Horry County LID Compliance Spreadsheet Guidance

## (replaces Section A.2 of Low Impact Development in Coastal South Carolina: A Planning and Design Guide)

The following guidance explains how to use each of the worksheets in the compliance calculator spreadsheet.

Note: All cells highlighted in blue are user input cells. Cells highlighted in gray are calculation cells, and cells highlighted in yellow are constant values that generally should not be changed.

**Site Data Sheet**

1. Enter the name of the proposed project on line 9.
2. Enter the pre-development land cover areas (in acres) of forest cover, turf cover, and impervious cover on the site for Natural Resource Conservation Service (NRCS) soil types A, B, C, and D in **cells C15-C17**, **E15-E17**, **G15-G17**, and **I15-I17**, respectively.
3. Verify/enter the NRCS runoff curve numbers for each land use/soil type combination in **cells D15-D17**, **F15-F17**, **H15-H17**, and **J15-J17**. Default values have already been included in these cells, but they can be changed if necessary.
4. Enter the post-development land cover areas (in acres) of forest cover/open space, turf cover, and impervious cover on the site for Natural Resource Conservation Service (NRCS) soil types A, B, C, and D in **cells C24-C26**, **E24-E26**, **G24-G26**, and **I24-I26**, respectively.
5. Verify/enter the NRCS runoff curve numbers for each land use/soil type combination in **cells D24-D26**, **F24-F26**, **H24-H26**, and **J24-J26**. As with the pre-development entries, default values have already been included in these cells, but they can be changed if necessary.
6. From the land cover input, weighted site-runoff coefficients (*Rv*) will be calculated (column M) for both the pre-development and post-development land cover conditions, based upon the *Rv* values listed in **cells L4-O6**. The Rv values determine what fraction of rainfall is converted to runoff for small storm events.
7. Answer yes or no to the questions on **line 29-31** regarding the location of the site. The runoff reduction volume target (**cell C34)** depends on the answers to these questions. If the site is not located within 1,000 feet of a shellfish bed, the runoff reduction volume target is equal to the runoff produced by 1” of rainfall over the entire project:

$$RRV=\frac{1"}{12}×Rv ×A×43,560$$

Where:

RRV = Runoff Reduction Volume Target (cf)

Rv = Runoff Coefficient determined in cell M27.

A = Disturbed Area (acres)

If the site is located within 1,000 feet of a shellfish bed, the runoff volume target becomes the maximum of the runoff produced by 1” of rainfall over the entire project, or 1.5” of runoff over the project’s impervious cover:

$$RRV=MAX(\frac{1"}{12}×Rv×A×43,560, \frac{1.5"}{12}×IA×43,560)$$

Where:

RRV = Runoff Reduction Volume Target (cf)

Rv = Runoff Coefficient determined in cell M27.

A = Disturbed Area (acres)

IA = Impervious Area (acres)

1. The spreadsheet also calculates a Water Quality Volume Target (**cell C35**). This is the equal to the runoff produced by 1.2” of rainfall over the entire project multiplied by 80% (or 85% if discharging to an impaired waterbody):

$$WQV=\frac{1.2"}{12}×Rv ×A×43,560×0.80 (or 0.85)$$

Where:

WQV = Water Quality Volume Target (cf)

Rv = Runoff Coefficient determined in cell M27.

A = Disturbed Area (acres)

If the site is located within 1,000 feet of a shellfish bed, the runoff volume target becomes the maximum of the runoff produced by 1.2” of rainfall over the entire project multiplied by 80% (or 85% if discharging to an impaired waterbody), or 1.5” of runoff over the project’s impervious cover:

$$WQV=MAX(\frac{1.2"}{12}×Rv×A×43,560×0.80 (or 0.85), \frac{1.5"}{12}×IA×43,560)$$

Where:

WQV = Runoff Reduction Volume Target (cf)

Rv = Runoff Coefficient determined in cell M27.

A = Disturbed Area (acres)

IA = Impervious Area (acres)

1. The final compliance statements on this sheet are for redevelopment projects only. Statement A asks if the project reduced the total runoff volume by 10% for the 2-year storm. The redevelopment project has achieved this if, in the **Channel and Flood Protection** sheet, the Post-Development Runoff Volume (in) with BMPs (**cell D40**) is less than the Post-Development Runoff Volume (in) with no BMPs (**cell D39**).

Statement B asks if the project reduced the peak flow by 20% for the 10-year and 25-year storms. The curve numbers on the **Channel and Flood Protection** sheet can be used to calculate if the project has met this requirement.

Finally, Statement C ask if the site’s impervious cover was reduced by 20%. The redevelopment project has achieved this if, in the **Site Data** sheet, the Post Development Impervious Cover (**cell K26**) is less than the Pre-Development Impervious Cover (**cell K17**).

