PERMANENT (POST-CONSTRUCTION) STORMWATER MANAGEMENT

- Draft Chapter From: *Innovative Land Use Planning Techniques* -

Related Tools in Innovative Land Use Planning Techniques: *Landscaping, and Steep Slopes and Ridgeline Development*

Background and Purpose

Stormwater runoff is water from rain or melting snow that does not soak into the ground. It flows over land from rooftops, paved areas and bare soil, and steep slopes and saturated vegetated areas. As it flows, stormwater runoff collects and transports pollutants including sediment and organic matter; pet waste; automobile fluids (oil, grease, gasoline, antifreeze); deicing products (road salt); pesticides and fertilizers; grass clippings, leaves and other yard waste; and cigarette butts and other litter.

While traditional stormwater management practices are designed to collect, detain, and divert water to the nearest surface water body or watercourse, time and experience have shown that this approach does not adequately address the cumulative hydrologic or water quality impacts of stormwater. Development creates impervious surfaces that prevent water from infiltrating through the underlying soil. Impervious and disturbed surfaces from development can cause changes to both water quality and hydrology, or the movement of water through the landscape.

[MARGIN NOTE: Infiltration is the movement of water from the land surface into the soil. Infiltration occurs naturally in the undeveloped landscape as water, from rain or snowmelt, soaks into the ground, often using the roots of trees and other vegetation to travel through soil layers. Infiltration is important to replenish groundwater supplies, often used for drinking water, and for maintaining the volume of water flowing in streams and wetlands during dry weather. It is also important in treating stormwater to remove pollutants.

On an undeveloped site, the land has a natural rate of infiltration, also referred to as groundwater recharge, which is the volume of water that soaks into the ground and replenishes groundwater aquifers over a set period of time. This rate is dependent on a number of factors including type of soil, slope of the land, type of vegetation cover and depth to a confining layer, such as bedrock or the water table.

When that same site is developed, impervious surfaces, such as rooftops, roads, and driveways, block water on the land surface from soaking into the soil. This reduces the volume of water that infiltrates to recharge groundwater supplies and increases the amount of runoff from a site.]

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Changes to water quality from increased impervious surface cover include increased pollutant loads, higher bacterial contamination, and higher temperatures. These changes can degrade fisheries, inhibit certain uses, such as swimming, and increase treatment costs for public water supplies. Hydrologic changes resulting from increased impervious area include increased volume and velocity of stormwater runoff entering receiving waters, reduced groundwater levels, more frequent high flows in streams during wet weather (i.e. "flashy" streams), reduced stream flows during dry weather, unnatural changes in stream channels and banks that reduce habitat quality, and more frequent and severe flooding.

Thus, an essential part of stormwater management is maintaining the natural hydrology of a site to the maximum extent possible. This is accomplished by limiting land disturbance as much as possible, slowing down the flow of stormwater to maintain peak flows and increase infiltration, and treating stormwater on-site to maintain and protect the quality of receiving waters. Non-traditional and non-structural methods, such as minimizing clearing and grading, maintaining natural flow paths, and disconnecting impervious surfaces, focus on prevention and reduction of stormwater volumes and pollutants at their source and help to maintain the natural hydrology of a site. These approaches are typically preferred where possible and may reduce the need for structural best management practices. For example, runoff can be diverted along existing land contours to localized low spots on a site where it will be retained, infiltrated or taken up by vegetation. Where natural vegetation is limited, areas can be constructed and planted with water tolerant vegetation, such as the creation of a bioretention area or rain garden, to provide similar treatment. If a lot is hilly, terraced slopes can slow the flow of runoff, while preservation or creation of wooded areas can effectively retain water on larger lots. Buffers of thick vegetation around surface water resources such as wetlands, lakes, ponds, or streams are considered among the most effective stormwater management practices. Since site disturbance has great influence over the hydrology of a site, the model stormwater ordinance presented here includes specific requirements and limits for site disturbance.

Appropriate Circumstances and Context for Use

Stormwater controls are recommended for all development sites. While state and federal permit requirements address the impacts of development on large sites, considerable development occurs on smaller sites that do not require permits from the U.S. Environmental Protection Agency (EPA) or New Hampshire Department of Environmental Services (DES). Yet these small-scale developments can have serious, cumulative impacts on water quality. To mitigate these effects, communities are encouraged to adopt a local stormwater management ordinance instituting stormwater controls for projects of all sizes and during all phases of development. This combination of local, state, and federal requirements will help to promote the long-term protection of water resources.

The model ordinance should satisfy EPA's requirements under Phase II of the National Pollutant Discharge and Elimination System (NPDES) for small municipal separate storm sewer systems (MS4, see margin note) to regulate land disturbances greater than one acre.

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[MARGIN NOTE: NPDES Stormwater Phase II requirements apply to municipalities located in or near an urbanized area as defined by U.S. Census (i.e., a central place (or places) adjacent to a densely settled surrounding territory that together have a residential population of at least 50,000 and an average density of at least 1,000 people per square mile). In New Hampshire, 45 communities must comply with Phase II requirements. However, the NPDES Construction General Permit, which applies to any construction activity disturbing more than 1 acre, applies statewide. See http://des.nh.gov/Stormwater/ for more information.]

DES also regulates alteration of terrain activity disturbing greater than 100,000 square feet, or 50,000 square feet within the protected shoreland zone. The model presented here is intended to be at least as stringent as the DES requirements and does take into account the proposed changes to the DES requirements. However, because the model is a performance standard approach, it does not include all the technical specifications for specific types of best management practices that are contained within the DES rules. Every effort has been made to ensure that any technical specifications that are included in the model are consistent with the DES requirements. In addition, in some areas, the model includes more stringent requirements and/or additional provisions not addressed by the DES program.

