Stormwater Management Regulations Language

Under the appropriate section(s) addressing administrative review procedures and standards:

1. [*List required performance standards for Land Disturbance Review, including provisions required to comply with the MS4 General Permit, including its requirements pertaining to the retention and treatment of runoff for new development and redevelopment sites. Modify or amend to include the following provisions relative to runoff reduction credits for tree canopy.*]

2. To meet or partially meet the runoff retention requirements described above, stormwater management systems on new and redeveloped sites may use low impact development (LID) techniques to achieve reduction in stormwater runoff where soil, groundwater and topographic conditions allow. These may include but not be limited to reduction in impervious surfaces, disconnection of impervious surfaces, infiltration systems, [*list other LID techniques allowed*[1]] and preservation or provision of tree canopy in compliance with the [*name of municipality*] Stormwater Management Bylaw and these Stormwater Management Regulations.

Under the appropriate sections prescribing the development of a Stormwater Management Plan required for permit applications

The Stormwater Management Plan shall fully describe the project in narrative, drawings, and calculations. It shall at a minimum include:

1. [*List requirements for the Stormwater Management Plan and include the following provisions for describing tree canopy for which runoff credits will be claimed.*]

2. Narrative describing:

    a. [*List required contents of stormwater management narrative and include the following provision regarding tree canopy protection and enhancement.*]

    b. Where and how the project will provide for preservation of existing trees or the installation of new trees for which runoff reduction credits will be claimed under the provisions of these regulations. The narrative shall describe completely how existing trees will be preserved, how new trees will be installed, who will be responsible for maintenance and replanting, and how the tree canopy will be permanently maintained for the life of the project (40 years) or until redevelopment occurs.

[1] LID techniques covered by this provision should be addressed under the accompanying stormwater regulations. Also, the techniques should have a runoff reduction volume (or an equivalent reduction of area of impervious cover) that be quantified. Other sections of the Regulations which list acceptable LID practices should include tree canopy preservation and enhancement.

3. Plans

    a. [*List required contents of stormwater management plans and include the following provision regarding tree canopy protection and enhancement.*]

    b. Indicate existing trees to be preserved and for which runoff reduction credits are claimed under the application.

        i. Indicate size, species, and dimensions of existing tree crown for each tree qualifying for runoff reduction credit.

        ii. Provide a tabulation of the total area of ground-level impervious surface that will be located beneath existing tree canopy.

    c. Indicate proposed trees to be installed for which runoff reduction credits are claimed under the application.

        i. Indicate size, species, and projected dimensions of mature tree crown (use an age of 40 years for estimating mature crown diameter).

        ii. Provide a tabulation of the total area of ground level impervious surface that will be located beneath proposed canopy at maturity.

4. Calculations

    a. [*List required stormwater management calculations and include the following provision regarding tree canopy protection and enhancement.*]

    b. Provide calculations showing the computed runoff reduction credit for preservation of existing trees or provision of new trees, as stipulated in the methodology included in these Regulations.

Under the appropriate section(s) prescribing the provision of an Operation and Maintenance Plan for permit applications:

A stand-alone Operation and Maintenance Plan (O&M Plan) shall be provided at the time of application and shall include:

1. [*List requirements for the Stormwater Operation and Management Plan, and include the following provision for maintaining tree canopy for which runoff credits will be claimed.*]

2. For projects that claim runoff reduction credits for existing or new tree canopy, the O&M Plan shall include:

    a. A map showing locations of all trees designated for tree canopy reduction credits. The map shall be annotated to advise the party responsible for maintenance of

the obligation to maintain and replace the designated trees for the life of the project (40 years).

b. Instructions for the routine care of the trees for the life of the project. The instructions shall be prepared by a qualified professional (Registered Landscape Architect, Massachusetts Certified Arborist, or other professional approved by the municipality).

c. Provisions for the replacement of trees that die or are damaged beyond salvage, for the life of the project. Dead or severely damaged trees shall be replaced within 6 months with new trees meeting the requirements of these regulations.

