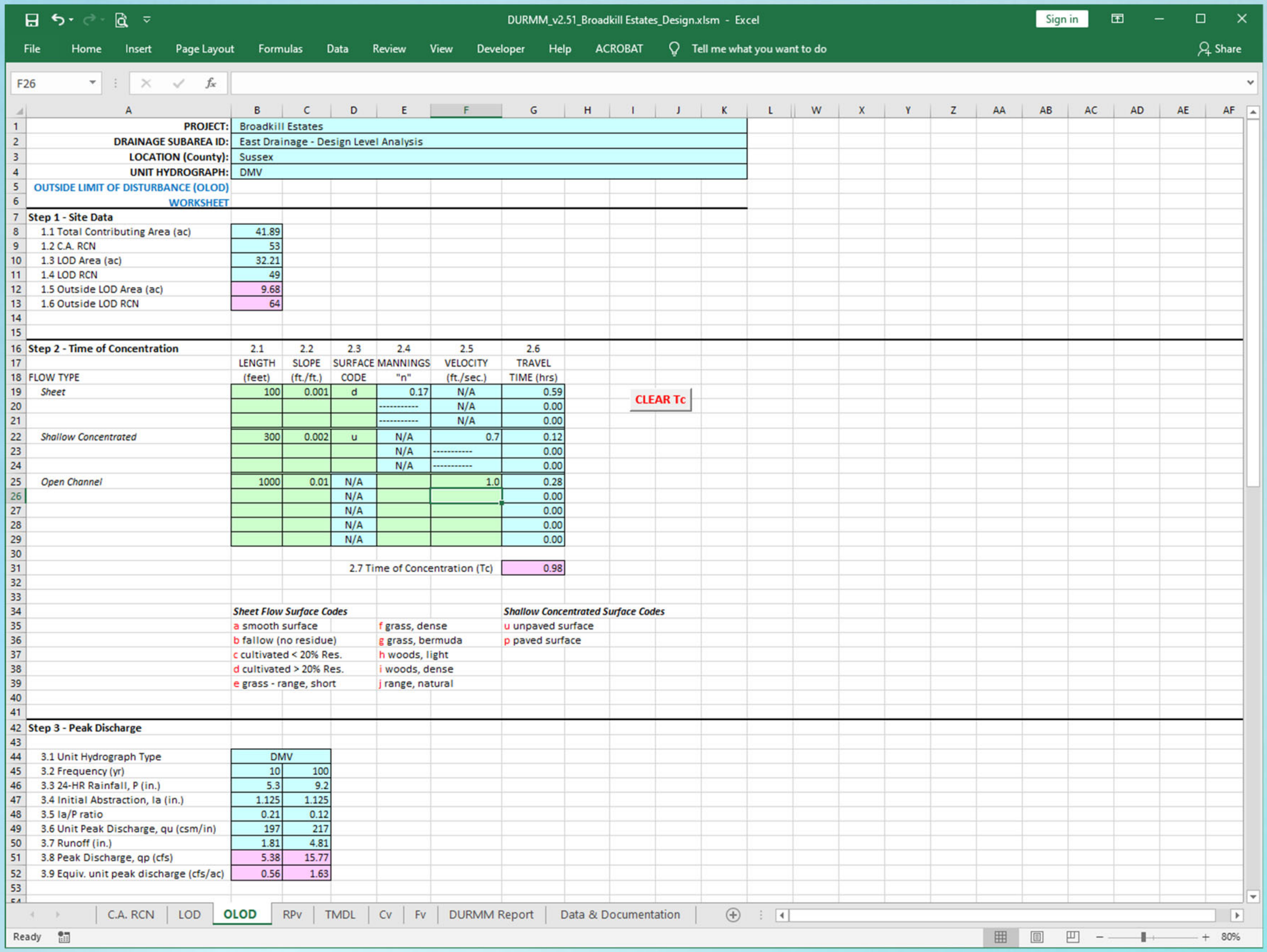


DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

	PROJECT:	Broadkill Estates				
	DRAINAGE SUBAREA ID:	East Drainage - Design Level Analysis				
	LOCATION (County):	Sussex				
	UNIT HYDROGRAPH:	DMV				
	LIMIT OF DISTURBANCE (LOD) WORKSHEET					
Step 1 - Subarea LOD Data		**HSG A**	**HSG B**	**HSG C**	**HSG D**	RESET
1.1 HSG Area Within LOD (ac)		29.22	2.99			
1.2 Pre-Developed Woods/Meadow Within LOD (ac)		1.55				
1.3 Pre-Developed Impervious Within LOD (ac)						
1.4.a Post-Developed Imperviousness Within LOD, Option #1 (ac); ***OR***		4.23	0.15			
1.4.b Post-Developed Imperviousness Within LOD, Option #2 (%)		14%	5%	0%	0%	
Step 2 - Subarea LOD Runoff Calculations						
2.1 RCN per HSG		47.54	62.86	0.00	0.00	
2.2 RPv per HSG (in.)		0.35	0.70	0.00	0.00	
2.3 Target RCN per HSG		38.52	61.00	0.00	0.00	
2.4 Target Runoff per HSG (in.)		0.20	0.65	0.00	0.00	
2.5 Subarea LOD (ac)		32.21				
2.6 Subarea Weighted RCN		48.96				
2.7 Subarea Weighted RPv (in.)		0.38				
2.8 Subarea Weighted Target Runoff (in.)		0.24				
Step 3 - Upstream LOD Areas *(from previous DURMM Report as applicable)*		**Area 1**	**Area 2**	**Area 3**	**Area 4**	
3.1 Upstream Sub-Area ID						
3.2 Upstream Contributing Area (ac)						
3.3 Target Runoff for Upstream Area (in.)						
3.4 Adjusted CN after all reductions						
3.5 Adjusted RPv (in.)						
3.6 Adjusted Cv (in.)						
3.7 Adjusted Fv (in.)						
Step 4 - RPv Calculations for Combined LOD						
4.1 Combined LOD (ac)		32.21				
4.2 Weighted RCN		48.96				
4.3 Weighted RPv (in.)		0.38				
4.4 Weighted Target Runoff (in.)		0.24				
4.5 Estimated Annual Runoff (in.)		3.29				
4.6 Req'd Runoff to be Managed within LOD (in.)		0.14				
4.7 Req'd Runoff to be Managed within LOD (%)		36%				

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

“OLOD” Worksheet



DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

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

FLOW TYPE	2.1 LENGTH (feet)	2.2 SLOPE (ft./ft.)	2.3 SURFACE CODE	2.4 MANNINGS "n"	2.5 VELOCITY (ft./sec.)	2.6 TRAVEL TIME (hrs)
Sheet	100	0.001	d	0.17	N/A	0.59
				----------	N/A	0.00
				----------	N/A	0.00
Shallow Concentrated	300	0.002	u	N/A	0.7	0.12
				N/A	----------	0.00
				N/A	----------	0.00
Open Channel	1000	0.01	N/A		1.0	0.28
			N/A			0.00
			N/A			0.00
			N/A			0.00
			N/A			0.00