Stormwater management is necessary during all stages of site development including site planning and design, design review, construction, and post-construction permanent controls. The model language below is focused on post-construction stormwater management and assumes communities have adopted and will institute construction-phase stormwater management and sedimentation and erosion control requirements. Permanent stormwater management systems cannot be expected to function properly if adequate controls are not implemented during construction.

Construction-phase mitigation is not addressed in the model ordinance included in this chapter. Stormwater management controls instituted during construction are typically designed to be temporary, using methods such as silt fences, sediment basins, mulch, erosion control mats, berms, and check dams. Construction-phase requirements (also called sedimentation and erosion controls) deal primarily with preventing a build-up of sediments in on- and off-site surface waters, by controlling unstable soils. Alternatively, post-construction stormwater management measures are designed as permanent solutions to keep and treat water on-site. For more information on construction-phase stormwater management, refer to the Model Stormwater Management and Erosion Control Regulation prepared by the N.H. Association of Conservation Districts (February 1997) as well as the EPA and DES websites noted under references.

Legal Basis and Considerations for New Hampshire

Stormwater management requirements are best addressed through a performance-based zoning ordinance. Zoning is the appropriate means for addressing stormwater for the purpose of

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"promoting the health, safety, or the general welfare of the community" (RSA 674:16) and "to assure proper use of natural resources" (RSA 674:17). A performance-based approach (authorized under RSA 674:21) allows the community to specify the desired outcome or performance required by any development activity without being overly prescriptive regarding the specific techniques or approaches used. A zoning ordinance is also the appropriate means for addressing several issues affecting stormwater management, such as lot usage, density, location of buildings, and vegetative cover.

Although many larger sites are subject to state and federal stormwater management requirements, a local zoning ordinance provides the municipality the authority to act independently from state and federal officials to address any problems on the site or local water quality impacts. In addition, many building lots are too small to be subject to federal or state stormwater regulations. A local zoning ordinance ensures that all development activity must comply with the stormwater management requirements, including projects not subject to state or federal regulations and individual building lots that are not subject to subdivision or site plan review. Stormwater management requirements that apply to an individual building site that does not go through subdivision or site plan review are enforceable at the building permit stage and by a code enforcement officer.

A zoning ordinance can also authorize the planning board to require a more detailed stormwater management plan for certain types of development, such as for larger developments, developments subject to subdivision and/or site plan review, or for developments near sensitive resources. Under this situation, the planning board will develop site plan and subdivision regulations specifying what information is required in a plan and establishing any additional requirements for such sites.

Examples and Outcomes Where Techniques have been Applied

Nashua – The City of Nashua has a stormwater management ordinance that prefers runoff prevention measures and on-site stormwater treatment.

Merrimack – The Pennichuck Square redevelopment project used innovative stormwater practices to infiltrate runoff on a densely developed retail site. The project resulted in over 88 percent of the site's runoff being infiltrated and treated on-site where it had previously been piped untreated into Pennichuck Brook, Nashua's water supply. See Figure 1 for illustration.

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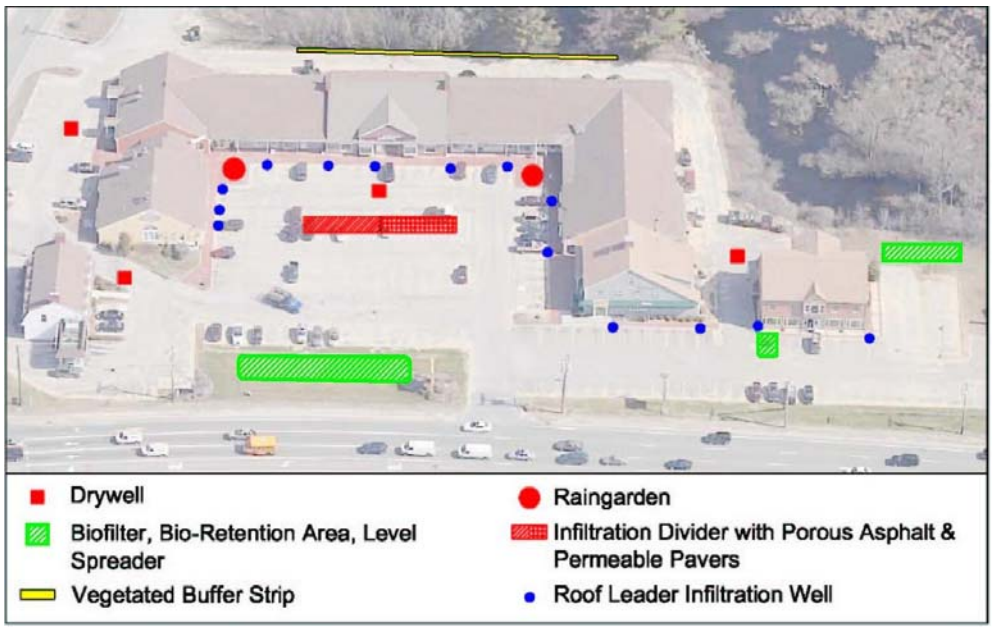
Figure 1: Low Impact Development Redevelopment Plan: Pennichuck Square, Merrimack NH



Comprehensive Engineers, Incorporated (CEI, 2005)

[NOTE: Need higher resolution picture for publication]

Model Zoning Language & Guidance for Implementation

PERMANENT (POST-CONSTRUCTION) STORMWATER MANAGEMENT MODEL ORDINANCE

I. PURPOSE

To protect, maintain and enhance the public health, safety, environment, and general welfare by establishing minimum requirements and procedures to control the adverse affects of increased post-development stormwater runoff, decreased groundwater recharge, and non-point source pollution associated with new development and redevelopment.

