

PC-1 Post Construction Runoff Control Assessment

ACTON SUBDIVISION RULES AND REGULATIONS (Rules)		STATE STORMWATER POLICY HANDBOOK (SPH)		NOTES
Section	Requirement	Number	Standard	
2.5	References			The Rules refer to agencies whose names have changed. Names of documents referenced in the Rules have to be reviewed to see if they need to be changed.
3	Approval Not Required (ANR) Plans	Page 1-13	SPH does apply to a series of ANR lots under the Subdivision Control Law	Rules do not apply stormwater management standards to ANRs because State Subdivision Control Law does not give the Town the authority to do so. State laws conflict.
5.3.10	Contents of a Definitive Plan: Storm drainage runoff calculations	2,4,5,6	100-year 24-hour storm events must be evaluated, system must remove 80% of the average annual load of total suspended solids (TSS); certain BMPs are required where discharge is from higher potential pollutant loads and in critical areas	Unsure whether Rules' formula for calculating runoff is consistent with SPH. Rules do not discuss 100-year storm event or different standards for critical areas.
5.3.19	Contents of a Definitive Plan: Detail of Typical cross-section of roadway	4,5,6	System must remove 80% of the average annual load of total suspended solids (TSS), discharge from higher potential pollutant loads areas and critical areas are required to use certain BMPs	Rules list the types of stormwater management facilities allowed/to be shown. It appears the SPH prefers to minimize the use of pipes and gas trap/oil separator catchbasins.
5.3.20	Contents of a Definitive Plan: Surface water that drains onto adjacent streets or properties	2	Post-development = or < pre-development peak discharge	Rules discuss prevention of drainage overflow on adjacent streets & properties – can't find a SPH reference to the issue.
5.3.22	Contents of a Definitive Plan: Erosion & sedimentation control plan	4,5,6,8	System must remove 80% of the average annual load of total suspended solids (TSS); discharge from higher potential pollutant loads areas and critical areas are required	Rules refer to a different erosion control document than SPH – so unsure if consistent.

			to use certain BMPs, erosion and sediment controls must be implemented	
8.2	Design Standards: Drainage	2,4,5,6	100-year 24-hour storm events must be evaluated; system must remove 80% of the average annual load of total suspended solids (TSS); certain BMPs are required where discharge is from higher potential pollutant loads and in critical areas	8.2.1 of Rules discuss a manhole system, and 8.2.2.1 discusses drainage structures. These structures that are generally not preferred by SHP, but aren't necessarily inconsistent with SHP standards. 8.2.2.4 - 8.2.3.2 of Rules discuss design based on a 10-year storm only.
8.3	Design Standards: Erosion & Sediment Control	4,5,6,8	System must remove 80% of the average annual load of total suspended solids (TSS); discharge from higher potential pollutant loads areas and critical areas are required to use certain BMPs; erosion and sediment controls must be implemented	8.3.2 - 8.3.4 of Rules list types of erosion control measures. These structures that are generally not preferred by SHP, but aren't necessarily inconsistent with SHP standards. 8.3.5 of Rules discusses velocity check dams. Unsure if SHP recommends them and if so, if Rules' requirements are consistent.
8.5.1	Subdivision Standards in Groundwater Protection District: Street drainage	4,5,6	System must remove 80% of the average annual load of total suspended solids (TSS); discharge from higher potential pollutant loads areas and critical areas are required to use certain BMPs	Rules discuss that all street drainage in Zones 1-3 must be funneled into gas trap catch basins - which isn't a preferred method in the SHP, but not necessarily inconsistent with the SHP. Rules also only discuss impervious cover related to streets - not other impervious cover because State Subdivision Control Law does not provide the Town with the authority to control impervious cover on individual residential lots.

