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By email

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Re: Draft General Permit for Small Municipal Storm Sewer Systems ("MS4") for Massachusetts South Coastal, Merrimack, and Interstate South-Flowing Watersheds

Dear Ms. Renahan:

The Conservation Law Foundation ("CLF") appreciates the opportunity to comment on the Small Municipal Separate Storm Sewer System Draft General Permit for Massachusetts South Coastal, Merrimack, and Interstate South-Flowing Watersheds Watersheds ("Draft Permit").

Founded in 1966, the Conservation Law Foundation ("CLF") is a member-supported environmental advocacy organization that works to solve the problems threatening our natural resources and communities in Massachusetts and throughout New England. Among those problems, CLF has worked, and continues to work, to promote effective regulations and strategies to reduce and minimize the significant impacts of stormwater pollution.

I. General Comments

"Stormwater runoff is one of the most significant sources of pollution in the nation, 'at times comparable to, if not greater than, contamination from industrial and sewage sources."[1] As the U.S. Environmental Protection Agency (EPA) acknowledged in 1999, "[s]torm water runoff from lands modified by human activity can harm surface water resources and, in turn, cause or contribute to an exceedance of water quality standards by changing natural hydrologic patterns, accelerating stream flows, destroying aquatic habitat, and elevating pollutant concentrations and loading." 64 Fed. Reg. 68,724 (Dec. 8, 1999). This is no less true in

[1] *Environmental Defense Center v. Browner*, 344 F.3d 832, 840 (9th Cir. 2003), *cert. denied*, 124 S.Ct. 2811 (2004) (*citing* Richard G. Cohn-Lee and Diane M. Cameron, *Urban Stormwater Runoff Contamination of the Chesapeake Bay: Sources and Mitigation,* THE ENVIRONMENTAL PROFESSIONAL, Vol. 14, p. 10, at 10 (1992) and *Natural Res. Def. Council v. EPA*, 966 F.2d 1292, 1295 (9th Cir. 1992)).

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Massachusetts. Stormwater has been cited as the primary cause of water quality impairment in the Commonwealth, and municipal small separate storm sewer systems (“MS4s”) are a significant contributor to those problems.[2]

An enhanced Small Municipal Storm Sewer (“MS4”) permit program for Massachusetts with meaningful standards, clear milestones, and strong enforcement is necessary as part of the overall effort to restore degraded rivers, streams, and ponds and maintain fishable, swimmable water quality in the state’s waterways. The Draft Permit represents a substantial step forward in this direction, and we recognize the work EPA Region 1 (“EPA”) has undertaken to evaluate the effectiveness of the 2003 permit and to involve stakeholders in discussions about the permit reissuance. However, from CLF’s perspective there are a number of areas where the permit must be strengthened in order to fully reflect legal requirements and to accomplish the objectives of the MS4 program.

Compliance with the Massachusetts MS4 permit, and success at achieving water quality outcomes, has varied widely across the permittees under the 2000 permit.[3] EPA’s own review of the MA MS4 program revealed that only 171 of 240 towns submitted their annual report for Year 7 (2009-10).[4] In compliance Year 6 (2008-09), only 25% of Communities reported they were doing outfall inspection and monitoring, and 30% still had not completed outfall mapping. These are baseline requirements that municipalities have been aware of since the 1999,[5] and that form the building blocks of the program. These monitoring, planning and assessment steps are prerequisites to the full achievement of what this permit program requires, which is a systematic analysis of impervious area, the creation and implementation of a plan to retrofit existing infrastructure to meet water quality standards, and incorporation of LID into all new development.

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[2] MassDEP, *Moving Toward a Statewide Stormwater Policy,* Presentation to Stormwater Stakeholders Group, March 6, 2008 (citing pollutants associated with stormwater runoff as the cause of 60% of impairments statewide; *see also* Massachusetts Integrated List of Waters (2008), available at http://www.mass.gov/dep/water/resources/tmdls.htm; Lower Charles River Nutrient TMDL, available at http://www.mass.gov/dep/water/resources/tmdls.htm.

[3] MassHighway, for example, failed to submit an NOI meeting even basic authorization requirements until CLF, the Charles River Watershed Association, and the Leominster Land Trust sued the Commonwealth in federal court in 2006. CLF v. Patrick, Case No. 06-11295wgy (U.S. District Court for the District of Massachusetts).

[4] *See* EPA NPDES Phase II Small MS4 Permit Program – Massachusetts Annual reports summary Permit Year 7 (2009-2010), *available at* http://www.epa.gov/ne/npdes/stormwater/assets/pdfs/MA-SWMP-Summaries-Metrics-Yr-7.pdf.

[5] 64 Fed. Reg. 68722 (Dec. 8, 1999). Had these requirements been meaningfully considered by the permittees from the outset, there was ample time to incorporate infrastructure improvements into annual and multi-annual budgeting and capital planning processes, and to establish funding mechanisms to ensure the financial resources for management of stormwater. Newton, for example, has implemented a stormwater utility.

Although achieving these objectives, and compliance with the Clean Water Act, will require a sustained commitment of resources, EPA and the entities regulated under the Phase II program must not lose sight of the fact that there are significant costs associated with continued stormwater pollution – such as ongoing and increasing degradation of water quality, loss of recreational value, adverse impacts on water supplies, and declining property values – that can only be reduced and avoided by improved stormwater regulation and management.[6] Low Impact Development ("LID") and green infrastructure practices that restore the natural hydrological cycle and reduce the demand on piped infrastructure can be, in the long run, more cost-effective to implement and maintain than conventional stormwater infrastructure.[7] Thus, in addition to improving and protecting water quality, the increased use of LID and green infrastructure has the potential to generate financial benefits and more livable communities.

A recent (2010) EPA report found that:

> Communities across the nation are increasingly recognizing the potential for green infrastructure to address social and economic, as well as water quality concerns. Green infrastructure can reduce infrastructure costs, promote economic growth, and provide opportunities for outdoor reflection and recreation. As interest in green infrastructure becomes more widespread, the demand for related job skills continues to rise. These skills are required not only for the initial design and installation of green infrastructure practices, but for long-term operation and maintenance as well.
>
> Research indicates that the potential economic benefits of widespread green infrastructure implementation are substantial. According to a study by American Rivers, NRDC, and other groups, 153 water-related green infrastructure projects worth $1.025 billion are ready to be implemented within 6 to 9 months in communities across the country.

[6] See, e.g., "How Much Value Does the City of Philadelphia Receive from its Park and Recreation System? A Report by The Trust for Public Land's Center for City Park Excellence for the Philadelphia Parks Alliance," June 2008 at 3-4 (estimating that Philadelphia's 10,000 acres of parks save $5.9 million annually in stormwater management costs).

[7] Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, U.S. EPA, Nonpoint Source Control Branch (4503T), Washington, D.C., Dec. 2007 (EPA 841-F-07-006). This EPA report on seventeen LID case studies found that in the majority of the LID projects "significant savings were realized due to reduced costs for site grading and preparation, stormwater infrastructure, site paving, and landscaping." LID projects resulted in up to 80% total capital cost savings. Furthermore, additional benefits, such as improved aesthetics and faster sales, were not factored into these savings figures. The case studies included redevelopment projects (for example, green roofs in Toronto) as well as new development.

U.S. EPA, Managing Wet Weather with Green Infrastructure: Green Jobs Training: A Catalog of Training Opportunities for Green Infrastructure Technologies, at i (Sept. 2010).[8]

II. Water Quality-Based Requirements

A central tenet of the Clean Water Act (CWA) as well as the small MS4 program is the principle that NPDES permits ensure compliance with water quality standards.[9] This concept is reiterated in the CWA, its regulations, case law, and the Small-MS4 General Permit. In enacting the CWA, one of Congress' principal goals was to "recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, [and] to plan the development and use (including restoration, preservation, and enhancement) of land and water resources."[10] In accordance with this goal, the CWA is clear that all provisions in a NPDES permit must comply with state water quality standards.[11] Federal case law has also underscored EPA's authority to include in stormwater permits all conditions and limitations necessary to assure the attainment water quality standards are met.[12]

The implementation of the MS4 program to date, and analysis done in connection with the Charles River Watershed phosphorus TMDLs, indicates that retrofits of existing infrastructure will be needed to ensure water quality standards are met in urban and suburban waterways. CLF encourages EPA to more clearly state where stormwater retrofits and new structural BMPs are expected as the result of the minimum control measures and Section 2. As described more fully below, LID-based performance standards are warranted in this permit, as it is not clear the permit's objectives can be met without them.

Section 1.3(k), providing that discharges that cause or contribute to instream exceedances of water quality standards are not authorized under the permit, should be retained in the final

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[8] listing green jobs training programs, more than half of which include LID/ green infrastructure stormwater management. *See also* www.epa.gov/greeninfrastructure.

[9] CWA §301(b)(1)(C), 33 U.S.C. § 1331(b)(1)(C), and 40 C.F.R. § 122.4(d).

[10] *See* 33 U.S.C. § 1251(b).

[11] *See* 33 U.S.C. § 1370 (allowing state water quality standards to be more stringent than federal technology-based standards); 33 U.S.C. § 1341(a) (requiring compliance with water quality standards of both the state where the discharge originates and of any state affected by the discharge). The requirement that permits comply with state water quality standards allows no exceptions for cost or technological feasibility. *In re City of Fayetteville, Ark.*, 2 E.A.D. 594, 600-01 (CJO 1988) (interpreting the language of section 301(b)(1)(C) to require "unequivocal compliance with applicable water quality standards," and prohibit "exceptions for cost or technological feasibility"), *aff'd sub nom.* Arkansas v. Oklahoma, 503 U.S. 91 (1992).

[12] *Defenders of Wildlife v Browner* affirmed EPA's authority to include in small and medium MS4 permits controls and limitations necessary to ensure water quality standards are met. 191 F.3d 1159, 1166-67, (9th Cir. 1999) *See also* 33 U.S.C. 1312(p)(3)(b)(iii) (as cited in Fact Sheet, at 4).

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permit as an expression of EPA's responsibility and authority to ensure water quality standards are met.

Today, more than ten years since the commencement of the Small MS4 Program, and in light of current agency policy, EPA should be including numeric effluent limitations and performance standards in this permit that are clear, objective, enforceable, and reflect the state of the art, which is low-impact development ("LID") and "green infrastructure." The Draft Permit is an improvement over the 2003 permit in this regard, but does not go far enough toward this standard. As stated in a 2010 EPA guidance document:

> EPA now recognizes that where the NPDES authority determines that MS4 discharges and/or small construction storm water discharges have the reasonable potential to cause or contribute to water quality standards excursions, permits for MS4s and/or small construction stormwater discharges should contain numeric effluent limitations where feasible to do so. EPA recommends that NPDES permitting authorities use numeric effluent limitations where feasible as these types of effluent limitations create objective and accountable means for controlling stormwater discharges.

EPA Memorandum, James Hanlon to Regional Administrators, Nov. 10, 2010, "Revisions to the November 22, 2002 Memorandum 'Establishing Total Maximum Daily Load (TMDL) Waste Load Allocations (WLAs) for Stonm Water Sources and NPDES Permits Based on Those WLAs." The substantial body of water quality data collected in Massachusetts since 2003 shows that MS4 discharges not only have the reasonable potential to cause water quality standards exceedances, they *are* causing and contributing to exceedances of standards.[13]

CLF recognizes that EPA has taken steps to clarify the relationship between water quality-related requirements and the six minimum measures (and that both sets of requirements are applicable), which is generally a beneficial change. However, the Draft Permit still raises significant concerns and should be further clarified and strengthened.

a. Section 2.1.1, Requirement to Meet Water Quality Standards.

[13] See footnote 2, supra (citing MassDEP assessment that 60% of impairments are associated with stormwater pollution); . Massachusetts Integrated List of Impaired Waters, updated 2008 and 2010, available at http://www.mass.gov/dep/water/resources/tmdls.htm; MassDEP Mystic River Water Quality Assessment Report 2004-2008, at xi, *available at* http://www.mass.gov/dep/water/resources/71wqar09.pdf. The U.S. District Court for Massachusetts found that MassHighway was causing and contributing to instream exceedances of water quality standards at three locations. Case No. 06-cv-11295WGY, electronic order May 30, 2008; Order, May 11, 2010.

CLF objects to the "presumptive approach" set forth in the Draft Permit and Fact Sheet, in which discharges are presumed to satisfy water quality requirements if minimum measures are implemented. (*See* Fact Sheet, at 30).

Section 2.1.1 is problematic in that it attempts to create the presumption that water quality standards are met if permittee "fully satisfies" all other permit requirements.' The presumption that "in the absence of information suggesting otherwise, discharges will be presumed to meet the applicable water quality standards . . . " is contrary to the permit itself (Section 1.3(b)) as well as the Clean Water Act and the Phase II regulatory scheme, which establish that the burden is on the discharger to demonstrate that water quality standards are met. This presumption should be removed in the final permit. CLF supports EPA's clarification that the 60-day period for the permittee to cure the exceedance is not create grace period and that EPA retains the ability to undertake any enforcement action allowed under the CWA. EPA should further clarify that this presumption and the 60-day period do not create any obstacle to the right of citizen enforcement conferred by Section 505 of the Clean Water Act, 33 U.S.C. § 1605, which would be illegal.

The Fact Sheet cites language in the 1999 Federal Register notice anticipated the ongoing obligation of the permittee to modify the SWMP to meet water quality standards.

> As discussed further below, however, small MS4 permittees should modify their programs if and when available information indicates that water quality considerations warrant greater attention or prescriptiveness in specific components of the municipal program. If the program is inadequate to protect water quality, including water quality standards, then the permit will need to be modified to include any more stringent limitations necessary to protect water quality.

64 Fed. Reg. 68722, 68753 (Dec. 8, 1999) (emphasis added).

CLF does not concede that the phrase "if and when available information indicates…" in the Phase II rule allows permittees to wait for citizens or regulatory agencies to notify them that a discharge is causing or contributing to water quality problems.[14] The burden is more properly on the discharger to actively assess and monitor their discharges, and to immediately correct problems, whether discovered through their own assessment or by others.

[14] *See* 64 Fed. Reg. 68722, 68753 (Dec. 8, 1999) ("[p]ermittees should modify their programs if and when available information indicates that water quality considerations warrant greater attention or prescriptiveness in specific components of the municipal program.")

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b. 2.2.1 – Discharges to Impaired Waterways With an Approved TMDL

CLF objects to the draft permit language stating that approved TMDLs are those that have been approved as of the effective date. As new TMDLs are approved during the permit term, they ought to be considered approved TMDLs. This better reflects the reality that new TMDLs will be issued throughout the permit term. Incorporating new TMDLs would ensure that their implementation will not be held up by the MS4 permit reissuance.

Section 2.2.1(b) refers to Appendix G, in which EPA has done some 'translating' of what the TMDLs mean in terms of requirements for MS4s. In general, this type of chart is a helpful addition to the permit, as the prior permit term revealed that there was a gap in some permittees' understanding of and acceptance of responsibility for loading reductions. The draft permit also reflects an important clarification in 2.2.2 that TMDL is not a license to pollute – that discharges to impaired waters must also comply with Part 2.1.1, the prohibition on causing or contributing to instream exceedance

CLF supports EPA's inclusion of specific requirements from TMDLs in Appendix G of the permit. However, certain of the assumptions that have been made in translating the TMDLs to requirements in Table G are objectionable and result in less stringent requirements in the Permit than are appropriate. There are numerous TMDLs in Massachusetts that clearly identify stormwater from impervious areas as a contributor to the impairment although the LA and WLA may not explicitly ascribe a specific percentage reductions to the MS4 system. TMDLs of this nature should be included in this appendix.