Under the appropriate section(s) prescribing Performance and Design Standards for permit applicants

[*List performance and design standards applicable to the Stormwater Management System required under the regulations and include the following provision for tree canopy for which runoff credits will be claimed.*]

Tree Canopy Runoff Credits and Requirements[2]

1. A "Tree Canopy Runoff Credit" shall be allowed when new or existing tree canopy from a list of approved species extends over ground level impervious cover:

   a. The credit shall consist of a reduction in effective impervious area, and shall be calculated as stipulated in these Regulations.

   b. Ground level impervious cover includes paved streets and parking areas, sidewalks, and other impervious surfaces at grade. Ground level impervious cover does not include the roofs of structures.

   c. The credit (in terms of square feet of impervious cover) may be deducted from the total area of impervious surface that must be managed under the runoff retention and treatment requirement of the USEPA MS4 Massachusetts General Permit (see Paragraph 7 below.[3]

   d. The tree canopy credit shall <u>not</u> be used to reduce the area of impervious surface for the analysis of peak runoff rates or volumes.

[2] If MassDEP adopts a Low Impact Development Credit for Tree Canopy, then this regulation could reference the MassDEP provision instead of adopting the following tree credit allowance provisions.

[3] If MassDEP amends the Massachusetts Stormwater Handbook to include runoff reduction credits for tree canopy, then the qualifying area could also be used to reduce the area requiring management under Stormwater Management Standards 3 (Recharge) and 4 (TSS Removal).

e. To qualify for tree canopy runoff reduction credits, existing trees to be preserved and proposed tree plantings shall meet the requirements specified in these regulations.

2. To qualify for tree canopy runoff reduction credit, the tree species must be non-invasive species suitable for use in an urban environment. Trees shall be species found on the municipality's approved tree list, unless otherwise authorized by the (*stormwater review authority*).

3. Drawings and supporting documents shall indicate how existing and new trees will be protected and maintained during construction.

   a. To qualify for tree canopy runoff reduction credits, existing and proposed trees shall be protected during construction according to written instructions prepared by a qualified professional (Registered Landscape Architect, Massachusetts Certified Arborist, or other professional approved by the municipality).

   b. Generally, disturbance within the essential root zone, defined as the area located on the ground between the tree trunk and 10 feet beyond the drip line of an existing tree, shall not be permitted, except where conducted in strict accordance with such instructions.

4. Existing trees proposed for preservation and new trees proposed for installation to qualify for runoff reduction credits shall be considered an integral component of the stormwater management system, and shall be subject to the review, inspection, completion, surety, and other procedural requirements applicable to other stormwater management system components under these regulations.

5. Tree Canopy Credits for new trees

   a. New trees shall be deciduous trees at least 2-inch diameter at breast height (dbh) to qualify for the credit. (Coniferous trees are not typically installed to overhang impervious surfaces, and are not included as qualifying trees for the purposes of this regulation.)

   b. The Effective Impervious Cover Reduction (EIC_R) shall be calculated for new trees as follows:

      i. Tabulate the qualifying Canopy Area (CA) consisting of the area of ground level impervious surface beneath the canopy projection area (i.e., within the drip line) of new trees for which credit is claimed. The area shall assume the tree canopy projection at maturity (40 years). Pervious surfaces beneath the canopy shall not be included in this tabulation.

      ii. Credit for EIC_R shall be computed as follows:

Stormwater Management Regulations Language

Maximum $EIC_R = (0.075) \times (CA)$[4] where EIC_R and CA are measured in square feet.

c. The reduction credit shall be dependent on the provision of sufficient soil volume to sustain a mature tree, as follows:

i. For full credit, each new tree shall be installed in a planting bed or trench with a soil volume available for rooting (S_v) equal to two (2) times the total canopy projection area (CP) of the tree at maturity (use 40 years as the age at maturity):[5]

