



10-2008

Town of Chester Stormwater Management Project

NHEP Community Technical Assistance Program

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Town of Chester Stormwater Management Project NHEP Community Technical Assistance Program

Final Project Report – October 2008

Summary

Great Bay Environmental Consulting (GBEC) worked with the Town of Chester Planning Board to improve regulatory approaches to stormwater management. The project was conducted in two phases: Phase I involved an inventory and assessment of existing regulations for their treatment of stormwater management, with recommendations for an approach to improve stormwater management in the town. The Planning Board opted to focus on specific changes to existing subdivision and site planning regulations, so Phase II of the project involved the development of specific recommendations for those regulations.

Overview

In 2007, the Town of Chester's Planning Board applied for assistance through Round 2 of the New Hampshire Estuaries Project's (NHEP's) Community Technical Assistance Program. GBEC was selected as the technical assistance provider for the project. GBEC and NHEP staff met with the town several times to develop the work scope and project timeline and to present findings and recommendations.

The project was set up in two phases. Phase I involved reviewing the town's existing ordinances and regulations, with GBEC providing recommendations on how to improve stormwater management with a focus on integrating low impact development and infiltration criteria. The evaluation also included a review of the town's water resources and other natural resource features that could be impacted by stormwater runoff. GBEC recommended developing a stand-alone stormwater ordinance to provide the overarching vision and authority for enhanced stormwater protections (*see project phase I memorandum, dated February 13, 2008*).

The board opted to focus on amending existing site plan and subdivision regulations, so for Phase II of the project, GBEC developed specific changes to those regulations to improve stormwater management to incorporate low impact development and infiltration criteria (*see project phase II memorandum, dated October 8, 2008*). Recommendations were intended to be consistent with new or pending NHDES regulations and guidance. In addition, GBEC compiled technical resources on stormwater management to assist the town in its review of development projects. The Planning Board intends to adopt recommendations in 2009 after holding public meetings.

Attachments

- Phase I memorandum from GBEC to Town of Chester Planning Board
- Phase II memorandum from GBEC to Town of Chester Planning Board
- Resource manual prepared by GBEC for the Town of Chester Planning Board (hard copy provided to the town)

This project was supported through the NHEP's Community Technical Assistance Program, with funding from the US Environmental Protection Agency through an agreement with the University of New Hampshire.

February 13, 2008

Cynthia J. Robinson
Planning Coordinator
Chester Planning Board
84 Chester Street
Chester, NH 03036

RE: NHEP Community Technical Assistance Program: Town of Chester Planning Board; Phase I Results for the Planned Update of the Town of Chester's Stormwater Regulations and Requirements

Dear Cynthia,

The following provides a summary of the results for the three separate work tasks completed under Phase I. The three separate tasks for Phase I include the following:

1. Identify the natural resources located within the Town boundaries for consideration as resource priorities needing additional stormwater protection;
2. Review the Town of Chester's existing stormwater management regulations and requirements and compare to those contained in the NHDES Draft Model Ordinance for Stormwater Management or other recently adopted or proposed stormwater regulations and ordinances,
3. Develop Recommendations for the Town of Chester's Planning Board to consider in improving their stormwater management regulations and requirements.

Rationale for Enhanced Regulations: The creation of new impervious surfaces and disturbed areas resulting from development can result in adverse impacts on the water quality and hydrology conditions for surface and ground water resources. For surface waters, increases in the amount and rate of surface runoff can lead to an increase in channel scouring and stream bank erosion resulting in a larger channel cross-sectional area and greater siltation and sedimentation downstream. This process negatively affects habitat conditions and often results a decline in the aquatic ecosystem diversity. The change in the rainfall/runoff dynamics also results in lower base flows during summer months and higher peak flows during major rainfall events. In addition, the water quality conditions in downstream receiving waters may also diminish as more pollutants are washed off and transported by greater runoff volumes. Eventually, streams and ponds can become "impaired" due to the cumulative effects on both habitat or water quality conditions such that a water body may no longer support its designated uses, which include use as a water supply, aquatic life support, swimming and fishing and other recreational uses. Once impaired, the efforts required to restore the designated uses are generally very costly. Groundwater resources are also adversely affected as more and more rainfall runs off as surface runoff and less rainfall infiltrates into the ground to recharge groundwater resources.

Various structural and non-structural measures have been found to be effective in minimizing the potential adverse impacts from development activity. The structural measures generally relate to the more traditional stormwater control and treatment measures including grassed swales, water quality inlets, hydrodynamic separators, wet ponds and extended detention ponds. These represent the more or less end-of-pipe treatment measures that require long-term maintenance. Recently, greater focus has been on the various non-structural measures that reduce the generation of runoff and increasing more infiltration. These measures are generally referred to as Low Impact Development (LID) measures and can include limiting the area of disturbance, disconnecting impervious areas, use of rain gardens and bioretention areas adjacent to impervious area or to capture roof runoff and porous pavement. For stormwater management practitioners and regulators, the LID measures are being heavily promoted because they tend to best maintain the existing natural hydrology of the site, which is the most effective means of avoiding changes in the hydrology and water quality of off-site water resources. The LID measures can also be less costly in the long run because they generally require little maintenance.

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Given the Town of Chester's juxtaposition in the regional landscape, the proposed adoption of more stringent stormwater management requirements could be highly effective. First, the Town still contains great deal of undeveloped and unconstrained, buildable land area even though the Town has experienced considerable development growth and is likely to see even more development in the future as other surrounding Towns are reaching their build-out limits. Secondly, since the Town is situated on a major drainage divide between the Merrimack River and the Exeter/Squamscott River system, there are many small, headwater streams that originate within its borders and lead to the larger streams downstream. The smaller, headwater streams tend to be more vulnerable to the affects of urbanization. Implementing stormwater measures prior to extensive urbanization not only help to these smaller, headwater streams, but also minimizes any effects to the larger streams downstream.