Table G2 sets forth TMDL requirements for Long Island Sound, and appropriately requires a 10% reduction from existing levels, as this reflects the approved Load Allocation for urban and agricultural loads for out-of-basin sources. This target is an important element of the TMDL, as other loading allocations are predicated on this nitrogen removal from out of basin sources. EPA should change the language in the fact sheet that could create the impression that MS4 permittees need not actually achieve and document this reduction.

Table G4, TMDLs for Buzzards' Bay and Cape Cod TMDLs, states that in many Cape Cod municipalities with an approved nitrogen TMDL, the approved TMDL allocation for nitrogen is "negligible." This is unsupported by the Cape Cod TMDLs[15] and their underlying technical

[15] Stage Harbor, Sulphur Springs, Taylors Pond, Bassing Harbor and Muddy Creek (Chatham) TMDLs for Total Nitrogen, approved by EPA Region 1 on June 21, 2006; Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River (Waquoit Bay System) TMDLs for Total Nitrogen, approved by EPA Region 1 on Nov. 7, 2007; Great, Green, and Bournes Pond Embayment Systems TMDLs for Total Nitrogen, approved by EPA Region 1 on July 18, 2007; Popponesset Bay TMDLs for Total Nitrogen, approved by EPA Region 1 on Jan. 22, 2008; Pleasant Bay System

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reports for several reasons. First, CLF disagrees with EPA's statement in the fact sheet that "The TMDLs for nitrogen do not identify MS4 sources as significant contributors of nitrogen." In fact, the TMDLs consistently identify stormwater runoff from impervious areas as substantial proportion of the "controllable" load reduction – as high as 30%.[16] In addition, it is well documented that nitrogen in stormwater runoff from impervious areas and roads contributes substantially to pollution of waterways.[17]

Second, the entire stormwater contributions of nitrogen from MS4 systems should properly be accounted for and placed in the WLA of the TMDLs and accordingly in Table G4. Municipal stormwater systems on Cape Cod that collect and convey stormwater to surface waters are "municipal separate storm sewer systems" as that term is defined in EPA's regulations, and are therefore point sources under the CWA that must be included in the WLA as a matter of law. 40 C.F.R. §§ 122.26(b)(16) & 122.32(a)(1); see also, 64 Fed. Reg. 68722, 68818-19 (Dec. 8, 1999). This is the case whether the MS4 conveys and discharges pollutants via groundwater aquifers, surface flow through discrete conveyances such as ditches or swales, direct piped discharges, or a combination of these conveyances. *See* CWA § 502(14), 33 U.S.C. § 1362(14) ("point source.") The TMDLs draw an arbitrary distinction between impervious area more or less than 200 feet from surface water bodies,[18] which is contrary to EPA's own mapping of MS4 areas of coverage for various municipalities associated with this MS4 permit reissuance. *See*

TMDLs for Total Nitrogen, approved by EPA Region 1 on Oct. 24, 2007; Three Bays System TMDLs for Total Nitrogen, approved by EPA Region 1 on Feb. 13, 2008; Centerville River – East Bay System TMDLs for Total Nitrogen, approved by EPA Region 1 on Dec. 20, 2007; West Falmouth Harbor Embayment System TMDLs for Total Nitrogen, approved by EPA Region 1 on May 5, 2008; Phinney's Harbor Embayment System TMDLs for Total Nitrogen, approved by EPA Region 1 on Feb. 5, 2008; Little Pond Embayment System TMDLs for Total Nitrogen, approved by EPA Region 1 on Mar. 3, 2008; Oyster Pond Embayment System TMDLs for Total Nitrogen, approved by EPA Region 1 on May 5, 2008; Nantucket Harbor Bay System TMDL for Total Nitrogen, approved by EPA Region 1 on May 12, 2009, and Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek (Chatham Southern Embayments) TMDL Re-Evaluations for Total Nitrogen, approved by EPA Region 1 on June 22, 2009.

[16] See, e.g., Chatham Draft TMDL, 2008, at v. ("fertilizer and runoff" account for **12%** of the controllable load reduction); Centerville Final TMDL ("land use" accounts for **19%** of controllable load and 16% of overall load); Pleasant Bay Final TMDL ("land use" accounts for **30%** of controllable load, and 9% of overall load); Three Bays Final TMDL ("land use" accounts for **23%** of controllable load and 17% of overall load); Phinneys' Harbor Final TMDL ("land use" accounts for **25%** of controllable load and 15% of overall load).

[17] *See* Attachments D1-D81 (LID documents); see e.g. Project Report No.515: Contamination of Soil and Groundwater Due to Stormwater Infiltration Practices: A Literature Review by Peter T. Weiss, Greg LeFevre and John S. Gulliver of the University of Minnesota Stormwater Assessment Project, prepared for the Minnesota Pollution Control Agency (June 23, 2010), at ii, 6, 7 ("In areas with traditional development (i.e. no LID), nitrate export was found to increase logarithmically with increased impervious area. In LID areas, nitrate export did not correlate with impervious surface area"). *Available at* http://www.safl.umn.edu/.

[18] The TMDLs are predicated on the assumption that nitrogen from MS4 stormwater discharges beyond 200' from surface water bodies is presumed to infiltrate and therefore not to reach the receiving waters covered by the TMDLs. See, e.g. Centerville River TMDL, at 18.

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http://www.epa.gov/ne/npdes/stormwater/ma.html. To the extent that EPA's statement in Table G4 that nitrogen contribution is "negligible" based on this distinction, the permit and the table should be changed to reflect nitrogen reductions commensurate with the full extent of the MS4 contribution.

Third, Appendix G should clarify that the Cape Cod Nitrogen TMDLs provide no allocation for new growth. Thus, if any new MS4 impervious area is created, the additional nitrogen loading must be removed or offset on that basis alone. *See, e.g., Centerville TMDL, at 18.* TMDLs.

Finally, the chart is confusing, inconsistent, and apparently incorrect in that for some waterbodies with approved TMDLs, nitrogen is not listed in the column of approved TMDL components (while other pollutants are listed in this column), or the word "negligible" appears but the word nitrogen does not.

CLF disagrees with the approach to documenting compliance with TMDLs reflected in the Fact Sheet, that "the permittee's demonstration of meeting the requirements of the WLA should focus on evidence that shows that the BMPs are implemented properly and adequately maintained."[19] A quantitative approach should be used where the permittee estimates or its overall pollutant loading and the expected reduction if BMPs are properly maintained, as well as the expected impacts on water quality. This estimation should then be verified by real world information.

c. 2.3.1.1-2 – New or Increased Discharges to Impaired Waters

- The Draft Permit's requirement that new or increased discharges to impaired waters are disclosed and offset are critical on both a legal and practical level. Over half of Massachusetts waterways are already impaired for stormwater-related pollutants. Preventing polluted stormwater discharges from new impervious area represents the most straightforward opportunity to prevent further inputs of pollution into these degraded waterways. MS4 permittees are already obligated to control their discharges to the point where they are not causing or contributing to instream exceedances of water quality standards. Therefore, where new outfalls , higher pollutant loadings, or increased stormwater volume are proposed, 40 C.F.R. § 122.4(i) requires no less.

- CLF agrees generally that any new or increased discharges to impaired waters must be evaluated by the permittee before they occur, in relation to TMDLs and water quality standards. CLF supports the requirement that permittees give prior notice and receive approval from EPA before a new discharge will commence into a water with a TMDL,

[19] Fact Sheet, at 33.

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and strongly encourage EPA to require this information is made available to the public in real time. The draft permit does not appear to provide for any notice to EPA or the public prior to increased discharges, or prior to new discharges in impaired waters without a TMDL. CLF recommends this provision be changed in the final permit. It is critical that citizens, as well as regulatory agencies, have the opportunity to be informed *before* any new or increased discharge is permitted, to ensure that full dialogue occurs in the municipality as to how stormwater will be managed, and so that EPA and the public can make sure that the offsets or promised infrastructure are, in fact implemented. Merely requiring a statement in the annual report is not enough -- for example if a development or infrastructure project has been completed nearly a year ago and no offsets actually occurred as part of the project, or the project was changed from the initial design, it would be more difficult and costly to go back and mitigate the new or increased discharge after the fact. The spirit of this important permit provision would not be served by self-reporting on an annual basis.

- The draft permit represents an improvement over the 2003 permit in that "increased discharge" is defined, and that this situation is addressed more explicitly.[20] CLF agrees with EPA that no net increase in pollutant loading should be allowed from increased discharges to impaired waters, and that offsets need to be documented before construction begins. However, the application of the term "new discharger" is inappropriately proscribed due to EPA's overly broad reading of the term "new discharge," relying on an objectionable interpretation of the term "site"[21] to include an entire MS4 system. *See* 40 C.F.R. 122.2 (definitions). As a result, many discharges that should properly be treated as "new discharges" are considered to be "increased discharges."

- Functionally, this accomplishes an end run around the requirements of 122.4(i), as interpreted in the *Pinto Creek* decision, that "no permit may be issued to a new discharger if the discharge will contribute to the violation of water quality standards." A narrow exception to this prohibition is carved out for situations where a TMDL has been calculated, if the discharger can show, before the end of the comment period, that "there are sufficient remaining pollutant load allocations to allow for the discharge and that the existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality

[20] "Increased discharge" is defined in the draft permit as a discharge "directly into the MS4 or from the MS4 that commences after the effective date of this permit and results from creation of one or more acres of new impervious surface." Draft permit, § 2.3.1.
[21] The term "site" is defined to mean "the land or water area where any 'facility or activity' is physically located or conducted including adjacent land used in connection with the facility or activity." 40 C.F.R. 122.2.

standards."[22] CLF does not agree that new impervious area or new stormwater outfalls created by a municipality are properly defined as "increased discharges" rather than "new discharges" or "new dischargers" for purposes of triggering the Pinto Creek analysis. Any new stormwater outfalls created by an MS4 discharger into an impaired waterbody would contribute to the violation of water quality standards, and should be subject to the Pinto Creek requirements. We recommend this provision be changed in the final permit.

- Under the draft permit, "increased discharges" must provide for a net decrease in pollutant loading through enhanced control or offsets.[23] Without conceding that these discharges can be allowed under the permit, absent a TMDL and a demonstration that compliance schedules are in place for other point sources, CLF agrees agree that that a net decrease in pollutant loading should be required for any increased discharges to impaired waters. More specificity is needed as to what kinds of measures are an appropriate offset (for example, structural BMPs installed and functioning, and verified by the permittee to accomplish a particular pollutant loading, mass or volume reduction). Quantitative analysis and verification should be required to document the pollutant reduction and that the discharge will not contribute to water quality standards exceedances.

- Regarding Section 2.3.1.2, the "increased discharge" analysis and verification for TMDL waterways is not sufficient to ensure consistency with TMDLs. Step "a" is appropriate, and permittees should be required to calculate their loading contribution in this circumstance. However, steps "b" and "c" are too vague and leave an impermissible degree of discretion to the permittee. A better defined quantitative approach should be required, and the permittee should be required to certify as to the measures that have been taken on the ground and that they are achieving the necessary pollution reductions.

d. **2.3.3** - Antidegradation Requirements.

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[22] 40 C.F.R. 122.4(i); *Friends of Pinto Creek v. EPA*, Slip Op. No. 05-70785, 13505, 13515 (9th Cir., Oct. 4, 2007). The rationale for this section of the regulations is that it "corresponds to the stated objectives of the Clean Water Act 'to restore and maintain the chemical, physical, and biological integrity of the nation's waters.' 33 U.S.C. § 1251(a) (1987). And that 'it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited.' 33 U.S.C. § 1251(a)(3) (1987)." *Pinto Creek,* at 13515 (9th Cir. 2007).

[23] The Draft Permit provides that increased discharges are only eligible for General Permit coverage if the permittee identifies and estimates a load for each pollutant of concern, implements structural BMPs, and identifies the BMPs it has implemented such that the MS4 will not cause or contribute to exceedences of water quality standards or, in the case of a TMDL waterbody, will be consistent with the TMDL. Draft Permit, Sections 2.3.1.1 – 2.3.1.2.

- In general, the draft permit contains more thorough descriptions of the elements the antidegradation analysis must include than did the prior permit. This is an improvement over the prior permit, but this section is still not sufficiently clear and prescriptive to ensure the state's antidegradation policy is carried out.

- A second general concern is that the antidegradation provisions of the permit are too narrow in their application; antidegradation should be an ongoing and prospective analysis that applies to all permitted activities. This is because all NPDES permits must meet the non-degradation standard throughout the lifespan of the permit. *See* 40 C.F.R. 131.12.

- Section 2.3.3(b)(1) appears to create a de minimis exception, but this is not explained in the Fact Sheet. We do not agree that there is any de minimis threshold in the state's anti-degradation regulations at 314 Code Mass. Regs. 4.04, and therefore this should be removed.[24]

- The "Tier II" provisions in Section 2.3.3(b) are problematic, in that section 2.3.3(b) creates a subjective "out" on a number of grounds that are not consistent with 40 C.F.R. 131.12. The permittee can claim the discharge is "not significant because it is temporary in nature and that upon completion of the discharge period the existing water uses . . . will be equal to or better than . . . prior to commencing the discharge," or that "the effluent will be of a better quality than the existing water quality of the receiving water." These categories are too subjective to be enforceable, and at a minimum are susceptible to overly generous interpretation by permittees. This type of subjective self-regulation was struck down in *Environmental Defense Center v. Browner.*[25] In addition, allowing for a discharge that is "temporary in nature" implies that water quality standards during particular periods or events, which appears contrary to the water-quality based requirements of the MS4 program.[26]

- Section 2.3.3(f) provides that new or increased discharges to Outstanding Resource Waters require an individual permit. EPA should meaningfully enforce this provision. Given the wide range of waterways receiving discharges from the Department of

[24] If this is a reference to 314 Code Mass. Regs. 4.04(5), it appears to be mischaracterized. That section requires a four part analysis to be performed by the applicant to demonstrate that a number of substantive criteria are met before *"limited degradation"* (i.e. a new or increased discharge) is allowed to a high quality water. 4.04(5) would not be properly characterized as a de minimis threshold.
[25] *Environmental Defense Center v. Browner,* 344 F.3d 832, 840 (9th Cir. 2003), *cert. denied*, 124 S.Ct. 2811 (2004).
[26] *See* 40 C.F.R. § 122.4.

Transportation roads and infrastructure, including public water supply areas,[27] DOT should be required to obtain an individual permit on this basis alone.

