Worksheet for Single Family Lot

Help Sheet – May 16, 2011

This sheet will give explanation of worksheet/program sections, definitions and explanation of calculations being performed

Purpose

The purpose of this worksheet and web-based program is to help a homeowner or builder determine the amount of excess stormwater runoff that will come off their property after construction of the home.

It will also assist in selecting the controls necessary to control this excess runoff so that our water resources are not impacted. Scientists have determined that excess freshwater runoff into our saltwater tidal waters can impact our fishery resources.

It will allow the user to print out a sheet that can be used to document satisfactory controls so that a zoning permit can be obtained. This zoning permit is necessary for issuance of a building permit.

Section 1- Lot Information

This information is used to compute the excess runoff after construction. If a homeowner is planning an irrigation system, (entered in section 1) storage and reuse of stormwater from rooftop should be considered for a portion of the irrigation needs. Use of drinking water for irrigation is an expensive alternative for homeowners and reduction of this can save money as well as reducing amount of water running off the parcel after construction. While this is recommended storage and reuse is optional because of its initial cost.

Section 2 – Post Construction Stormwater Run-off Calculations

The amount of excess run-off in gallons will be computed for you. It will depend on whether your soil is sandy or clay (entered in section 1). The rainfall event that is used to determine the amount of runoff to be controlled is a 1.95 inch rainfall (95^{th} percentile of average events in a year) in a 24 hour period. Before construction, on sandy soils generally no runoff will occur with the 1.95 inch rainfall event. For clay soils, over 0.5 inch of a 1.95 rainfall will runoff before construction. Taking this into account the program will determine the runoff to be controlled, in gallons, after construction.

Section 3 – Application of Best Management Practices

This section takes the gallons determined in section two and takes you through three steps that will reduce these gallons until they are all being controlled. The first step is an optional **storage and reuse/infiltration practice.** This practice will utilize a holding facility of some size and then the water can be utilized for reuse or infiltrated at a slow rate from the storage facility.

When storage is utilized it will control a certain amount of rooftop impervious surface. The maximum storage allowed for credit is limited to the rooftop impervious surface in

square feet times 1.15. Additional storage can be added but credit is limited to 1.15 gallon per square feet of rooftop surface. When storage is used it decreases the amount of impervious surface that needs to be handled by the other practices. This is called unaddressed impervious surface.

The second practice is **disconnected impervious surface** and it can utilize the natural infiltration capacity of the lot to contol water running off unaddressed impervious surfaces. It will require a determination of which way the water sheet flows across the lot. The program allows up to two directions to be selected. You must estimate the impervious surfaces and pervious portion of the lot it is running over. If lot flows in one direction this is easy. It would be the unaddressed impervious surface and the previous surface it flows over to the end of the lot. If the ratio of unaddressed impervious surface to pervious area is greater than 5 there will be no credit and runoff is better controlled by the next step. The attached figures 1 and 2 give examples of one and two direction calculations to help you determine input figures for this practice.

If after the employing the first two practices there is still excess runoff to be handled, **raingardens and other bioretention practices** will be used to control the remaining runoff. This will be computed for you and you will be given a square foot size of a standard raingarden. This standard size raingarden is three feet deep and can have special soil or sand and rock mixture that will store runoff and allow it to infiltration.There is some flexibility between storage and reuse and raingardens. If you want less raingardens, you can increase storage and vice-versa.
There is an attached sheet at the end of this help sheet that gives examples of practices under this step.

It should be remembered that impervious surface on the property causes the excess volume that needs to be controlled. The amount of controls can be reduced by decreasing the impervious surface on the property by considering pervious driveways and walks, reducing rooftop size (two story vs one) and other practices.

Section 4 – Summary of Volume Reduction Practices

This section is computed for you to show a summary.
This program allows you to print a one page sheet that summarizes entry and practices being used. This sheet would be attached to zoning and building permits and will be checked at completion of the project.

Definitions

Impervious Surface – hard surface that allow rainfall to run off and not infiltrate into soil.
Rooftop impervious surface – horizontal surface area of rooftops including overhangs and other detached buildings/sheds.
Other impervious – generally hard surfaces on the ground like paved driveways, patios, walkways and sidewalks..