Task 1.0 – Identify Sensitive Resource Areas within the Town

Based on review of available GIS mapping, the recent Master Plan and the Local Priority Resource Protection data prepared for the Town of Chester by the Southern New Hampshire Regional Planning Commission, the following resources and areas of the Town should be consider priorities for additional stormwater protection. As stated earlier, the wetland areas and small ponds that exist at the base of the hills within the central portion of Town, represent the head water areas for several major regional streams and rivers including Cohas Brook, the Exeter River and Beaver Brook located in southern New Hampshire. For this reason, adopting regulations to require enhanced stormwater management measures for future development in the Town of Chester has regional significance and major implications to protecting the integrity of not only the headwater streams and wetlands located in Town but also in maintaining the integrity of the downstream water resources.

Surface Water Resource	Reason for Protection	Area of Town/Watershed
Wason Brook/ Pond	Recreation Area/Town Beach	Along Rte 102 –NE near Raymond
Exeter River	Designated Protected River Segment as part of DES RMPP	Northeast section near Raymond & Fremont
Towle Brook/ Exeter R	Exiting Flooding Problems – tributary to Exeter River	Southeast Section near Deep Hole Rd. & Haverhill Rd draining into Sandown
Harantis Pond	Recreation Use/Beaver lake Watershed	Southwest corner into Derry
North Pond Wetland complex	Large, diverse ecosystem that represents headwaters of Exeter River watershed	Central portion of along ledge Rd
Cohas Brook / Black Gum Swamp habitat	Unique Habitat –part of a watershed to larger stream, NW corner near Villager Rd	Northwest Corner draining to Auburn

Groundwater Resources

1. Existing Sand & Gravel Areas along North Pond and Rte 102 in southeast corner near Raymond and Fremont
2. Public Well Wellhead Protection Areas -associated with public wells serving schools and other public facilities.

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Task 2.0 – Comparison of Town of Chester's Existing Stormwater Management Requirements with NHDES' DRAFT Model Ordinance Requirements

There are generally eight (8) principal components associated with proper stormwater management that need to be addressed as part of any regulations and include the following:

- | | |
|--|--|
| 1. Peak Flow Control | 6. Erosion and Sediment Control |
| 2. Impervious Surface Restrictions | 7. Water quality Protection/Stormwater Treatment |
| 3. Runoff Volume or Source Control | 8. Inspections and Maintenance Operations |
| 4. Recharge to Groundwater | |
| 5. Establishment of Buffers and Setbacks | |

GBEC has noted that there are several existing stormwater management provisions in the Town of Chester's current ordinances (e.g. Wetland Conservation Overlay District, Groundwater Protection) and in the subdivision regulations (Sec. 4.7 and 4.8) The following table summarizes these existing requirements with NHDES' recent recommended requirements contained in their Draft Stormwater Management Model Ordinance.

Table 1.0 – Comparison of the Town of Chester's Existing Stormwater Requirements against NHDES' Stormwater Model Recommendations

Category	Existing Stormwater Requirements in Chester's Ordinances and/or Subdiv./ Site Plan		NHDES Model Ordinance Recommendations
	Ordinance/Regulation	Existing Requirements	
Site Design – Impervious Area	Article 16 Grndwater Protection	Impervious Area no more than 15% or 10,000 sf of lot area, whichever is greater Is this applicable to all areas of Town or just Sand & Gravel deposit areas?	Maximum Effective Impervious Cover to no more 10% of site; Runoff volume and flow rate must be equivalent to 10% impervious cover; *Mostly applies to Comm. Develop
Peak Flow Control	Subdiv/Site Plan 4.7 Sec 4.8.3.8 –Erosion Control	10 yr storm – no downstream damage; 50 yr storm – no road washout 25 yr storm – no net increase over pre-development flow –	1. Channel protection - Post-develop peak flow rate for 2-yr, 24 hour design storm be ≤ 50% of pre-develop. Peak flow and also be ≤ 1yr, 24-hr pre-develop. peak flow. 2. No net increase in 10 yr, 24 hr peak flow rate; 3. BMPs designed to convey up to 50 yr storm without damage
Volume Reduction/ Infiltration	Article 16 Grndwater Protection	Limits on impervious area to no more than 15 % or 10,000 sf, whichever is greater;	Post-develop total runoff volume shall be equal to 90 to 110% of the pre-develop runoff volume for 2, 10, 25 & 50 yr, 24 hr storms).
Recharge to Groundwater	Article 16 Grndwater protection	Limits on impervious area to no more than 15 % or 10,000 sf, whichever is greater;	Requires 10 to 40% of the first inch of runoff from impervious area depending on soil types Also, limits on impervious area (see above)
Buffers / Setbacks	Wetland Conserv Overlay 5.7	Building setback; 75 ft from surface water No Clearing Zones of 25, 50 and 300 ft adjacent to wetlands, vernal pools & Exeter River, respectively	A 50-foot no disturbance zone shall be maintained along all surface waters, wetlands and natural drainage swales.
Erosion Control	Subdiv/Site Plan Regs 4.8	Sec 4.8 Requires an Erosion/SC Plan for any soil disturbance > 20,000 sf; ***Note: Unclear if this Plan is a narrative Plan or notes on plan sheets***	1. Any contiguous area of disturbance, (excl. roadways) shall be limited to 20,000 sf for residential develop and 100,000 sf for other types of develop; 2. Contiguous disturbed areas shall be separated by > 20 ft of mature vegetated cover;

Table 1.0 (cont.)