III. Performance Standards Reflecting Low-Impact Development and Green Infrastructure

CLF strongly urges EPA to include in the permit performance standards that reflect Low-Impact Development or "green infrastructure" stormwater management practices, and/or numeric effluent limitations that are commensurate with such standards. These practices are widely available, well proven, are generally more effective than conventional infrastructure at pollutant removal and volume reduction, and confer additional benefits to the community and environment. As detailed in attachments A,B,C, and D1-75 to this comment letter, **LID/green infrastructure is the current expression of controlling polluted stormwater runoff to the "maximum extent practicable" ("MEP").** Furthermore, the attached documents demonstrate that the permit cannot effectively ensure that water quality standards will be met *without* inclusion of such LID/green infrastructure-based performance standards. Performance standards based on LID/green infrastructure should be included in this permit.[28] In particular, performance standards for LID/ green infrastructure should be included in Section 2.4.5, the Post-Construction bylaw, and should be required as the means by which permittees fulfill water-quality based requirements under Section 2.

From the outset, EPA has made clear the expectations that technologies would evolve, and that the Maximum Extent Practicable standard in the second round of small MS4 permits would reflect what was learned about the effectiveness of the BMP implemented during the first round. The need to meet water quality standards was to drive the evolution of the MEP standard, itself, because the ultimate objective of all BMPs is to ensure the attainment of water quality standards. As EPA expressed in the MS4 Final Rule:

> [The Maximum Extent Practicable standard] should continually adapt to current conditions and BMP effectiveness and should strive to attain water quality standards. Successive iterations of the mix of BMPs and measurable goals will be driven by the objective of assuring maintenance of water quality standards. If, after implementing the six minimum control measures there is still water quality impairment associated with discharges from the MS4, after successive permit terms

[27] including the Hobbs Brook Reservoir, which is listed as a Class A, Outstanding Resource Water. *See* 314 Code Mass. Regs. 4.06, Figures, available at http://www.mass.gov/dep/water/laws/tblfig.pdf.

[28] Whether an expression of technology-based effluent limitations, water-quality based effluent limitations, or both, such performance standards are timely and necessary for the reasons described above.

> the permittee will need to expand or better tailor its BMPs within the scope of the six minimum control measures for each subsequent permit.

64 Fed. Reg. 68722, 68754 (Dec. 8, 1999) (EPA Stormwater Phase II Final Rule).

EPA anticipated that "the NPDES permitting authority may ask the permittee to revise their mix of BMPs, for example, to better reflect the MEP pollution reduction requirement." 64 Fed. Reg. 68722, 68754 (Dec. 8, 1999) (EPA Stormwater Phase II Final Rule). Even more recent (2010) EPA guidance on this issue -- the establishment of water-quality based effluent limitations in stormwater permits -- stated that "[i]mproved knowledge of BMP effectiveness gained since 2002 should be reflected in the demonstration and supporting rationale that implementation of the BMPs will attain water quality standards and WLAs."[29] **At this juncture, ten years after the Small MS4 program was first enacted, and given the wealth of data generated in the interim, it would be inappropriate for EPA Region 1 *not* to include LID-based performance standards and revise the scope of required BMPs to reflect LID/green infrastructure.**

Comments by Dr. Robert Roseen, Director of the University of New Hampshire Stormwater Center on the North Coastal MS4 Draft permit (Attachment A) and Dr. Stephanie Hurley's Statement on Low-Impact Development, included with CLF's Comments on the North Coastal MS4 Draft Permit (Attachment B) confirm that Low-Impact Development and green infrastructure is well tested, effective at stormwater volume reduction and pollutant removal, suitable for New England, and confers ancillary benefits.

Dr. Roseen's professional opinion is that "LID stormwater management works effectively throughout multiple seasons including challenging winter conditions. Data shows that it works better for water quality than conventional stormwater management."[30] He also confirms that studies have shown LID to be cost effective and in some cases to result in cost savings.[31] Furthermore, Dr. Roseen cautions that "with the raising of the standards for MEP . . . certain practices should be *disallowed* for usage. Practices that have been demonstrated to be contributing to the water quality failures should be eliminated . . . ."[32]

Dr. Hurley's professional opinion regarding LID is that it "offers a more ecological, flexible, and context-sensitive stormwater management approach—and more readily meets water quality

[29] EPA Memorandum, James Hanlon to Regional Administrators, Nov. 10, 2010, "Revisions to the November 22, 2002 Memorandum 'Establishing Total Maximum Daily Load (TMDL) Waste d Allocations (WLAs) for Stonm Water Sources and NPDES Permits Based on Those WLAs', at 4.
[30] Attachment A, at 1.
[31] *Id.* at 2.
[32] *Id.* at 1 (emphasis added).

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and hydrologic performance standards—than conventional stormwater management."[33] Furthermore, Dr. Hurley has personally evaluated LID implementation sites at various locations throughout the U.S. and internationally, and confirms that "the principles of LID design can be successfully applied in various topographies, geographies, and climates" including New England, and at a variety of scales.[34] Her conclusion is that LID represents the maximum extent practicable for stormwater treatment.[35]

The direct testimony of Richard Horner, before the Pollution Control Hearings Board for the State of Washington in the matter of the Seattle Phase I stormwater permit (Attachment D3) affirmed that LID techniques are " unquestionably 'known' and 'available' techniques. In many cases, implementation of LID for new or redevelopment is less costly than conventional BMPs, and offers other economic benefits such as improved property values or reduced water use."[36] Dr. Horner further asserted that the Seattle Phase I permit at issue did not "use all known available and reasonable methods" to control stormwater from new and redevelopment, and it was "highly unlikely" that compliance with water quality standards could be achieved using conventional techniques.[37] Further, he asserted that "LID approaches are far more protective of water quality than the conventional BMPs" and that the permit did not reflect the maximum extent practicable standard.[38]

The direct testimony of Dr. Derek Booth in the same matter asserted that "the [Seattle Phase I] Permit . . . does not protect rivers and streams, beneficial uses, or aquatic life. Continued reliance on such a [flow-based] standard for new development in western Washington will not prevent serious and significant additional degradation to these resources," and in his professional opinion, "a more protective performance standard that more closely matches natural hydrology . . . is readily achievable without sacrificing opportunities for future development. Achieving a more protective standard would rely on site- and basin-level LID BMPs that are in my opinion, sufficiently well known, understood, available and economically and technologically feasible that they can be implemented throughout western Washington."[39]

Thomas Holz, an experienced civil engineer, testified that

> "LID approaches are generally more effective at protecting water quality and beneficial uses than the engineered, end-of-pipe standards embraced in the

[33] Attachment B, at 2.
[34] *Id.* at 2-3.
[35] *Id.* at 3.
[36] (Attachment D3, at ¶27).
[37] *Id.*
[38] *Id.*
[39] Attachment D2, at ¶ 33.

> 2005 [Washington] Manual and Permit. They are known, available, and reasonable (as well as "practicable") in virtually all new and redevelopment situations.

(Attachment D1, at ¶ 33.)

In addition, a wealth of technical articles, case studies, litigation documents, and federal government guidance documents and fact sheets summarized in Attachment C and included as Attachments D4-81 all demonstrate these principles.

The greater adoption of LID, spurred by regulatory approaches including the MS4 permit, will benefit Massachusetts communities by keeping pollutants and concentrated pulses of stormwater out of our rivers, ponds and streams, generating increased green space, cooling urban areas, and relieving some of the cost and maintenance burden on aging municipal stormwater infrastructure.

IV. Six Minimum Measures

One theme that emerged from the implementation of the 2003 MA Small MS4 permit was the need for additional clarity, and greater enforceability of requirements under the six minimum measures. CLF recognizes that EPA has significantly clarified a number of these requirements in the draft permit, and generally supports these changes. The permittees' inconsistent progress toward improved water quality also indicates that additional best management practices are needed, in addition to clarification of the requirements.

a. IDDE and System Mapping

The requirement at Section 2.4. that IDDE be continued is important, and CLF supports the continued inclusion of IDDE requirements in the MS4 permit. Illicit connections can contain extremely high levels of bacteria as well as substantial nutrient loads, and should continue to be a core element of compliance with the permit.

CLF strongly supports the requirement for enhanced mapping of the sewer infrastructure and affected waterways in Section 2.4.4.6. As referenced above, complete mapping of sewer infrastructure, outfalls, and adjacent waterways, is a prerequisite to the full engagement of all stakeholders in better stormwater management. It is also necessary for meaningful consideration by permittees as to where increased BMPs will be installed to meet water-quality based requirements of the permit.

Sanitary Sewer Overflows ("SSOs") are illegal, and CLF concurs that the permit should so state. CLF urges EPA to require that MS4 permittees provide real time public notification of SSOs in addition to notification to MassDEP and EPA. This would better ensure that citizens can make informed decisions about their own health and safety during and after SSO events and that the public can accurately understand the scope of overflows before deciding on investment of public resources to cure the problems.

b. Impervious area/ DCIA mapping

CLF supports the new requirements in the draft permit that towns track impervious cover[40] and "Directly Connected Impervious Area," ("DCIA"), assess possible locations for LID retrofits (presumably so that trading can occur), and assess the possibility of requiring LID town-wide for new construction. . The link between impervious cover and stream degradation has been well established since before the issuance of the 2000 permit.[41] Tracking overall impervious cover as well as DCIA will allow communities to fully account for the causes of waterway impairment, and is an important step towards the deployment of Low-Impact Development on a broader scale

c. Post-Construction LID Ordinance

CLF strongly supports the requirement that permittees institute a post-construction ordinance, as one of the core minimum measures laid out in the initial Phase II rule. Permittees covered under the 2003 permit were required to pass an ordinance addressing post-construction stormwater discharges, and to "develop, implement and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than one acre and discharge into the municipal system." The adjustment of the ordinance to reflect the use of LID should be mandatory, and should not require a great deal of additional time to be put into place.

Rather than merely requiring that municipalities "assess the possibility of" requiring LID town-wide for new contruction, EPA should go one step farther and require that a LID-based performance standard is met. LID technologies are now well proven, widely available, demonstrated to be as effective or more effective as conventional technologies, while conferring additional benefits, and necessary to ensure the attainment of water quality standards.

[40] (hard surfaces such as roadways, sidewalks, driveways, parking lots, and rooftops)
[41] 64 Fed. Reg. 68722, 68725 (Dec. 8, 1999); *see id*. at 68726-8.

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As drafted, the Permit requires municipalities to enact an ordinance that tracks certain requirements of the Massachusetts Stormwater Standards. CLF supports the requirement that permittees enact ordinances requiring stormwater controls from new and redevelopment. For the reasons detailed above and in the Attachments to CLF's comments), the final permit should require that Low-Impact Development or "green infrastructure" stormwater management techniques are used, including on-site infiltration of stormwater. The Massachusetts Stormwater Standards may not equate to meeting water quality standards in all areas.

Therefore, we recommend that EPA implement a more protective standard. An alternative is the standard reflected in the EPA Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act ("EPA Federal Facilities Guidance"), The guidance was enacted pursuant to Executive Order 13514, and requires that facilities of a certain size either treat stormwater on-site sufficiently to infiltrate the 95th percentile storm event, or implement measures that will restore or maintain pre-development hydrology on a site-specific basis. This standard has been determined to be feasible and cost-effective in the context of federal facility building standards.[42] In issuing the Federal Facilities Guidance, EPA relied on the testimony of Derek Booth, Thomas Holtz and Richard Horner regarding LID in the Seattle MS4 litigation (Attachments D1-D3).[43]

In heavily urbanized areas including the Boston metropolitan area, the typical parcel size is smaller than one acre. Consequently, a one-acre threshold for post-construction stormwater management is too high to capture a significant portion of development. For the reasons EPA has already identified, a post-construction stormwater bylaw is important to controlling inputs into the MS4 system, and the threshold should be lower than one acre. One half acre would be a more appropriate threshold in urban areas. Dr. Robert Roseen's comments on the draft permit have also identified this as a concern. (*See* Attachment A).

V. Monitoring and Assessment, and Public Participation

Monitoring and assessment are critical to assessing whether the measures municipalities have chosen to implement are, in fact, working to accomplish the objectives of the Permit, and to guide decisions about what additional measures can and should be taken in each community. That is why CLF supports strong provisions for outfall monitoring, GIS mapping, tracking of Directly Connected Impervious Area in the Final Permit, as well as requirements to report all of the above data and information.

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[42] Attachment D67, EPA Federal Facilities Guidance (Dec. 2009).

[43] *See* Attachment D67, EPA Federal Facilities Guidance, at 55 (Dec. 2009).

a. **Monitoring**

- CLF strongly supports increased monitoring, in both wet and dry weather, as a critical component of this permit. The outfall monitoring requirements in the draft permit will yield important information about current water quality, sources of pollution, and over the span of the permit, will reveal long-term trends, and where strategies employed by municipalities are effective or ineffective. Outfall monitoring is important for numerous reasons beyond merely supporting the illicit detection and elimination program. It provides a baseline that can then be compared to discharges in future years. Monitoring data indicates whether the BMPs a permittee has chosen to use are sufficiently effective at reducing pollution. The data can also shed light on trends that are outside of the permittee's control, but that should inform choices made about stormwater BMPs.

- For these reasons, the Permit should require more than one wet and one dry sample of each outfall within the five-year term. Three samples at each outfall during the permit term would better characterize conditions in light of the variability of stormwater discharges. CLF's experience has been that outfalls near interconnections between permittees are an important place for attention to be focused, and we support the requirement that these areas be sampled.

- Given the importance of monitoring data, CLF is concerned about the scope of the exemptions, framed as a "permittee-specific monitoring plan" in Sections 3.1.4 and urges EPA to remove these exemptions so they do not undermine the rule.

- In particular, 3.1.4.1 is problematic because it is important that permittees continually assess the effectiveness of their BMPs at controlling pollutants. It is not clear under what circumstances a permittee would have completed outfall monitoring under the 2003 permit that would be equivalent to the outfall monitoring required under this permit. Section 3.1.4.2, which allows an opt-out if the outfall is associated with a Problem Catchment, seems counter-intuitive. It would seem even more important and relevant to have data on outfalls where high pollutant loadings are detected, whether or not the source is suspected to be known. Section 3.1.4.3 allows an opt-out if the amount of impervious cover discharging through an outfall is less than 10 percent of the catchment area. Water quality impacts can occur from less than ten percent impervious cover, so EPA should consider lowering this threshold.

- Section 3.1.4.5 appears to allow the permittee to opt out of monitoring if "the permittee has conducted or will conduct in its permittee-specific monitoring plan wet and dry weather in-stream monitoring which is representative of one or more discharges to the same water body." If this provision is kept, EPA should clarify that the permittee must affirmatively certify and describe why the outfalls are representative of others, and the use of this opt-out should be limited to a certain proportion of outfalls overall, to ensure that adequate monitoring is done throughout the MS4 system during the span of the permit.