II. AUTHORITY

The provisions of this Article are adopted pursuant to RSA 674:16, Grant of Power, RSA 674:17, Purposes of Zoning Ordinance, and RSA 674:21, Innovative Land Use Controls.

III. APPLICABILITY

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The requirements of this Article shall apply to land disturbance, development, and/or construction activities in all zoning district(s).

IV. DEFINITIONS

[MARGIN NOTE: Communities should review existing definitions sections prior to the adoption of any of the following definitions to avoid duplication or conflicting definitions.]

Best Management Practice (BMP): Structural, non-structural and managerial techniques that are recognized to be the most effective and practical means to prevent and/or reduce increases in stormwater volumes and flows, reduce point source and non-point source pollution, and promote stormwater quality and protection of the environment.

Developer: A person who undertakes or proposes to undertake land disturbance activities.

Development: For the purposes of this article, development refers to alterations to the landscape that create, expand or change the location of impervious surfaces or alters the natural drainage of a site.

Drainage Area: Means a geographic area within which stormwater, sediments, or dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

Effective Impervious Cover: Impervious surfaces that contribute to stormwater runoff leaving the site. Effective impervious cover can be reduced by capturing and directing stormwater runoff generated by the impervious surface to an on-site retention, treatment and infiltration management device or practice. Detention practices that simply collect and slow the release of stormwater, such as large detention basins or ponds, do not reduce the effective impervious cover on a site.

Erosion: The detachment and movement of soil, rock, or rock fragments by water, wind, ice or gravity.

Impervious Surface: Land surface with a low capacity for soil infiltration, including but not limited to pavement, roofs, roadways, or other human structures, paved parking lots, sidewalks, driveways (gravel and paved), and patios. Total impervious surface cover shall be calculated by determining the total area of all impervious surfaces on a site as described above, regardless of whether the impervious surfaces are contiguous or non-contiguous.

Infiltration: The process by which water enters the soil profile (seeps into the soil).

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Land Disturbance or Land Disturbing Activity: For the purposes of this Article, refers to any exposed soil resulting from activities such as clearing of trees or vegetation, grading, blasting, and excavation.

Openness Ratio: Calculated by dividing a culvert's cross-sectional area by its length (OR = x-sec area ÷ length).

Owner: A person with a legal or equitable interest in a property.

Pervious Surface: Any material or structure on or above the ground that permits water to infiltrate into the underlying soil.

Recharge: The amount of water from precipitation that infiltrates into the ground and is not evaporated or transpired.

Redevelopment: The reuse of a site or structure with existing man-made land alterations. A site is considered a redevelopment if it has 35 percent or more of existing impervious surface, calculated by dividing the total existing impervious surface by the size of the parcel and convert to a percentage.

Regulated Substance: (1) Oil, as defined pursuant to RSA 146-A:2, III, or
(2) A substance listed in 40 CFR 302, 7-1-90 edition, with the following exclusions: ammonia, sodium hypochlorite, sodium hydroxide, acetic acid, sulfuric acid, potassium hydroxide, and potassium permanganate.

Sediment: Solid material, mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

Sensitive Area: For the purpose this Article include lakes, ponds, perennial and intermittent streams, vernal pools, wetlands, and highly erodable soils.

Sheet flow: Runoff that flows or is directed to flow across a relatively broad area at a depth of less than 0.1 feet for a maximum distance of 100 feet in such a way that velocity is minimized.

Site: The lot or lots on upon which development is to occur or has occurred.

Stormwater: Water resulting from precipitation (including rain and snow) that runs off the land's surface, is transmitted to the subsurface, or is captured by separate storm sewers or other drainage facility.

Stormwater Runoff: Water flow on the surface of the ground or in storm sewers, resulting from precipitation.

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Undisturbed Cover: A natural, vegetated land surface whose permeability has not been altered by human activity.

Vegetation: Is defined to include a tree, plant, shrub, vine or other form of plant growth.

Water Supply Intake Protection Area: Designated protection area for a surface water intake used as a source by a public water system.

Well Head Protection Area: As defined in RSA 485-C:2, the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such well or well field.

V. STORMWATER MANAGEMENT PLAN

All developments disturbing greater than 20,000 square feet of area shall submit a permanent (post-construction) Stormwater Management Plan (SMP) with an application for subdivision or site plan review. The permanent SMP, which shall be prepared by a licensed New Hampshire, professional engineer, shall address and comply with the requirements set forth herein and as specified by the planning board.

[**MARGIN NOTE: Each community should decide whether they want to require a separate management plan and, if so, what size development or disturbed area is subject to this requirement. A community might also decide to restrict the applicability of additional provisions from this model ordinance to larger developments or developments in more sensitive areas.]**

VI. PERMANENT STORMWATER MANAGEMENT REQUIREMENTS

All development activity must comply with the following provisions to reduce and properly manage stormwater post-construction:

A. Maximum effective impervious cover, that is, impervious surfaces that contribute to stormwater leaving the site, shall not exceed 10 percent of a site. Impervious surfaces may be disconnected from the stormwater drainage network, to reduce total effective impervious cover, through such techniques as infiltration or sheet flow over a pervious area.