Pervious Surface – surface that is not hard, might be grass, garden or forest area. Also includes gravel and dirt driveways
Irrigated area is area that would be served by an installed irrigation system.
Unaddressed impervious surface – term used to determine amount of impervious surface or runoff gallons that had not been controlled by a previous practice.
Standard Raingarden – raingarden that has 3 ft of fill material and a 6 inch maximum ponding depth. Different sizes can be constructed but then credits must be computed from Beaufort County BMP manual.

Conversions

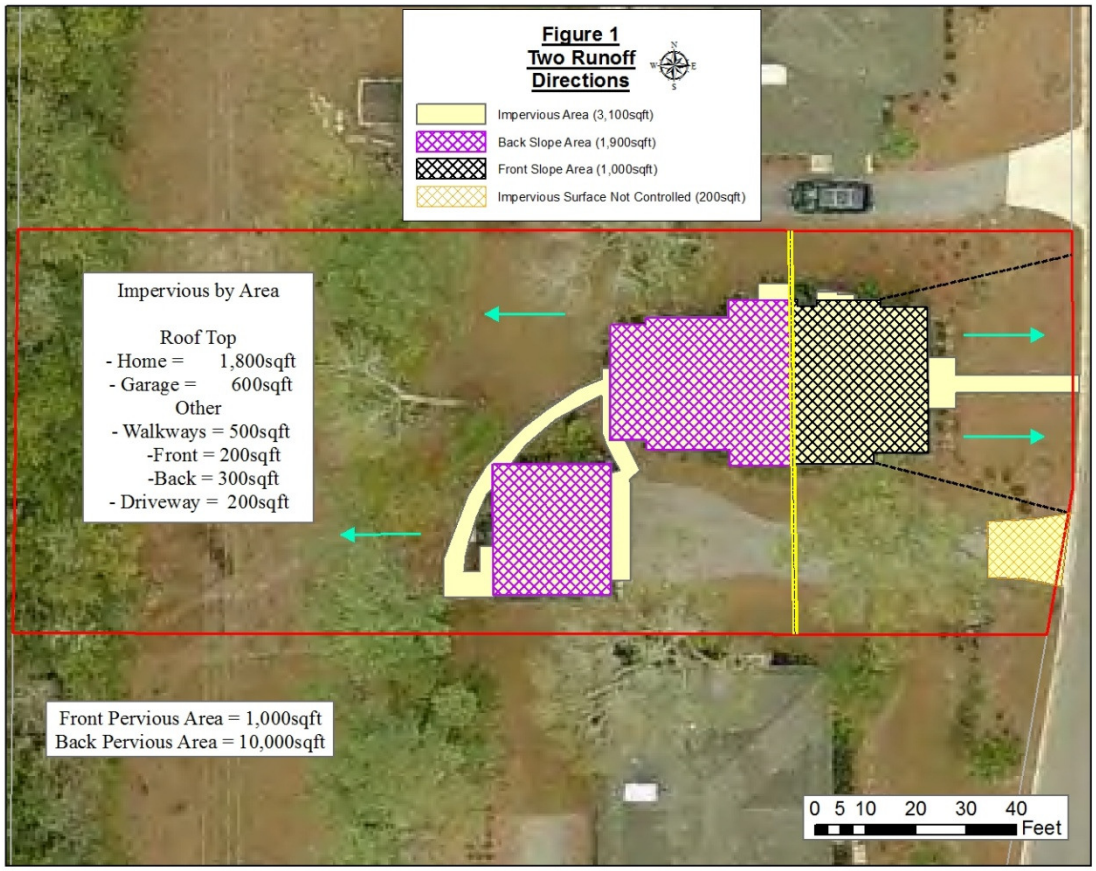
Rainfall to gallons of Runoff
Design storm is 1.95 inch of which 1.85 inch is available to run off impervious surface. 1.85 inch on 1 square foot of impervious surface is equivalent to 1.15 gallon of runoff
Preconstruction Runoff
Clayey Soils – 0.53 inches run off for a 1.95 inch storm. 0.53 inch on 1 square foot is equivalent to 0.33 gallon of runoff.
Sandy Soils – No runoff for a 1.95 inch storm
Storage and Reuse – if irrigation is used on parcel then storage must be between 0.3 gallon/square foot of rooftop impervious surface to maximum credit of 1.15 gallon/square foot of rooftop impervious surface. Storage can be larger but maximum credit is 1.15g/sqft.
Raingarden
Square foot of impervious surface per square foot of standard raingarden