- Instream monitoring of receiving waters is also an important component of evaluating the overall relationship between MS4 discharges and water quality, and can inform the appropriate level of stormwater controls – in some cases directly indicating impacts from particular MS4 drainage areas, and in some cases yielding a more general understanding of the types and levels of contaminants found under given conditions. CLF recommends that EPA consider including targeted instream monitoring requirements in the final permit. It is noteworthy that stormwater expert Derek Booth testified in the litigation over the sufficiency Seattle's Phase I stormwater permit that monitoring was critical. (Attachment D1, at 97-99). Rather than relying on presumptions as to the effect of particular BMPs, he maintained that "if you want to know the condition of this water body, you have to go measure that condition in that water body." (Attachment D1, at 99).

b. Transparency and Public Participation

The importance of public participation to the MS4 program was recognized at the outset of the program, when a federal appeals court found that EPA's failure to make Notices of Intent for coverage under the MS4 permits available to the public for comment contravened the Clean Water Act.[44] The experience to date under the Small MS4 permit in Massachusetts confirms that public participation is vital to successful implementation of this permit. Transparency and public participation are an effective means to augment EPA's enforcement, and to foster stronger support for town decision-makers to dedicate resources to stormwater management. In instances where municipalities are falling short due to capacity or resource constraints, watershed groups can step forward to call needed attention to overlooked issues, help to secure resources, and supplement existing data and information about outfalls and the condition of waterways. However, this is only possible when information is publicly available about the municipality's efforts, the location of infrastructure and outfalls, and the condition of local waterways. Residents and community- or watershed-based organizations are in a unique position to enhance the efforts of municipalities through the MS4 program, but without full access to information, citizens are less able to assist in these ways.

[44] *Environmental Defense Center v. EPA*, 344 F.3d 832, 856-859 (9th Cir. 2003).

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CLF strongly supports the provision in the Draft permit requiring SWMPs to be made available to the public, and urges EPA to additionally require that all SWMPs, storm sewer infrastructure system maps, annual reports, Phosphorus Control Plans, monitoring plans, and monitoring data be required to be made available, and more specifically that they are placed on line in real time. Given modern technology, this need not be burdensome for the permittees, while it adds a great deal of value to the information collected by making it more accessible and usable to a wider range of stakeholders.

We support the provision in the draft permit that a comment period will occur for NOIs. This is legally required as per federal case law and will have the benefits described above. In addition, CLF encourages EPA to provide for a comment opportunity on the content of SWMPs.

VI. Enforceability

In some cases, the flexibility EPA afforded under the 2003 Massachusetts Small MS4 permit was abused. Our waterways are now exhibiting the effects of that neglect, and it is important going forward that all permit requirements are expressed in clear terms with enforceable parameters. The draft permit generally reflects clearer requirements and terminology, and this letter points out a number of instances where the requirements must be strengthened in order to be enforceable, or could be clarified for the benefit of permittees and the public.

CLF has reviewed many of the annual reports under the 2003 MS4 permit. The annual reporting form template is an opportunity for EPA to ensure clear expectations and accountability for permit requirements. In part because the 2003 form was so general, MS4 annual reporting has been less effective than it could have been over the last 8 years as a compliance tracking tool. In addition to clarifying requirements in the body of the permit, EPA should make Appendix F to the Draft Permit, the Annual Reporting form spreadsheet, more specific so that the reports will be comparable across municipalities. EPA should prescribe in the permit and reflect in this template *standard numeric metrics for each BMP and water-quality based or technology-based effluent limitation* that every MS4 must report – i.e. outfalls sampled, illicit connections removed, acres of impervious cover retrofitted, number of new BMPs installed, pounds of pollution removed – instead of leaving complete discretion to the permittee. EPA should also require clear “yes or no” answers as to the status of compliance with requirements like enacting a post-construction ordinance. This will allow the EPA, MassDEP, and other stakeholders to track progress, and will allow MS4s to target their own resources when preparing reports.

VII. State Transportation Agencies

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High pollutant loadings from roads and highways are well documented.[45] Highways are specifically referenced in a number of TMDLs in Massachusetts as a significant contributor and a source that must be controlled in order to achieve the needed pollutant loading reductions in that waterway.[46] MassDOT should be required to (1) identify and prioritize outfalls in water in TMDL, also identify where cross headwater streams, with low flows, (2) identify areas where highways cross sensitive habitat, (3) develop a prioritization for stormwater retrofits for those areas, and (4) develop a retrofit plan for its entire system as needed to comply with TMDLs and to correct its cause of and contribution to instream exceedances of water quality standards. "Storm water discharges from State DOTs in Phase 1 areas should already be regulated under Phase I. The preamble to Phase 1 clearly states that "all systems within a geographical area including highways and flood control districts will be covered."[47]

MassDOT expressed the view in the public hearing on the North Coastal MS4 Permit (in 2010) that DOT should not be subject to the same requirements as municipalities in the MS4 permit as proposed.

The Commonwealth is no less accountable to the requirements of the Clean Water Act than other public entities, and in fact has a greater responsibility to demonstrate leadership in protecting the resources that support the state's economy and the health of its citizens. Other highway departments are implementing LID and system-wide retrofit plans, which demonstrates that compliance is feasible.

An individual permit would more appropriately reflect the high pollutant loads from highways, and would allow for a more transparent accounting of the BMPs currently used, and that are available and appropriate, and should be deployed, throughout the highway system.

For these reasons, we strongly urge EPA to issue an individual permit to state transportation agencies, including the Department of Transportation.

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[45] *See e.g*. National Academy of Sciences, Urban Stormwater in the United States: Report in Brief, at 4 (2009) ("[f]reeway, industrial, and commercial areas can be very significant sources of heavy metals, and their discharge significance is usually much greater than their land area indicates") (available at http://dels.nas.edu/dels/rpt_briefs/stormwater_discharge_final.pdf); 64 Fed. Reg. 68722, 68727 (Dec. 8, 2009) (Stormwater Phase II Final Rule); Expert Report of Vladimir Novotny, P.E., Docket No. 55-6, Feb. 7, 2008, CLF v. Deval Patrick et. al.,case no. 11295wgy, U.S. District Court for the District of Massachusetts.

[46] *See e.g.* TMDLs for Boston Harbor/Neponset River (bacteria), Buzzards' Bay watershed (bacteria), Blackstone Lakes (nutrients), Chicopee Basin Lakes (nutrients), Cape Cod (pathogens and nutrients), Charles River (phosphorus), French Basin (phosphorus), Shawsheen River (bacteria) available at MassDEP website, http://www.mass.gov/dep/water/resources/tmdls.htm.

[47] Phase II Final Rule, 64 Fed. Reg. 68722 (Dec. 8, 1999).

To the extent state agencies remain within the General Permit, CLF strongly objects to the language in Sections 6.0-6.3 and 7.0-7.3 of the draft permit appearing to weaken the permit's requirements as applicable to state agencies. CLF does not agree with the apparent assumption that it is not possible for state agencies to comply fully with the requirements of the permit. For example, state agencies appear to be excused from Section 2.4.6.7 of the permit, which requires an assessment of current street design and parking lot guidelines and other local requirements that affect the creation of impervious cover . . . to determine if changes to design standards…can be made." The essence of this requirement – evaluating codes and design standards that affect creation of impervious cover, and identifying changes that can be made, is entirely applicable and appropriate for the Department of Transportation or other state agencies. For example, in addition to being directed to assess "facilities," parking areas and walkways, the DOT should be directed to assess its entire highway system for opportunities to reduce impervious area. A specific timeframe should be provided for this analysis, and the results should be disclosed to EPA and the public.

The same is true for Section 2.4.6.8, requiring an assessment of existing local regulations to determine the feasibility of making LID and green infrastructure practices "at a minimum . . . allowable." Again, in its essence, this is exactly the type of action EPA should be requiring of all permittees – to analyze the internal policies, regulations, or design standards that are barriers to LID, and to take action to remove them. While a state agency may or may not have its own "regulations," there are doubtless statewide regulations, internal agency policies, design guides, or standards that can and should be evaluated and changed to allow for LID.[48] EPA does not appear to have offered any legitimate rationale in the fact sheet or otherwise for state agencies to be excused from these requirements.

VIII. Additional Requirements

A. State Water Quality Certification

It is notable that no draft state water quality certification (pursuant to Section 401 of the Clean Water Act) was noticed with the Draft Permit. The fact sheet indicates that the certification process is "underway." A draft Section 401 Water Quality Certification was made public along with the draft 2003 Massachusetts MS4 permit. It is important that the public have an opportunity to understand how MassDEP is viewing the draft permit conditions, and whether any additional requirements will be added through the certification to ensure state water quality standards are met. We request that EPA and MassDEP clarify the status of the state water quality certification.

[48] In particular, the Mass Department of Transportation, Highway Division's design guide is in need of updating to reflect LID.

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B. Snow and Ice Removal and Chlorides

Research has indicated that, in the Northeast, chloride concentrations are increasing at a rate that threatens freshwater in the region.[49] Indeed, a 2001 article in *Stormwater* magazine ranked Massachusetts as having the highest annual road salt loadings in the United States. Chlorides TMDLs completed in New Hampshire confirm that stormwater runoff from roadways is a significant contributor to impairment, due to the high concentrations of chlorides, metals, and other additives in road salt that are washed into nearby waterways. Comments of Dr. Robert Roseen, Director of the NH Stormwater Center on the draft permit (Attachment A) highlight the potential of porous pavements to reduce salt application rates. Porous pavement and pervious concrete, both considered LID practices, require reduced de-icing application because water typically infiltrates rather than pooling on the surface.[50]

EPA should include in the final permit more robust requirements to address this growing threat to our freshwater bodies and drinking water supplies, including through LID and green infrastructure. Reducing the need for deicing agents through LID, making fully informed choices about the de-icing agents used, and maximizing efficiency of de-icing applications can allow MS4s to achieve the same benefits with less pollution to waterways.

CLF recommends EPA add a requirement that permittees' salt storage facilities be enclosed, not merely covered (as the draft permit requires). We also support the requirement that salt storage be located away from drinking water supplies. The final permit should be more specific as to what constitutes a safe distance between salt storage and water supplies.

CLF strongly supports the requirement in Section 3 of the draft permit that permittees conduct outfall monitoring for conductivity and chlorine, as this will help to identify locations where road salt is impacting water quality. In addition, CLF encourages EPA to require <u>disclosure</u> by MS4s of the types and quantities of de-icing agents they are using, and to require MS4 permittees to carry out targeted *monitoring* for pollutants commonly found in road salt (toxic metals and ferrocyanide) and other de-icing chemicals such as propylene glycol, in receiving waters of MS4 systems where they are used, to more accurately determine the degree of their impact on waterways and to establish a baseline to track whether conditions are improving or worsening over time. Only after any impacts to water resources have been brought to light can the state, municipalities, and citizens can make fully informed decisions about how to approach winter road maintenance.

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[49] Susay S. Kaushal et al., *Increased salinization of fresh water in the northeastern United States*, 102 ECOLOGY 38, 13517-20 (2005), *available at* http://www.pnas.org/cgi/content/abstract/102/38/13517.
[50] *See* EPA Green Parking Lot Resource Guide, at 27, 55 n.97 (EPA, 2008)

Thank you for the opportunity to comment. CLF looks forward to continued dialogue with EPA and MS4 permittees about strategies to improve the effectiveness of stormwater regulatory programs, with the goal of restoring and maintaining fishable, swimmable waterways throughout Massachusetts.

Sincerely,

Cynthia E. Liebman

Staff Attorney
Conservation Law Foundation

CC: Thelma Murphy, U.S. EPA Region 1
Dave Webster, U.S. EPA Region 1
Stormwater Permitting Staff, MassDEP

Attachments:

A. Comment Letter and C.V. of Dr. Robert Roseen
B. Statement and C.V. of Dr. Stephanie Hurley
C. Chart Summarizing Attached Documents Regarding LID Approaches to Stormwater Management
D. Attachments D1-D81 (by hand delivery)*

*Attachments D1-D65 were presented to the Pollution Control Hearings Board for the state of Washington by Earthjustice and co-counsel for Plaintiffs, in connection with the Seattle MS4 litigation.

Attachment A
to CLF Comments on MA N. Coastal
MS4 Permit, 3/31/10

UNIVERSITY *of* NEW HAMPSHIRE

Wednesday, March 31, 2010

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RE: Comments on the Draft General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts North Coastal Watersheds

I am writing to express my support of the Draft General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts North Coastal Watersheds. The changes in the new permit are necessary, and include many important improvements, and some important limitations.

Perhaps most importantly is the usage and application of Low Impact Development (LID) stormwater management as the expression of the Maximum Extent Practicable (MEP). The need for LID as MEP is reasonable and well documented[1]. The usage of LID as MEP is exemplified by its application in both state[2] and municipal applications throughout the US. LID stormwater management is evolving and becoming increasing affordable, increasingly familiar with the design community, and increasingly manageable from a maintenance perspective. It is also important to note that with the raising of the standards for MEP, that certain practices should be disallowed for usage. Practices that have been demonstrated to be contributing to the water quality failures should be eliminated were feasible.

Arguments against the usage of LID as MEP are typically due to a lack of familiarity with the practices and inflated cost estimates taken out of context of typical municipal activities. The majority of problems associated with LID stormwater management are less to do with the technology, and more to do with poor design, installation, and maintenance. A careful permit that requires qualified personnel during the design and installation process will prevent widespread problems.

LID stormwater management works effectively throughout multiple seasons including challenging winter conditions. Data shows that it works better for water quality than conventional stormwater management, and that in the winter standard practices suffer dramatically[3].

LID stormwater management is reasonable to construct and maintain. Existing municipal staff can be effectively trained to build and maintain these practices[4]. Maintenance requirements should not be

[1] NRC. (2008). "Urban Stormwater Management in the United States." National Research Council, Washington DC.
[2] Rhode Island General Assembly (RIGA). (2007). "Smart Development for a Cleaner Bay." HB6143.
[3] Roseen, R. M., Ballestero, T. P., Houle, J. J., Avellaneda, P., Briggs, J. F., Fowler, G., and Wildey, R. (2009). "Seasonal Performance Variations for Stormwater Management Systems in Cold Climate Conditions." Journal of Environmental Engineering-ASCE, 135(3), 128-137.

substantially different than current Good Housekeeping Practices requiring regular inspection and maintenance of stormwater infrastructure.

Cost concerns about LID stormwater management need to be balanced. Effective stormwater management will never be cost competitive with no stormwater management. However it can be cost competitive with common stormwater management using catch basins, curbing, pipe, and ponds. Two cost studies to be published in 2010 demonstrated a 6%[5] and 26%[6] savings in stormwater management infrastructure for a residential and commercial LID application. These projects had significant cost savings through the elimination of pipe, curb, retention ponds, clearing, and hydraulic control structures despite the usage of LID measures including porous asphalt, infiltration, and gravel wetlands.

Another significant element of the draft permit is the linkage to the TMDL program. Water quality improvements will not occur unless permits are grounded in the application of TMDLs. Arguably, a municipality could be in compliance with the first round of MS4 permits conditions, and still show no measurable improvements in water quality. For this reason, some type of wet weather monitoring should be required. There needs to be data demonstrating impacts and results from the MS4 activities. Water quality data needs to play an important role in the verification of permit efforts. A strong example for why this is needed is the Chesapeake Bay. While many important substantive challenges exist for the management of the Chesapeake Bay, some very poor guidance was given for years detailing improperly the success of nutrient control measures. The success was gauged on modeling results, and not based on water quality monitoring, which showed the opposite. Successful permit implementation must be based on water quality monitoring results.