8.5.2	Subdivision Standards in Groundwater Protection District: 1" inch of every storm event	4,5,6	System must remove 80% of the average annual load of total suspended solids (TSS); discharge from higher potential pollutant loads areas and critical areas are required to use certain BMPs	In the Rules, some of the design details related to retention ponds (pond lining, diversion box, etc., are generally not preferred by SHP, but aren't necessarily inconsistent with SHP standards. Also, see the 2 nd note under 8.5.1 above related to other impervious cover.
8.5.4	Subdivision Standards in Groundwater Protection District: Groundwater recharge in Zones 1-4	3	Annual groundwater recharge from post-development should approximate the annual recharge from pre-development or existing conditions, based on soil types.	Rules appear more strict than SHP because Rules require post-development = or < pre-development peak discharge, regardless of the soil type.
8.7.3	Easements for drainage across lots			Rules appear consistent with SHP but unsure whether required easement width for drainage course is consistent with State wetlands laws. 8.7.3 of the Rules should also be compared to the Acton Wetlands Bylaw.
9.2.1 - 9.2.4	Utilities: <ul style="list-style-type: none"> Construction of drain pipes and related equipment Adequate disposal of surface water Sub-drains Open drainage trenches 	4,5,6	System must remove 80% of the average annual load of total suspended solids (TSS); discharge from higher potential pollutant loads areas and critical areas are required to use certain BMPs to use certain BMPs	Rules state that utilities / infrastructure must be constructed in conformance with certain MassHighway & State DPW documents and lists certain infrastructure to be used. Some of the infrastructure listed is generally not preferred by SHP, but is not necessarily inconsistent with SHP standards. Unsure if the documents referenced are consistent w/SHP requirements.
9.8.3	Trees and Other Vegetation	3	Erosion and sediment controls must be implemented	Rules refer to seeding for erosion control where the SHP refers to hydroseeding. Rules also refer to wood chips, mulch, and sodding –

				unsure if consistent w/SHP.
11.4.5.2	Administration: Inspection	4,5,8	System must remove 80% of the average annual load of total suspended solids (TSS); discharge from higher potential pollutant loads areas and critical areas are required to use certain BMPs to use certain BMPs	In the Rules, the structures listed are generally not preferred by SHP, but aren't necessarily inconsistent with SHP standards.
DIR – A.10, C.34, E.46.	Development Impact Report (DIR): <ul style="list-style-type: none"> • Soil Types / Drainage • Storm Drainage • Controlling Peak Runoff 	2,3	Controls must be developed for 2-year & 10-year 24-hour storm events, and 100-year 24-hour storm events must be evaluated; annual groundwater recharge from post-development should approximate the annual recharge from pre-development or existing conditions, based on soil types	<ul style="list-style-type: none"> • In DIR, the "Soil Conservation Service" should be updated with the new agency name. Unsure if soil type categories in the DIR are consistent with soil categories referenced in SHP. • In the Rules, "NPDES" is misspelled. • Rules discuss design based on a 10-year storm only.
	Special Permit Rules and Regulations			All Town special permit rules and regulations should be reviewed for consistency w/SHP.

PC-2 Municipal Code and Ordinance Analysis

**Encouraging Low-Impact-Development Stormwater-Management Practices:
Assabet River Watershed Sub-Basin Case Study**

By

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SUBMITTED TO THE DEPARTMENT OF CIVIL AND ENVIRONMENTAL
ENGINEERING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF
MASTER OF ENGINEERING IN CIVIL AND ENVIRONMENTAL ENGINEERING
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
JUNE 2005

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III. Municipal Code and Ordinance Analysis

A. Introduction

Stormwater Quality - Regulatory Overview

Recognizing a rapid reduction of water quality throughout the U.S. and the potential impacts this degraded quality would have on human health and aquatic ecosystems, the U.S. Congress enacted the Water Pollution Control Act in 1948. This act gives the Surgeon General of the Public Health Service authority to establish comprehensive programs to reduce pollutant discharges and to raise the sanitary condition of surface and groundwater to protect the public it serves. This act has been amended over the years to provide funding for research, increase cross-departmental responsibilities, increase state and local responsibilities, and, as discussed below, significantly reorganize water-quality management. The most significant amendments came in 1970, 1972, and 1977.

As previously mentioned in part C of Chapter I of this thesis, the Environmental Protection Agency was established in 1970 as part of Reorganization Plan No. 3. This plan also abolished the Federal Water Quality Administration in the Department of Interior. Water-quality functions that were previously assigned to the Secretary of Interior and the Department of Interior were transferred to the newly established EPA. The year 1970 was also witness to a number of new water-quality regulations dealing with identification and reduction in pollutant discharge into navigable waters. The 1972 amendments established the National Pollutant Discharge Elimination System (NPDES). This system authorized the EPA to issue discharge permits but stipulated specific guidelines to issue permits for discharges into the territorial sea, the contiguous zone, and offshore ocean waters. The amendments in 1977, also referred to as the Clean Water Act of 1977, broadly amended the existing act. The Clean Water Act (CWA) included development of a "Best Management Practices" Program. This program provided states with stipulated best management practices (BMP) for water quality control. The CWA of 1977 also transferred responsibility for the program over to individual states.

The NPDES program was carried out in two phases. The first phase began with the issuance of the 1972 act and targeted large point source pollutant discharges. These included industrial discharges, municipal combined sewer systems, and medium and large municipal separate storm sewer systems (MS4s). Designation as a medium or large MS4 is based on the population served by the system. A medium MS4 services 100,000 to 249,000 and a large serves 250,000 and greater.