**BMP Sheet**

1. Apply BMPs to the drainage area to address the target runoff reduction volume or water quality volume by indicating the area in square feet of forest cover, turf cover, and impervious cover to be treated by a given BMP in columns B, C, and D. This will likely be an iterative process. The available BMPs include the following:
* Bioretention - Enhanced
* Bioretention - Standard
* Permeable Pavement - Infiltration
* Permeable Pavement - Standard
* Infiltration
* Green Roof
* Rainwater Harvesting
* Disconnection to A/B or Amended Soils
* Disconnection to Forest Cover/Open Space
* Grass Channel in A/B or Amended Soils
* Grass Channel in C/D Soils
* Dry Swale
* Wet Swale
* Regenerative Stormwater Conveyance (RSC)
* Filtration
* Dry Detention Practice
* Wet Detention Pond
* Wetland
1. Enter the BMP’s storage volume (cf) in **column E**.
2. The volume from direct drainage to the BMP is calculated and reported in **column F**, according to the following formula:

$V\_{dd}=3630×P×(Rv\_{F}×A\_{F}+Rv\_{T}×A\_{T}+Rv\_{I}×A\_{I})$

Where:

 Vdd = Volume from Direct Drainage (cf)

 P = Design Storm (1.2 in. or 1.58 in.)

 RvF = Runoff coefficient from forest

 AF = Area of forest (acres) from **column B**

 RvT = Runoff coefficient from turf

 AT = Area of turf (acres) from **column C**

 RvI = Runoff coefficient from impervious cover

 AI = Area of impervious cover (acres) from **column D**

1. If more than one BMP will be employed in series, any overflow from upstream BMPs (VUS)will be accounted for in column G.
2. The total volume captured by the practice (VCAP) is reported in **column H** and is equal to the following:

$V\_{CAP}=Minimum(Sv,V\_{US}+V\_{DD}$)

Where:

VCAP = Runoff Reduction Volume captured by the practice (cf)

Sv = Storage Volume (cf)

VUS = Volume of runoff from upstream practice (cf)

VDD = Volume of runoff from direct drainage (cf)

1. The spreadsheet calculates the runoff reduction volume credited in column J, based on the storage volume of the BMP and the runoff reduction credit percentage assigned to the BMP in column I (Table A.2-1). Regardless of the storage volume of the BMP, the storage achieved cannot be greater than the total volume received by the BMP (column H).

|  |
| --- |
| **Table A.2-1. Runoff Reduction Credit for Each BMP** |
| **Practice Type** | **Runoff Reduction Credit** |
| Bioretention - Enhanced | 100% |
| Bioretention - Standard | 60% |
| Permeable Pavement - Infiltration | 100% |
| Permeable Pavement - Standard | 50% |
| Infiltration | 100% |
| Green Roof | 100% |
| Rainwater Harvesting | 100% |
| Disconnection to A/B or Amended Soils | 50% |
| Disconnection to C/D Soils | 25% |
| Disconnection to Forest Cover/Open Space | 75% |
| Grass Channel in A/B or Amended Soils | 20% |
| Grass Channel in C/D Soils | 10% |
| Dry Swale | 60% |
| Wet Swale | 0% |
| Regenerative Stormwater Conveyance (RSC) | 100% |
| Filtration | 0% |
| Dry Detention Practice | 0% |
| Wet Detention Pond | 0% |
| Wetland | 0% |

1. The Runoff Reduction Volume Credited is calculated in **column J**, and is equal to the following:

$$RRV\_{CR}=Minimum(CR×Sv, V\_{CAP})$$

Where:

 RRVCR = Runoff Reduction Volume Credited (cf)

 Sv = Storage Volume (cf)

 CR = Credit (%)

 VCAP = Volume Captured by the Practice (cf)

1. The Remaining Runoff Reduction Volume (column K) is calculated as:

$$RRV\_{R}=RRV\_{REC}-RRV\_{CR}$$

Where:

 RRVR = Runoff Reduction Volume Remaining (cf)

 RRVREC = Runoff Reduction Volume Received (cf)

 RRVCR = Runoff Reduction Volume Credited (cf)

1. Any runoff volume remaining can be directed to a downstream BMP by selecting a practice from the pull-down menu in column O. Selecting a BMP from the menu will automatically direct the runoff volume remaining to column G for the appropriate BMP.
2. The Target Runoff Reduction Volume is calculated in **cell B31**.
3. The Total Runoff Reduction Volume Credited is calculated in **Cell J26,** and reported in **cell C31.**
4. **Cell E31** reports whether the Target Runoff Reduction Volume has been achieved for the site.
5. The spreadsheet calculates the water quality volume credited in column M, based on the storage volume of the BMP and the water quality credit percentage assigned to the BMP in **column L** (Table A.2-2). Regardless of the storage volume of the BMP, the storage achieved cannot be greater than the total volume received by the BMP (column H).