[MARGIN NOTE: As noted in the definitions, Effective Impervious Cover is different from Impervious Cover. For example, to comply with this section, a site that creates 50 percent impervious cover must provide ample opportunities to capture and infiltrate stormwater to reduce the amount of stormwater leaving the site to be equivalent to having just 10 percent impervious cover (i.e., the site has 10 percent effective impervious cover).]

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B. BMP techniques shall be used to meet the conditions below for control of peak flow and total volume of runoff, water quality protection, and maintenance of on-site groundwater recharge.

1. Stormwater management practices shall be selected to accommodate the unique hydrologic and geologic conditions of the site.

[MARGIN NOTE: An example of a site condition that should be factored into the stormwater management approach is soil type. The areas of a site with the best soils for infiltration should be preserved to maintain natural infiltration or set aside to be used for infiltrating stormwater generated elsewhere on the site.]

2. The use of nontraditional and/or nonstructural stormwater management measures, including site design approaches to reduce runoff rates, volumes, and pollutant loads, are preferred and shall be implemented to the maximum extent practical. Such techniques include, but are not limited to, minimization and/or disconnection of impervious surfaces; development design that reduces the rate and volume of runoff; restoration or enhancement of natural areas such as riparian areas, wetlands, and forests; and use of practices that intercept, treat, and infiltrate runoff from developed areas distributed throughout the site (e.g. bioretention, infiltration dividers or islands, or planters and raingardens). Applicants shall demonstrate why the use of nontraditional and/or nonstructural approaches is not possible before proposing to use a traditional, structural stormwater management measures (e.g., stormwater ponds, vegetated swales).

3. The applicant shall demonstrate how the proposed control(s) will comply with the requirements of this ordinance, including the control of peak flow and total volume of runoff, protection of water quality, and recharge of stormwater to groundwater. The applicant must provide design calculations and other back-up materials necessary.

4. At the discretion of the planning board, stormwater management systems shall incorporate designs that allow for shutdown and containment in the event of an emergency spill or other unexpected contamination event.

[Margin note: Communities may wish to include a provision to require emergency shutdown and containment, particularly in commercial and industrial areas or in drinking water supply areas, as an added protection against contamination of surface waters or groundwaters.]

5. Stormwater management systems shall not discharge to surface waters, ground surface, subsurface, or groundwater within 100 feet of a surface water within a water supply intake protection area.

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6. Stormwater management systems shall not discharge within the setback area for a water supply well as specified in the following table:

Well Type	Well Production Volume (gallons per day)	Setback from Well (feet)
Private Water Supply Well	Any Volume	75
Non-Community Public Water Supply Well	0 to 750	75
	751 to 1,440	100
	1,441 to 4,320	125
	4,321 to 14,400	150
Community Public Water Supply Well	0 to 14,400	150
Non-Community and Community Public Water Supply Well	14,401 to 28,800	175
	28,801 to 57,600	200
	57,601 to 86,400	250
	86,401 to 115,200	300
	115,201 to 144,000	350
	Greater than 144,000	400

[MARGIN NOTE: The NHDES Alteration of Terrain program provides for exemptions to the above standards (5) and (6) for stormwater management systems that discharge stormwater from areas less than 0.5 acres and that do not and will not receive stormwater from a high-load area.]

7. BMPs shall be designed to convey a minimum design storm event, as described in the table below, without overtopping or causing damage to the stormwater management facility.

Treatment Practice	Design Storm Event
Stormwater Pond	50-year, 24-hour storm
Stormwater Wetland	50-year, 24-hour storm
Infiltration Practices	10-year, 24-hour storm
Filtering Practices	10-year, 24-hour storm
Flow through Treatment Swales	10-year, 24-hour storm

C. Protection of natural hydrologic features and functions.

1. Site disturbance shall be minimized. Vegetation outside the project disturbance area shall be maintained. The project disturbance area shall be depicted on site plans submitted as part of the site plan review process. The project disturbance area shall include only the area necessary to reasonably accommodate construction activities. The applicant may be required to install construction fencing around the perimeter of

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the proposed project disturbance area prior to commencing land disturbance activities.

2. Soil compaction on site shall be minimized by using the smallest (lightest) equipment possible and minimizing travel over areas that will be revegetated (e.g., lawn areas) or used to infiltrate stormwater (e.g., bioretention areas). In no case shall excavation equipment be placed in the base of an infiltration area during construction.

3. Development shall follow the natural contours of the landscape to the maximum extent possible. A grading plan shall be submitted as part of the site plan review process showing both existing and finished grade for the proposed development.

4. Cut and fill shall be minimized. The maximum height of any fill or depth of any cut area, as measured from the natural grade, shall not greater than 10 feet.

5. Any contiguous area of disturbance, not associated with the installation of a roadway, shall be limited to 20,000 square feet for residential development and to 100,000 square feet for other types of development. Contiguous areas of disturbance shall be separated by an area maintained at natural grade and retaining existing, mature vegetated cover that is at least 20 feet wide at its narrowest point.

[MARGIN NOTE: Communities may decide to allow a larger contiguous area of disturbance overall or in certain areas where appropriate, such as in areas zoned for larger-scale commercial or industrial use.]

6. No ground disturbed as a result of site construction and development shall be left as exposed bare soil at project completion. All areas exposed by construction, with the exception of finished building, structure, and pavement footprints, shall be decompacted (aerated) and covered with a minimum thickness of six inches of non-compacted topsoil, and shall be subsequently planted with a combination of living vegetation such as grass, groundcovers, trees, and shrubs, and other landscaping materials (mulch, loose rock, gravel, stone).