Category	Existing Stormwater Requirements in Chester's Ordinances and/or Subdiv./ Site Plan		NHDES Model Ordinance Recommendations
	Ordinance/Regulation	Existing Requirements	
Water Quality/Stormwater Treatment	Subdiv/Site Plan Regs	Sec 4.7.2 - requires grass swales at outlet of culverts prior to discharge to wetland or surface water;	<ol style="list-style-type: none"> 1. Demonstrate 80% TSS Removal and 40% Phosphorus Removal if > 35% of site area will be disturbed or has > 25% impervious cover; 2. No stormwater BMPs to discharge w/in 100 ft of a surface water or ground water source used of drinking water supply; 3. BMPs shall be designed to convey a min. 25 yr, 24 hr storm without damage to BMP.
Maintenance & Operations	Subdiv/Site Plan Regs 4.8.7.2	See 4.8.7 - Requires narrative of O&M but there are no specific details listed on O&M components	<ol style="list-style-type: none"> 1. An O&M Plan shall be submitted for all stormwater mgt systems; 2. Execution of the O & M Plan should be a condition of approval, 3. Plan should include schedule of inspection and maintenance activities. 4. Landowner of the property shall be responsible of O&M plan unless other legally binding agreements are established.

Task 3.0 – Develop Recommendations for Enhancing the Town of Chester’s Stormwater Regulations and Requirements.

GBEC has prepared the following recommendations for the Planning Board's consideration in adopting new performance standards to be included in a new Stormwater Management Ordinance. Notwithstanding the potential environmental benefits, discussed above, it would appear that a new Stormwater Ordinance, at the very least, would be beneficial in consolidating the various existing stormwater related requirements contained in other existing ordinances. At the same time, the Town of Chester can take a leading role in adopting standards that reflect today’s current knowledge and understanding of how to minimize adverse impacts related to stormwater runoff. The recommendations are presented below.

Recommended Measures for Possible Implementation

Statement of 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.

Applicability

Applicability to include any of the proposed activities:

- 1) Land disturbances of more 40,000 square feet (the current Subdivision Regs require an Erosion Control Plan for 20,000 sf of disturbance but the 40,000 sf threshold is consistent with EPA Construction GP Requirements; Groundwater Protection also requires SMP for impervious area of 10,000 sf or 15% of lot area – this can discussed).

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- 2) New Commercial Excavations of more 1,000 cubic yards or
- 3) Any increase of impervious area that will render more than 15% or 10,000 sf of any lot area to be impervious (**consistent with existing Groundwater Protection Ordinance**)

Options: Could also add applicability threshold for new roadway surfaces and redevelopment proposals.

Application Submittals (this may be more appropriate in Subdivision or Site Plan Regs)

Require Submittal of a Storm Water Management Plan (currently a SMP is required under Groundwater Protection Ordinance but would also be required for other activities listed above)
Plan details should be added in Subdivision/ Site Plan req'ments and would include
Drainage Calcs and assumptions for pre-develop and post-develop peak flow,
Drainage paths and discharge location,
Impervious Area estimates
Demonstration of Low Impact Development Measures
Groundwater Recharge Estimates
Description of Water Quality Treatment measures;
Pollutant loading calcs (if applicable)
Erosion Control details
Maintenance and Operations

Peak Flow Control

1. Require No Net increase in Peak Flow rates for Smaller Storms (i.e., 2 & 10-yr storms) as well as 25-yr storm; **(the more stringent NHDES requirement for the 2 yr, 24 hr storm being less than or equal to 50% of the 2-yr or the 1-yr pre-development peak flow may be to stringent implement at this point since it has no precedent yet):**
2. Require Drainage Infrastructure and BMPs to be able to convey flow from 50 yr storm **(already required);**
3. Additional Language: At Planning Board's discretion, additional drainage analyses may be required of the larger watershed to evaluate the impacts to downstream flooding where flooding problems currently persist or where there are significant resources or infrastructure of concern. Similarly, provisions may allow the applicant to request a waiver for onsite peak flow control, if the applicant can demonstrate that onsite detention for peak flow control could worsen flooding downstream particularly if the site is located in lower portions of the watershed on a larger stream.

Site Imperviousness

Continue with Existing Impervious area threshold used in Groundwater Protection Ordinance limiting impervious cover to no more than 15 % or 10,000 sf, whichever is greater;

Note: The NHDES model ordinance suggests a more stringent requirement limiting the maximum Effective Impervious Cover to be no more than 10% of the site area. In other words, the amount of runoff volume and flow rate must be equivalent to 10% impervious cover. This mostly applies to Commercial Development, of which, there is few areas zoned for commercial development in the Town of Chester. This could be incorporated now or phased in later.

Volume Reduction

Consider adopting NHDES volume requirement of post-development runoff volume being within 90 to 110 % of the estimated pre-development runoff volume.

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Note: The Planning Board could adopt a less quantitative threshold of requiring the applicant to demonstrate use of various Low Impact Design measures such as disconnecting impervious area, use of bioretention areas, or pervious pavement to reduce runoff volume potential.

Recharge to Groundwater

Use the NHDES proposed Alteration of Terrain regulations to maintain the existing average annual recharge based on the existing Hydrologic Soil Groups identified through NRCS soil mapping.

The NRCS classifies soils into four hydrologic groups A thru D indicative of their infiltration capacity or potential under saturated conditions. Group A soils have the lowest runoff potential and the highest infiltration rates, while Group D soils have the highest runoff potential and the lowest infiltration rates. The prescribed stormwater volume that is required to be infiltrated is determined using existing site conditions and the infiltration rates set forth below.

Hydrologic Group Volume to Recharge (x Total Impervious Area)

Hydrologic Group	Volume to Recharge x Total Impervious Area
A gravels, sand, loamy sand or sandy loam	0.6 inches of runoff
B silty loam	0.35 inches of runoff
C sandy clay loam	0.25 inches of runoff
D clay, silty clay loam, sandy clay, silty clay	0.10 inches of runoff

Note: Infiltration of stormwater from paved surfaces should be discouraged in Wellhead Protection Areas for public water systems to prevent ground water contamination. In these cases, efforts should be made to promote LID measures and limit impervious surfaces within a WHPA and especially on Hydrologic Group A soils that are within a WHPA.