$S_v = 2 \times (CP)$, where is CP is measured in square feet and S_v in cubic feet.

ii. If the actual provided soil volume does not equal 2 times the mature canopy area, the tree may receive partial credit, prorated based on soil volume according to the formulas:

Adjustment factor = (actual S_v) / (2 x CP)

Credited EIC_R = (Adjustment Factor) x (Maximum EIC_R) [6]

iii. The soil shall consist of native natural soil materials or installed planting media meeting standard horticultural practices, designed to promote normal, healthy root penetration and tree growth. The required soil volume shall not extend under pavement or other compacted surfaces, unless the applicant provides for specialized structural soils systems specifically designed for tree plantings.[7]

iv. The soil shall have a depth of at least 3 feet.

6. Tree Canopy Credits for existing trees.

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[4] This formula accounts for the average interception benefit of a tree from the time it is installed (2-inch caliper) until the time it reaches its mature size.

[5] For example, a tree with a mature crown diameter of 30 feet has an area at the drip line equal to 707 square feet. The required soil volume for this tree would be 2 X 707 = 1414 cubic feet. At four feet of soil depth, the required planting area for this tree would be 354 square feet of suitable planting material.

[6] For example, in the above case, if the designed planting bed has only 400 cubic feet of soil volume (e.g., 10 ft. x 10 ft. x 4 ft. depth), then the tree credit shall be multiplied by the factor: 400/1414 = 0.28. That is, only 28% of the maximum allowable credit shall be allowed for that tree. Note that tree boxes are typically much smaller than the reduced area used for this example; their size confines the roots of the installed trees and inhibits the natural growth and crown development of the trees, reducing the long term potential runoff reduction benefits. One purpose of this report and the recommended regulatory language is to encourage the provision of a growing environment that fosters the long-term viability of canopy trees.

[7] See discussion of structural soils systems in Chapter 4.

Stormwater Management Regulations Language

a. Existing trees shall be at least 4-inch diameter at breast height (dbh) to be eligible for the reduction.

b. A qualified professional (Massachusetts Registered Landscape Architect, Massachusetts Certified Arborist, or other professional approved by the municipality[8]) shall document the following:

   i. The location of each existing tree proposed for credit is suitable for continued growth and health of the tree (including but not limited to consideration of such factors as proximity to power lines, overshadowing by larger trees, and proximity to buildings and pavements);

   ii. The tree is in healthy condition, based on visual examination of factors including but not necessarily limited to evidence of disease, pest infestation, foliage die-back, and structural deficiencies.

c. The reduction credit shall be calculated for existing trees as follows:

   i. Tabulate the qualifying Canopy Area (CA) consisting of the area of ground level impervious surface beneath the canopy projection area (i.e., within the drip line) of the existing trees for which credit is claimed. Pervious surfaces beneath the canopy shall not be included in this tabulation. Project plans should documentation the extent of the existing canopy.

   ii. Credit for Effective Impervious Cover Reduction (EIC_R) shall be computed as follows:

   Credited $EIC_R = (0.15) \times (CA)$[9]

d. The project design shall ensure the existing tree will be viable following completion of the project.

   i. Except as may be otherwise provided by a qualified professional as described below, the tree shall be protected during construction according to the practices outlined in the publication *Protecting Trees from Construction Damage* (Nancy

[8] If the community employs a tree warden or community arborist, this provision may include that person in the list of approved professionals.

[9] This formula accounts for the interception benefit of the tree at the time of permit issuance, and assumes no increase in benefit over time.