CLEAR Tc

2.7 Time of Concentration (Tc) 0.98

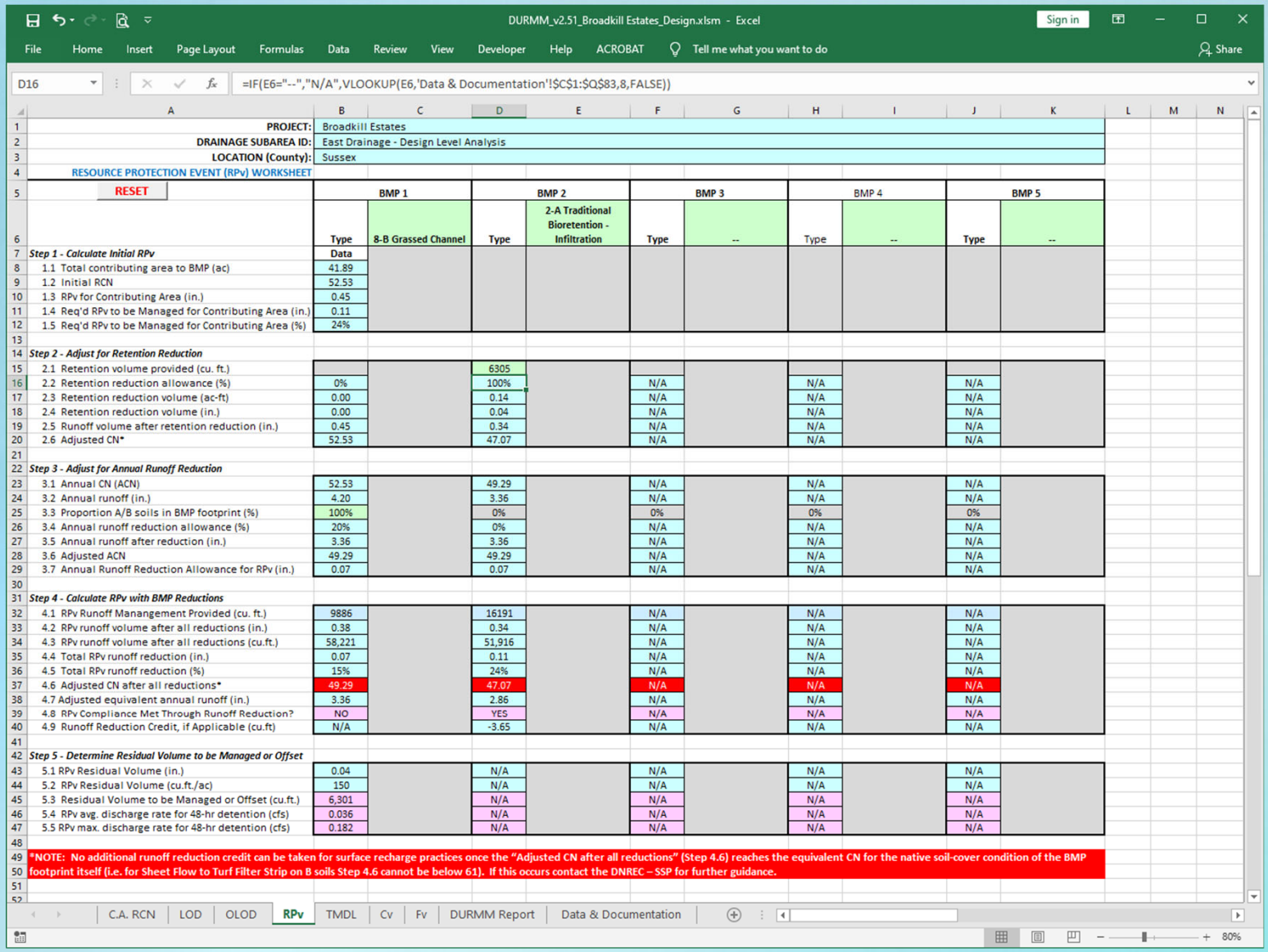
Sheet Flow Surface Codes
- a smooth surface
- b fallow (no residue)
- c cultivated < 20% Res.
- d cultivated > 20% Res.
- e grass - range, short
- f grass, dense
- g grass, bermuda
- h woods, light
- i woods, dense
- j range, natural

Shallow Concentrated Surface Codes
- u unpaved surface
- p paved surface

Step 3 - Peak Discharge

3.1 Unit Hydrograph Type	DMV	
3.2 Frequency (yr)	10	100
3.3 24-HR Rainfall, P (in.)	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