A substantial limitation to the Draft MS4 Permit is the lack of adequate funding mechanisms. Given the current economical conditions that challenge municipal budgets, the MS4 permit should include some additional funding mechanisms. The State of Maryland [7] has legislation to require formation of stormwater utilities created by the state, and managed by towns. Other states are considering similar legislation. This is needed because municipalities lack the political will to pass utilities, without which no reasonable implementation of MS4 permit requirements will be implemented. The MS4 permit should require, as it does for the creation of municipal stormwater ordinance, the creation of municipal stormwater utility developed solely to support permit activities. This blanket approach is needed to facilitate and improve the rate of adoption of utilities. There are a limited number in the northeast, the state of NH has none, with the City of Manchester having one in process for nearly 5 years and counting.

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[4] Cocheco River Watershed Coalition (CRWC), Chase, L., and Roseen, R. (2009). "Introducing LID in the Willow Brook Watershed." Funding Source: NHDES Watershed Assistance Grants, Rochester, NH.
[5] Gunderson, J. (2010-In preparation). "Boulder Hills LID Economic Case Study." Forging the Link Between Research-Based Institutions, Watershed Assistance Groups, and Municipal Land Use Decisions, UNH Stormwater Center, Durham.
[6] Gunderson, J. (2010-In preparation). "Greenland Meadows LID Economic Case Study." Forging the Link Between Research-Based Institutions, Watershed Assistance Groups, and Municipal Land Use Decisions, UNH Stormwater Center, Durham.
[7] Raskin, Frosh, Harrington, Lenett, Madaleno, Pinsky, Pugh, Rosapepe (2010). "SB 686: Watershed Protection and Restoration Act." State of Maryland.

Another limitation is the size of disturbance to trigger the post construction stormwater controls is too large. Many projects with the significant impacts are smaller than 1 acre. The cumulative impact of small sites is tremendous. In many urban and suburban areas, very few lots will exceed 1 acre but will represent the major form of development.

The permit needs to encourage more widely the usage of porous pavements. There is a misconception that porous pavements present a unique risk to groundwater contamination. The risk to groundwater exists for all infiltration and filtration practices and the measures and means by which this threat is controlled should be similar. Systems can be limited or lined. Porous pavements represent substantial potential benefits hydrologically. No other LID practices can have such profound hydrologic impacts. Porous pavements can commonly recharge more rainfall than in a predevelopment condition. The same limitations do not exist for soil types as do for typical infiltration systems. Data shows that porous pavements on Hydrologic Group C soils can have as much as 25% recharge[8] and annual volume reduction and type B soils can have as much as 92% annual volume reduction[9]. Porous pavements can be built to be durable, and have tremendous water quality and quantity benefits.[10] Improvements to design specifications are routine and the standard of practice is advancing rapidly[11]. Additionally, porous pavements have also been shown to provide substantial salt reduction potential. As much as 50-75% salt reduction has been observed in some instances with the use of porous asphalt.[9]

Thank you for your consideration of my comments.

Regards,

Robert M. Roseen, P.E., Ph.D.
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Environmental Research Group, Department of Civil Engineering
35 Colovos Road
University of New Hampshire
Durham, NH 03824
Phone: 603-862-4024 Fax: 603-862-3957

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[8] Briggs, J. (2006). "Performance Assessment Of Porous Asphalt For Stormwater Treatment," University of New Hampshire, Durham.

[9] UNHSC, Houle, J., Roseen, R., and Ballestero, T. (2010). "UNH Stormwater Center 2009 Annual Report." University of New Hampshire, Cooperative Institute for Coastal and Estuarine Environmental Technology, Durham, NH.

[10] Roseen, R. M., Ballestero, T. P., Houle, J. J., Briggs, J. F., and Houle, J. P. (2010-Accepted). "Water Quality and Hydrologic Performance of a Porous Asphalt Pavement as a Stormwater Treatment Strategy in a Cold Climate." ASCE Journal of Environmental Engineering, 8.

[11] UNHSC, Roseen, R. M., Ballestero, T. P., Briggs, J. F., and Pochily, J. (2009). "UNHSC Design Specifications for Porous Asphalt Pavement and Infiltration Beds." University of New Hampshire Stormwater Center, Durham, NH.

CURRICULUM VITAE
UNIVERSITY OF NEW HAMPSHIRE, DEPARTMENT OF CIVIL ENGINEERING

ROBERT M. ROSEEN, P.E., PH.D
Research Assistant Professor, Civil and Water Resources Engineering

Degrees
PHD., 2002, University New Hampshire, Civil Engineering, Water Resources Engineering.
M.S., 1998, Colorado School of Mines, Environmental Science and Engineering.
B.A., 1994, Clark University, Environmental Science/Chemistry.

Experience as a Faculty Member, Department of Civil Engineering, UNH
Research Assistant Professor, 2007-present

Other Related Experience (in reverse chronological order)

Director, The UNH Stormwater Center, 2004-Present, University of New Hampshire.
Research Project Engineer III, 2001-2007, University of New Hampshire.
Water Resources Engineer, 2001-2004, The Bioengineering Group, Inc., Salem, Massachusetts.
Graduate Research Assistant, 1998-2002, University of New Hampshire.
Environmental Scientist and Engineer, 1997–1998, Waterstone Environmental Hydrology and Engineering, Boulder, Colorado.
Environmental Geographer, 1996, Southern Rockies Ecosystem Project, Denver, CO.
Environmental Field Technician, 1994–1995, Gascoyne Labs, Baltimore, MD.

Select Research Activities and Professional Consulting
Stormwater Management Related
Microbial Pathogen Removal Guidance for Stormwater Management . NH Seagrant. (2010-2011). Role: Principal Investigator
UNH Cold Climate Permeable Interlocking Concrete Pavement Test Facility. ICPI. (2010-2011). Role: Principal Investigator
Stakeholder-Driven Decision-Making for Adaptation: Design and Implementation of a Water Infrastructure Adaptation Plan. NOAA-SARP. (2009-2010). Role: Collaborator, Technical Lead for LID.
Assessing the Risk of 100-year Freshwater Floods in the Lamprey River Watershed of New Hampshire Resulting from Changes in Climate and Land Use, CICEET (2009-2010), Role: Technical Lead
Introducing LID in the Willow Brook Watershed. NHDES (2009-2010). Role: Technical Lead
The Lower Hodgson Brook Pilot Project. Funded by NHDES (2009-2010). Role: Technical Lead
Effect Of Best Management Practices On Stormwater Runoff Temperature, USEPA Region 1 (2009-2010). Role: Principal Investigator
Forging the Link Between Research-Based Institutions, Watershed Assistance Groups, and Municipal Land Use Decisions. CICEET (2008-2010). Role: Principal Investigator
6-year research project titled the UNH Stormwater Center. CICEET. (2005-10) Role: Co-Principal Investigator and Director

Greenland Meadows, Greenland, NH. (2005- Present) Role: Directed selection and design of integrated stormwater management strategy, Conservation Law Foundation and Packard Development LLC. (2006-9).

Water Quality Performance Monitoring for Greenland Meadows, Greenland, NH. (2006-10). Role: Principal Investigator

Interstate 93, Exit 2 Park and Ride, Gravel-Wetland Design Project, New Hampshire Department of Transportation (2005- 8). Role: Provided design expertise and review.

Development of a Pervious Concrete Test Facility at UNH. Performance Assessment of Pervious Concrete in a Northern Climate. NECSA, NNECPA (2006-Present). Role: Principal Investigator

Winter Performance Assessment of Porous Pavements. CICEET/NOAA. (2006-2009). Role: Directed Research

Examination of Sediment Concentration Methods in Surface Water Runoff. CICEET/NOAA (2006-2008). Role: Directed Research

PAHs and Sealcoated Parking Lots. NH Sea Grant. (2007-9). Role: Collaborator

Nutrient Removal Mechanisms In A Constructed Gravel Wetland. EPA AWPP Program. (2008-10): Role: Principal Investigator

LID Practices And Their Ability To Mitigate Climate Change Hydrologic Impacts. CICEET/NOAA. (2007-2009). Role: Collaborator

Microbial Processes In Stormwater Treatment Systems. CICEET/NOAA. (2006-8). Role: Directed Research

Dam Removal, Riparian Restoration, Hydrologic Monitoring, Modeling, and Channel Design

Participating member of dam removal feasibility study for the Gonic Dam and Gonic Sawmill Dam for the NH Coastal Program. Responsibilities include sediment transport, stable particle and scour analyses. Spring 2004-Summer 2005.

Participating member of dam removal feasibility study for the Merrimack Village Dam for the Pennichuck Water Works. Responsibilities include sediment transport, stable particle and scour analyses. Spring 2004-Winter 2005.

Selected as UNH Team member for the NH Coastal Program “On-Call Engineering Team” for Dam Removal Feasibility Studies, Fall 2003. Dr. Roseen has been working with the New Hampshire Department of Environmental Services and the River Restoration Task Force to develop a collaborative monitoring and research endeavor between the state and UNH.

Hydrology and hydraulic modeling analysis and report produced for proposed dam removal and associated restoration for the Mill River Dam, Stamford Connecticut. The impoundment is a head-of-the-tide dam with water quality degradation associated with low-velocity, high-residence time waters. Restoration impacts evaluated included sediment transport and impacts on flooding.

Hydrology and hydraulic modeling analysis and report produced for current, proposed restoration, and historic conditions for the Popes Branch and Fort Dupont watersheds. The project is for the Army Corps of Engineers, Baltimore District, in partnership with the District of Columbia Department of Health.

Hydrology and Hydraulics modeling analysis and report for the salt marsh restoration of Broad Meadows Marsh, Quincy, MA. This report entailed evaluating 100-year risk of tidal flooding, wave overtopping, designing flooding regime to optimize salt marsh revegetation and channel design for the Army Corps of Engineers, New England Division.

Patents
None

Professional License(s)
Professional Engineer, License #12215 , New Hampshire, 2007.

Principal Publications of Last Five Years
In Press

Roseen, R. M., Ballestero, T. P., Houle, J. J., Briggs, J. F., and Houle, J. P. (2010). "Water Quality and Hydrologic Performance of a Porous Asphalt Pavement as a Stormwater Treatment Strategy in a Cold Climate." ASCE Journal of Environmental Engineering.

Roseen, R. M., Ballestero, T. P., Houle, J. J., Avellaneda, P., Briggs, J. F., Fowler, G., and Wildey, R. (2009). "Seasonal Performance Variations for Stormwater Management Systems in Cold Climate Conditions." Journal of Environmental Engineering-ASCE, 135(3), 128-137.

Roseen, R. M., T. P. Ballestero, et al. (2006). "Performance evaluations for a range of stormwater LID, conventional structural, and manufactured treatment strategies for parking lot runoff under varied mass loading conditions." Transportation Research Record: Journal of the Transportation Research Board(No. 1984): 135–147.

Avellaneda, P., Ballestero, T. P., Roseen, R. M., and Houle, J. J. (8/2009). "On Parameter Estimation Of An Urban Stormwater Runoff Model." Journal of Environmental Engineering.

Avellaneda, P., Ballestero, T. P., Roseen, R. M., and Houle, J. J. (2010). "Modeling Urban Stormwater Quality Treatment: Model Development and Application to a Surface Sand Filter." Journal of Environmental Engineering.

In Review

Roseen, R. M., Ballestero, T. P., Fowler, G. D., Guo, Q., and Houle, J. (2009). "Sediment Monitoring Bias by Autosampler in Comparison with Whole Volume Sampling for Parking Lot Runoff." Journal of Irrigation and Drainage Engineering.

In Preparation

Jones, S., Roseen, R. M., Wildey, R., Maimes, J., Houle, J. J., Ballestero, T. P., and Puls, T. (2008-In-draft). "Enterococci Population Dynamics in Conventional, Manufactured, and LID Stormwater Treatment Systems." Environment, Science and Technology.

Roseen, R. M., Houle, K. M., Ballestero, T. P., Heath, D., and Houle, J. J. (2008-In draft). "Winter Performance Assessment of Porous Asphalt and its Function for Chloride Source Control."

Houle, K. M., Roseen, R. M., Ballestero, T. P., Heath, D., and Houle, J. J. (2008-in draft). "A Winter Performance Comparison of Porous Asphalt, Pervious Concrete, and Conventional Asphalt Pavements in Northern Climates."

Reports

UNHSC, Houle, J., Roseen, R., and Ballestero, T. (2010). "UNH Stormwater Center 2009 Annual Report." University of New Hampshire, Cooperative Institute for Coastal and Estuarine Environmental Technology, Durham, NH.

UNHSC, Roseen, R., Watts, A., Houle, J., Farah, K., and Ballestero, T. (2010). "Investigation of Nutrient Removal Mechanisms of a Constructed Gravel Wetland Used for Stormwater Control in a Northern Climate." New England Interstate Water Pollution Control Commission.

UNHSC, Roseen, R. M., Houle, J. J., Ballestero, T. P., and Puls, T. (2010). "Technology Assessment Protocol (TAP) For Innovative and Emerging Technologies." Rhode Island Stormwater Design and Installation Standards Manual, Rhode Island Department of Environmental Management.

UNHSC, Roseen, R. M., Briggs, J. F., Ballestero, T. P., and Pochily, J. (2009). "UNHSC Design Specifications for Porous Asphalt Pavement and Infiltration Beds." University of New Hampshire Stormwater Center, Durham, NH.

UNHSC, Roseen, R., T. Ballestero, and Houle, J. (2008). "UNH Stormwater Center 2007 Annual Report." University of New Hampshire, Cooperative Institute for Coastal and Estuarine Environmental Technology, Durham, NH.

UNHSC, Roseen, R. M., Briggs, J. F., Ballestero, T. P., and Pochily, J, (2007). "UNHSC Design Specifications for Porous Asphalt Pavement and Infiltration Beds." University of New Hampshire Stormwater Center.

UNHSC, (2005). University of New Hampshire Stormwater Center 2005 Data Report. Durham, NH, University of New Hampshire.

***Book chapter*—None.**
***Conference Proceedings*—**Numerous, Available Upon Request

Scientific and Professional Society Memberships

New Hampshire Stormwater Commission formed by HB 1295, Subcommittee Chair on Funding Alternatives, Member since 2008

New Hampshire Alteration of Terrain Anti-Degradation Work Group, Member since April 2009.

ASCE EWRI-WERF Task Committee on Guidelines for Certification of Manufactured Stormwater BMPs-Subgroup Chair, Member since 2007

Transportation Research Board: Member of the Hydrology, hydraulics, and water quality Sub-Committee AFB-60, Member since 2005

ASCE-EWRI Stormwater Infrastructure Committee, Member since 2007

EWRI / UWRRC / LID Standing Committee, subcommittees on Permeable Pavements, and National LID Guidelines, Member since 2007

Piscataqua Regions Estuaries Project Technical Advisory Committee, Member since May 2009.

American Society of Civil Engineers

Honors and Awards

None.

Institutional and Professional Service of Last Five Years

Board of Directors, The Low Impact Development Center, Beltsville, MD, Since 2009.

Board of Directors, The NH Coastal Protection Partnership, Since 2008.