The second phase of the NPDES program includes "regulated small MS4s." To be designated as small the system serves a population of less than 100,000. A "regulated" small MS4 is generally located within the boundaries of a Census Bureau designated

“urbanized area” with a residential population of at least 50,000 and an average population density of 1000 people per square mile. However, some small rural MS4s outside of designated urbanized areas may still require NPDES Phase II permitting if they meet specific population thresholds. An illustration of the Massachusetts’ NPDES Phase II designations with detailed coverage specific to Acton is shown in Figure 12 (EPA 2004).

Over 97% of Acton’s population is now regulated under the NPDES Phase II requirements. Acton recently submitted a notice of intent (NOI) to the EPA (MDEP 2003), which details receiving waters that have stormwater outfalls and details of particular impairments under the NPDES regulations. Acton’s NOI lists ten outfalls into two locations of the Assabet River. Both locations are listed as impaired and require an active stormwater management program with six program areas detailing initiatives to correct this impairment. The six required program areas are:

- Public education
- Public participation
- Illicit discharge detection and elimination
- Construction site runoff control
- Post construction runoff control
- Municipal good housekeeping

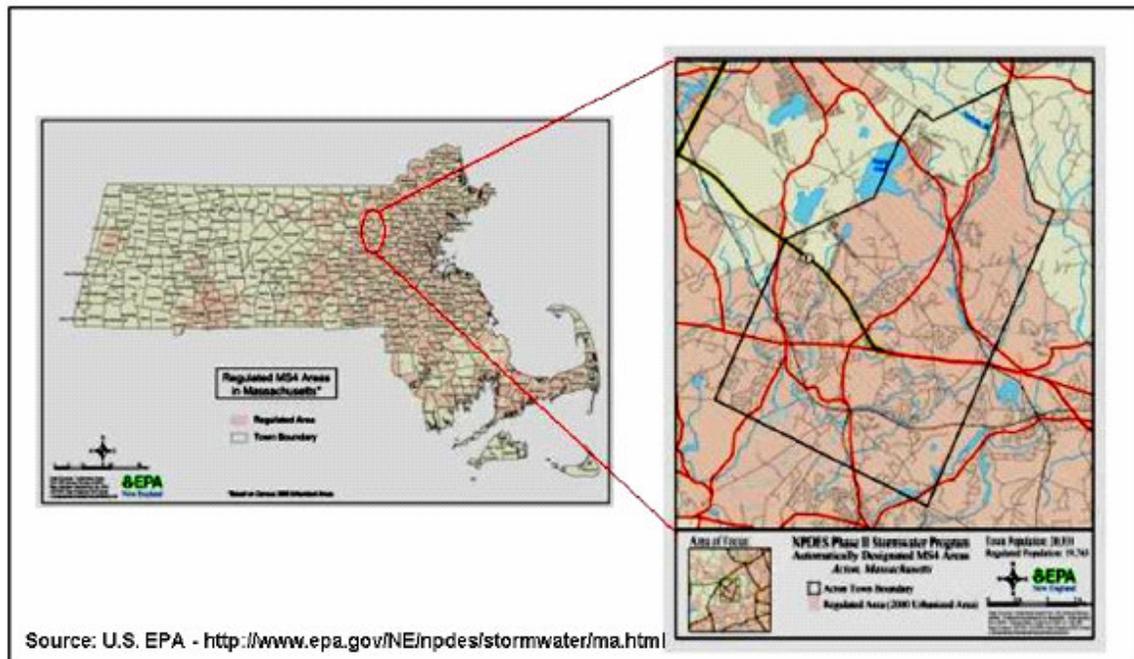


Figure 12: Massachusetts NPDES Phase II Designated MS4s

Stormwater Volume Control – Regulatory Overview

Conventional stormwater management is based on targeted control and timed release of runoff volume. The purpose behind this control is to prevent localized flooding but also to prevent volume overload of the stormwater management infrastructure and receiving waters. The most efficient method of controlling both the volume and the time release of collected storm water has been through the use of controlled grading towards curbs, gutters, and catch basins to quickly direct water to a central detention/ retention area. Controlled release is typically accomplished through the use of an engineered weir or orifice outlet structure.

There are numerous regulations detailing specifications and requirements for each step of the catch-and-convey process. The EPA sets the minimum standards for stormwater management with each state and town adding additional detail and requirement. Acton has specific standards that are detailed in the Acton Zoning Bylaw (Acton 2004b) and Subdivision Regulations (Acton 2004a), as well as basic engineering and construction standards regulations by reference.