“RPV” Worksheet



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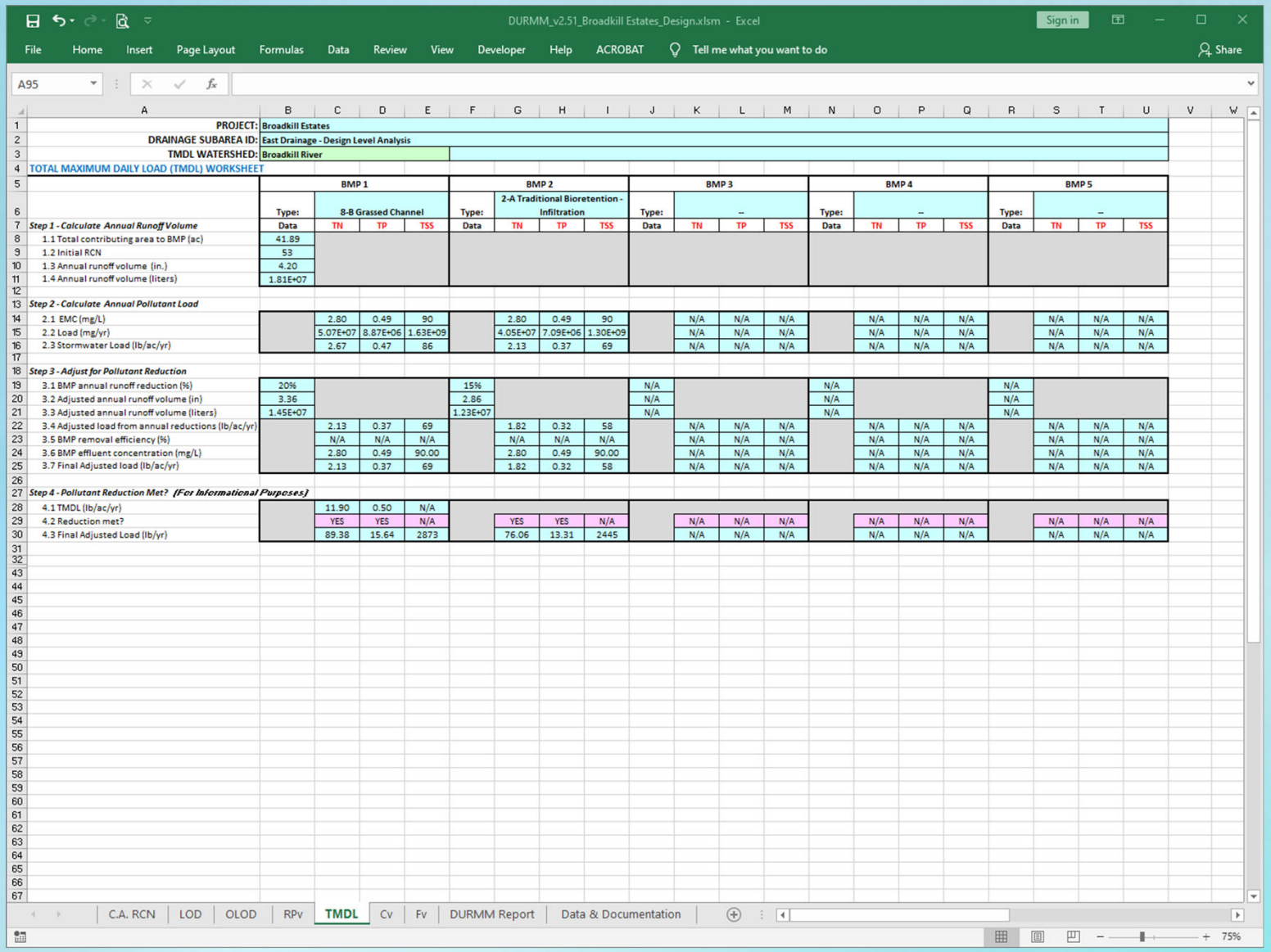
		B	C	D	E	F	G	H	I	J	K
1	PROJECT:	Broadkill Estates									
2	DRAINAGE SUBAREA ID:	East Drainage - Design Level Analysis									
3	LOCATION (County):	Sussex									
4	RESOURCE PROTECTION EVENT (RPv) WORKSHEET										
5	RESET	BMP 1		BMP 2		BMP 3		BMP 4		BMP 5	
6		Type	8-B Grassed Channel	Type	2-A Traditional Bioretention - Infiltration	Type	--	Type	--	Type	--
7	*Step 1 - Calculate Initial RPv*	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%									
13											
14	*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	
17	2.3 Retention reduction volume (ac-ft)	0.00		0.14		N/A		N/A		N/A	
18	2.4 Retention reduction volume (in.)	0.00		0.04		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	
20	2.6 Adjusted CN*	52.53		47.07		N/A		N/A		N/A	
21											
22	*Step 3 - Adjust for Annual Runoff Reduction*										
23	3.1 Annual CN (ACN)	52.53		49.29		N/A		N/A		N/A	
24	3.2 Annual runoff (in.)	4.20		3.36		N/A		N/A		N/A	
25	3.3 Proportion A/B soils in BMP footprint (%)	100%		0%		0%		0%		0%	
26	3.4 Annual runoff reduction allowance (%)	20%		0%		N/A		N/A		N/A	
27	3.5 Annual runoff after reduction (in.)	3.36		3.36		N/A		N/A		N/A	
28	3.6 Adjusted ACN	49.29		49.29		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	
30											
31	*Step 4 - Calculate RPv with BMP Reductions*										
32	4.1 RPv Runoff Manangement Provided (cu. ft.)	9886		16191		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	
34	4.3 RPv runoff volume after all reductions (cu.ft.)	58,221		51,916		N/A		N/A		N/A	
35	4.4 Total RPv runoff reduction (in.)	0.07		0.11		N/A		N/A		N/A	
36	4.5 Total RPv runoff reduction (%)	15%		24%		N/A		N/A		N/A	
37	4.6 Adjusted CN after all reductions*	49.29		47.07		N/A		N/A		N/A	
38	4.7 Adjusted equivalent annual runoff (in.)	3.36		2.86		N/A		N/A		N/A	
39	4.8 RPv Compliance Met Through Runoff Reduction?	NO		YES		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	
41											
42	*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	
44	5.2 RPv Residual Volume (cu.ft./ac)	150		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	
46	5.4 RPv avg. discharge rate for 48-hr detention (cfs)	0.036		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	
48											
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										
50	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											