Planning Board Member, Town of Stratham, NH, Since February 2009.
Volunteer Design and engineering design and supervision of site installation for Hugh Gregg Coastal Conservation Center Porous Asphalt Design
Porous Asphalt Review for numerous projects (Exeter, Londonderry, Seabrook)

Select Professional Development Activities of Last Five Years

(Keynote) *Performance Monitoring of BMPs*, Robert Roseen, From the Rooftop to the Bay: Implementing Stormwater Management , Strategies In The Chesapeake Bay Watershed , Center for Watershed Protection, March 10, 2010, Staunton, Virginia

(Invited) *Recent Advances in Permeable Pavements*, Robert Roseen, Thomas Ballestero, James Houle, From the Rooftop to the Bay: Implementing Stormwater Management , Strategies In The Chesapeake Bay Watershed , Center for Watershed Protection, March 10, 2010, Staunton, Virginia

(Invited) *Nutrient Removal Mechanisms in a Cold Climate Gravel Wetland*, New England Interstate Water Pollution Control Commission February 2nd, 2010, Robert Roseen, Alison Watts, Kim Farah, Heather Gilbert, Thomas Ballestero, James Houle, Tim Puls

(Organized) *Research and Uses of Low Impact Development Techniques in a Highway Environment, Part II: Benefits, Limitations, and Research Needs* at the 89th Annual Transportation Research Board Meeting, January 10-14, 2010, Washington, D.C.

Examination of Thermal Impacts from Stormwater BMPs, Robert Roseen, Nicholas DiGennaro, Alison Watts, Thomas Ballestero, Transportation Research Board 2010, Washington D.C.

2008-2009. Instructed UNHSC Porous Pavement Workshops. 6 workshops, 48 hours, over 180 participants.

2005-2009. Instructed UNH Stormwater Center Technology Demonstration Workshops. 45 workshops, 180 hours, 74 agencies and watershed entities, 80 private sector groups including design professionals, for a total of over 1000 thousand participants.

(Invited) *Sustainable Site Design: Stormwater Management Based on Natural Systems*, Robert Roseen, December, 2009, for the Ecosystem Services, the Natural Resources and Earth Systems Science Ph.D. Program, University of New Hampshire.

(Invited) Porous Pavements Design, Robert Roseen, Thomas Ballestero, James Houle, December 2009, Maine NEMO LID Design Review, Portland, ME

(Invited) *Systematic Stormwater Retrofits*, Robert Roseen, Thomas Ballestero, James J. Houle, Alison Watts, Tim Puls, EPA Regional Science Workshop, October 21st, 2009, Edison, NJ

Lid Practices As A Means Of Resilience And Short-Term Adaptation To Climate Change, Robert Roseen, Thomas Ballestero, Iulia Barbu, James Houle, Alison Watts, Tim Puls, NH Joint Water and Watersheds Conference, November 2009, Concord, NH.

Stormwater Management Strategies for Reduction of Nitrogen and Phosphorus Loading to Surface Waters, Robert Roseen, James Houle, Thomas Ballestero, Alison Watts, Tim Puls, NH Joint Water and Watersheds Conference, November 2009, Concord, NH

Sediment Monitoring Bias by Autosampler in Comparison with Whole Volume Sampling for Parking Lot Runoff. By Roseen, R. M., Ballestero, T. P., Fowler, G. D., Guo, Q., and Houle, J., May 2009, EWRI World Water Resources Congress, Kansas City, Mo.

"*Data Reporting Guidelines for Certification of Manufactured Stormwater BMPs: Part II*." By Roseen, R. M., Carrasco, E., Cheng, Y., Hunt, B., Johnston, C., Mailloux, J., Stein, W., and Williams, T., May 2009, ASCE EWRI World Water Resources Congress, Kansas City, MO.

Examinations of Pervious Concrete and Porous Asphalt Pavements Performance for Stormwater Management in Northern Climates, by Roseen, R. M., Houle, K. M., Briggs, J. F., Houle, J. J., and Ballestero, T. P. , May 2009, EWRI World Water Resources Congress, Kansas City, Mo.

(Keynote Address) *Stormwater Management and the Future of Water Resources*, Blackstone Watershed Stormwater Conference, May 14, 2009, Whitinsville, MA.

(Invited) *Technical Research to Aid Compliance with Proposed Regulations*, 3rd Annual Low Impact Development Conference, Friday, May 29, 2009, Framingham, Massachusetts

(Invited) *Acceptable BMPs for Water Quality and Associated Pollutant Removal Performance*, Rhode Island Stormwater Design And Installation Standards Manual – Revision Summary, June 4, 2009, Kingston, Rhode Island

Chaired Sessions at 2009 EWRI National Conference on 1) Low Impact Development – Pervious Surfaces and Other, 2) Low Impact Development – Bioretention

Chaired Session at 2009 TRB National Meeting on Subsurface Drainage and Water Quality: Benefits and Concerns

Effects of Northern Climates on Stormwater Infiltration for Porous Pavements and Filtration Systems, TRB 2009

(Invited) *The Changing Face of Stormwater Management*, TetraTech Rizzo, Thursday June 18th, 2009, Framingham, Massachusetts

(Invited) *Design and Performance Considerations for Porous Asphalt Pavements*, April 29,2009, AECOM Water, Wakefield, MA ,

(Invited) *Cold Climate Performance of Low Impact Development Stormwater Management* , January 27,2009, NEWEA 2009 ANNUAL CONFERENCE, Boston, MA

(Invited*) Stormwater Management, Design, & Future Water Resources*, DES Workshop on the Comprehensive Shoreland Protection Act, Wednesday, January 21st, 2009

(Invited) *Cold Climate Performance of Low Impact Development Stormwater Management* , 5th Annual Smart Growth/Smart Energy Conference, December 12,Boston, MA

(Invited) *Stormwater Management, Community Resiliency, And Climate Change*, New Hampshire Stormwater Commission HB1295. October 2008

Pervious Concrete and Porous Asphalt Pavements Performance for Stormwater Management in Northern Climates by Robert M. Roseen, Kristopher M. Houle, Joshua F. Briggs, Thomas P. Ballestero, James J. Houle, StormCon08, August 4, 2008, Orlando, Fl.

The Hydraulic and Water Quality Performance of a Subsurface Gravel Wetland for Stormwater Management, Robert Roseen, Thomas Ballestero, James Houle, Alison Watts, Tim Puls, Heather Gilbert, StormCon08, August 5, 2008, Orlando, Fl.

The University of New Hampshire Stormwater Center: Research Summary, Presented at ETV Wet Weather Stakeholder Meeting, July 17, 2008, Edison, NJ

(Invited) *The University of New Hampshire Stormwater Center: Research Summary*, Presented at New Jersey Department of Environmental Protection, July 16, 2008, Trenton, NJ

(Invited) *Climate Change and Stormwater Management Challenges: LID and Community Resiliency*, Presented at the USEPA New England Climate Change Workshop, June 18, 2008 at the University of New Hampshire.

(Invited) *Greenland Meadows: Gold Star Stormwater Management For A Commercial Application*, Presented at Weathering The Storm: Managing Stormwater With Low Impact Development In Northern New England June 12, 2008

(Invited) *Stormwater Management, Design, & Future Water Resources*, Presented at the Southern California Coastal Water Research Project, June 2008, Costa Mesa, CA.
(Invited) *Hydraulic And Water Quality Performance Of Two Bioretention Systems In A Cold Climate*, Presented at the Bioretention Research And Extension Symposium, Rutgers, New Brunswick, NJ, May 29, 2008.
(Invited) *Comparison Of Pervious Concrete And Porous Asphalt Pavements Performance For Stormwater Management In Northern Climates*, Presented at RI Department of Environmental Management, May 2008, Providence, Rhode Island.
(Invited) *Stormwater Management, Community Resiliency, And Climate Change*, Presented to the Northern New England VT LID Conference, April 21st, 2008, Burlington, VT.
Stormwater BMP Performance: University Of New Hampshire Stormwater Center, Presented to USEPA Region 1, March 31, 2008, Durham, NH
Stormwater Management, Land Use, and Flooding Implications, Presented to the NH Flooding Commission established by HB648 on January 28, 2008 in Concord, NH
Sediments And Stormwater Runoff To The Great Bay, NH, Presented to the Great Bay Siltation Committee November, 2007, Newington, NH.
Pervious Concrete as a Compliance Measure and Regulatory Considerations, Presented at the Land Development Workshop in Portsmouth, NH on November 07, 2007.
Subsurface Gravel Wetland Design and Performance, Presented at the IECA Northeast Chapter Annual Conference in Burlington, VT on October 26, 2007.
Water Quality and Hydraulic Performance of Porous Asphalt Pavement as a Stormwater Management Strategy in a Cold Climate, Presented at the IECA Northeast Chapter Annual Conference in Burlington, VT on October 26, 2007.
(Invited) *Stormwater BMP Performance: University of New Hampshire Stormwater Center*, Presented at the IECA Northeast Chapter Annual Conference in Burlington, VT on October 26, 2007.
Water Quality and Hydraulic Performance of Porous Asphalt Pavement as a Stormwater Management Strategy in a Cold Climate, Presented at StormCon 07, Phoenix, Arizona, Augusut 20 - 23, 2007.
Infiltration Systems for Stormwater Management and Flow Reduction, Presented at the New England Water Environment Association 2007 Spring Meeting & Exhibit in North Conway, New Hampshire on June 3 - 6, 2007. Co-sponsored by the New Hampshire Water Pollution Control Association.
LID Stormwater Management Systems Demonstrate Superior Cold Climate Performance than Conventional Stormwater Management Systems, Presented at the 18th Annual Nonpoint Source Pollution Conference in Newport, Rhode Island, May 21-23, 2007.
Stormwater Controls, Transportation Infrastructure, and the Protection of Water Resources, Presented in Concord, NH on April 10, 2007 at the 8th Annual Technical Transfer Conference sponsored by NHDOT and the American Council of Engineering Companies of New Hampshire (ACEC-NH).
Goals for Future Stormwater Controls for the Protection of Water Resources , Presented at Sustainability of New Hampshire's Water Resources in a Developing Landscape, the 1st Annual NH Water Conference, Grappone Center, Concord, NH on April 9, 2007
(Invited) *Porous Pavement in Cold Climates*, Presented at the Maine Section ASCE Meeting in South Portland, Maine on February 15, 2007

Winter 2007 Presented a talk at Transportation Research Board 2007, entitled *Barriers to Implementation of Porous Asphalt Pavement Parking Lots: Construction and Performance.*

Current Grant Awards and Support

UNH Cold Climate Permeable Interlocking Concrete Pavement Test Facility, Submitted to Interlocking Concrete Pavement Institute (ICPI), Project Duration: 2 Years, 2009-2011, Total Funds: $110,704 + materials and installation.

Microbial Pathogen Removal Guidance for Stormwater Management, Submitted to NH SeaGrant Program, Project Duration: 18 months, Federal Funds: $118,422.

Design and Implementation of a Decision-Support Program for Adapting Civil Infrastructures to Climate Change, Co-investigator with Syntectic International, Submitted to NOAA Climate Program Office (CPO) Project Duration: 1 Year, Subcontract Funds: $28,000

Assessing the Risk of 100-year Freshwater Floods in the Lamprey River Watershed of New Hampshire Resulting from Changes in Climate and Land Use, Co-Investigator, Funded by The Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), Place-based Solutions to Land Use & Climate Change Impacts Funding Opportunity, Project Duration: 2 Years, Total Subcontract: $31,000 from 2009-2012.

Introducing LID in the Willow Brook Watershed, Co-Investigator with the Cocheco River Watershed Coalition, Funded by New Hampshire Department of Environmental Services Watershed Assistance Program, Total Funds: $84,912 , Total Subcontract: $48,400, Project Duration 18 months from 6/1/09-10/31/2010.

The Lower Hodgson Brook Pilot Project, Co-Investigator with the Blue Ocean Society for Marine Conservation, Funded by New Hampshire Department of Environmental Services Watershed Assistance Program, Total Funds: $120,416 , Total Subcontract: $20,829, Project Duration 18 months from 6/1/09-10/31/2010

Draft Site Development Regulations for the Town of Newington, NH-- Technical Assistance Provider, Funded by the Piscataqua Regions Estuaries Project, Duration: 1 Year, Total Funds: $6,700 from 2009-2010.

Forging the Link Between Research-Based Institutions, Watershed Assistance Groups, and Municipal Land Use Decisions, Funded by The Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), Environmental Technology Development and Demonstration Program, Project Duration: 2 Years, Total Funds: $268,427 from 2008-2010.

Update of the Rhode Island Stormwater Design and Installation Standards Manual, by the Horsley Witten Group and the UNH Stormwater Center, Funded by the Rhode Island Department of Environmental Management, Project Duration 1 yr., Total Funds, $66,317.

Product Testing Proposal for the Stormtech Isolator Row: Yr 2, Funded by StormTech, LLC, Project Duration: 1.25 Years, Total Funds: $71,695 from 2008-2010.

Product Testing Proposal for the AquaFilter Pathex, Funded by AquaShield, Inc., Project Duration: 1 Year, Total Funds: $83,794 from 2008-2009.

Examination of Thermal Impacts and Stormwater BMPs, by The UNH Stormwater Center and the Massachusetts Division of Fisheries and Wildlife; Funded by USEPA Region TMDL Program; Funding Amount: $85,954 from 2008-2009.

Water Quality Monitoring for Packard Development, RT 33, Greenland, NH, for a 5 year monitoring project to evaluate the efficacy of a stormwater management strategy for high-volume commercial setting using gravel wetlands, porous asphalt, and vacuuming. This effort was funded in July 2007. Total Funds: $138,616.

Year II Product Testing for the Stormtech Isolator Row, The UNH Stormwater Center, Principal Investigator, University of New Hampshire, 2008-2009, Total Funds: $56,166.

Investigation of Nutrient Removal Mechanisms of a Constructed Gravel Wetland Used for Stormwater Control in a Northern Climate, by New England Interstate Water Pollution Control Commission

(NEIWPCC) and the UNH Stormwater Center for $100,000 ($58,702 for UNHSC) EPA AWPP Program, 2007-2008

Stormwater Outreach Education Support in New England Region I, to USEPA-NPS, 2007, Total Funds: $15,000.

Pending and Recent Attempted Support

Development of Phosphorous and Bacteria Removal Strategies for the Greater Chicago Area: Tools, Optimization, and Demonstration, By the UNH Stormwater Center and the City of Chicago Sustainability Programs, to Great Lakes Pollution Restoration Initiative, EPA-R5-L2010-1, Federal Funds Requested: $999,900

Creating A Culture Of Stewardship Through Habitat Restoration In The Berry Brook Watershed, by the City Of Dover, NH and Roseen of the UNH Stormwater Center, Submitted to NOAA ARRA Restoration Program, Project Duration: 18 months, Federal Funds Requested: $1,758,943

(Under Development) *A pooled-funds initiative* with the New England Interstate Water Pollution Control Commission and New England State Environmental Agency Non Point Source and Stormwater Programs to support UNHSC baseline operations as regional stormwater resource.

Evaluation of Porous Pavements as a Chloride Source Reduction Strategy—Problem Statement, Submitted to National Cooperative Highway Research Program, Federal Funds Requested: $450,000

Bacterial Pathogen Removal in Conventional, Low Impact Development, and Manufactured Treatment Devices for Stormwater Treatment, Submitted to USEPA Region 1 TMDL Program, Project Duration: 12 months, Federal Funds Requested: $80,000.

Select Teaching Experience

(2006 to present). Taught course on Stormwater Design and Management, for Department of Civil Engineering, University of New Hampshire.

Fall 2007, 2005. Taught course in introductory Fluid Mechanics, with laboratory session, for Department of Civil Engineering, University of New Hampshire.