The EPA allows a number of methods for estimating and modeling stormwater runoff. However, the more stringent Acton Subdivision Regulations (Section 5.3.18) specify the use of the rational method using the 10-year storm for determining peak runoff and associated pipe sizing. Section 5.3.18 goes on to establish minimum stormwater pipe size of 12” diameter. Section 8.2 of the Acton Subdivision Regulations details construction standards for drainage including a requirement to use a “manhole system” for street runoff. Paragraph 8.2.3 of this section mandates control of peak runoff from the site to that of its pre-developed condition. Paragraph 8.2.4 prohibits direct discharge of any collected runoff to natural receiving waters until the runoff has been directed into a vegetated detention basin.

The aforementioned list of specific stormwater management requirements is only part of a much longer list of requirements that, when comprehensively compiled, direct specific conventional stormwater management technologies that do not necessarily match up with LID BMPs. However, without exception, all of the regulations provide a means to submit Stormwater management plans and specific designs for regulatory variance approval as long as they can be shown to meet all conventionally specified performance standards.

LID technology and associated BMPs are a fairly new concept, but recent research provides adequate physical and empirical data to support implementation. However, Acton’s aforementioned code and ordinance requirements present obstacles to implementation. To ensure maximum effectiveness for potential LID implementation, Acton’s regulations need to be reviewed and possibly amended from prescriptive to performance-based requirements. These revisions would reduce or eliminate variances and decrease approval times. In turn, developers would be more inclined to use LID technologies as a first alternative to conventional Stormwater management. Developer’s use of LID strategies in conspicuous locations would be helpful to the Town in adding

additional NPDES program initiatives in public education and public participation at little or no additional cost to taxpayers.

B. Background

Recognizing that many small communities and local municipalities were in dire need of watershed management assistance, a 501(c)3 non-profit corporation was formed in 1992 to service this need. The organization is called the Center for Watershed Protection (CWP) and their mission is to provide communities with technical assistance and water management tools needed to ensure protection of natural water systems. The CWP protection strategy includes watershed planning, restoration, stormwater management assistance, watershed research, better site design tools, education and outreach programs, and watershed training (CWP 1992).

In 1996 the CWP brought together a diverse group of participants to take part in a Site Planning Roundtable (SPR). The group was comprised of key planning, design, and community development representatives. The objective of the roundtable was to develop a consensus agreement on model development principles that would help protect streams, lakes, and wetlands. After two years of collaborative work and consensus processes they developed a set of twenty-two model development principles. In the six years since the model development principles were released many regional governments and local municipalities have been incorporating and/or including directives for their use in their developmental regulatory requirements. In doing so, they have established an institutional requirement for more thoughtful use of impervious cover, preservation of natural cover, and lower stormwater pollutant loading and transport.

The twenty-two principles are grouped into three sections that include:

- Residential Streets and Parking Lots (Principles No. 1-10)
- Lot Development (Principles No. 11-16)
- Conservation of Natural Areas (Principles No. 17-22)

Using the twenty-two principles as a guide, a standardized Code and Ordinance Worksheet (COW) was developed (CWP 1998a). The COW presents the twenty-two principles as planning benchmark questions that require the user to answer yes, no, or include a quantified value for mandated design parameters. Points are awarded for answers based on their agreement with the benchmarks. There are 100 possible points available for the entire worksheet with subtotal stopping points for each of the three sections mentioned above. Point distribution among the three sections is not made equally. Section 1 has the strongest weighting with a total of 40 possible points. Sections 2 and 3 (36 points and 24 points respectively) carry less weighting. Point allocations and resulting weight distribution are based on estimated environmental impact of each principle. General interpretive guidance is provided at the end of the worksheet to help communities understand the meaning of their overall worksheet scores. Interpretive guidance for COW total score is presented in Table 2 (CWP 1998a).

When the site planning roundtable was complete the Center for Watershed Protection published a 200-page book titled *Better Site Design: A Handbook for Changing Development Rules in Your Community*. The book includes the twenty-two model development principles, COW, general Site Development Roundtable consensus agreement, and case studies detailing examples of each development principle.

Table 2: Code and Ordinance Worksheet Total Score Evaluation

90-100	Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work.
80-89	Your local development rules are pretty good, but could use some tweaking in some areas.
70-79	Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.
60-69	Developmental rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.
Less than 69	Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.

After the release of this book, a number of local communities requested that CWP facilitate similar Site Planning Roundtables within their own regions. Completed COW scores for 18 of these communities are discussed in paragraph D of this section.