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

80%

“TMDL” Worksheet



DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

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A95

1	PROJECT:	Broadkill Estates																			
2	DRAINAGE SUBAREA ID:	East Drainage - Design Level Analysis																			
3	TMDL WATERSHED:	Broadkill River																			
4	TOTAL MAXIMUM DAILY LOAD (TMDL) WORKSHEET																				
5		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 Annual Runoff Volume*	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS	Data	TN	TP	TSS
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																			
12																					
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)		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		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		N/A	N/A	N/A
17																					
18	*Step 3 - Adjust for Pollutant Reduction*																				
19	3.1 BMP annual runoff reduction (%)	20%				15%				N/A				N/A				N/A			
20	3.2 Adjusted annual runoff volume (in)	3.36				2.86				N/A				N/A				N/A			
21	3.3 Adjusted annual runoff volume (liters)	1.45E+07				1.23E+07				N/A				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		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)		2.13	0.37	69		1.82	0.32	58		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
26																					
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	YES	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)		89.38	15.64	2873		76.06	13.31	2445		N/A	N/A	N/A		N/A	N/A	N/A		N/A	N/A	N/A
31																					
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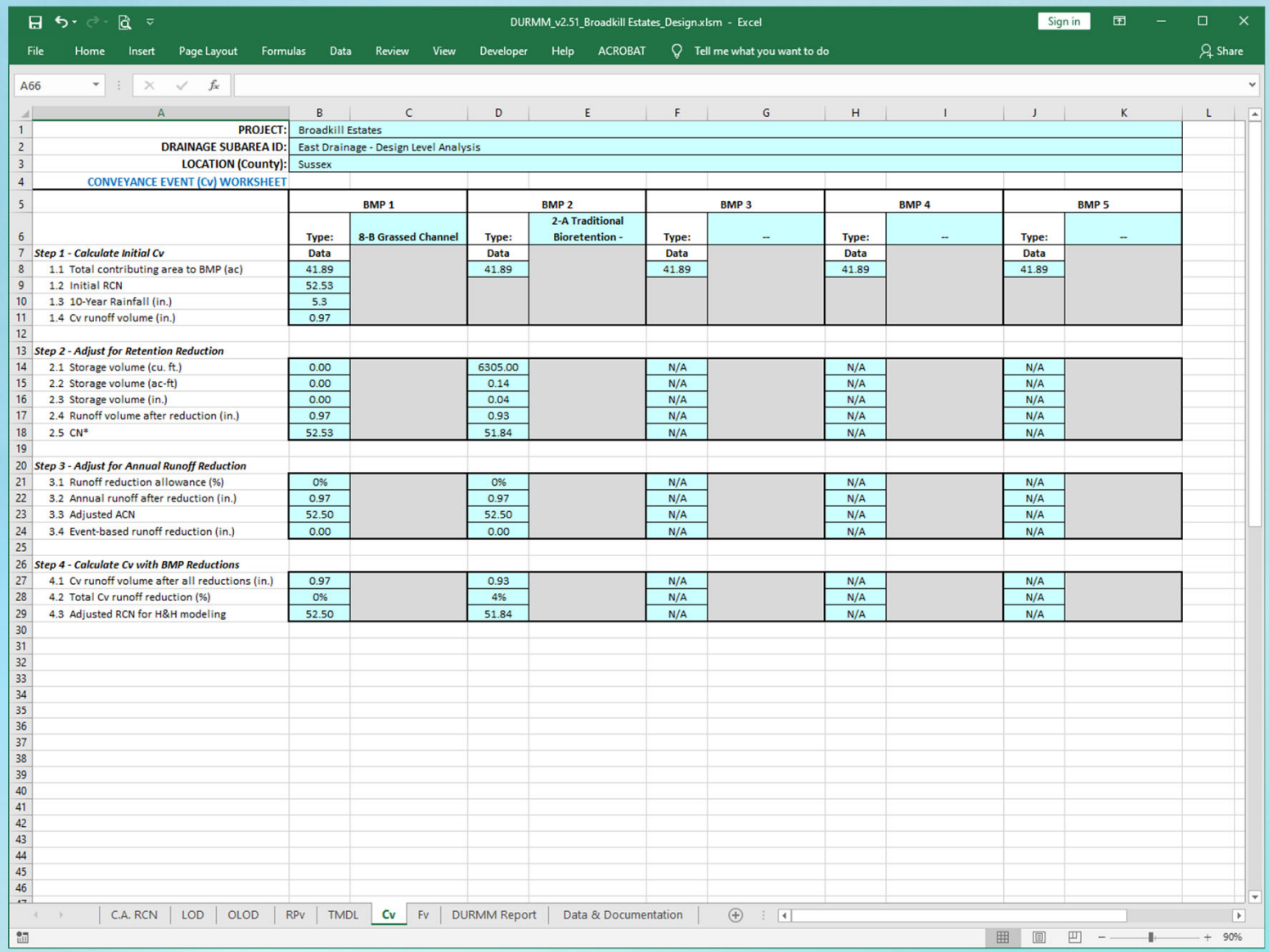
C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation

