

11.0 Post Construction BMPs Standards and Specifications

11.8 Vegetated Channels

11.8.1 Vegetated channels are open conveyances planted with grass or other suitable vegetation and having a shallow depth of flow to allow runoff to be filtered and recharged along the length of the channel. Design variants include:

11.8.1.1 Bioswale

11.8.1.2 Grassed Channel

11.8.2 Vegetated channels receive the following annual runoff reduction and pollutant reduction credits.

11.8.2.1 The R_{Pv} runoff reduction performance credit for a Bioswale on A/B soil or compost amended C soil is 50% annual runoff reduction.

11.8.2.2 The R_{Pv} runoff reduction performance credit for a Grassed Channel on A/B soil or compost amended C soil is 20% annual runoff reduction.

11.8.2.3 The R_{Pv} runoff reduction performance credit for a Bioswale on C/D soil is 25% annual runoff reduction.

11.8.2.4 The R_{Pv} runoff reduction performance credit for a Grassed Channel on C/D soil is 10% annual runoff reduction.

11.8.2.5 The C_v runoff reduction performance credit for Vegetated Channels is 10% of the R_{Pv} allowance.

11.8.2.6 The F_v runoff reduction performance credit for Vegetated Channels is 1% of the R_{Pv} allowance.

11.8.2.7 The total nitrogen pollutant reduction performance credit for Vegetated Channels is 100% of the load reduction.

11.8.2.8 The total phosphorous pollutant reduction performance credit for Vegetated Channels is 100% of the load reduction.

11.8.2.9 The total suspended solids pollutant reduction performance credit for Vegetated Channels is 100% of the load reduction.

11.8.3 Vegetated Channel Feasibility Criteria

11.8.3.1 The bottom of vegetated channels shall be above the seasonal high water table.

11.8.3.2 Approval from the applicable utility company or agency is required if utility lines will run below the vegetated channel.

11.8.4 Vegetated Channel Conveyance Criteria

11.8.4.1 The bottom width and slope of a vegetated channel shall be designed such that the flow depth based on 50% of R_{Pv} peak flow rate, does not exceed 4 inches.

11.8.4.2 Vegetated channels shall convey the Cv and Fv peak flow rate at non-erosive velocities for the soil and vegetative cover provided.

11.8.5 Every inlet into a vegetated channel system shall have pretreatment.

11.8.6 Vegetated Channel Design Criteria

11.8.6.1 Channel Geometry

11.8.6.1.1 The bottom width of a trapezoidal channel shall be a minimum of 2 feet wide to ensure that an adequate surface area exists along the bottom of the channel for filtering.

11.8.6.1.2 If a channel bottom will be wider than 8 feet, benches, check dams, level spreaders, or multi-level cross sections shall be incorporated to prevent braiding and erosion along the channel bottom.

11.8.6.1.3 Vegetated channel side slopes shall be no steeper than 3H:1V.

11.8.6.2 Check Dams

11.8.6.2.1 Check dams must be firmly anchored into the side-slopes to prevent outflanking; check dams must also be anchored into the channel bottom to prevent hydrostatic head from pushing out the underlying soils.

11.8.6.2.2 Check dams must be designed to pass the Cv design storm peak flow.

11.8.6.2.3 Check dams shall be composed of wood, concrete, stone, or other non-erodible material.

11.8.6.2.4 Each check dam shall have a weep hole or similar drainage feature, to allow for dewatering following a storm event.

11.8.6.3 All seeded vegetated channels require a minimum SSM-III biodegradable erosion control matting conforming to Delaware Erosion and Sediment Control Handbook.

11.8.6.4 The soil amendments, when used, shall extend over the length and width of the channel bottom, and the compost shall be incorporated to the depth as shown on the approved plan.

11.8.6.5 Adequate conveyance and treatment capacity shall be provided in accordance with the following guidelines:

11.8.6.5.1 Hydraulic capacity shall be verified using Manning's equation or an accepted equivalent method, such as tractive forces and vegetal retardance.

11.8.6.5.2 Design storm flow depth based on 50% of R_{PV} peak flow rate shall be maintained at 4 inches or less.

11.8.6.5.3 Manning's "n" value for vegetated channels shall be 0.2 for flow depths up to 4 inches, decreasing to 0.03 above 4 inches of flow depth. If alternative vegetation is used to increase the Manning's "n" value and decrease the

resulting channel width, material specifications and construction oversight shall be provided to ensure that the denser vegetation is actually established.