C. Acton Code and Ordinance Review

Conduct of Review

The CWP COW was used as a basis for comparing Acton’s regulations against the twenty-two model development principles. The CWP COW was chosen due to its acceptance by the EPA and because the standardized approach provides a means to make direct comparisons to communities that have completed the same assessment.

In recognition of potential differences in regulatory language and fit into the standard language of the COW, I performed the Acton assessment using applicable code and ordinance publications as well as input provided by the Acton regulators themselves. On March 17, 2005 I met with the Town Engineer and Director of Public Works, Mr. Bruce Stamski, P.E. and one of his staff engineers, Mr. Corey York. The Director of Natural Resources, Mr. Tom Tidman, also attended and provided input to the worksheet. The completed worksheet is provided in Appendix A.

Worksheet Results

Table 3 provides a summary of the worksheet results. Section 1, Residential Streets and Parking Lots (Principles No. 1-10), has the least agreement with the model development principles with a raw score of 48%. Lot Development (Principles No. 11-16) and Conservation of Natural Areas (Principles No. 17-22) each with scores of 71% have the greatest agreement with the model development principles. Based on the interpretive guidance shown in Table 2, Acton’s composite score of 62% suggests that their current developmental rules are not adequate to protect the local aquatic resources. It can also be inferred that their regulations will not contribute to improving the Assabet water quality impairments listed in their NPDES Phase II MS4 NOI. Considering the 40% weight of Section 1 principles, the 52% disagreement of this section represents 55% of the total code and ordinance disagreement.

Section deficiency and total deficiency scores are also presented in Table 3. The section deficiency is defined as the amount (by percentage) that the individual principle deficiency contributes to its section deficiency. Likewise, the total deficiency listed for each principle represents the contribution it makes to the total deficiency. Examining these figures, it can be seen that there are five principles that each contribute more than 10% to their respective section deficiency and 4% towards the total deficiency. These areas are shown in Table 4 as target areas. Principles 5 and 8 with scores of 0% and 20% respectively have the greatest disagreement with their model principles. Principles 12 and 13 make up 29% of the Section 2 deficiency. Finally, Principle 21 has a 17% section deficiency, which is the largest section deficiency contributor of all twenty-two principles.

Table 3: Acton Code and Ordinance Worksheet summary

Principle #	Score	Out-of	%	Section Score	Section Deficiency	Total Deficiency	Target Areas
1	4	7	57%	48%	8%	3%	
2	1	1	100%		0%	0%	
3	4	4	100%		0%	0%	
4	2	5	40%		8%	3%	
5	0	4	0%		10%	4%	√
6	2	5	40%		8%	3%	
7	1	4	25%		8%	3%	
8	1	5	20%		10%	4%	√
9	0	1	0%		3%	1%	
10	4	4	100%		0%	0%	
11	8	8	100%	71%	0%	0%	
12	2	6	33%		11%	4%	√
13	2.5	6	42%		10%	4%	√
14	6	6	100%		0%	0%	
15	3	6	50%		8%	3%	
16	4	4	100%		0%	0%	
17	3	4	75%		4%	1%	
18	4	4	100%		0%	0%	
19	1	3	33%		8%	2%	
20	3	3	100%		0%	0%	
21	0	4	0%	17%	4%	√	
22	6	6	100%	0%	0%		
Total Score				62%			

Principle #5 – *Vegetated Open Channels*: Both the Zoning Bylaw and Subdivision Regulations mandate the installation of 5” curbs along streets and around landscape features. Additionally, the Subdivision regulations require the use of a “manhole” system for street drainage. The Acton regulators explained that the curbing requirement has both a functional and aesthetic purpose. Curbing provides protection from snow removal equipment such as plows and snow-blowers, a suitable lateral anchor for bituminous pavement, and functions as a channel to move Stormwater towards catch basins and other collection infrastructure. Acton’s regulations fail to achieve the two points for the second part of principle #5 because there are no established design criteria provided for swales. The existing regulations require stormwater basins to be lined with low hydraulic conductivity soils as a water-quality protection measure—i.e., to limit Stormwater infiltration to groundwater. However, combining both the curbing and manhole system requirement with the detention basin design requirement, it becomes very clear that Acton’s regulations direct the use of conventional collect-and-convey stormwater practices. This disagrees with the model principle for use of vegetated open channels and is scored accordingly.