Summer 2003, 2005, 2007. Team-taught course in Hydrologic Monitoring: topics include Sediment Transport and Sampling, Velocity Profiling, Stream Restoration, and Dam Removal, for Department of Civil Engineering, University of New Hampshire.

Attachment B
to CLF 3/10/10 comments
on N. Coastal MS4 Permit

LANDWATER

LandWater Collaborative

PO BOX 400756
Cambridge, MA 02140

LW–COLLABORATIVE.COM
T 857 225 4625

March 31, 2010

Statement on Low Impact Development Stormwater Management by Dr. Stephanie Hurley of LandWater Collaborative

My name is Stephanie Hurley and I hold a Doctorate in Design (DDes) from Harvard University, as well as a Master's Degree in Landscape Architecture from the University of Washington in Seattle. I have written a doctoral dissertation, master's thesis, two book chapters, two articles, and given numerous lectures and conference presentations on the subjects of urban watershed management and low impact development (LID). I am currently a post-doctoral researcher at the University of Vermont and a founding member of the design and engineering group LandWater Collaborative based in Cambridge MA. I have worked in the northwest for Seattle Public Utilities, Washington State Department of Transportation, and in the northeast for the Charles River Watershed Association and as an independent consultant. I am a member of the advisory committee for revising the Stormwater Manual for the State of Vermont's Agency of Natural Resources. My attached CV describes my additional pertinent experience.

I am writing this statement in order to describe the current view of Low Impact Development (LID) stormwater practices in the science and design literature. In summary, the literature indicates that LID is the most promising framework for stormwater management in the context of both new development and redevelopment/retrofit projects.

The history of stormwater management in urban environments is hundreds of years old. Essentially, runoff is a byproduct of the way we have chosen to build the urban environment, sealing it with impervious surfaces and compromising the ability of natural landscapes to absorb rainfall. By erecting rooftops, roads, and parking lots, we effectively waterproof our cities, impeding groundwater recharge, and subverting the opportunities for stormwater pollutants to naturally be removed via water's passage through soil and vegetation. Engineered stormwater management systems evolved to reduce the flooding generated by built areas and to help minimize human contact with pollutants washing off impervious surfaces. Following conventional stormwater management approaches, runoff is directed from impervious surfaces as quickly as possible and conveyed into receiving waters. This results in dramatic high and low flows in waterways. During storm events, erratic pulses of water enter streams, rivers, lakes, and bays. Runoff moves through pipes and ditches at high velocity, scouring and eroding stream channels and beaches where the storm sewer outfalls discharge. The result is aquatic environments that are hostile to most organisms who might otherwise inhabit them. In addition, stormwater runoff is laden with a host of pollutants generated by urban land uses including heavy metals, oils and greases, fertilizers, pesticides, and bacteria. The flow of these pollutants from built surfaces into waterways impacts the ability for people to use aquatic resources for drinking water, swimming, and fishing; stimulates algae blooms; facilitates the accumulation of toxins in sediments; and impacts the health and survival of aquatic plants and animals.

In some cases, permitting requires the use of stormwater Best Management Practices (BMPs). Conventional stormwater BMPs tend to focus on "peak flow" attenuation; detention ponds or basins, are constructed to capture the first large slug of runoff flowing from developed landscapes during a storm event and to slow the rate of release of water downstream. These BMPs are typically located downstream from built areas, often occupying a large footprint. High volumes of runoff are conveyed to the grass-lined ponds/basins from many

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different rooftops, driveways, parking areas and sidewalks. The presence of these BMPs dampens some effects of high-velocity flows, but does little for water quality and little to nothing for the health of downstream biota.

By contrast, LID strategies can ameliorate both hydrology and water quality problems by employing design systems that mimic pre-development (natural) conditions. Using a LID approach, the developed environment is designed to function like an undeveloped, natural landscape. A variety of different types and textures of vegetation and soils is used to slow, collect, infiltrate and remove pollutants from water flowing from development.

In the case of new development on previously un-built sites, the first principle of LID is to preserve as much existing vegetation as possible. In doing so, the capacity of native vegetation to intercept rainfall is preserved. Impervious surfaces are also minimized in the site design process, for example with roadways and building footprints being only as large as functionality requires. Any runoff generated by the new development is directed toward existing vegetated areas or constructed LID BMPs that further filter and treat pollutants and store water via infiltration into sub-surface soils.

LID is also the best option for treating runoff in the redevelopment context. LID principles recognize that each site is different and stormwater solutions should be tailored to site-specific conditions; "one size fits all" solutions do not work. As such, LID can be tailored to fit within small sites where space is limited. (Conversely, conventional "end of pipe" stormwater BMPs require large areas of land for detention basins/ponds located downstream (or "down-pipe") from built areas.) LID BMPs such as "bioretention" rain gardens, green roofs, porous pavements, and rain barrels can be applied in situ as localized retrofits within the existing developed landscape. With these design interventions, no new impervious surfaces are created and vegetation replaces existing impervious surfaces, thus reducing the volume of runoff generated by a site.

Whether applied in a new development or redevelopment context, LID enables groundwater recharge, increases opportunities for removal of water pollutants by soils and vegetation, slows the releases of stormwater into downstream waters, and improves the integrity of water bodies and aquatic organisms living downstream.

I have reviewed the testimony submitted in 2008 during the Pollution Control Hearings for the State of Washington by Dr. Richard Horner on the subject of Low Impact Development.[1] I worked with Dr. Horner for three years on my master's thesis and am quite familiar with his breadth of expertise in the field. My opinion is that LID offers a more ecological, flexible, and context-sensitive stormwater management approach—and more readily meets water quality and hydrologic performance standards—than conventional stormwater management. This statement is corroborated by Horner's comparison of LID with conventional stormwater management BMPs.

I have personally visited, researched, and evaluated numerous LID projects in Seattle, WA, Portland, OR, Santa Barbara, CA, various sites in Maryland, Massachusetts, and Vermont, as well as internationally in Vancouver, Canada, Malmö, Sweden and Berlin, Germany. It is my opinion that the principles of LID design can be successfully applied in various topographies, geographies, and climates. Dr. Horner's testimony supports this statement by reviewing

[1] Horner, Richard Direct Testimony. 2008. Pollution Control Hearings Board for the State of Washington, Puget Soundkeeper Alliance and People for Puget Sound; Pierce County Public Works and Utilities Department; City of Tacoma; The Port of Seattle; Snohomish County; Clark County; and Pacificorp and Puget Sound Energy, Appellants, vs. Department of Ecology, Respondent, and King County; City of Seattle; Port of Tacoma, and Washington State Department of Transportation, Intervenors, August 2008.

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well-studied examples from the Pacific Northwest and California. In New England research conducted by Dr. Robert Roseen and his colleagues at the University of New Hampshire Stormwater Center shows the success of LID projects in the climate and conditions of the northeast. [2]

LID is also applicable at many different scales, from small privately owned sites to large watershed-wide infrastructural networks. Projects I have visited range from residential driveways to twenty-block neighborhood street networks to dense high-rise developments on former industrial sites.

LID practices have been documented to be technically feasible, cost effective and ecologically functional in different location, at different scales, across different land uses, and in both new and redevelopment projects. Research on LID has become increasingly available in the last decade. Numerous databases compile the results of LID implementations.[3 4] The data indicate that suspended sediments, nutrients, toxics, pathogens, and oils and greases can all be significantly removed with LID practices. A wide array of journal articles offers reviews of LID performance and recommends design, construction, and maintenance practices aimed at maximizing the performance of LID BMPs. [5 6 7]

At present, LID has not been as widely adopted and implemented as it could be. This is not because LID doesn't work. It is not due to any significant technological or economic drawbacks of LID. It is my opinion that the reason LID is not yet widespread in our cities and towns is that regulatory incentives or requirements are lacking. The design and engineering professions need the regulatory momentum to require infrastructure to meet water quality standards as LID is able to do. I know of no other option for stormwater management that will as readily mitigate the detrimental water quality effects of development and improve the health of urban and suburban waterways, and the organisms that dwell therein, than LID. It is my opinion that LID is the maximum extent practicable for stormwater treatment.

Thank you for taking my statement into consideration.

Dr. Stephanie E. Hurley /s

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[2] University of New Hampshire, Stormwater Center. (UNHSC). 2008. 2008 Pollutant Removal Fact Sheet. http://www.unh.edu/erg/cstev/fact_sheets/gw_fact_sheet_08.pdf

[3] Center for Watershed Protection, T. Schueler. 2007. National Pollutant Removal Performance Database, Version 3. Ellicott City, MD.

[4] Geosyntec Consultants and Wright Water Engineers Inc. 2007. Analysis of Treatment System Performance: International Stormwater Best Management Practices (BMP) Database [1999-2007]: Water Environment Research Foundation, American Society of Civil Engineers (Environmental and Water Resources Institute/Urban Water Resources Research Council), U.S. Environmental Protection Agency, Federal Highway Administration, American Public Works Association.

[5] Carter, T., and R. Jackson. 2007. Vegetated roofs for stormwater management at multiple spatial scales. *Landscape and Urban Planning.* 80 (1-2):84-94.

[6] Davis, A. 2005. Green engineering principles promote low impact development. *Environmental Science and Technology.* 39 (16):338A–344A.

[7] Dietz, M.E., and J.C. Clausen. 2008. Stormwater runoff and export changes with development in a traditional and low impact subdivision. *Journal of Environmental Management* 87 (4):560-566.

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Education

Harvard University, Graduate School of Design
Doctor of Design 2009
Dissertation: *Urban Watershed Redevelopment: Design Scenarios for Reducing Phosphorus Pollution from Stormwater in Boston's Charles River Basin, USA.* Committee Chair: Richard T.T. Forman

University of Washington
Master of Landscape Architecture (MLA) June 2004
Thesis*: Great (Wet) Streets: Merging Street Design and Stormwater Management to Improve Neighborhood Streets.* Co-author: Megan Wilson. Committee Chair: Richard Horner

University of California, Berkeley
Bachelor of Science (BS) May 1999
Conservation and Resource Studies major, Forestry minor

Professional Experience & Design Practice

Postdoctoral Associate & Lecturer
University of Vermont. November 2009-present
I am working with Mary Watzin, Dean of the Rubenstein School of Environment and Natural Resources, to research, analyze, and make management recommendations pertaining to land use-based "ecological thresholds" for eutrophication of shallow bays in Lake Champlain. Also teaching a capstone undergraduate lecture course on Ecological Risk Assessment for students in the Environmental Science major.

LandWater Collaborative
Design for Innovative Stormwater Management, based in Cambridge, MA. Summer 2009-present
I am a partner in a new collaborative formed to work on urban stormwater design across the fields of landscape architecture, urban planning, urban design, civil engineering, and ecology.

Stephanie Hurley Design Consulting, LLC
Independent Consulting, now based in Montpelier, VT. 2004-present
Vermont Agency of Natural Resources, current project (2010): Sponsored by Conservation Law Foundation, I received an Ecosystem Restoration Grant from the VT ANR. The project, "Stormwater Management Planning for I-89, Exit 20, Saint Albans, Vermont," focuses on stormwater planning for a mixed residential, commercial, and agricultural watershed.
Charles River Watershed Association Weston, MA. October 2005–December 2006
(Please see description below under "Landscape Designer.")
Paul Lukez Architecture Somerville, MA. March 2006
Landscape consultant for Transit-Oriented Development project proposal.
Seattle Public Utilities, Resource Management. Seattle, WA. August 2004-January 2005
Development of graphic presentation and text for three "virtual tours" of the City's Natural Drainage Systems stormwater streets program (e.g., search online for 'SEA Street Tour').

Landscape Designer

Charles River Watershed Association Weston, MA. January-August 2007

Research, analysis and project development for urban redevelopment projects in greater Boston. Production of graphic and written materials on ecological stormwater management in residential, commercial, campus, institutional, and industrial settings. Collaborated with *Allston Brighton Community Development Corporation* on neighborhood "green street" project.

Transportation Planner / Landscape Designer

Washington State Department of Transportation November 2004 – July 2005

Landscape design, construction inspection, and coordination with environmental permitting staff for wetland mitigation projects, wetland delineation, fish habitat restoration, and roadside restoration for state and federal highway projects.

Graduate Teaching and Research

Teaching Fellowships, Harvard University

Reviving the Tajo River in Spain, Profs. Christian Werthmann & Carl Steinitz Autumn 2007

Teaching fellow and hydrology consultant for large scale regional planning studio in central Spain.

Designing the American City, Prof. Alex Krieger Spring 2007

Discussion leader for two undergraduate sections for core lecture course.

Planning and Design of Landscapes, Prof. Scheri Fultineer Autumn 2006

Teaching and reviewing for graduate landscape architecture core studio course.

Environmental Science Policy and Planning, Prof. Richard Forman Springs 2006, 2007, 2008, 2009

Teaching assistant for undergraduate field trips to biological research station in central Florida.

Research Assistant, Univ. of Washington & Seattle Public Utilities

Center for Water and Watershed Studies, Professor Richard Horner March 2002 - June 2004

Research topics included: water quality and hydrological parameters for stormwater best management practices; options for sustainable golf courses (alternatives to pesticide use); and development of a maintenance activity protocol (MAP) for Seattle Public Utilities' Natural Drainage Systems program.

Additional Academic and Research Interests: watershed management, stormwater hydrology, wastewater treatment, wetland and stream ecology, limnology, fisheries management, habitat restoration, forest succession, forest management, smart growth, transit-oriented development, brownfields, park and greenway planning, international sustainable development, urban design, redevelopment policy, and environmental law.

Publications

Research Article "Stormwater pond and biofilter patterns for large urban sites, modeled to achieve the phosphorus reduction target for Boston's Charles River, USA." S. Hurley and R.T.T. Forman *In Draft.*

Publication for Nonprofit *Blue Cities Guide: Environmentally Sensitive Urban Development,* Charles River Watershed Association 2009. Contributed images and text. Funding from The Boston Foundation & Cabot Family Charitable Trust.

Book Collaboration & Editing for Academic Study *The Rebirth of the Tajo River (Spain)*. 2008.
With Professors Christian Werthmann and Carl Steinitz. Funded by Foro Civitas Nova, Fundacion+SUMA, Castilla-La Mancha, and Harvard Graduate School of Design.

Research Article "Innovative Approaches for Retrofitting Drainage Infrastructure in the Urban Landscape" K. Yocom and S. Hurley. [Bridging the Pacific Series.] *Journal of Landscape Architecture, Construction, and Ecology (LAC),* South Korea Vol. 46, pp. 32-37. June 2008

Book Chapters *Handbook of Regenerative Landscape Design*, Robert L. France (Ed.), CRC Press 2008.
Chapter 8 (with Mark Rasmussen), "Coastal Ecosystem Restoration with a Stormwater Wetland: A Decade of Success, Reviving Shellfish Beds in Marion, Massachusetts."
Chapter 13 (with Megan Wilson Stromberg), "Residential Street Design with Watersheds in Mind: Toward Ecological Streets."

Book Collaboration for Academic Study *Padova and the Landscape: Alternative Futures for the Roncajette Park and the Industrial Zone (Italy)*. 2005.
Landscape Planning Studio with Professor Carl Steinitz. Funded by Comune di Padova, and ZIP (Zona Industriale Padova).