7. Priority shall be given to maintaining existing surface waters and systems, including, but not limited to, perennial and intermittent streams, wetlands, vernal pools, and natural swales.

a) Existing site hydrology shall not be modified so as to disrupt on-site and adjacent surface waters. The applicant must provide evidence that this standard can be achieved and maintained over time.

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b) Existing surface waters, including lakes, ponds, rivers, perennial and intermittent streams, wetlands, vernal pools, and natural swales, shall be protected by a 50 foot no disturbance, vegetated buffer.

[MARGIN NOTE: The 50 foot buffer requirement under 7.c. is meant as a bare-minimum standard for communities that do not have more specific buffer requirements. While a 50 foot buffer will provide some water quality benefits, it will not be adequate in all situations (e.g., particularly steep slopes) or sufficient to meet all the natural resource protection goals of a community. Communities should determine whether a broader buffer requirement is appropriate for their community to provide additional water quality and other benefits, such as wildlife habitat and corridor protection and human recreation opportunities. Other chapters in this series, particularly those pertaining specifically to the protection of surface water resources and habitat, provide additional information on appropriate buffer widths and protections to achieve various natural resource protection goals.]

c) BMPs shall not be located within the 50 foot no disturbance, vegetated buffer or within 50 feet of steep banks (greater than 15 percent slope).

d) Where roadway or driveway crossings of surface waters cannot be eliminated, disturbance to the surface water shall be minimized, hydrologic flows shall be maintained, there shall be no direct discharge of runoff from the roadway to the surface water, and the area shall be revegetated post-construction.

e) Roadway and driveway crossings over streams shall meet the following design criteria to accommodate high flows, minimize erosion, and support aquatic habitat and wildlife passage:

i. Natural stream bottoms.

ii. Sized for 1.2 x bank-full stream width (i.e., the width of the stream during the 1.5 year flow event).

iii. Bridges and culverts must have an openness ratio of ≥ 0.25 (calculated in meters) for perennial streams.

iv. Passageways under roads shall be designed to maintain water velocity at a variety of flows that is comparable to flows upstream and downstream segments of the natural stream.

v. Culverts shall have a trough or narrow channel in the bottom running the full length of the culvert to maintain sufficient water depth during low-flow periods to support fish passage.

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vi. Round culverts must be imbedded at least 25 percent.

D. Post-development peak flow rates and total runoff volumes.

1. The applicant shall provide pre- and post-development peak flow rates. Any site that was wooded in the last five years must be considered undisturbed woods for the purposes of calculating pre-development peak flow rates.

2. The two-year, 24-hour post-development peak flow rate shall be (a) less than or equal to 50 percent of two-year, 24-hour storm pre-development peak flow rate or (b) less than or equal to the one-year, 24-hour storm pre-development peak flow rate.

3. The 10-year, 24-hour post-development peak flow rate shall not exceed the 10-year, 24-hour pre-development peak flow rate for all flows off-site.

4. The 50-year, 24-hour post-development peak flow rate shall not exceed the 50-year, 24-hour pre-development peak flow rate for all flows off-site.

[MARGIN NOTE: The NHDES Alteration of Terrain program provides for exemptions to the above standards (2), (3), and (4) for projects that directly discharge to a stream, waterbody, estuary, or tidal water and where the applicant has provided supporting off-site drainage calculations for the 10-year and 50-year, 24-hour storm showing that at a point immediately downstream from the project site the post-development peak flow rate from the site and the off-site contributing area does not exceed the pre-development peak flow rate at that point.]

5. Measurement of peak discharge rates shall be calculated using point of discharge or the down-gradient property boundary. The topography of the site may require evaluation at more than one location if flow leaves the property in more than one direction. Calculations shall include runoff from adjacent up-gradient properties.

6. An applicant may demonstrate that a feature beyond the property boundary is more appropriate as a design point.

7. The applicant shall provide pre- and post-development total runoff volumes. Any site that was wooded in the last five years shall be considered undisturbed woods for the purposes of calculating pre-development total runoff volumes.

8. The post-development total runoff volume shall be equal to 90 to 110 percent of the pre-development total runoff volume (based on a two-year, 10-year, 25-year, and 50-year, 24-hour storms). Calculations shall include runoff from adjacent up-gradient properties.

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E. Water Quality.

1. If more than 35 percent of the total area of the site will be disturbed or the site will have greater than 10 percent effective impervious cover, the applicant shall demonstrate that their stormwater management system will:

a) Remove 80 percent of the average annual load of total suspended solids (TSS), floatables, greases, and oils after the site is developed.

b) Remove 40 percent of phosphorus.

[Margin Note: Depending on the existing water quality of downstream receiving waters, in particular if a waterbody is impaired or designated as an "outstanding resource water," development projects requiring an Alteration of Terrain Permit or a 401 Water Quality Certification from the state may be subject to more stringent pollutant removal requirements than specified in Sections E. 1. a) and b).]

2. Compliance with the recharge requirements under Section F, consistent with the pre-treatment and design requirements in Sections F.2 and F.3, shall be considered adequate to meet the treatment standards specified in VI.E.1.

3. Applicants not able to employ Section F must provide suitable documentation, including a pollutant loading analysis from an approved model, that the treatment standards specified in VI.E.1 will be met.