75%

“Cv” Worksheet

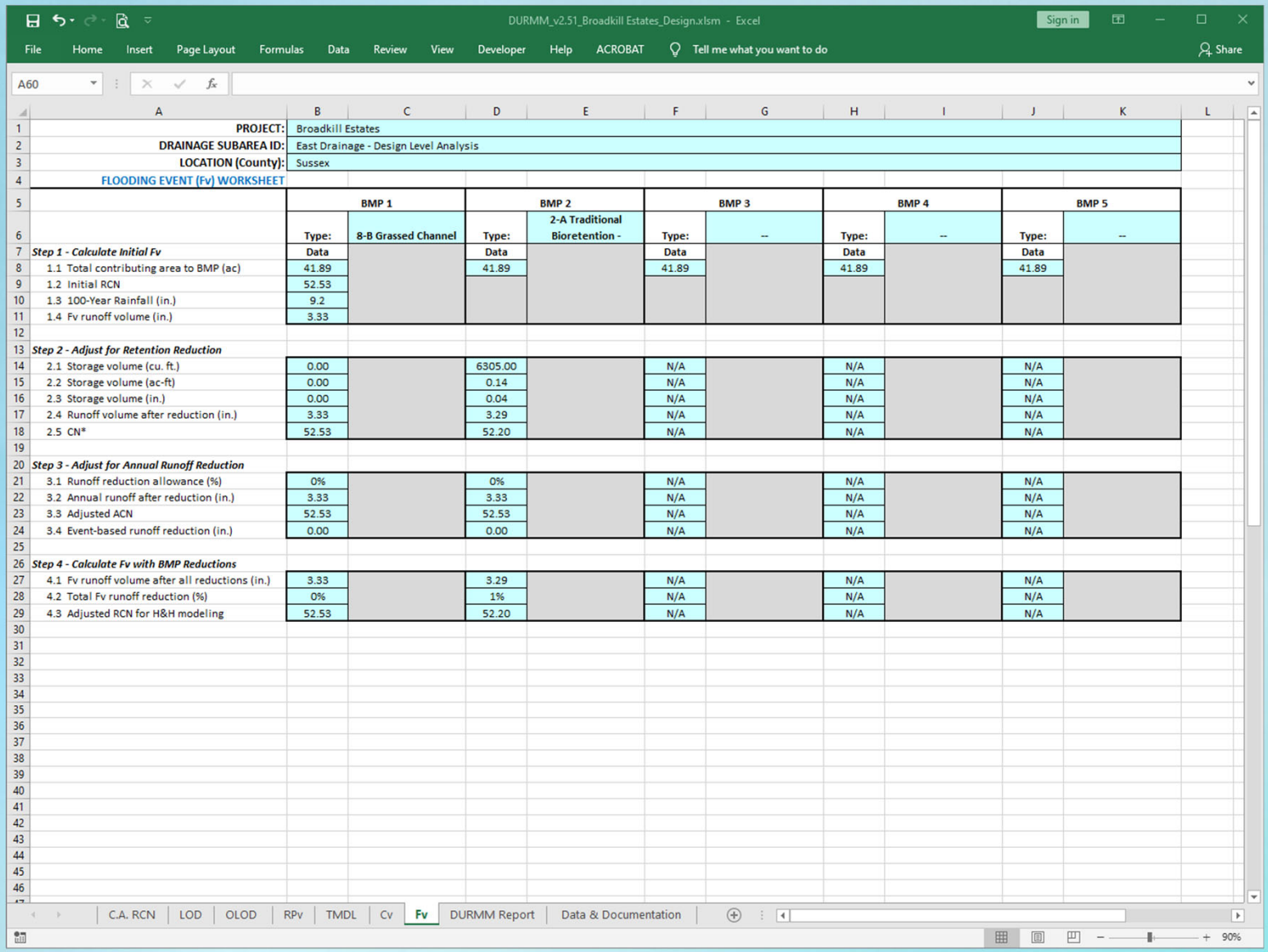


DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

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	

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

“Fv” Worksheet

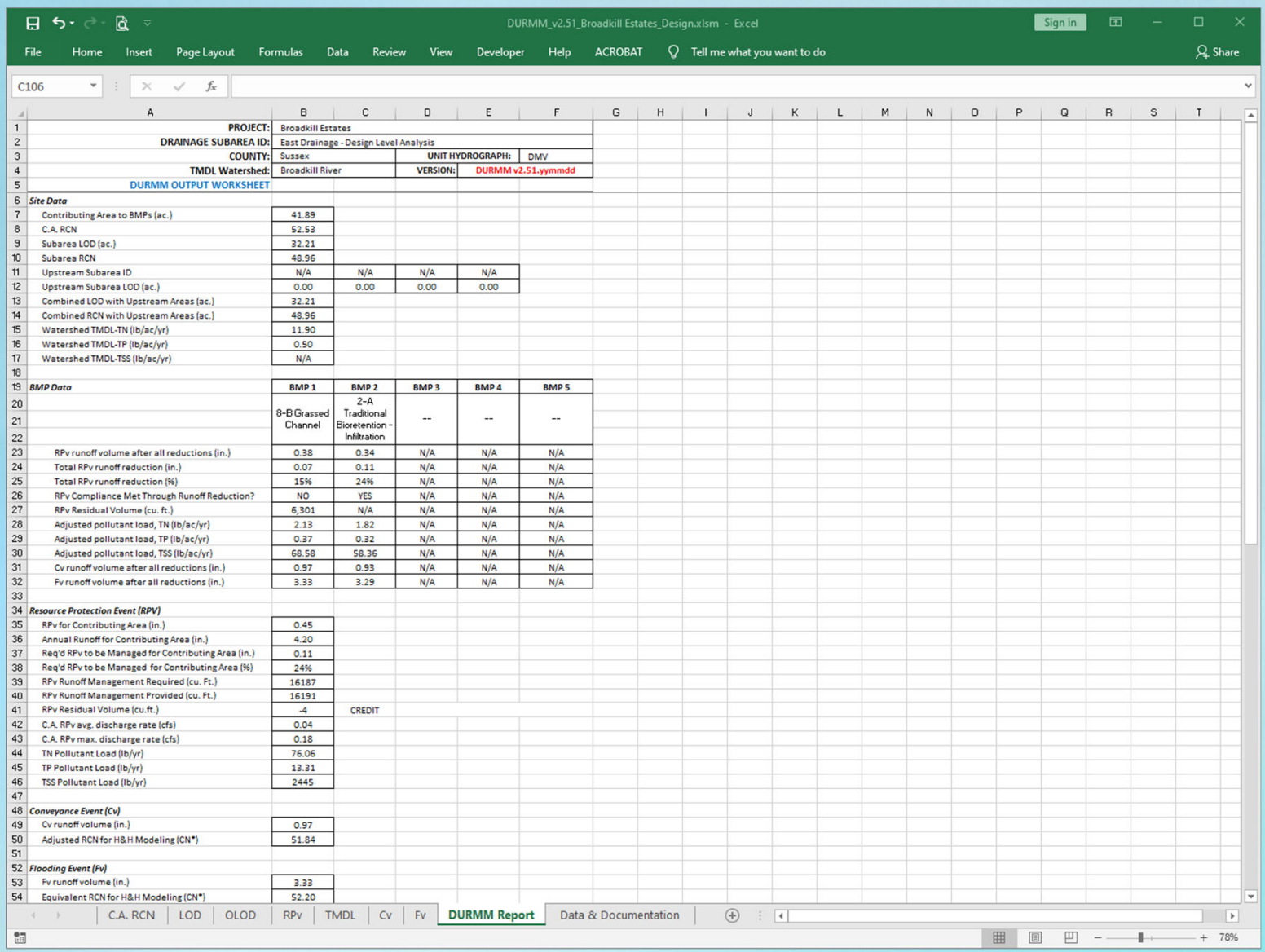


DURMM_v2.51_Broadkill Estates_Design.xlsm - Excel

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	

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

“DURMM Report” Worksheet



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C106

	PROJECT:	Broadkill Estates				
	DRAINAGE SUBAREA ID:	East Drainage - Design Level Analysis				
	COUNTY:	Sussex		UNIT HYDROGRAPH:	DMV	
	TMDL Watershed:	Broadkill River		VERSION:	DURMM v2.51.yymmdd	
	DURMM OUTPUT WORKSHEET					
Site Data						
Contributing Area to BMPs (ac.)	41.89					
C.A. RCN	52.53					
Subarea LOD (ac.)	32.21					
Subarea RCN	48.96					
Upstream Subarea ID	N/A	N/A	N/A	N/A		
Upstream Subarea LOD (ac.)	0.00	0.00	0.00	0.00		
Combined LOD with Upstream Areas (ac.)	32.21					
Combined RCN with Upstream Areas (ac.)	48.96					
Watershed TMDL-TN (lb/ac/yr)	11.90					
Watershed TMDL-TP (lb/ac/yr)	0.50					
Watershed TMDL-TSS (lb/ac/yr)	N/A					
BMP Data	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5	
	8-B Grassed Channel	2-A Traditional Bioretention - Infiltration	--	--	--	
RPv runoff volume after all reductions (in.)	0.38	0.34	N/A	N/A	N/A	
Total RPv runoff reduction (in.)	0.07	0.11	N/A	N/A	N/A	
Total RPv runoff reduction (%)	15%	24%	N/A	N/A	N/A	
RPv Compliance Met Through Runoff Reduction?	NO	YES	N/A	N/A	N/A	
RPv Residual Volume (cu. ft.)	6,301	N/A	N/A	N/A	N/A	
Adjusted pollutant load, TN (lb/ac/yr)	2.13	1.82	N/A	N/A	N/A	
Adjusted pollutant load, TP (lb/ac/yr)	0.37	0.32	N/A	N/A	N/A	
Adjusted pollutant load, TSS (lb/ac/yr)	68.58	58.36	N/A	N/A	N/A	
Cv runoff volume after all reductions (in.)	0.97	0.93	N/A	N/A	N/A	
Fv runoff volume after all reductions (in.)	3.33	3.29	N/A	N/A	N/A	
Resource Protection Event (RPV)						
RPv for Contributing Area (in.)	0.45					
Annual Runoff for Contributing Area (in.)	4.20					
Req'd RPv to be Managed for Contributing Area (in.)	0.11					
Req'd RPv to be Managed for Contributing Area (%)	24%					
RPv Runoff Management Required (cu. Ft.)	16187					
RPv Runoff Management Provided (cu. Ft.)	16191					
RPv Residual Volume (cu.ft.)	-4	CREDIT				
C.A. RPv avg. discharge rate (cfs)	0.04					
C.A. RPv max. discharge rate (cfs)	0.18					
TN Pollutant Load (lb/yr)	76.06					
TP Pollutant Load (lb/yr)	13.31					
TSS Pollutant Load (lb/yr)	2445					
Conveyance Event (Cv)						
Cv runoff volume (in.)	0.97					
Adjusted RCN for H&H Modeling (CN*)	51.84					
Flooding Event (Fv)						
Fv runoff volume (in.)	3.33					
Equivalent RCN for H&H Modeling (CN*)	52.20					