- Clayey soils 4 sqft of impervious surface to 1 sqft of standard raingarden
- Sandy soils 7 sqft of impervious surface to 1 sqft of standard raingarden

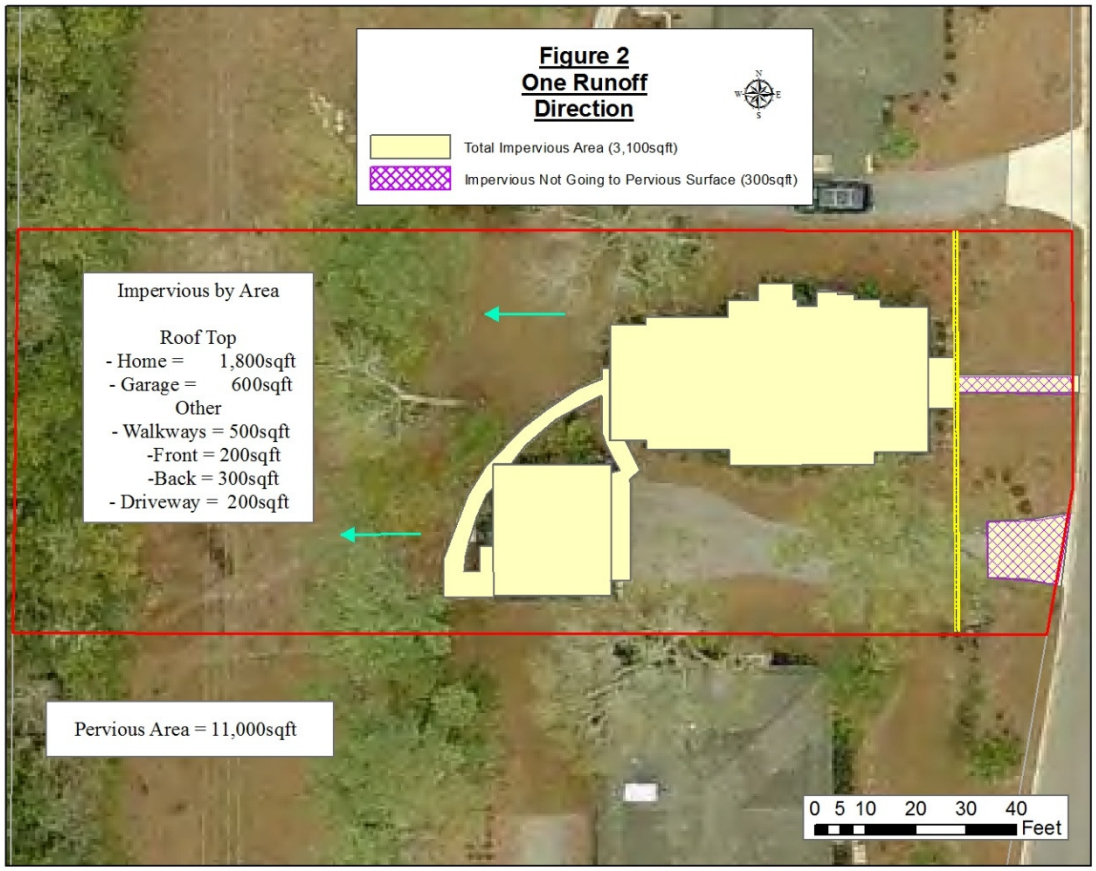
Disconnected Imperviousness – is practice of running uncontrolled stormwater flow from impervious surfaces over pervious surfaces to take advantage of natural infiltration of the soil. Credit is given in the following tables based on ratio of impervious surface over pervious surface to compute a ratio.