Principle #8 – *Parking Lots*: Section Six of Acton’s Zoning Regulations details all of the Town’s parking requirements. Acton’s parking standards have only a 20% agreement with the model parking lot principle. The model principle is based on a philosophy of reducing the impervious cover that is associated with parking lots. Acton agrees with the model principle of having minimum stall widths of nine feet or smaller. However, nine feet is the minimum width allowed for a standard space in Acton. There is no maximum width stated. The minimum stall width is the only principle on which Acton and the model agree. The minimum length for a standard parking stall in Acton is 18 feet 6 inches, which exceeds the standard principle by 6 inches. Acton provides allowance for a maximum of 30% any lot’s spaces to be configured for compact cars. The model principle would mandate a minimum of 30% compact stalls. Last, Acton does not allow pervious materials for spillover parking areas. Mr. Tidman did state that pervious materials may be used for pedestrian pathways and walks in conservation areas.

Principle #12 – *Setbacks and Frontages*: Acton’s regulations are in line with the model principle with regard to allowance of irregularly shaped lots and having a rear setback allowance of less than 25 feet. However, these are the only two items of agreement and make up all of the 33% scored for this principle. There is disagreement in the minimum front and side setbacks and minimum lot frontage for ½-acre residential lots. Reducing side setbacks and lot frontage will decrease total road length in the community. Lowering the front setback requirement will reduce the amount of driveway and walk surfaces required to support the individual dwellings.

Principle #13 – *Sidewalks*: There is some agreement between Acton’s regulations and the model principle for sidewalks, but the majority of Acton’s sidewalk regulations depart from the ideal principle. Acton does not mandate sidewalks on both sides of the road, but sidewalks are required to be at least five feet wide. Bruce Stamski said the sidewalk width is based on the standard width of the Town’s snow removal equipment and also to allow sufficient space for two-way pedestrian traffic. Acton’s sidewalks are sloped to

direct water towards the street, which differs from the model principle. However, half-credit (0.5 points) was given for this item because Acton has a grass/landscaped pervious strip between their sidewalks and the street. Acton does not allow alternate pedestrian networks to replace standard walks, but does allow them as additional supplements. No points could be awarded for this item because their sidewalks are impervious and the supplemental allowance does not reduce the amount of impervious surface required.

Principle #21 – *Land Conservation Incentives*: By percent (17%), this principle was the single greatest contributor to any Section’s model principle deficiency. Tom Tidman provided the response and input to this section. At the present time, Acton does not offer incentives or flexibility to developers for land conservation or meeting regulatory restrictions. For this reason, no points were awarded for the Acton land conservation regulations.

D. Comparative Studies

A direct result of the Better Site Design: A Handbook for Changing Development Rules in Your Community release and the recent MS4 Phase II NPDES requirement has been requests for CWP facilitation of local site planning round-tables. The majority of these CWP sponsored roundtables have been conducted in towns along the mid-Atlantic coast. However, similar adaptations of these roundtables have been conducted without CWP facilitation throughout the country (Hoyt 2005). The CWP has a growing database of completed COW scores as well as roundtable summaries. These summaries include detailed discussions and recommendations born from COW results and consensus agreements.

Table 4 shows a detailed breakdown of completed worksheets of eighteen communities from five different states (Hoyt 2005, Dreps 2005). Average scores are based on the average raw score divided by total available score (either principle total, section total, or worksheet total as appropriate). Available points for each category can be found in Table 3. The eighteen communities completing the worksheet have codes and ordinances that have an average of 58% agreement with the model development principles. Residential streets and parking lots have the lowest section average at just 48% agreement while lot development has the largest section average at 67%.