Also, Land Uses considered to have “Higher Potential Pollutant Loads” such as Vehicle maintenance and fueling areas, fleet storage areas, public works storage areas, etc (see NHDES listing) should not be allowed to infiltrate runoff to groundwater (These are also regulated under Groundwater protection Ordinance)..

Erosion Control

Currently, the Town of Chester’s Subdivision and Site Plan Regulations (Sec. 4.8) has very good requirements and design standards for Erosion Control Plan submittals. An Erosion Control Plan is required for Land disturbances of more 20,000 square feet, or construction of reconstruction of a road and for disturbances in critical areas (i.e., within 75 feet of a stream or wetland, >2,000 sf of highly erodible soils, or disturbance with slopes lengths of more 25 feet on slopes of 15% or more).

GBEC suggests that some of these requirements be integrated a new Stormwater Management Ordinance, especially those dealing with peak flow control and permanent control measures, however, other requirements may be best left in the Erosion Control Plan. There could be two separate Plans submitted, an Erosion Control and Stormwater Management Plan or perhaps completed as one. The pros and cons will need to be discussed. The applicability thresholds may be different.

Note: Currently does the Planning Board allow the use of Stormwater Pollution Prevention Plan (SWPPP) as required by EPA for Construction Activity as a substitute for this Erosion Control Plan so long as the SWPPP contains the relevant details as required by the EPA General Permit for Construction Activities?

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Water Quality/ Stormwater Treatment

Minimum Standard: No new stormwater conveyances (e.g. outfalls) may discharge stormwater directly to a wetlands or adjacent surface waters without prior treatment using appropriate BMPs subject to review by the Planning Board and/or the review engineer or other qualified professional..

Higher Standard: The NHDES Draft Model Ordinance suggests that an applicant demonstrate that the Stormwater Management System will achieve a TSS removal efficiency of 80% and Total Phosphorus removal efficiency of 40% **if the following is proposed:**

1. More than 35 % of the total site area is disturbed or;
2. The site will have more than 25% impervious cover;

Note: The pollutant loading aspect is a relatively new concept that very few Towns have adopted and or likely to adopt in the immediate future since it will require review from a qualified engineer or water resource specialist - GBEC recommends that this be discussed and perhaps it is best to go with minimum standard language.

Buffers / Setbacks

Consider increasing the No Clearing Zones from 25 feet to 50-feet along ponds, wetlands and larger 3rd order streams consistent with new requirements for maintaining a waterfront buffer as part of the proposed Shoreland Protection Regulations. Of course, the larger 300-foot no clearing buffer setback currently required along the Exeter River would still apply.

Maintenance & Operations

Section 4.8.7 of the Subdivision/Site Plan requirements addressing Maintenance and Inspection as part of an Erosion Control Plan has fairly comprehensive details and requirements. Perhaps there are some opportunities for greater specificity and clarity including requiring the submittal of the following;

- Proposed schedule of inspections and maintenance activities;
- A checklist to be used during inspections;
- Contact information for the parties responsible for maintenance and inspections;
- A Plan showing the location of all stormwater management facilities covered by O&M Plan;
- A Certification signed by the owner(s) attesting to their commitment to comply with O&M Plan.

In summary, the Town of Chester already has a great deal of the requirements relevant to proper Stormwater Management for the protection of resource areas. There would be an advantage to creating a new Stormwater Management Ordinance to outline the objectives, goals and authority for additional requirements. GBEC hopes you find this review to be useful and looks forward to discussing the various options and approaches with the Planning Board at the February 20th meeting. If you have questions, please do not hesitate to call or email me.

Sincerely,

Great Bay Environmental Consulting



William R. Arcieri, Principal

Great Bay Environmental Consulting

October 8, 2008

Cynthia J. Robinson
Planning Coordinator
Chester Planning Board
84 Chester Street
Chester, NH 03036

RE: NHEP Community Technical Assistance Program: Town of Chester Planning Board; Phase II – Recommended Updates to the Town of Chester’s Subdivision and Site Plan Regulations to Enhance Stormwater Management Requirements for Future Development and Provide a Resource Manual

Dear Cynthia,

The following provides a summary of the results for the works tasks completed under Phase II of the NHEP Community Assistance Program effort as referenced above. The three separate tasks for Phase II include the following:

Task 1: Review and recommend specific revisions to Chester's Subdivision and Site Plan Regulations that will promote infiltration of stormwater and encourage the implementation of low impact development (LID) practices and technologies.

Task 2: Compile information into a technical reference document for use by the Chester Planning Board in reviewing stormwater management plans. The document will reference readily-accessible and commonly used manuals, guides, websites, and/or reports that include specifications and performance measures for stormwater infiltration systems and other treatment BMPs and LID measures.

Task 3: Present suggested revisions to Subdivision and Site Plan Regulations and present reference technical document to the Chester Planning Board at a regularly scheduled meeting.

General Comments: GBEC limited its review to only the stormwater related provisions of the Subdivision and Site Plan Regulations and, specifically, to Articles 3-Planning, 4-Design and 5-Construction of the Subdivision Regulations (May 2002) and Article 7 of the Site Plan Regulations (March 2000). Review of the Wetland Conservation Overlay and the Groundwater Protection Overlay District requirements as part of the zoning ordinances were also included. The recommendations provided herein are based on technical guidance information included in various recent reference documents that promote the latest trends for stormwater management (refer to the Resource Manual). These include publications from the Center for Watershed Protection as well as recent draft regulations included in the proposed Alteration of Terrain requirements and NHDES' DRAFT Stormwater Management Manual due to be released by the end of this year. A principal focus of the most recent technical guidance is to promote infiltration of stormwater and include Low Impact Development (LID) principles and practices where appropriate.