Credit Table for Disconnected Impervious Area

Disconnected Impervious Ratio	Runoff reduction Gal/sq.ft-impervious area	Runoff reduction Gal/sq.ft-impervious area
	Clayey	Sandy
0.1	.40	1.15
0.2	.40	1.12
0.4	.38	1.08
0.8	.33	1.01
1.0	.31	.98
2.0	.24	.84
3.0	.19	.74
4.0	.16	.67
5.0	.14	.60



This is a home on a 16,000 sqft lot with about 2,500 sq ft of living space.
In this example runoff from 1000sqft of impervious surface flows towards the front of the house. It can be made to sheet flow over 1000 sq ft of lawn (pervious surface). Therefore on the worksheet or web program you would enter 1000 in impervious area and 1,000 in pervious area of the first direction.
The second direction is to the back of the home and this 1900 sqft of rooftop and other impervious surface flow over 10,000 sqft of lawn and forest area.
Therefore we would enter in second direction 1900 sqft in impervious area and 10,000 in pervious area.
In this example there is 200 sqft (paved portion of driveway) that cannot sheet flow over enough pervious area to receive a credit and would not be included in calculations
If storage and reuse/infiltration was used in the first step (say two 500 cisterns/tanks in front of house) then the unaddressed impervious surface would be computed by reducing the first direction impervious surface.
Therefore the in first direction we would enter 130 in impervious surface (reduced by 870 sqft = 1000 gal/1.15 gal/sqft) and still 1000 in pervious surface.
See attached program printout for this example (with storage)



In this example we would have 2,800 (3,100- 300) sqft of impervious surface sheet flowing over 11,000 sqft of pervious surface out the back yard.

Therefore we would enter 2,800 in the first impervious area and 11,000 in the pervious area. The second direction would have zero entered in both categories.

Again if storage and reuse/infiltration was used we would need to reduce the impervious surface that we included in the worksheet or web program.

If for example we utilized two 500 gallon storage devices we would need to reduce the impevious surface by 870 sqft (1000gal/1.15 gal/sqft).
Therefore we would enter 1,930 in first impervious area and 11,000 in pervious area. The second direction would have zero in both categories.

Projected Web Based Zoning Permit Attachment

Date: 5/16/2011

Builder/Homeowner Input

Address	**Figure 1 Example with Storage**
Parcel Number	**R123-6-423**

Home/Rooftop	**2400**Square Feet
Other Impervious	**700Square Feet**
Total Lot Size	**16000Square Feet**
Soil Type	**Sandy**
Area to be Irrigated	**5000Square Feet**

Excess Stormwater from Homeowner Input = 3565

Program Approved Practices

Storage and Reuse

Practice	Number	Size	Quantity
Rainbarrel	0	0	0
Cisterns	2	500	1000

Disconnected Impervious Area

Practice	Impervious	Runoff Area	Quantity
First Runoff Direction	130	1000	149.5
Second Runoff Direction	1900	10000	2128

Raingarden

Size **35.71** Square Feet

Excess Stormwater controlled from practices = 3565 Gallons

Projected Web Based Zoning Permit Attachment

Date: 5/16/2011

Builder/Homeowner Input

Address	**Figure 2 Example with Storage**
Parcel Number	**R123-6-424**

Home/Rooftop	**2400**Square Feet
Other Impervious	**700Square Feet**
Total Lot Size	**16000Square Feet**
Soil Type	**Sandy**
Area to be Irrigated	**5000Square Feet**

Excess Stormwater from Homeowner Input = 3565

Program Approved Practices

Storage and Reuse

Practice	Number	Size	Quantity
Rainbarrel	0	0	0
Cisterns	2	500	1000

Disconnected Impervious Area

Practice	Impervious	Runoff Area	Quantity
First Runoff Direction	1930	11000	2161.6
Second Runoff Direction	0	0	0

Raingarden

Size 50.11 Square Feet

Excess Stormwater controlled from practices = 3565 Gallons

Examples of Raingardens and Bioretention Practices