F. Recharge to Groundwater

Except where prohibited, stormwater management designs shall demonstrate that the annual average pre-development groundwater recharge volume (GRV) for the major hydrologic soil groups found on-site are maintained.

1. For all areas covered by impervious surfaces, the total volume of recharge that must be maintained shall be calculated as follows:

a) REQUIRED GRV = (Impervious Area) x (Groundwater Recharge Depth)

Where **Impervious Area** is the area of proposed impervious surfaces that will exist on the site after development.

And where **Groundwater Recharge Depth** is expressed as follows:

USDA/NRCS Hydrologic	Groundwater Recharge Depth (inches)

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Soil Group (HSG)	
A	0.40
B	0.25
C	0.10
D	not required

Example: Applicant proposes 30,000 square foot parking lot over C soils.

REQUIRED GRV = 30,000 X 0.10

REQUIRED GRV= 250 ft^3

b) Where more than one hydrologic soil group is present, a weighted soil recharge factor shall be computed.

2. Pre-Treatment Requirements

a) All runoff must be pretreated prior to its entrance into the groundwater recharge device to remove materials that would clog the soils receiving the recharge water.

b) Pretreatment devices shall be provided for each BMP, shall be designed to accommodate a minimum of one-year's worth of sediment, shall be designed to capture anticipated pollutants, and be designed and located to be easily accessible to facilitate inspection and maintenance.

[MARGIN NOTE: The use of below-ground pre-treatment devices should be discouraged because of the added difficulty in assessing their function and performing regular inspections and maintenance.]

3. Sizing and design of infiltration (recharge) BMPs

a) All units shall be designed to drain within 72 hours from the end of the storm.

[MARGIN NOTE: This design requirement addresses concerns about infiltration BMPs contributing to mosquito problems. Requiring such facilities to drain within 72 hours will prevent mosquitoes from successfully breeding.]

b) The floor of the recharge device shall be at least three feet above the seasonal high water table and bedrock.

c) Soils under BMPs shall be scarified or tilled to improve infiltration.

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d) Infiltration BMPs shall not be located in areas with materials or soils containing regulated or hazardous substances or in areas known to DES to have contaminants in groundwater above ambient groundwater quality standards or in soil above site-specific soil standards.

4. Infiltration may be prohibited or subject to additional pre-treatment requirements under the following circumstances:

a) The facility is located in a well-head protection area or water supply intake protection area; or

b) The facility is located in an area where groundwater has been reclassified to GAA, GA1 or GA2 pursuant to RSA 485-C and Env-Dw 901; or

c) Stormwater is generated from a "high-load area," as described under Section G.

G. Land Uses with Higher Potential Pollutant Loads

1. The following uses or activities are considered "high-load areas," with the potential to contribute higher pollutant loads to stormwater, and must comply with the requirements set forth in subsections 2, 3, and 4 below:

a) Areas where regulated substances are exposed to rainfall or runoff; or

b) Areas that typically generate higher concentrations of hydrocarbons, metals, or suspended solids than are found in typical stormwater runoff, including but not limited to the following:

i. Industrial facilities subject to the NPDES Multi-Sector General Permit (MSGP); not including areas where industrial activities do not occur, such as at office buildings and their associated parking facilities or in drainage areas at the facility where a certification of no exposure will always be possible [see 40CFR122.26(g)]".

ii. Petroleum storage facilities.

iii. Petroleum dispensing facilities.

iv. Vehicle fueling facilities.

v. Vehicle service, maintenance and equipment cleaning facilities.

vi. Fleet storage areas.

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vii. Public works storage areas.

viii. Road salt storage and loading facilities.

ix. Commercial nurseries.

x. Non-residential facilities having uncoated metal roofs with a slope flatter than 20 percent.

xi. Facilities with outdoor storage, loading, or unloading of hazardous substances, regardless of the primary use of the facility.

xii. Facilities subject to chemical inventory under Section 312 of the Superfund Amendments and Reauthorization Act of 1986 (SARA).

xiii. Commercial parking areas with over 1,000 trips per day.

c) If a high-load area demonstrates, through its source control plan, the use of best management practices that result in no exposure of regulated substances to precipitation or runoff or release of regulated substances, it shall no longer be considered a high-load area.

[MARGIN NOTE: Information on the Multi-Sector General Permit for commercial and industrial sites is available at http://cfpub.epa.gov/npdes/stormwater/swppp-msgp.cfm.]

[MARGIN NOTE: The above uses, (ii)-(xiii), are generally not subject to the MSGP, unless associated with another use or specific activity that is covered under the MSGP. A municipality may decide not to regulate one or more of these types of uses, or to cover additional types of uses that may represent a threat to water quality in their community (e.g., auto recyclers/salvage yards; marina service areas)]

2. In addition to implementation of BMPs for designing site-specific stormwater management controls, uses included under subsection G.1 shall provide a stormwater pollution prevention plan (SWPPP, see margin note), describing methods for source reduction and methods for pretreatment.

[MARGIN NOTE: Example Stormwater Pollution Prevention Plans (SWPPP) are available at http://cfpub.epa.gov/npdes/stormwater/swppp-msgp.cfm.]

3. Infiltration of stormwater from high-load areas, except commercial parking areas, is prohibited. Infiltration, with appropriate pre-treatment (e.g., oil/water separation) and subject to the conditions of the SWPPP, is allowed in commercial parking areas and others areas of a site that do not involve potential "high-load" uses or activities (e.g., where a certification of "no exposure" under the MSGP will always be possible).