|  |
| --- |
| **Table A.2-2. Water Quality Credit for Each BMP** |
| **Practice Type** | **Water Quality Credit** |
| Bioretention - Enhanced | 100% |
| Bioretention - Standard | 85% |
| Permeable Pavement - Infiltration | 100% |
| Permeable Pavement - Standard | 80% |
| Infiltration | 100% |
| Green Roof | 80% |
| Rainwater Harvesting | 80% |
| Disconnection to A/B or Amended Soils | 80% |
| Disconnection to C/D Soils | 80% |
| Disconnection to Forest Cover/Open Space | 80% |
| Grass Channel in A/B or Amended Soils | 40% |
| Grass Channel in C/D Soils | 40% |
| Dry Swale | 85% |
| Wet Swale | 85% |
| Regenerative Stormwater Conveyance (RSC) | 85% |
| Filtration | 90% |
| Dry Detention Practice | 0% |
| Wet Detention Pond | 85% |
| Wetland | 80% |

1. The Water Quality Volume Credited is calculated in **column M**, and is equal to the following:

$$WQV\_{CR}=Minimum(CR×Sv, V\_{CAP})$$

Where:

WQVCR = Water Quality Volume Credited (cf)

Sv = Storage Volume (cf)

CR = Credit (%)

VCAP = Volume Captured by the Practice (cf)

1. The Remaining Runoff Reduction Volume (column N) is calculated as:

$$WQV\_{R}=WQV\_{REC}-WQV\_{CR}$$

Where:

 WQVR = Runoff Reduction Volume Remaining (cf)

 WQVREC = Runoff Reduction Volume Received (cf)

 WQVCR = Runoff Reduction Volume Credited (cf)

1. Again, any runoff volume remaining can be directed to a downstream BMP by selecting a practice from the pull-down menu in column O. Selecting a BMP from the menu will automatically direct the runoff volume remaining to column G for the appropriate BMP.
2. The Target Water Quality Volume is calculated in **cell B32**.
3. The Total Water Qualtiy Volume Credited is calculated in **Cell M26,** and reported in **cell D32.**
4. **Cell E32** reports whether the Target Water Quality Volume has been achieved for the site.

Channel and Flood Protection

This sheet assists with calculation of Adjusted Curve Numbers that can be used to calculate peak flows associated with the 2-year storm, 10-year storm, or other storm events.

1. Indicate the appropriate depths for the 2-year, 10-year, 25-year, and 100-year 24-hour storms (or other storms as needed) on line 5 (The values provided are taken from the Horry County Stormwater Management Design Manual)**.**
2. The Total Site Area (from the **Site Data** sheet), is reported in **cell C7**.
3. The Storage Volume Provided by BMPs (cf) is calculated in **cell C8**, using the following equation:

$$V\_{RR}=\sum\_{BMPs}^{}V\_{CAP}$$

Where:

 VRR = Runoff Reduction Volume achieved (cf)

 VCAP = Storage Volume Provided by Each BMP (cf)

 (from **column E** of the **BMPs** sheet)

 As indicated in the Site Data sheet, each cover type is associated with a NRCS curve number. Cells D15–G20 show the pre-development land cover areas and curve numbers that were indicated on the Site Data sheet. Using these curve numbers, a weighted curve number is calculated in **cell G22**.

1. Cells D27–G32 show the post-development land cover areas and curve numbers that were indicated on the Site Data Sheet. Using these curve numbers, a weighted curve number is calculated in **cell G39**.
2. Using NRCS methodology, **line 38** calculates the pre-development runoff volume (inches) for the various storm events.

*Potential Abstraction*

$$S= \frac{1000}{(CN-10)}$$

Where:

 *S* = potential abstraction (in.)

 *CN* = weighted curve number

*Runoff Volume*

$$Q= \frac{\left(P-0.2⋅S\right)^{2}}{\left(P+0.8⋅S\right)}$$

Where:

 *Q* = runoff volume (in.)

 *P* = precipitation depth for a given 24-hour storm (in.)

 *S* = potential abstraction (in.)

1. Line 39 calculates the post-development runoff volume based solely on land cover (without regard to the BMPs selected on the BMP sheet). Line 40 then subtracts the runoff reduction volume provided by BMPs, from **cell C8**.
2. Based upon the reduced runoff volumes calculated in **line 40**, the spreadsheet then calculates corresponding reduced curve numbers for each storm event. This Adjusted Curve Number is reported on line 41.
3. **Line 42** compares the pre-development runoff volume in **line 38** with the post-development (with BMPs) runoff volume in **line 40**. If the post-development volume (with BMPs) for the 10-year or 25-year storm is less than or equal to the pre-development volume for a given storm event, then detention is not required. If the post-development volume (with BMPs) for the 10-year or 25-year storm is greater than the pre-development volume for a given storm event, then detention will be necessary, and the Adjusted Curve Numbers from **line 41** should be used to calculate the post-development peak runoff rates.