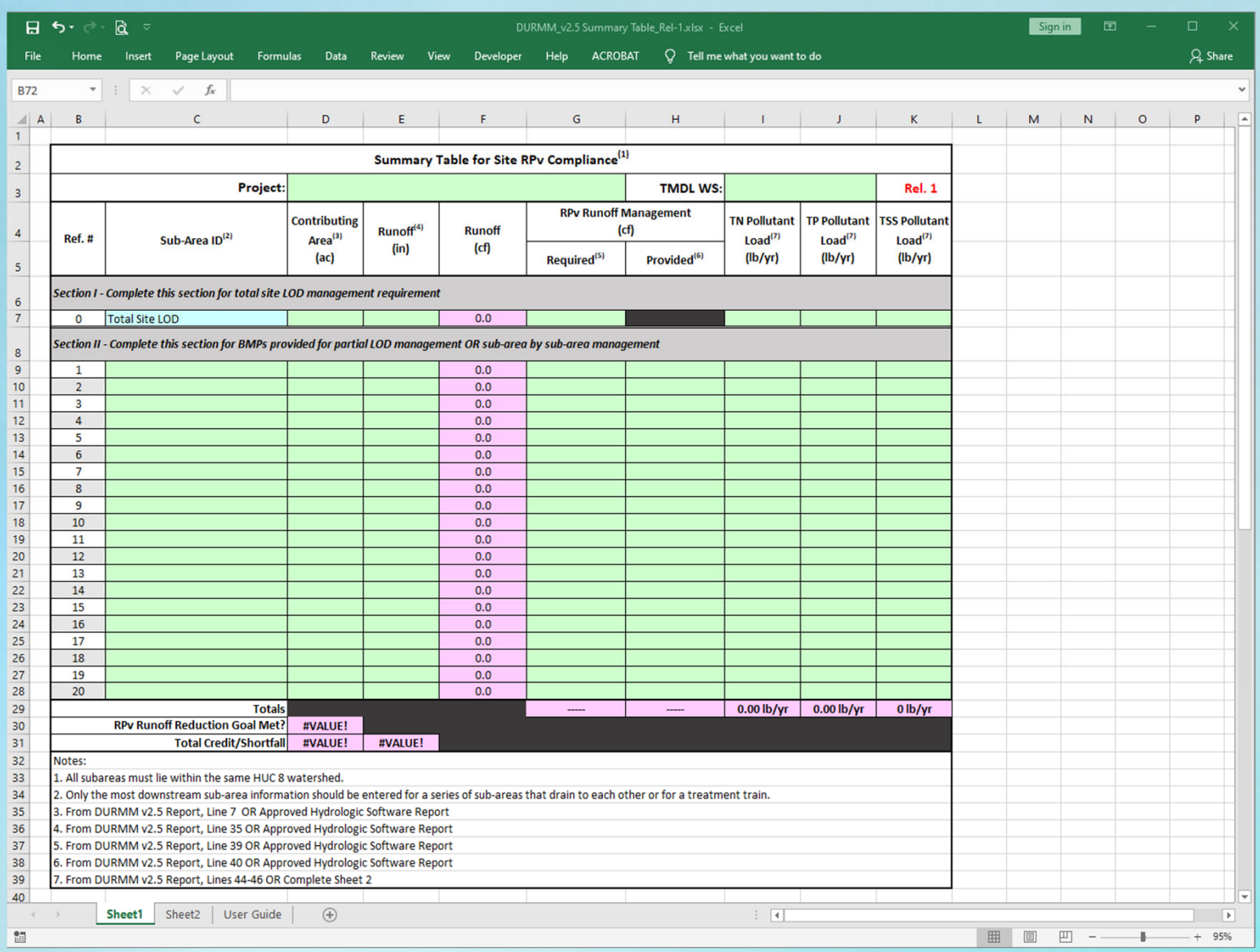
C.A. RCN | LOD | OLOD | RPv | TMDL | Cv | Fv | DURMM Report | Data & Documentation

78%

DURMM v2.5

“Broadkill Estates” Example Site Summary Table for RPV Compliance

Summary Table for RPv Compliance Sheet 1



DURMM_v2.5 Summary Table_Rel-1.xlsx - Excel

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B72

Summary Table for Site RPv Compliance[1]

Project:						TMDL WS:				Rel. 1
Ref. #	Sub-Area ID[2]	Contributing Area[3] (ac)	Runoff[4] (in)	Runoff (cf)	RPv 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	
RPv Runoff Reduction Goal Met?		#VALUE!								
Total Credit/Shortfall		#VALUE!	#VALUE!							