GBEC noted that very similar stormwater related requirements are included in both the current Subdivision Regulations and Site Plan regulations. For example, Section 4.8 of the Subdivision Regulations is very much the same as Section 7.4 of the Site Plan Regulations. Similarly, the road design specs in Section 4.5 of the Subdivision Regulations are the same as those in Appendix A in the Site Plan regulations. GBEC did not attempt to repeat recommendations or cross-reference sections that had similar requirements in other sections of the regulations. The Planning Board may want to consider consolidating these elements into the Design Standards of the Site Plan Regulations to avoid possible confusion and make this and future updates easier. The Subdivision regulations could then

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refer to the relevant Site Plan Design Sections for subdivision applications that involve land use changes and site alterations.

This is an ideal time for the Town of Chester to update and enhance its stormwater management requirements since NHDES is on the verge of a similar effort with pending changes to their Alteration of Terrain Permit requirements and proposed new Stream Crossing and Culvert Replacement Rules (draft 08/07/08). It is also an ideal time since much of the land area in Town remains relatively rural, in a region that has experienced and will likely see increasing development pressures in future years. The adoption of enhanced stormwater management requirements could be highly effective in minimizing the potential adverse affects to downstream resources as a result of future development.

Top Eight (8) Stormwater Management Issues / Concerns

As noted in Phase I technical memorandum, there are generally eight (8) principal issues that need to be addressed for proper stormwater management planning to occur and include the following:

1. Peak Flow Control
2. Impervious Surface Restrictions
3. Runoff Volume or Source Control
4. Recharge to Groundwater
5. Establishment of Buffers and Setbacks
6. Erosion and Sediment Control
7. Water quality Protection/Stormwater Treatment
8. Inspections and Maintenance Operations

Low Impact Development (LID) Practices as Alternatives to Conventional Stormwater Management Practices

The Planning Board should require and/or encourage the use of LID Practices in the site planning and approval process. LID practices focus on reducing runoff volumes through minimizing impervious areas and promoting infiltration near the source rather than rely on end-of-pipe treatment measures or conveying runoff offsite, which are more typical of conventional site design. LID practices are generally cost-effective since the reduction in runoff volume typically translates into less onsite drainage infrastructure (i.e., piping, catchbasins, etc.) and reduced risk of flooding downstream. The Planning Board may want to consider providing incentives in the subdivision or site plan requirements to require that at least two LID practices be incorporated into each major site development design. It should be recognized, however, that LID practices are most feasible in areas where the more permeable soils such as Hydrologic Group A and B soils exist to allow some infiltration of runoff. There are areas in Town where only Hydrologic Group C and D soils exist and these areas will have limited potential for infiltration. In these areas, the opportunity to reduce runoff volumes through infiltration will be limited but measures to control peak runoff rates and provide water quality treatment can still be provided using conventional stormwater BMPs. LID Practices are generally grouped into two major categories:

Site Planning:

1. Minimize the amount of contiguous impervious area
 - a. Narrower subdivision roads, reduced parking, green roofs, porous pavement, etc.
 - b. Disconnect impervious areas through vegetative islands, buffers, rain gardens, dry wells or cisterns for roof runoff, etc.
2. Maintain existing vegetated areas through open space and vegetative buffers
3. Preserve natural flow patterns and features;
4. Identify areas onsite most appropriate for infiltration – infiltrate as close to source as possible.

Runoff Collection/ Infiltration

5. Promote Infiltration
 - a. Rain gardens, bioretention swales, dry wells
6. Collect water for reuse, i.e., cisterns, rain barrels for irrigation, supply for fire fighting purposes
7. Separate roof runoff from site runoff – Infiltrate roof runoff whenever feasible,

See Additional Information in the Stormwater Resource Manual provided.

Recommendations

General Recommendations

1. The Stormwater related requirements included in the Subdivision Regulations (Sec 4.7) could be moved to a new Stormwater Management Design section of Article 7 of the Site Plan Regulations (all other related sections could then refer to this section as means of maintaining clarity- currently very similar requirements are contained in Sec 4.7 and 4.8 of Subdivision Regs and Sec 7.4 of Site Plan Regulations – the requirement for a Stormwater Mgt Plan is contained in Sec. 16.6.1 of the Ground water Protection Ordinance).
2. If it hasn't been done already, a mechanism will need to be established through the Planning Board review process and/or someone may need to be designated in enforcing and/or monitoring whether stormwater BMPs and erosion controls are being maintained.
3. In the future, consideration should be given to establishing a new Stormwater Management and Erosion Control Ordinance similar to the Wetland and Groundwater Protection Ordinances (generally provides greater emphasis to the importance of both these issues- the Erosion Control Sec.4.8 in Subdivision and Sec 7.4 of Site Plan is already in the form of an Ordinance).
4. The use of Low Impact Development (LID) measures, especially those that minimize impervious area and infiltrate runoff should be greatly encouraged.
5. Article 3 –Planning of Subdivision Regs should probably include or reference the soils based lot size determination included in Sec. 5.7.5.2 of the Wetland Conservation District Zoning Ordinance.
6. The NHDES Alteration of Terrain Regulations (when adopted) and the pending NHDES Stormwater Management Manual should be referenced in the Site Plan Regs and the Wetland and Groundwater Protection Overlay Zoning Ordinances.

Subdivision Regulations Article 3-Planning

3.13 Drainage Calculations

This Section should be revised to say “*Drainage calculations and a Stormwater Management Plan shall be submitted to the Planning Board, consistent with the requirements outlined in Sec16.6.1 of the Groundwater Protection Ordinance for any proposed subdivision and site plan applications that will cause permanent land cover changes or that will render an area impervious for more than 15% or 10,000 square feet of any lot, whichever is greater*”

3.14 Storm Drainage

GBEC recommend that this paragraph be replaced with a Statement that “Where a Stormwater Management Plan is required, the applicant shall demonstrate as part of this plan that all drainage from impervious and gravel surfaces will be treated to enhance water quality and avoid increases in peak runoff flow prior to discharge to any existing streams, water courses and wetlands, consistent with the design guidance contained in the NHDES Stormwater Management Manual.” Also, where existing streams traverse through proposed subdivided lots, efforts will be made to protect and preserve the existing vegetation and ground cover along the shores of this stream, consistent with the setback requirements contained in Table 2.0, Setbacks, No-cut and No Clearing Zones as well as those contained in the NHDES Shoreland Protection regulations, where applicable.