Table 4: Code and Ordinance Worksheet comparative historical data summary

	Principle #	Woroster, MD*	Wappinger, NY**	Dinton, NY*	James City County, VA*	Creamer, NC**	Durham City, NC**	Durham County, NC**	Franklin County, NC**	Somerville County, NC**	Hillsborough, NC**	Orange County, NC**	Person County, NC**	Raleigh, NC**	Wake County, NC**	Lenoir, PA*	Marion Township, PA*	East Hampfield, PA*	West Hampfield, PA*	Average Raw Score	Out-of	Average Score (%)	
Section 1 Residential Streets and Parking Lots	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3.6	7	51%	
	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3.7	1	72%
	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1.7	4	42%
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2.6	5	51%
	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2.0	4	50%
	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1.3	5	27%
	7	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1.7	4	43%
	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2.8	5	57%
	9	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0.0	1	0%
	10	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2.7	4	67%
	Section Subtotal	25	7	12	27	16	24	24	22	30	17	20	10	20	20	19	20	13	12	19.1	40	48%	
Section 2 Lot Development	11	6	5	7	5	8	8	8	6	8	7	8	0	8	7	7	8	7	8	6.3	8	70%	
	12	6	5	3	1	4	2	2	6	2	1	2	2	3	6	3	1	4	3	3.0	6	50%	
	13	5	4	5	5	2	2	2	3	2	2	2	1	2	0	6	6	4	3	3.1	6	52%	
	14	4	0	4	6	6	4	4	6	6	6	4	3	3	1	6	6	3.5	3	4.2	6	70%	
	15	4	4	3	5	4	5	5	3	4	3	5	0	3	5	4	3	3.5	5	3.8	6	63%	
	16	4	4	4	4	2	4	4	4	2	2	4	2	4	4	4	4	4	4	4	3.6	4	80%
		Section Subtotal	31	19	26	26	24	25	25	20	22	21	8	21	20	33	28	23	25	23.0	36	67%	
Section 3 Conservation of Natural Areas	17	4	4	4	4	2	2	2	2	3	2	3	3	3	2.5	0	0	0	0	2.3	4	56%	
	18	4	0	1	4	3	3	3	3	3	3	4	0	4	4	0	0	0	0	2.2	4	54%	
	19	3	1	1	3	3	3	3	1	3	1	3	0	0	2	3	3	2	3	2.2	3	72%	
	20	3	1	0	3	1	3	3	0	1	1	3	0	1	0	3	3	3	3	1.8	3	50%	
	21	3	0	4	2	3	2	2	4	3	0	4	0	2	4	4	2	4	4	2.6	4	65%	
	22	4	6	0	6	3	8	8	3	3	0	5	0	8	6	3	3	3	2	3.9	6	66%	
	Section Subtotal	21	13	10	22	15	21	21	13	16	7	22	3	18	18.5	13	11	12	12	14.0	24	62%	
	Total Score	77	30	48	75	55	70	70	64	68	45	67	21	50	58.5	65	50	53	49	57.9	100.0		
	Overall Percentage	77%	30%	48%	75%	55%	70%	70%	64%	68%	45%	67%	21%	50%	58%	65%	50%	53%	49%	57.9%	100%	58%	
* Source: Hoyt, Sally. Water resources engineer, Center for Watershed Protection. Email correspondence February 7, 2006																							
** Source: Draps, Chris. Upper Neuse River Basin Association program advisor. Triangle J. Council of Governments. Email correspondence February 11, 2005																							

The overall average of 58% is a very telling metric. Based on the COW scoring guidance presented in Table 2 all but four of these communities “definitely are not environmentally friendly” and “serious reform of the development rules is needed.”

Table 5 compares Acton’s COW results to the averages from Table 4. With a composite average of 62%, Acton’s regulations are more in agreement with the model principles than the comparative average of only 58%. Acton’s regulations dealing with residential streets and parking lots (Section 1) are on par with the historic 48% average.

Table 5: Code and Ordinance data comparison

	Principle #	Possible Score	Acton, MA			Comparative Studies		
			Raw Score	Score (%)	Target Area	Average Raw Score	Average Score (%)	Target Area
Section 1 Residential Streets and Parking Lots	1	7	4.0	57%	↓	3.8	51%	↓
	2	1	1.0	100%		0.7	72%	
	3	4	4.0	100%		1.7	42%	
	4	6	2.0	40%	↓	2.6	51%	
	5	4	0.0	0%	↓	2.0	50%	
	6	5	2.0	40%	↓	1.3	27%	↓
	7	4	1.0	25%	↓	1.7	43%	
	8	5	1.0	20%	↓	2.8	57%	
	9	1	0.0	0%		0.0	0%	
	10	4	4.0	100%		2.7	67%	
	Section Subtotal	40	19.0	48%		19.1	48%	
Section 2 Lot Development	11	8	8.0	100%		6.3	79%	
	12	6	2.0	33%	√	3.0	50%	↓
	13	6	2.5	42%	√	3.1	52%	↓
	14	6	6.0	100%		4.2	70%	
	15	6	3.0	50%	↓	3.8	63%	
	16	4	4.0	100%		3.8	80%	
	Section Subtotal	38	25.5	71%		23.9	67%	
Section 3 Conservation of Natural Areas	17	4	3.0	75%		2.3	58%	
	18	4	4.0	100%		2.2	54%	↓
	19	3	1.0	33%	√	2.2	72%	
	20	3	3.0	100%		1.8	59%	
	21	4	0.0	0%	√	2.6	65%	
	22	6	6.0	100%		3.9	66%	↓
	Section Subtotal	24	17.0	71%		14.9	62%	
	Total Score	100	61.5			57.9		
	Overall Percentage			62%			58%	

Target areas chosen in Table 3 were those principles with deficiencies contributing at least 10% to their respective section deficiency and also 4% to the total worksheet deficiency. Target areas listed in Table 5 were chosen using a similar methodology, but with two different criteria. Table 5 targets were chosen if their contribution to the section's deficiency is = 8% or if their contribution to the total deficiency is = 2%. The logic for Table 5 is more inclusive than the 10%-section and 4%-total logic used in Table 3 and thus accounts for the averaging effect on the comparative data. The revised logic screen captures all of Acton's target principles from Table 4 (shown as bold checks in Table 5) but adds additional areas for suggested review.