Miller, David Rathke, and Gary Johnson, 1993, rev. 1999, Saint Paul, MN: Minnesota Extension Service).[10]

ii. Any new earth disturbance within the essential root zone, defined as the area located on the ground between the tree trunk and 10 feet beyond the drip line of an existing tree, shall be prohibited unless the following provisions are followed.

iii. Such disturbance shall only be conducted in strict accordance with written tree preservation/protection instructions prepared by a qualified professional (Massachusetts Registered Landscape Architect, Massachusetts Certified Arborist, or other professional approved by the municipality);

iv. Finished grade shall be no higher than the trunk flare of each tree to be retained. If a grade change of 6 inches or more at the base of a tree is proposed, a retaining wall or tree well shall be required, unless alternative measure is specified by a qualified professional;

v. The applicant shall provide performance surety approved by the municipality, providing for the replacement with a qualifying new tree in the case that the existing tree dies within 5 years of the date of issuance of a certificate of compliance under these regulations.

7. Remaining impervious surface requiring retention and/or treatment under the provisions of the MS4 General Permit.

   a. Tabulate the total area of impervious cover (IC) subject to runoff retention and treatment under these regulations.

   b. Tabulate the total Credited EIC_R for existing and new tree canopy as provided in these regulations.

   c. Compute the Effective Impervious Cover (EIC) for which runoff must be retained and infiltrated and/or treated under these regulations, using the following formula:

      $EIC = (IC) - (EIC_R)$ where EIC, IC, and EICR are measured in square feet.

   d. The remaining EIC shall be retained and treated as provided by these regulations using a combination of other LID techniques and Best Management Practices.

[10] Accessed at http://www.extension.umn.edu/garden/yard-garden/trees-shrubs/protecting-trees-from-construction-damage/

Example Tree Credit Calculation

A project subject to issuance of a stormwater permit under the regulations will result in the development of 60,000 square feet of impervious surface.

The site plans document the preservation of existing trees in compliance with the terms of the regulations, to provide 6,000 square feet of canopy extending over parking areas, walks, and drives.

The proposal also provides for 36 new trees whose estimated crown diameter at maturity will be 40 feet (20-foot radius), if the trees are planted with sufficient space for root growth.

- 12 of the new trees will <u>each</u> be planted in a 10-foot by 20-foot landscaped island located in a parking area, with suitable soils extending to at least 4 feet of depth.
- The remaining 24 trees are planted in lawn areas and spaced so that available soil for root penetration exceeds 2600 cubic feet for each tree. The drawings document that the canopy overhanging pavement at full maturity would be 8,000 square feet.

The allowable reduction in effective impervious cover under the recommended regulations is computed as follows:

<u>Credit for existing trees:</u>

EIC_R existing trees = 0.15 x 6,000 square feet = 900 square feet

<u>Credit for new trees in planted islands:</u>

Crown project each tree: CP = (π) x (20 ft.)^2 = 1257 sq. ft.

Area of each planter: A = 10 ft. x 20 ft. = 200 sq. ft.

Impervious area beneath crown: CA_{each} = 1257 - 200 = 1057 sq. ft.

Total area of impervious under canopy: CA = 12 x 1057 = 12,684 sq. ft.

Maximum credit: EIC_R max. = 0.075 x CA = 0.075 x 12,684 = 951 sq. ft.

Required soil volume each tree: S_v = 2 x CP = 2 x 1257 = 2514 cu. ft.

Soil volume provided each tree: S_v actual = 10 x 20 x 4 = 800 cu. ft.

Adjustment soil volume: Adj. Factor = 800/2514 = 0.32

Final credit for trees in planters:

EIC_R trees in islands = 0.32 x EIC_R max = 0.32 x 951 = 304 sq. ft.

<u>Credit for new trees in lawn areas, with tree canopy overhanging pavement:</u>

EIC_R trees in lawns = 0.075 x 8,000 sq. ft. = 600 square feet.

<u>Total credit for all qualifying trees:</u>

EIC_R = 900 + 304 + 600 = 1804 sq. ft.

Stormwater Management Regulations Language

This area can be deducted from total impervious area used to compute the volume of runoff that must be retained and/or treated under these standards.