3.15 Offsite Improvements

This section could be revised to state where major subdivisions and large areas of land cover changes are proposed, the Planning Board reserves the right to require an assessment of the potential impacts to offsite properties, public infrastructure and downstream natural resources. Additional offsite improvements may be requested as a condition of the subdivision approval if there is insufficient capacity in the downstream infrastructure to accommodate the additional drainage estimated to be produced from the proposed project or adverse impacts to natural resources or adjacent properties appear imminent based on review by the Planning Board, the Town Engineer or other Municipal Officials. (Refer to Article 8 of Site Plan Review Regulations.).

3.18 Open Space – This section should be updated to be consistent with the Open Space Subdivision Ordinance.

Subdivision Regulations Article 4 –Design;

Sec 4.1 Graphic Presentation – (this section focuses on subdivision plan presentation and plan contents - No specific recommendations provided – Information pertaining to proposed stormwater features and nearby natural resources can be addressed in Sections 4.7 and 4.8 of the Subdivision Regulations and Article 7 of the Site Plan requirements)

Sec 4.2 Open Space (this entire section could be eliminated or be updated to be consistent with the requirements of the Article 6.0–Open Space Subdivisions of the Zoning Ordinance passed on Feb. 23. 2005.)

Sec 4.5 Design Standards

4.5.17 – Table of Geometric and Other Standards for Streets: “Allowances should be made to allow narrower street widths (e.g. 20 feet) for smaller subdivision roads and reduce the amount of impervious surfaces”. (Also, required in Article 5 and Appendix A of Site Plan Regulations)

Sec. 4.5.2 Street System –The specific road design standards should be referred to the Street Design Section included in Appendix A –Road Design Standards of the Site Plan Regulations.

Sec 4.7 – Storm Drainage Systems (similar to Sec 3.1 of Site Plan checklist)

4.7.1 - *consider replacing this entire paragraph with the existing paragraph from Article 16.6.1 of Groundwater Protection Ordinance that requires “A Stormwater Management Plan (SMP) be prepared for any use that will render more than 15% or 10,000 square feet of any lot. A SMP shall also be required for the construction and **reconstruction** (includes widening and/or modifications to slopes and sub-base materials) of roadways.”*

The current language that refers to the design of open channels can be moved and included in Sec 4.7.7 and the maintenance issue can reinforced in the Operations and Maintenance Section 4.7.11.

4.7.2 – *consider replacing this entire paragraph to include language that states “any development requiring a Stormwater Management Plan should include at least two (2) Low Impact Development (LID) practices to the extent feasible, consistent with the onsite soils, and subject to review by the Town’s Engineer. LID measures may include, but not be limited to, the use of pervious pavement, maintaining 85% of the existing vegetative cover on the lot, providing groundwater recharge through use of rain gardens, collection and use of stormwater for reuse and infiltration practices, green roofs”.*

4.7.3 – *move the statements pertaining to maintenance and access concerns to a new maintenance under Sec. 4.7.11 of Subdivision or 7.3 of Site Plan Regs – Insert new language to state that “storm drainage systems must be designed to provide adequate treatment for the water quality flow, meet the requirements for maintaining water quality volume, groundwater recharge, where applicable, and for peak flow control as described below and is consistent with the NH Stormwater Management Manual”.*

4.7.4 Design Requirements (This entire section may be more appropriate as a new Stormwater Management Section under Site Plan Regs (possibly 7.3). The recommended design standards below are consistent with the DRAFT NHDES Stormwater Manual and should be confirmed when the Manual is complete).

(This entire section should be completely replaced with the following design guidance consistent with NHDES's Stormwater Management Manual: Planning Board could include details or reference the DES Manual). First Sentence should be replaced with: "All storm drain systems should be designed by a Registered Professional Engineer consistent with the following requirements and all drainage and sizing calculations should be included in the Stormwater Management Plan".

4.7.4.1 Water Quality Volume (WQV) – The Water Quality Volume (WQV) is the amount of stormwater runoff produced during rain events that should be treated through appropriate Best Management Practices (BMPs). The WQV represents the volume of runoff produced from the first one-inch of rainfall falling on impervious surfaces. On average and on an annual basis, 90% of the all runoff is produced by storms that produce one inch of rainfall or less. The WQV should be calculated using the following equation:

$$WQV = (P)(Rv)(A)$$

Where:

P = 1 inch

Rv= unitless runoff coefficient, $Rv = 0.05 + 0.9(I)$

I = the percent impervious cover draining to the structure, in decimal form

A = total site area draining to the structure

4.7.4.2 Water Quality Flow (WQF) – represents the flow rate (expressed in cubic feet per second) associated with the runoff produced from the first 1-inch of rainfall and is typically used in combination with the WQV to size of the water quality treatment practices such as rain gardens, treatment swales, the treatment storage of extended-detention basins as well as pre-treatment devices. The TR-55 or TR-20 Runoff Models are typically used to calculate the WQF as part of the typical engineering design and should the calculations and assumptions should be included in the Stormwater Management Plan.