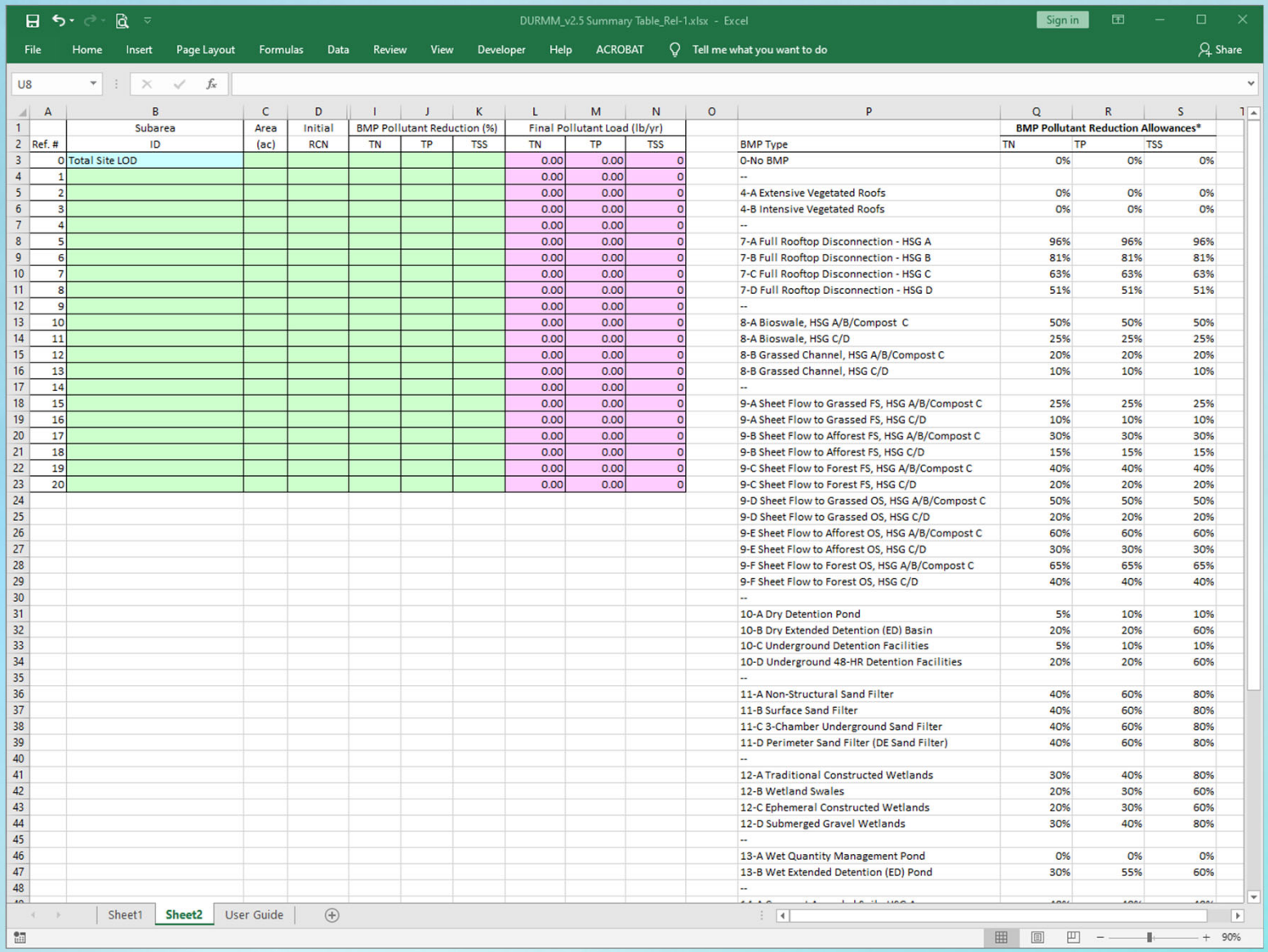
Notes:

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

95%

Summary Table for RPv Compliance
Sheet 2



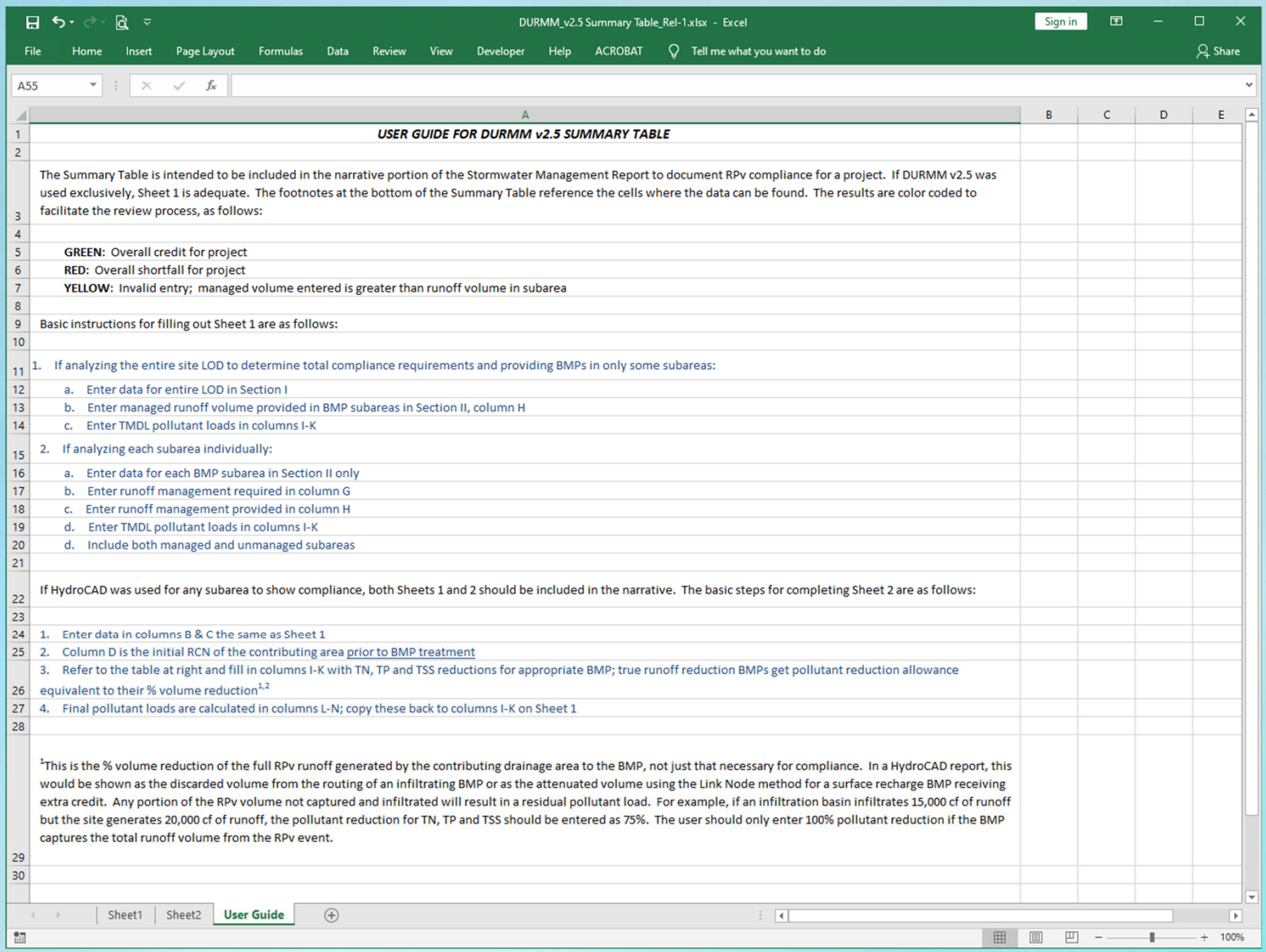
DURMM_v2.5 Summary Table_Rel-1.xlsx - Excel