Target Principles – Revised screen

Principle #1 – *Street width*: Acton's 57% agreement is slightly above the comparative average of 51%. In the comparative study areas, general recommendations for improvement included (Hoyt 2005):

- Designing residential streets for the minimum required width to support travel lanes, on-street parking, and emergency/service/maintenance vehicles
- Encouraging narrow pavement widths on residential collector and sub-collectors where parking is not anticipated or desired
- Reducing on-street parking requirements where off-street parking can be provided

Principle #4 – *Cul-de-Sacs*: Acton's score of 40% results in an 8% contribution to the section score and 3% overall deficiency contribution (see Table 3). Acton's Subdivision Regulations mandate a minimum cul-de-sac radius of 50 feet. The recommended radius is less than 35 feet with partial credit given if the required radius is above 36 feet but less than 45 feet. To their credit, Acton requires the construction of a landscaped island in the center of the cul-de-sac. However, to provide adequate space for the landscape island the minimum radius is driven above the recommended minimum radius. All else being equal, this might be considered an environmental tradeoff. In fact, it is not. Section 8.1.18.1 (d) mandates a sloped granite curb around the island and a convex grading of the island surface to prevent pooling of water in the island. The convex grading adds runoff to the cul-de-sac and prevents the use of this feature as a micro-level stormwater treatment device. Allowing concave grading of the island and inner-ring cul-de-sac grading towards island curb-cuts would allow the island landscape feature to act as a stormwater treatment device as well as an aesthetic landscape feature.

Principle #6 – *Parking Ratios*: Acton's principle score of 40% is well above the 27% historical data average. However, under the revised screening criteria both disagree with the model principle enough to be targeted for code and ordinance revision. Previous roundtable recommendations for parking ratio code revision have included (Hoyt 2005):

- Required parking ratios should be enforced as both a minimum and maximum
- Any parking area in excess of the mandated ratio should be constructed using porous technology
- Parking requirements based on floor area should be determined by the total gross floor area of the use, excluding incidental storage, mechanical areas, preparation areas, and additional common areas such as corridors, stairwells, and elevators.

Principle #7 – *Parking Codes*: Both Acton and most of the other communities completing the COW have parking codes that score fairly low compared to the model principle. Acton permits a reduction of the required number of parking spaces if a shared agreement is in place. However, there is no active promotion for shared parking nor is there a boiler-plate agreement available from the town. Acton regulators should promote the use of shared parking and provide guidance on optimal sharing arrangements. Assistance with shared agreements could be provided by making template model shared parking arrangements available to eligible candidates.

Principle #15 – *Open Space Management*: Acton’s principle score of 50% lags the historical comparative data set average of 63%. Mr. Tidman and Mr. Stamski provided the responses to the five open space management questions. Currently, Acton’s regulations mandate the preservation of open space as percentage of the developed area and detail allowable uses of the open space set-aside. Further, they allow third-party open-space managers. However, there is no mandate to establish an association to manage the space after development. Further, there is no requirement to keep a specified percentage of the open space in a natural condition. Use beyond that prohibited by regulation is left up to the property owner. For the most part, Acton’s open space is currently being managed and the vast majority of this space has been left in a natural condition.

Principle #18 – *Buffer Maintenance*: Acton’s 100% agreement with the model principle far exceeded the 54% comparative average. Acton requires a fifty-foot “no-touch” buffer along streams and along any designated wetland. The “no-touch” requirement ensures that the buffer is maintained in its natural condition. No regulatory revision is recommended.

Principle #19 – *Clearing and Grading*: With a principle score of only 33% the Acton regulations fall well short of the model principle. Further, they lag the 72% historical comparative average for this principle. The Acton Subdivision regulations do not explicitly encourage preservation of natural vegetation. The choice is left to the developer and land owner. This disagrees with the model principle of directing preservation of natural vegetation to the maximum extent practicable. Acton does not require reserve septic field areas to be cleared at the time of development, which agrees with the model principle. However, Bruce Stamski reports that there is no prohibition for early clearing. The practical result is that most developers clear the reserve septic areas during initial development when it is most economical and they have easy access to the area.

Principle #22 – *Stormwater Outfalls*: Due to the generic wording of the model principle Acton’s conventional BMP regulations receive full credit for agreement with the model outfall principle. The historical comparative average is only 66%.