4.7.4.3 Groundwater Recharge Volume (GRV) – As a means of maintaining the pre-development groundwater recharge volume from the site, the site design should include infiltration practices that enable groundwater recharge using the following equation:

$$GRV = (A_i)(R_d)$$

Where:

A_i = the total effective area of **impervious surface** that will exist post-development;

R_d = the groundwater recharge depth based on the USDA/NRCS hydrologic soil group, as follows,

<u>Hydrologic Group</u>	<u>R_d(inches)</u>
A	0.40
B	0.25
C	0.10
D	0.00

4.7.4.4 Peak Flow Control for Flood Control Purposes – Consistent with the proposed NHDES Stormwater Management Manual requirements, drainage calculations should be conducted to show that that the post-development peak flow rate for all flows leaving the site does not exceed the pre-development flow rates for the 10, 25 and 50-year, 24 hour design storms. The applicant should also demonstrate no adverse impact to downstream properties for proposed development within an identified 100-year floodplain.

4.7.4.5 Channel Protection – Consistent with the proposed NHDES Stormwater Management Manual requirements, channel protection post-development flow should comply to one of the two following criteria:

1. If the runoff volume for the 2-year, 24 hour-post-development storm volume has not increased over the pre-development volume, then only the post-development peak rate for the 2-year storm needs to be no greater than the pre-development peak flow.
2. If the runoff volume for the 2 year, 24-hour post-development storm will increase then the post-development peak rate of flow for the 2-year, 24 hour storm should be controlled to less than 50 percent of the peak flow rate of the 2 year, 24 hour storm or to the 1 year , 24 hour pre-development peak flow rate.

4.7.4.6 Effective Impervious Cover (EIC) – NHDES has established a target of limiting the effective impervious cover to more than 10% of the subwatershed area or maintaining 65% of the site as undisturbed as means to avoid or be considered except from pollutant load calculations associated with proposed developments.

4.7.5 Certification of No Adverse Effects on Downstream Drainage Facilities - Replace with "The Applicant's Engineer shall determine and certify that any additional runoff produced from the proposed development will not have any adverse impact or overload any existing downstream facilities either on public or private property. The following certification statement shall be included on the site plan:

"I certify that any additional runoff related to the proposed development on this site will not have any adverse effects on any open or closed, public or private downstream drainage facilities or natural resources, under the proposed design assumptions and considerations"

(Not sure how well this certification is enforced – engineers may balk at including this certification because the drainage is designed for certain sized design storms –the potential exists for these design conditions to be exceeded in the natural world)

4.7.5.1 Design Storm Frequency – Replace section with: The post-development peak flow rate should not exceed the pre-development flow rate for the 2, 10 and 25-year, 24 hour storm events for all flows leaving the site, as described above in design standards. All drainage facilities, onsite and downstream, shall be capable of passing the peak flow rate for a 50 year storm event without causing washouts or flooding of roadways or property damage.

GBEC recommends that the following existing sections could be eliminated and applicants should be referred to the pending NHDES Stormwater Manual and the Stream Culvert Replacement Regulations for Design Guidance on open and closed drainage systems and culvert design:

4.7.5.2 Design methods (omit)

4.7.5.3 Minimum Time of Concentration (omit)

4.7.5.4 Rainfall Intensity (omit)

4.7.6 Closed Drainage Systems (omit)

4.7.7 Open Drainage System (omit)

4.7.8 Culvert Design (No Recommendations)

4.7.9 Catch Basins and Manholes

Add to 4.7.9.1 – All catch basins shall be designed with a minimum 3-foot sump. Commercial sites that have the potential for oil and gasoline spills shall have catch basins equipped with inverted hood outlets.

4.7.10 Underdrains

Add to 4.7.10.1 – Underdrains shall be considered in all roadway design, an add grass swales and detention basins in areas prone to high seasonal water tables.

4.7.11 Add New Maintenance and Inspection Section

Add language from Section 4.8.7 and new language from NHDES Stormwater Manual.

4.8 Erosion and Sediment Control Plans (This Section is the same as that in Sec 7.4 of Site Plan Regs and thus, could be eliminated and just referenced from Subdivision Regulations where proposed subdivision applications trigger applicability thresholds)

4.8.1 Applicability (Question to Consider: Should the Applicability Criteria for an Erosion and Sediment Control Plan be the same as that triggering the need for a Stormwater Management Plan – that way they could be submitted as one Plan;

E&SC Plans are required for 20,000 sq ft of disturbance; construction of roadway or disturbance in critical areas, whereas,

Stormwater Mgt Plans are required when more than 10,000 sq ft or 15% of the lot area will be rendered impervious;

4.8.1.3 Should read “Critical Areas of Disturbance” - the definition of Critical Areas in 4.8.2 should also be revised accordingly.

4.8.3.1 Should refer to the pending NHDES Stormwater Manual Volume 3.

4.8.3.2 Should reference the No-cut and Clearing Buffer Setbacks contained in Table 2.0 of the Wetland Protection Zoning Ordinance. Consider increasing no-cut zone from 25 to 50 feet for wetlands and streams - Table 2 similar to vernal pools

4.8.3.4 Change time period from thirty (30) to fifteen (15) days requiring soil stabilization measures if disturbed areas are to remain idle.

4.8.3.6 Add phrase “and water resources” after downstream drainage facilities.

4.8.3.7 Should be revised to say site runoff from disturbed areas should be adequately treated to prevent the discharge of sediment to nearby streams, wetlands and vernal pools.

4.8.3.8 This requirement could be eliminated and/or referenced to Sections 4.7.4.4 and 4.7.5.1.

4.8.3.9 Same as 4.8.3.8 above

4.8.3.10 Maintenance Requirements should be detailed in one section 4.7.11.

4.8.3.11 no changes

4.8.3.12 Permanent stabilization measures should be in place within five (5) days after final grading is completed.

4.8.3.13 Deicing chemical usage and snow storage requirements should have its own section as part of the Stormwater Management Plan (not necessarily an erosion control issue).

4.8.4 Minimum Requirements

4.8.4.1 Discussion of waiver provisions should be included in a separate section of Site plan or Subdivision Regulations.