	A	B	C	D	I	J	K	L	M	N
1		Subarea	Area	Initial	BMP Pollutant Reduction (%)			Final Pollutant Load (lb/yr)		
2	Ref. #	ID	(ac)	RCN	TN	TP	TSS	TN	TP	TSS
3	0	Total Site LOD						0.00	0.00	0
4	1							0.00	0.00	0
5	2							0.00	0.00	0
6	3							0.00	0.00	0
7	4							0.00	0.00	0
8	5							0.00	0.00	0
9	6							0.00	0.00	0
10	7							0.00	0.00	0
11	8							0.00	0.00	0
12	9							0.00	0.00	0
13	10							0.00	0.00	0
14	11							0.00	0.00	0
15	12							0.00	0.00	0
16	13							0.00	0.00	0
17	14							0.00	0.00	0
18	15							0.00	0.00	0
19	16							0.00	0.00	0
20	17							0.00	0.00	0
21	18							0.00	0.00	0
22	19							0.00	0.00	0
23	20							0.00	0.00	0

P	Q	R	S
	BMP Pollutant Reduction Allowances*		
BMP Type	TN	TP	TSS
0-No BMP	0%	0%	0%
--			
4-A Extensive Vegetated Roofs	0%	0%	0%
4-B Intensive Vegetated Roofs	0%	0%	0%
--			
7-A Full Rooftop Disconnection - HSG A	96%	96%	96%
7-B Full Rooftop Disconnection - HSG B	81%	81%	81%
7-C Full Rooftop Disconnection - HSG C	63%	63%	63%
7-D Full Rooftop Disconnection - HSG D	51%	51%	51%
--			
8-A Bioswale, HSG A/B/Compost C	50%	50%	50%
8-A Bioswale, HSG C/D	25%	25%	25%
8-B Grassed Channel, HSG A/B/Compost C	20%	20%	20%
8-B Grassed Channel, HSG C/D	10%	10%	10%
--			
9-A Sheet Flow to Grassed FS, HSG A/B/Compost C	25%	25%	25%
9-A Sheet Flow to Grassed FS, HSG C/D	10%	10%	10%
9-B Sheet Flow to Afforest FS, HSG A/B/Compost C	30%	30%	30%
9-B Sheet Flow to Afforest FS, HSG C/D	15%	15%	15%
9-C Sheet Flow to Forest FS, HSG A/B/Compost C	40%	40%	40%
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%
--			

Sheet1 | Sheet2 | User Guide

Summary Table for RPv Compliance
User Guide



DURMM_v2.5 Summary Table_Rel-1.xlsx - Excel

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A55

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 RPv 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:

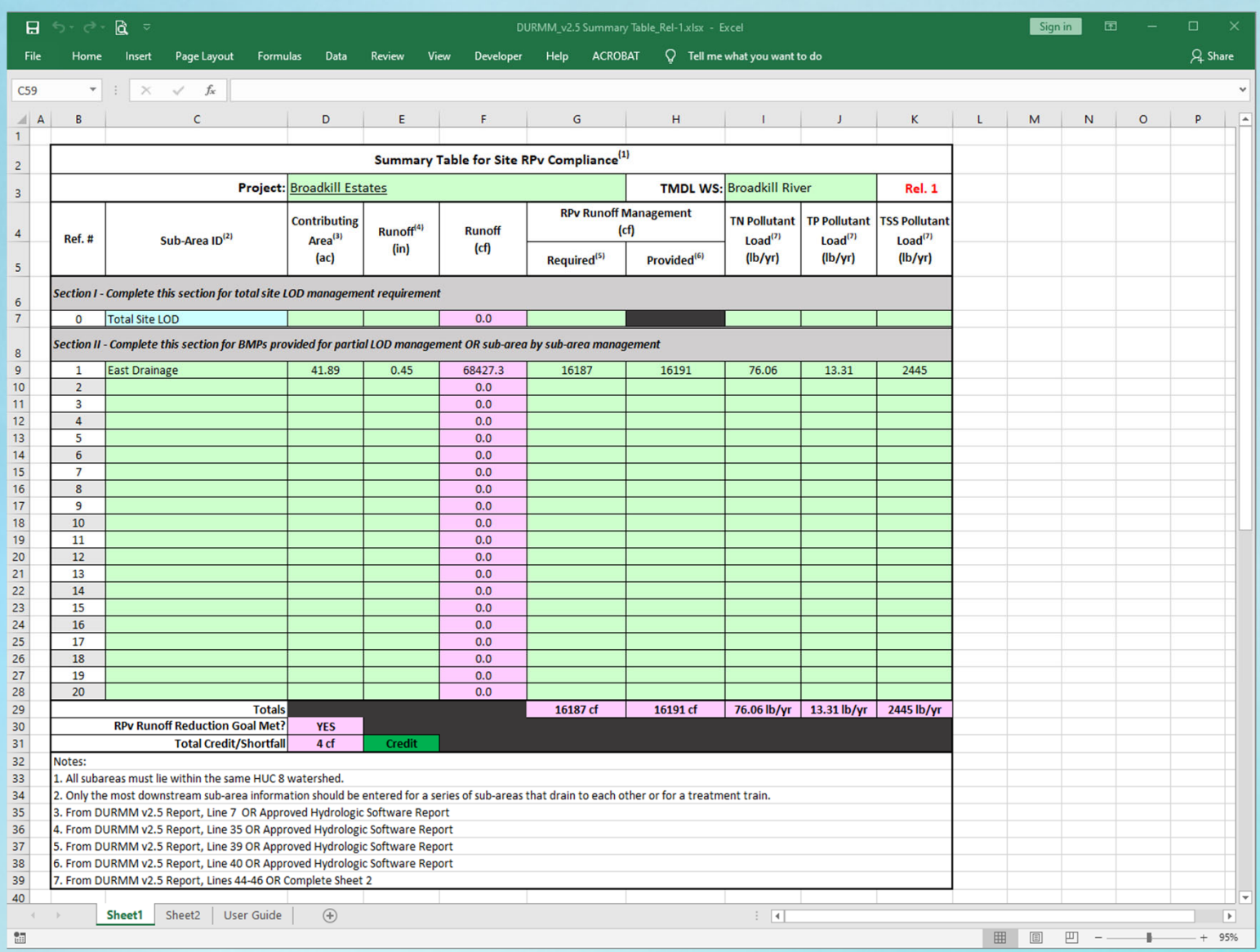
1. Enter data in columns B & C the same as Sheet 1
2. Column D is the initial RCN of the contributing area prior to BMP treatment
3. Refer to the table at right and fill in columns I-K with TN, TP and TSS reductions for appropriate BMP; true runoff reduction BMPs get pollutant reduction allowance equivalent 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

[1]This is the % volume reduction of the full RPv 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 RPv 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 RPv event.

Sheet1 Sheet2 User Guide

100%

Summary Table for RPv Compliance
Sheet 1 for Broadkill Estates Example



DURMM_v2.5 Summary Table_Rel-1.xlsx - Excel

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Summary Table for Site RPv 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)	RPv 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
RPv 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.
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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