Impervious Cover ("IC") Standard

It is desirable for a sub-watershed to be similar, in terms of water quality effects, to a watershed with 10% or less impervious cover overall. Accordingly, under the IC Standard, the amount of impervious cover that would need to be eliminated (or treated to act as if it were eliminated) from the sub-watershed to reach the 10% target is calculated, and Warwick's proportional share of that amount is also determined. The IC Standard requires Warwick to provide treatment of impervious cover that is equivalent to completely eliminating its proportional share of the target reduction. The required treatment that Warwick must achieve is referred to as the Equivalent Area Requirement, because Warwick may treat a greater amount of impervious cover acreage to a lesser degree, such that the overall reduction (in terms of pollutant removal reduction, runoff volume reduction and peak flow attenuation) is equivalent.

1. Required Treatment Level (Equivalent Area Requirement) - Based on the total size of the Impaired Sub-Watershed and the amount of all (MS4 and non-MS4) impervious cover in the Impaired Sub-Watershed, Warwick shall calculate the area of impervious cover that would need to be eliminated from the entire (MS4 and non-MS4) Impaired Sub-Watershed to reach 10% impervious cover for the Impaired Sub-Watershed as a whole, and then express that area to be eliminated as a percentage of existing impervious cover in the sub-watershed. Warwick shall calculate the Equivalent Area for the MS4 impervious cover by multiplying that calculated percentage reduction for the overall sub-watershed by the total area of the MS4 impervious cover in the Impaired Sub-Watershed that discharges directly or indirectly to the Impaired Water Body Segment.

   Warwick shall implement treatment at least equal to completely eliminating the acreage of impervious cover equal to the Equivalent Area. The required level of treatment can be achieved by treating an amount of impervious cover acreage that is greater than the calculated Equivalent Area to a lesser degree than complete elimination. Warwick may implement a mixture of types and sizes of structural controls across catchment areas to the MS4 Discharge Point(s) in an Impaired Sub-Watershed to meet the Impervious Cover Standard, using credits for each control as described below, but Warwick must at least evaluate the feasibility of distributing infiltration structural controls across the Impaired Sub-Watershed in areas where the MS4 discharges go directly or indirectly to the Impaired Water Body Segment.

2. Under 10% IC - If the total (MS4 and non-MS4) impervious cover for an Impaired Sub-Watershed is less than 10%, Warwick need not implement any new structural stormwater controls in the Impaired Sub-Watershed, unless (a) RIDEM has specifically determined in an EPA-approved TMDL that Warwick should implement structural stormwater controls, in which case Warwick shall implement, at the locations indicated by the RIDEM, structural stormwater controls that are consistent with the assumptions and recommendations of the TMDL and the performance standards and criteria in a document entitled "RHODE ISLAND STORMWATER DESIGN AND INSTALLATIONS MANUAL AMENDED MARCH 2015" for water quality and groundwater recharge or (b) new structural controls are needed to achieve the requirements of Paragraph C(4)(a)(xix)2&3 of the Consent Agreement.

3. Treatment Credits - To achieve treatment equal to the Equivalent Area Requirement, Warwick shall implement structural controls or enhanced non-structural BMPs within the Impaired Sub-

Watershed that achieve equivalent area credits that total the elimination of the Equivalent Area calculated in paragraph 1 of this Attachment. For each area treated by structural controls or enhanced non-structural BMPs, the equivalent area credit is equal to the area of impervious cover treated by the control multiplied by the equivalent pervious cover factor. The equivalent pervious cover factor is a fraction ranging from 0 to 1 representing how similar the discharge from the treated impervious cover is to a similar area of the same size with no impervious cover. For example, a factor of 1 indicates that the discharge from the treated impervious cover is equal to the discharge from an area of the same size with no impervious cover, while a factor of 0.5 indicates that the treated discharge is similar to a discharge from an area of the same size that has 50% impervious cover. The area treated for enhanced non-structural BMPs shall be only the area of impervious cover subject to the enhanced non-structural BMP (*e.g.*, the actual street area subject to increased street sweeping) that discharges to the impaired water body.

The equivalent pervious cover factor shall be calculated as the average of the pollutant removal factor and the flow factor; the flow factor is the average of the runoff volume reduction factor and the peak flow attenuation factor. In other words, the equivalent pervious cover factor = ¼ [(2* pollutant removal factor) + runoff volume reduction factor + peak flow attenuation factor].

The pollutant removal factor, runoff volume reduction factor, and peak flow attenuation factor for a particular control are each equal to the percentage of impervious cover that would need to be completely eliminated from the control's treated area to reach the same pollutant removal, runoff volume reduction, or peak flow attenuation, respectively, as the control. For instance, if a two-acre area of impervious cover has a peak flow after installation of a control that is similar to a two-acre area that is 25% pervious and 75% impervious, the control would have a 25% peak flow attenuation factor.

The pollutant removal factor shall be calculated as described in paragraph 4 below, or another method approved by the EPA. The runoff volume reduction factor shall be calculated as described in paragraph 5 below, or another method approved by the EPA. The peak flow attenuation factor shall be calculated as described in paragraph 6 below, or another method approved by the EPA.

4. Pollutant Removal Factor - Unless another method is approved by the EPA, the pollutant removal factor shall be calculated using average annual ("yearly") phosphorous removal by the control (expressed as a percentage) as a surrogate for all pollutants. No removal of phosphorous is considered to be equivalent to no reduction of impervious cover, and a 90% removal of phosphorous is equivalent to all impervious cover eliminated. It is assumed that pollutants vary linearly with percentage of impervious cover. Therefore the pollutant removal factor is the percentage of yearly phosphorous removal divided by 0.9 (except that the pollutant removal factor shall not exceed 1). If the Impaired Water Body Segment is only impaired for nitrogen, Warwick may use the yearly nitrogen removal by the control (expressed as a percentage, using a method approved by the EPA) as an option to the yearly phosphorous removal by the control (expressed as a percentage) in calculating the pollutant removal factor.

For each control, the yearly phosphorous removal percentage shall be calculated according to the methods in Attachment P of the Consent Agreement.

5. Runoff Volume Reduction Factor - Unless another method is approved by the EPA, the runoff volume reduction factor is based on the percentage yearly reduction of runoff volume as a result of the control. No reduction in runoff volume is considered to be equivalent to no reduction of impervious cover, and a reduction of 90% of runoff volume is equivalent to all impervious cover eliminated. It is also assumed that runoff volume varies linearly with impervious cover percentage. The runoff volume reduction factor is therefore the percentage yearly reduction of runoff volume divided by 0.9 (except that the runoff volume reduction factor shall not exceed 1).

   For each control, the percentage yearly reduction of runoff volume shall be calculated according to the methods in Attachment P of the Consent Agreement.

6. Peak Flow Attenuation Factor -
   The peak flow attenuation factor is based on the highest twelve-hour runoff flow rate in an average year for conditions ranging from 0 to 100% impervious cover. This will be calculated assuming that peak flow varies linearly with the size of the area contributing flow, and varies linearly with the percentage of impervious cover in the contributing area.

   The highest twelve-hour runoff flow rate for each control will be calculated using the methods in Attachment P of the Consent Agreement.

   The peak flow attenuation factor will be calculated based on the reduction in peak flow rate achieved by the structural control from the completely impervious model. No reduction from the completely impervious model shall have a peak flow attenuation factor of 0, while a control that reduces peak flow down to the level of the completely pervious model shall have a peak flow attenuation factor of 100%; for partial attenuation of peak flow, the peak flow attenuation factor will be based on linear interpolation between the peak flow rates for the completely pervious and completely impervious models.