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4. For high-load areas, except commercial parking areas, filtering and infiltration practices, including but not limited to, sand filters, detention basins, wet ponds, gravel wetlands, constructed wetlands, swales or ditches, may be used only if sealed or lined.

H. Parking

1. Snow may not be plowed to, dumped in, or otherwise stored within 15 feet of a wetland or waterbody, except for snow that naturally falls into this area. Snow storage areas shall be shown on the site plan to comply with these requirements.

2. At the discretion of the planning board, parking spaces may be allowed, or required, to be constructed of a pervious surface (i.e. grass, pervious asphalt, pervious pavers).

3. Infrequently used emergency access points or routes shall be constructed with pervious surfaces (i.e. grass, pervious asphalt, pervious pavers).

I. Redevelopment or Reuse

1. Redevelopment or reuse of previously developed sites must meet the stormwater management standards set forth herein to the maximum extent possible as determined by the planning board. To make this determination the planning board shall consider the benefits of redevelopment as compared to development of raw land with respect to stormwater.

2. Redevelopment or reuse activities shall not infiltrate stormwater through materials or soils containing regulated or hazardous substances.

3. Redevelopment or reuse of a site shall not involve uses or activities considered "high-load areas" unless the requirements under Section G. are met.

J. Easements

1. Where a site is traversed by or requires construction of a watercourse or drainageway, an easement of adequate width may be required for such purpose.

2. There shall be at least a ten foot wide maintenance easement path on each side of any stormwater management system element. For systems using underground pipes, the maintenance easement may need to be wider, depending on the depth of the pipe.

K. Performance Bond

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1. To ensure that proposed stormwater management controls are installed as approved, a performance bond shall be provided as a condition of approval in an amount determined by the planning board.

2. To ensure that stormwater management controls function properly, a performance bond shall be required, as a condition of approval, which may be held after final certificate of occupancy is issued.

L. Operation and Maintenance Plan

1. All stormwater management systems shall have an operations and maintenance (O&M) plan to ensure that systems function as designed. This plan shall be reviewed and approved as part of the review of the proposed permanent (post-construction) stormwater management system and incorporated in the Permanent Stormwater Management Plan, if applicable. Execution of the O&M plan shall be considered a condition of approval of a subdivision or site plan. If the stormwater management system is not dedicated to the city/town pursuant to a perpetual offer of dedication, the planning board may require an applicant to establish a homeowners association or similar entity to maintain the stormwater management system. For uses and activities under Section G, the O&M plan shall include implementation of the Stormwater Pollution Prevention Plan (SWPPP).

2. The stormwater management system owner is generally considered to be the landowner of the property, unless other legally binding agreements are established.

3. The O&M plan shall, at a minimum, identify the following:

a) Stormwater management system owner(s), (For subdivisions, the owner listed on the O&M plan shall be the owner of record, and responsibilities of the O&M plan shall be conveyed to the party ultimately responsible for the road maintenance, i.e. the Town of ____ should the road be accepted by the Town, or a homeowners association or other entity as determined/required under Section VI.L.1 above.)

b) The party or parties responsible for operation and maintenance and, if applicable, implementation of the Stormwater Pollution Prevention Plan (SWPPP).

c) A schedule for inspection and maintenance.

d) A checklist to be used during each inspection.

e) The description of routine and non-routine maintenance tasks to be undertaken.

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f) A plan showing the location of all stormwater management facilities covered by the O&M plan.

g) A certification signed by the owner(s) attesting to their commitment to comply with the O&M plan.

4. Recording:

a) The owner shall provide covenants for filing with the registry of deeds in a form satisfactory to the planning board, which provide that the obligations of the maintenance plan run with the land.

b) The owner shall file with the registry of deeds such legal instruments as are necessary to allow the city/town or its designee to inspect or maintain the stormwater management systems for compliance with the O&M plan.

5. Modifications:

a) The owner shall keep the O&M plan current, including making modifications to the O&M plan as necessary to ensure that BMPs continue to operate as designed and approved.

b) Proposed modifications of O&M plans including, but not limited to, changes in inspection frequency, maintenance schedule, or maintenance activity along with appropriate documentation, shall be submitted to the planning board for review and approval within thirty days of change.

c) The owner must notify the planning board within 30 days of a change in owner or party responsible for implementing the plan.

d) The planning board may, in its discretion, require increased or approve decreased frequency of inspection or maintenance or a change in maintenance activity. For a reduced frequency of inspection or maintenance, the owner shall demonstrate that such changes will not compromise the long-term function of the stormwater management system.

e) The planning board shall notify the owner of acceptance of the modified plan or request additional information within 60 days of receipt of proposed modifications. No notification from the planning board at the end of 60 days shall constitute acceptance of the plan modification. The currently approved plan shall remain in effect until notification of approval has been issued, or the 60 day period has lapsed.

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M. Record Keeping

1. Parties responsible for the operation and maintenance of a stormwater management system shall keep records of the installation, maintenance and repairs to the system, and shall retain records for at least five years.

2. Parties responsible for the operation and maintenance of a stormwater management system shall provide records of all maintenance and repairs to the _____ (i.e. Code Enforcement Officer, Board of Selectmen), during inspections and/or upon request.

N. Enforcement

When the responsible party fails to implement the O&M plan, including, where applicable, the SWPPP, as determined by the Code Enforcement Officer or Board of Selectmen, the municipality is authorized to assume responsibility for their implementation and to secure reimbursement for associated expenses from the responsible party, including, if necessary, placing a lien on the subject property.

