

## BIORETENTION ROUTING

There are three basic methods for bioretention design:

1. Just use DURMM;
2. Just use TR-55/20 and pond design software; and
3. Use both DURMM and TR-55/pond software.

**Method #1** is appropriate for small sites with a few subareas – you would simply add the peak discharges from each subarea if they drained to a common analysis point since DURMM does not produce a hydrograph (this applies in both pre- and post-development). Size the bioretention area for 80% TSS removal with a maximum hydraulic load of 2.75 feet, which will probably be the controlling factor. The DURMM bioretention design routine assumes that in the quality storm event, there will be 6" of ponding above the top of the mulch, and in the 2-, 10-, and 100-year storms DURMM assumes that there will be 18" of ponding above the top of the mulch. So your outlet structure should be set 6" above the mulch, and should be designed to convey your largest design storm away from the bioretention area with no more than 18" of ponding above the top of the mulch (using the peak discharges computed on the post-development sheet). If you still have a quantity increase after the bioretention design and have to provide additional detention storage, you will have to use another design method, because you cannot design detention storage areas with DURMM.

**Method #2** can be used on any site. Page 2 shows the routing procedure (provided by DNREC) for designing bioretention areas with TR-55/20 and pond routing software. It is generally self-explanatory – for purposes of setting up the model, you would treat the bioretention area just as you normally would a pond. The disadvantage of this method is that there is probably some trial and error in selecting the bioretention size to produce less than 6" of ponding in the quality storm and less than 18" in the 100-year storm. The advantage is that you will probably end up with a smaller bioretention system, due to the conservatism built into DURMM's maximum allowable hydraulic load of 2.75 feet. There are some consultants who use DURMM "unofficially" just to get a starting size for the bioretention area to enter into the routing program.

**Method #3** can also be used on any site, and is probably the most popular method for sites where Method #1 cannot be used. You use TR-55/20 for the pre- and post-development quantity calcs, use DURMM to size the bioretention area, and combine as follows:

1. Use DURMM to size the bioretention area – since you are using TR-55/20 for your quantity calculations, just fill out the DURMM post-development sheet and the BMP Design sheet because you do your pre-development quantity calculations with TR-55/20.
2. Take the DURMM CN's and Tc's for the 2-, 10-, and 100-year storms and direct-enter those, along with the subarea acreage, into TR-55/20 for the subarea that contains the bioretention area.
3. **IMPORTANT - DO NOT MODEL THE BIORETENTION AREA AS A POND IN TR-55/20!** Your DURMM CN's and Tc's already account for infiltration and storage in the bioretention area, so if you also model the bioretention area as a pond in TR-55/20, you will be double-counting some runoff losses.
4. If you are using bioretention for quality control and dry detention storage for quantity control, and you have a significant distance between your bioretention area discharge and your dry detention area, you could reach-route the bioretention subarea in TR-55/20 to the detention area. In this way, you would be accounting for any lag time that could affect the peak discharge and sizing of the detention area. If you are diverting the quantity storms to the detention area in a pipe, however, the travel time would be fairly short and it is probably not worth reach routing. If you are not going to reach route, then just set up the model so that the bioretention subarea discharges directly into the dry detention area, or to your analysis point.

## Design Criteria for Routing Bioretention Systems

### *Given:*

1. Bio-soil flow rate controls ( $f=2.83"/hr.$ ); if designed as infiltration system, design soil infiltration rate (DIR) controls if  $DIR < 2.83" hr.$
2. Available storage in bio-soil mix based on porosity ( $n = 0.40$ )
3. Available storage in aggregate based on porosity ( $n = 0.40$ )

*Determine:* Routed hydrograph results for 2.0", 2-YR, 10-YR and 100-YR storm events, as applicable.

### *Procedure:*

1. Develop stage-storage-discharge relationship for bioretention system.
  - a. Starting elevation to be bottom of bioretention system.
  - b. Multiply each incremental volume by porosity (0.40) to determine available storage in the stone aggregate and bio-soil mix; continue with this adjustment to top of bioretention system.
  - c. Discharge is determined based on given conditions above.
2. Route 2.0" rainfall event
  - a. System meets WQ requirements if routed water surface elevation does not exceed 6" in depth above the surface of the bioretention area.
  - b. If designed as infiltration practice, drawdown time not to exceed 48 hours.
3. Route remaining regulatory storm events.
  - a. System meets quantity control requirements if routed outflow does not exceed pre-developed rates.
  - b. System meets design specifications if maximum ponding depth does not exceed 1.5' and when all freeboard, conveyance and non-erosive velocity criteria have been met.
  - c. If designed as infiltration practice, drawdown time not to exceed 48 hours.