11.8.6.5.4 Peak flow rates for the Cv and Fv storms shall be non-erosive.

11.8.6.5.5 The Cv peak flow rate shall be contained within the channel banks.

11.8.6.5.6 If the Fv storm event is not contained within the channel, the area of inundation shall be shown.

11.8.6.5.7 The total peak discharge at the outlet shall be used to calculate the depth of flow and velocity for the channel unless lateral flow along the channel is calculated incrementally.

11.8.6.5.8 Hydraulic residence time is the time for runoff to travel the full length of the channel. For both Bioswales and Grassed Channels hydraulic residence time is computed based upon 50% of the RPv peak flow rate.

11.8.6.5.8.1 For Bioswales, the hydraulic residence time shall be a minimum of 9 minutes. If flow enters the channel at several locations, a 9-minute minimum hydraulic residence time shall be demonstrated for each entry point.

11.8.6.5.8.2 For Grassed Channels, the hydraulic residence time for concentrated flow entering the Grassed Channel shall be a minimum of 5 minutes.

11.8.6.5.8.3 Lateral flow entering the Grassed Channel as sheet flow may be excluded from residence time calculations but shall be accounted for in the channel depth and velocity calculations.

11.8.6.5.8.4 For Grassed Channels with in-line culverts, the proportion of grassed channel flow length shall be a minimum of 80% of the total flow length.

11.8.6.6 All Vegetated Channels must be designed so as to be accessible for maintenance.

11.8.6.6.1 A maintenance right-of-way or easement must extend to the Vegetated Channel from a public or private road.

11.8.6.6.2 Adequate maintenance access must extend to the full Vegetated Channel length.

11.8.6.6.3 Maintenance access must meet the following criteria:

11.8.6.6.3.1 Minimum width of 15 feet.

11.8.6.6.3.2 Profile grade that does not exceed

10H:1V.

11.8.6.6.3.3 Minimum 10H:1V cross slope.

11.8.7 Vegetated Channel Landscaping Criteria

11.8.7.1 A planting plan must be provided that indicates the methods used to establish and maintain vegetative stabilization of the vegetated channel.

11.8.7.2 Vegetated channels shall be established at such a density to achieve a 90% vegetated cover for project completion.

11.8.7.3 All seeded vegetated channels require a minimum SSM-III biodegradable erosion control matting conforming to Delaware Erosion and Sediment Control Handbook.

11.8.8 Vegetated Channel Construction

11.8.8.1 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:

11.8.8.1.1 Pre-construction meeting

11.8.8.1.2 Initial site preparation including installation of erosion and sediment controls, sensitive area protection surrounding vegetated channel locations, and blockage of inlets to vegetated channels

11.8.8.1.3 Excavation and grading including interim and final elevations

11.8.8.1.4 Construction of check dams and pretreatment practices, as applicable

11.8.8.1.5 Implementation of required stabilization and planting plan

11.8.8.1.6 Final construction review including development of a punch list for facility acceptance

11.8.8.2 Post Construction Verification Documentation.

11.8.8.2.1 Upon facility completion, the owner shall submit post construction verification documents as follows to demonstrate that the vegetated channel has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency:

11.8.8.2.1.1 Spot elevations of top of bank, bottom of bank, and centerline of the vegetated channel every 25 feet throughout the length of the channel

11.8.8.2.1.2 Additional spot elevations that demonstrate positive downstream drainage beyond the end of the vegetated channel

11.8.8.2.1.3 Cross section of the vegetated channel at the midpoint

11.8.8.2.1.4 Photo documentation of the vegetated channel depicting the channel bottom width and verification of achievement of the required 90% vegetated cover

11.8.8.2.2 The constructed slope, bottom width, depth, and length of the vegetated channel shall be within 10% of the design geometrics for those parameters.

11.8.8.2.3 In the event that the constructed allowable tolerances are exceeded for the vegetated channel, supplemental calculations shall be submitted to determine if the vegetated channel, as constructed, meets the design requirements. The computed residence time rounded to the nearest minute shall be no less than the minimum design residence time.

11.8.8.2.4 Performance of a vegetated channel shall be evaluated by the Department or Delegated Agency if requested in writing to determine if reconstruction of a vegetated channel that exceeds allowable tolerances is necessary.