VII. Engineering Review

A. The applicant shall submit a fee, as determined by the planning board, with their application for subdivision or site plan review to cover the cost of outside engineering review of their proposed permanent post-construction stormwater management system(s), and the separate Permanent Post-Construction Stormwater Management Plan (SMP) and Stormwater Pollution Prevention Plan (SWPPP), if applicable.

B. Additional copies of all plans, engineering studies, and additional information as requested by the planning board describing the proposed permanent post-construction stormwater management system shall be provided as necessary to allow for a thorough outside engineering review.

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References

General stormwater and ordinance information:

City of Nashua, NH
The City of Nashua Land Use Code stormwater management and landscaping requirements were referenced in the development of this chapter. The code also contains language for recordkeeping requirements for O&M plans approved as part of a subdivision or site plan. In addition, the city's "Alternative Stormwater Management Methods Part 1 – Planning and Guidance" (March 2003) and "Alternative Stormwater Management Methods Part 2– Designs and Specifications" (March 2003), prepared by Comprehensive Environmental Inc., are model resources for communities when reviewing proposed alternative stormwater management techniques. The city's Land Use Code is available on the city's website, www.ci.nashua.nh.us. The "Alternative Stormwater Management" resources are available on OEP's Resource Library under Low Impact Development, at http://nh.gov/oep/resourcelibrary/referencelibrary/l/lowimpactdevelopment/index.htm.

Comprehensive Environmental Inc. (CEI)
CEI has prepared numerous publications designed to assist communities with developing stormwater management regulations. "Design Guidelines and Criteria for Stormwater Management" (November 2003) and "Appendix A: Stormwater Technical Design Criteria: To Achieve Phase II Stormwater Compliance and Promote Low Impact Development" both referenced in the development of this chapter. For more information refer to the CEI website at http://ceiengineers.com/.

Jefferson County, Washington
Jefferson County stormwater management requirements for all types (scale) and phases of development provide a step-by-step process to help owners/developers understand the requirements. Several checklists and flowcharts could be adapted for use by New Hampshire municipalities. For more information, refer to the Jefferson County Department of Community Development website at www.co.jefferson.wa.us/commdevelopment/.

Low Impact Development Center Inc.
The Low Impact Development Center Inc. develops and provides information to individuals and organizations dedicated to protecting the environment and water resources through proper site design techniques that replicate pre-existing hydrologic site conditions. For more information refer to the Low Impact Development Center Inc. website at www.lowimpactdevelopment.org.

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Model Stormwater Management and Erosion Control Regulation, NHACD
The "Model Stormwater Management and Erosion Control Regulation" (final draft February 1997) prepared by the NH Association of Conservation Districts Water Quality and Urban Conservation Committee provides model language for temporary and permanent sedimentation and erosion control measures. To download a copy of NHACD's model, refer to the OEP website at http://nh.gov/oep/resourcelibrary/referencelibrary/s/stormwater/index.htm.

National Low Impact Development Clearinghouse
The Clearinghouse is a website developed through a Cooperative Assistance Agreement under the US EPA Office of Water 104b(3) Program in order to provide a web-based clearinghouse that allows researchers, practitioners, and program managers to collaborate and efficiently disseminate and share information with local governments, states, builders, developers, stakeholders, and environmental groups. The administrative and technical information available through this clearinghouse will be useful to permit writers, local government officials, watershed managers, and stakeholders. Refer to the Clearinghouse website at www.lid-stormwater.net/clearinghouse/home.htm.

The Practice of Low Impact Development (LID)
"The Practice of Low Impact Development," (July 2003) prepared by NAHB Research Center Inc. for the U.S. Dept. of Housing and Urban Development, Office of Policy Development and Research, provides an overview of LID including a discussion and examples of LID. For a copy of this publication, refer to the publications page of the Housing and Urban Development website at http://www.huduser.org/publications/destech/lowImpactDevl.html.

Town of Thornton, NH
The town of Thornton's Subdivision and Site Plan Regulations include stormwater management provisions referenced in the preparation of this chapter. Contact the town for a copy of the most current regulations.

Towns of Duxbury, Marshfield, and Plymouth, MA
The "Model Stormwater Management Bylaw" (December 31, 2004) prepared by Horsely Witten Group for the towns of Duxbury, Marshfield, and Plymouth, includes model bylaws, regulations, pollutant load calculations, and credits and incentives to support the implementation of municipal stormwater management controls. For more information, refer to the Horsely & Witten website at www.horsleywitten.com/.

US EPA Stormwater Management
U.S. EPA provides extensive information and resources for protecting water resources, including best management practices fact sheets for construction and post-construction stormwater management. For more information on techniques for the protection water and other resources refer to the US EPA website at www.epa.gov.

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BMP manuals that are currently available in New Hampshire, however, communities are encouraged to also review manuals available from other states (e.g., Vermont, Connecticut, New York) and other organizations (e.g., Center for Watershed Protection, Low-Impact Development Center):

> "Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire," Rockingham County Conservation District, NH Department of Environmental Services, Soil Conservation Service (now the Natural Resource Conservation Service), August 1992, as amended. Note: The Soil Conservation Service document is outdated and some of the methods described are no longer recommended criteria for the practices.
>
> Best Management Practices for Urban Stormwater Runoff, NH Department of Environmental Services, 1996, as amended.
>
> Innovative Stormwater Treatment Technologies Best Management Practices Manual, NH Department of Environmental Services, May 2002, as amended http://www.des.nh.gov/wmb/was/manual/.
>
> City of Nashua, Alternative Stormwater Management Methods, March 2003 or most current.

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