Site Plan Regulations Article 7 –Specific Plan Requirements;

In general, since nearly all proposed developments and land disturbances will typically require Site Plan Approval, all of the stormwater management and design requirements contained in the Sec. 3.1 and 4.7 of the Subdivision Regulations should be moved to the Site Plan Regulations under a new Section 7.3 entitled “Stormwater Management and Design”. This should help to streamline the subdivision regulations and alleviate irrelevant sections for proposed subdivisions that strictly involve the subdivision of lots and do not involve land disturbances nor will add impervious area. The Subdivision Regulations can reference the stormwater management and erosion control requirements of the Site Plan Regulations as being applicable for any proposed subdivision that involves land disturbances or adding impervious areas but for some reason that does not require Site Plan approval at the same time.

A placeholder for the new Section 7.3 for Stormwater Management and Design could be created by combining the contents under the existing Sec 7.3; Topographic Plan with the existing Sec 7.2; Surveyed Plan. The provisions for requiring a Stormwater Management Plan under Sec 16.6.1 of the Groundwater Protection Zoning ordinance should be included in this new Section 7.3. The No-Cut and Clearing Zone Buffers and Setbacks contained in the Wetland Conservation District Ordinance should also be included and/or referenced in the Stormwater Management Section.

Similarly, Section 4.8 of the Subdivision Regs can be eliminated and reference Section 7.4 of Site Plan Regs for Erosion and Sediment Control, which is essentially the same as Sec. 4.8.

All of the recommendations listed above for Sections 3.1 and 4.7 of the Subdivision Regulations should be included in the newly proposed Sec 7.3 of Site Plan Regs and the recommendations for Sec. 4.8 of Subdivision Regs should be included in Sec 7.4 of Site Plan Regs.

The Planning Board may want to wait to finalize these suggested changes until the pending NHDES Stormwater Management Manual is completed so that it can be adequately referenced.

Section 7.4 Erosion Control should also reference the requirements and design guidelines included in Volume 3 of the NHDES Stormwater Management Manual.

In closing, GBEC hopes that these recommendations are helpful for the Planning Board members. The challenge in developing effective subdivision and site plan regulations can sometimes be as much about the organization as the technical content. GBEC strived to maintain the current structure of the regulations as much as possible but a new Stormwater Management Section in the Site Plan regulations seems to be warranted. When the pending NHDES Stormwater Management Manual is completed, the additional design information may be easier to include or reference. If you have any questions, please do not hesitate to contact me. I will plan to attend your October 8th regular meeting to provide an overview of the recommendations.

Sincerely,

GREAT BAY ENVIRONMENTAL CONSULTING

*William R. Arcieri, CPESC, CPSWQ.
Principal*

Town of Chester
Planning Board

Stormwater Management

Resource Manual

This project was funded by a grant from the New Hampshire Estuaries Project, through the Community Technical Assistance Program (CTAP), as authorized by the U.S. Environmental Protection Agency's National Estuary Program.

Purpose: This Resource Manual was prepared by Great Bay Environmental Consulting with funding from the NH Estuaries Project under the CTAP Program for the primary use of the Town of Chester's Planning Board, in response to their request for a document that would assist them in gaining a greater understanding of the latest stormwater management and design principles that can be applied in the review and approval of future development proposals. As a related task, recommendations were also provided to update their existing site plan and subdivision regulations to reflect the latest guidance in stormwater management.

The materials included in this document were derived from the latest resources developed at both the state and regional level. At the State level, the New Hampshire Department of Environmental Services (NHDES) has several stormwater management related regulations and documents that are in the Draft Form. The following lists these resources:

1. Draft Model Stormwater Management Ordinance developed as part of the Regional Environmental Planning Program (REPP);
2. DRAFT Stormwater Management Manual; A three-volume manual geared toward municipal officials, developers and designers that discusses the issues, concerns and design guidance for stormwater management, flood control and water quality protection. This Manual is tentatively scheduled to be released to the public in late in 2008 or early 2009.
3. DRAFT Alteration of Terrain Regulations; latest Draft will soon be available for public review and comment (latest draft is 04/09/08).
4. DRAFT Stream Crossing and Culvert Replacement Rules (in draft; dated 08/07/2008)

In addition, the UNH Stormwater Center has become well renowned and a valuable resource for providing typical pollutant removal efficiency data for various Stormwater BMPs as well as for porous asphalt and other LID measures. The 2007 Annual Report has been included in this document. Last but not least, the Center for Watershed Protection is also a great resource for municipal officials to get the latest stormwater management information. The CWP website has variety of new information on regulations, designs, treatment mechanisms, etc. Website:

http://www.lowimpactdevelopment.org/publications.htm#LID_BMP_Fact_Sheets

Town of Chester - Planning Board

Stormwater Management

Resource Manual

Contents

Section	Description
1	Managing Stormwater in Your Community: A Guide for Building and Effective Post-Construction Program: Center for Watershed Protection, EPA Publication No. 833-R-08-001. July 2008. http://www.cwp.org/Resource_Library/Controlling_Runoff_and_Discharges/sm.htm
2	Massachusetts Low Impact Development Tool Kit: Brochures and Fact Sheets: Metropolitan Area Planning Council. Website http://www.mapc.org/LID.html
3	University of New Hampshire Stormwater Center; 2007 Annual Report; http://www.unh.edu/erg/cstev/
4	Urban Stormwater LID Design Tool Site website: http://www.lid-stormwater.net/background.htm
5	NHDES DRAFT Permanent (Post-Construction) Stormwater Management Ordinance: Innovative Land Use Planning Techniques, REPP. http://des.nh.gov/organization/divisions/water/wmb/repp/documents
6	NHDES Stormwater Manual, Volumes I, II and III (to be released at the end of 2008).
7	NHDES DRAFT Alteration of Terrain Regulations; 04/09/08. http://des.nh.gov/organization/commissioner/legal/rulemaking/documents/env-wq1500ip.pdf