Case Studies Editor 3/03-5/03
Landscape Architecture Community Design Studio, University of Washington, commissioned by Homer, Alaska. I was co-author and co-editor of *Alternative Futures for Homer, Alaska,* case studies on environment and economic planning and development of large-scale retail in small towns.

Lectures & Conferences

University of Vermont, Rubenstein School of Environment & Natural Resources 3/09
Burlington, VT. Presented Doctoral Thesis.

Vermont House Committee on Fish, Wildlife, and Water Resources Montpelier, VT 3/09
Expert Testimony: Green Infrastructure for Clean Water and Healthy People.

College of the Atlantic Bar Harbor, ME. Presented Doctoral Thesis. 1/09

American Water Resources Association Annual Conference New Orleans 11/08
Presented: "Design Scenarios for Low Impact Development: Ultra-Urban Watershed Scale Redevelopment Case Studies from the Charles River Watershed in Boston."

European Landscape Convention, Conference at Harvard University Cambridge, MA 10/08
Coordinated conference and hosted international speakers, organized by Prof. Carl Steinitz.

Northern New England Low Impact Development Conference/Workshop Burlington, VT. 2/08
Participant in Conference Sessions and Field Trips.

Harvard Graduate School of Design "Career Discovery" Program Cambridge, MA. 6/08
Guest lecture for landscape architecture students on "Green Stormwater Infrastructure."

Water in the City Conference Victoria, British Columbia 9/06
Presented to international audience on efforts to develop a stormwater management program on Harvard's Allston campus (Session: "Practical Techniques Your Community Can Use.")

River Rally Conference Bretton Woods, NH. 5/06
Co-presented with the Charles River Watershed Association: "Building a Blue Allston."

Sasaki Green Day Watertown, MA 5/06
Presented to teams of landscape architects, architects and planners on water quality strategies for urban and suburban areas. Lecture Title: "Streets are the Headwaters of Urban Streams."

Harvard Vision 2020: A Bridge to Sustainability Cambridge, MA. 4/06
Facilitated session and presented on early thesis work including collaborations with Charles River Watershed Association (Session: "Going with the Flow: Water at Harvard".)

Puget Sound Georgia Basin Research Conference Seattle, WA. Presented Master's Thesis. 3/05

Awards and Honors

ASLA Honor Award in Analysis and Planning for *The Rebirth of the Tajo River* *(Spain)* 2008.
Served as "Faculty Advisor" Group Project.
Arthur Lehman Scholarship Harvard Graduate School of Design, Academic Year 2006-7.
Penny White Student Projects Award Harvard Graduate School of Design, Spring 2006.
Travel and research grant, entitled: "Constructed Wetlands: Good, Clean, Fun?"
"Salmon Spirals" Design for Seattle's Waterfront Charrette, 2004.
Concept for Salmon Spirals-- to introduce shallow shoreline habitat for juvenile and spawning salmon along the working waterfront docks--published in Landscape Architecture Magazine in August 2004.
"Amphibitheater" Design for Willapa Bay Ecological Interpretive Trail, 2003.
Design for UW's Public Art/Landscape Architecture Studio-- an outdoor education earthwork sculpture-- was built by the U.S. Fish & Wildlife Service's Willapa Bay stream restoration and interpretation project in southwestern Washington.
Merit Award Washington Chapter of American Society of Landscape Architects, 2004
Alternative Futures for Homer Alaska, Group Project.
Americal Planning Association Honor Award 2003
"Learning From Small Towns: Community character, vitality, and large-scale retail," Group Project.
Terry Clark Gerrard Memorial Scholarship University of Washington, 2002-2003.
Landscape Architecture Department, Scholarship for Academic Year.

Additional Training & Experience

Laboratory and Field Studies: integrative pest management, urban gardening, forest succession, and stream ecosystem health and dynamics
Memberships: American Society of Landscape Architecture (ASLA), American Water Resources Association (AWRA)
Computer Programs: Proficiency with MS Office Suite, Adobe Photoshop, WinSLAMM Stormwater Modeling Program. Working knowledge of ArcGIS, Adobe Illustrator, Adobe InDesign.
Committee on Revisions to the Vermont Stormwater Manual 2009, ongoing Waterbury, VT
Meeting participation and recommendations as part of Low Impact Development work-group.
Yestermorrow Design Build School Visiting Reviewer 1/08 Served as reviewer for final student presentations on Planning for Rural Community Development.
Water Quality Monitoring 9/04-6/05 Puget Soundkeeper Alliance, volunteer.
Independent Study Seminar Coordinator 10-12/02 "Green" Materials in Architecture & Landscape Architecture, University of Washington.
Permaculture Design Certificate 7-8/01 Bullocks Farm, Orcas Island, WA
Environmental Education Program Assistant 4-8/00 Santa Barbara Botanic Garden, CA.
Substitute Teacher 1-6/00 Crane School, Santa Barbara, CA.: Science, Math, English.
Teaching Assistant 1-5/99 UC Berkeley: co-taught environmental philosophy course.
Laboratory Assistant 10/98-4/99 Integrative Pest Management (IPM) Lab, UC Berkeley: research assistant for entomological studies.
Tropical Rainforest Management Field Semester 1-5/98 School for Field Studies, North Queensland, Australia: coursework in Tropical Ecology, Forest Dynamics, Land Use Planning & Management.
Research Assistant 6/97-8/97 Sierra Nevada Aquatic Research Lab (SNARL), UC Santa Barbara: research assistance and data entry for Sierra snow melt/hydrology project.
Outdoor Education 1-5/96 UC Berkeley: outdoor education leadership course, working with youth from Oakland, CA.

References

available upon request

ATTACHMENT C
CLF MA S. Coastal MS4 Permit Comments 3/11/11

CLF SUMMARY CHART:

DOCUMENTS EVALUATING LOW-IMPACT DEVELOPMENT ("LID") APPROACHES TO STORMWATER MANAGEMENT

CLF #	Author	Title	Year	Main points
Attach A	University of NH Stormwater Center	Dr. Robert Roseen Comment Letter	2010	• Supports the Draft General Permit for Stormwater Discharges from Small MS4 in Massachusetts North Coastal Watersheds • Expresses many benefits and some limitations of LID
Attach B	LandWater Collaborative	Dr. Stephanie Hurley Statement		• Characterizes LID as well proven, effective, and feasible. • Concludes that LID is the maximum extent practicable
D1	Pollution Control Hearings Board, State of WA	Direct Testimony of Thomas Holz	2008	
D2	Pollution Control Hearings Board, State of WA	Direct Testimony of Derrick Booth	2008	
D3	Pollution Control Hearings Board, State of WA	Direct Testimony of Richard Horner	2008	
D4	Pollution Control Hearings Board, State of WA	Puget Soundkeeper Alliance's First Motion for Partial Summary Judgment	2008	• Argues that LID performance standards must be included in the permit in order to fulfill requirements of the Phase I stormwater program and protect water quality.
D5	Pollution Control Hearings Board, State of WA	Examination of Derrick Booth	2007	• Examination of Derrick Booth, geologist of Stillwater Sciences, by Mr. Young in Puget Soundkeeper Alliance vs Dept of Ecology •
D6	EPA	Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, Publication Number EPA 841-F-07-006	2007	• Documents cost savings and benefits of LID vs conventional stormwater practices. • Looks at 17 case studies, 16 of which resulted in cost savings when using LID instead of conventional practices • Environmental benefits (pollution abatement, protection of downstream water resources, groundwater recharge, water quality improvements/reduced treatment costs, reduced incidence of CSOs) • Land value and quality of life benefits (reduced downstream flooding and property damage, real estate value/property tax rev, lot yield, aesthetic

				value, public spaces/quality of life/public participation) • Compliance incentives (regulatory compliance credits)
D7	CA State Water Resources Control Board Stormwater Program & The Water Board Academy	A Review of LID Policies: Removing Institutional Barriers to Adoption	2007	• California has already made steps toward a regulatory system that encourages the application of LID • The water quality benefits of Smart Growth programs can be enhanced by using LID. • LID can also be used within the Leadership in Energy and Environmental Design (LEED®) system to gain points for environmentally sensitive design.
D8		Basin Planning/Watershed-based Stormwater Programs	2006	• Briefing paper which addresses the issues of: Should the permits require basin planning? Should the permits require coordination among all municipal stormwater permittees? Should permits be issued to cover all municipal stormwater permittees in a watershed, instead of basing permit coverage on political boundaries? Should the permits require watershed based stormwater Management Programs (SWMPs) instead of jurisdiction-wide SWMPs?
D9	Washington State University	Low Impact Development: Technical Guidance Manual for Puget Sound	2005	• LID strategies an integral part of Prince George's County's stormwater management approach • Organizations most active in using LID: cities of Seattle, Olympia, and Bellingham; King, Snohomish, and Pierce counties; Washington depts of Ecology and Transportation; and Puget Sound Action Team • LID can be applied in variety of settings
D10		Pierce County Stormwater Management and Site Development Manual		• LID strategies meet multiple objectives such as open space, critical area, and habitat protection while still meeting the standards and requirements set forth under the County's National Pollutant Discharge Elimination System (NPDES) permit and GMA density requirements.
D11	Prince George's County, Maryland; Department of Environmental Resources	Low-Impact Development Design Strategies: An Integrated Design Approach	1999	• US EPA encouraged and supported this doc • LID represents a significant advancement in the state of the art in stormwater management • LID enhances our ability to protect surface and ground water quality, maintain the integrity of aquatic living resources and ecosystems, and preserve the physical integrity of receiving streams. • LID can reduce development costs • Sets forth an approach to site planning for LID
D12	Dept of Environ Resources, Prince George's County,	Low-Impact Development Hydrologic Analysis	1999	• Provides LID hydrologic analysis and computational procedures used to determine LID stormwater management requirements.

	Maryland			
D13	Dept of Defense	Unified Facilities Criteria (UFC); Low Impact Development	2004	• Several successful pilot programs have been constructed by the Navy and other Dept of Defense agencies • Use of LID has eliminated the need for a traditional stormwater detention pond, thereby reducing the disturbance to existing forested area. • The LID approach has the added benefit of improving the aesthetics of the development and providing opportunities for community involvement in the protection and maintenance of the local environment.
D14	NAHB Research Center	The Practice of Low Impact Development	2003	• LID simultaneously incorporates economic and environmental considerations into the land development process
D15	EPA, Office of Water	Stormwater Phase II Final Rule: Post-Construction Runoff Control Minimum Control Measure	2000, revised 2005	• This fact sheet outlines the Phase II Final Rule requirements for post-construction runoff control and offers some general guidance on how to satisfy those requirements (e.g. non-structural BMPs such as planning procedures and site-based BMPs; and structural BMPs such as stormwater retention/detention BMPs, infiltration BMPs, and vegetative BMPs)
D16	EPA	Post-Construction Stormwater Management in New Development and Redevelopment	2007	• The best way to mitigate stormwater impacts from new developments is to use practices to treat, store, and infiltrate runoff onsite *before* it can affect water bodies downstream. • Phase II MS4s are required to address post-construction stormwater runoff from new development and redevelopments that disturb one or more acres. Info on LID and smart growth for key resources for MS4s.
D17	EPA	Low Impact Development (LID) and Other Green Design Strategies	2008	• Communities are implementing Green Design strategies, such as LID, Conservation Development, Better Site Design, and Smart Growth. The complementary goals of these design schemes lessen the impact of stormwater while still 1providing opportunities for development. • LID can be simple and effective; controls runoff at the source.
D18		Resource List for Stormwater Management Programs	2004	• A list of helpful resources for stormwater program managers. • List is divided into six sections—general stormwater information, public education and outreach, illicit discharge detection and elimination, construction site runoff control, post-construction site runoff control, and pollution prevention/good housekeeping.
D19	EPA	National Management Measures to Control Non-point Source Pollution from Urban	2005	• Guidance for all urban and urbanizing areas, including MS4s. • Evaluates feasibility, advantages and disadvantages, and pollutant removal efficiencies of numerous BMPs including LID or “green” BMPs.

		Areas		• Recommends LID site design, finding that dispersed, low-impact development practices can help to control both runoff quality and quantity at the site level. • Pembroke Woods is a 43-acre LID residential subdivision where designers have identified significant cost savings compared to the traditional development plan created in the 1990s. Brief project overview found here: http://www.buckeyedevelopment.net/lowimpactdevelopment.htm.
D20	EPA	Using Green Infrastructure to Protect Water Quality in Stormwater, CSO, Nonpoint Source and other Water Programs	2007	• Lists 7 main benefits of green infrastructure • Cost effective and an environmentally preferable approach in combination with, or in lieu of, centralized hard infrastructure solutions.
D21	EPA & NACWA, NRDC, LID, ASIWPCA	Green Infrastructure Statement of Intent	2007	• Statement of intent between the EPA and the 4 other organizations to promote the benefits of using green infrastructure and to encourage the use of green infrastructure by cities and wastewater treatment plants as a prominent component of their Combined and Separate Sewer Overflow (CSO & SSO) and municipal stormwater (MS4) programs.
D22	ECO Northwest	The Economics of Low-Impact Development: A Literature Review	2007	• LID methods can cost less to install, have lower operations and maintenance costs, and provide more cost-effective stormwater management and water-quality services than conventional stormwater controls. • LID also provides ecosystem services and associated economic benefits that conventional stormwater controls do not.
D23		Recommended Speaking Points on the Four Most Significant Changes in the Updated Stormwater Management Manual for Western Washington	2005	• 4 points are: • Exemptions from the Recommendation to Control Stormwater Discharge Flow Rates, • Using Treatment Systems that Remove Metals for Roads with Heavier Traffic, • Reducing the Flow Control Requirements for Projects in Highly Urbanized Areas, • Credits for Projects That Use Low Impact Development Techniques to Help Reduce Stormwater Runoff and Stormwater Pollution
D24	Allen P. Davis, Mohammad Shokouhian, Himanshu Sharma, Christie Minami, Derek Winogrado	Water Quality Improvement through Bioretention: Lead, Copper, and Zinc Removal	2003	• Bioretention, a LID best management practice, is effective at removing dissolved heavy metals, thereby improving stormwater quality
D25	EPA, Office of Water	Low Impact Development (LID)	2000	• Determines the availability and reliability of data/studies to assess the effectiveness of LID

		A Literature Review EPA-841-B-00-005		practices (bioretention areas, grass swales, permeable pavements, and green roofs). • All were found to be effective at runoff volume reduction. However, more long-term analysis is required to more accurately assess the effectiveness of LID and to determine long term trends.
D26	EPA, Region 10	Letter to Jay Manning, Director of Washington State Dept of Ecology	2006	• Letter and accompanying enclosure intended to communicate EPA's recommendations (total of 8) regarding draft Phase I and II permits and storm water management in western Washington
D27	Dept of Fish and Wildlife, State of Wash	Letter to Megan White, Manager of the Water Quality Program in the Dept of Ecology	2000	• Comments on the draft Ecology Stormwater Manual. Lists 7 concerns with it.
D28	State of Cali, Los Angeles Region	Second draft Ventura County Municipal Separate Storm Sewer System Permit	2007	• Findings in: ORDER 07-xxx; NPDES PERMIT NO. CAS004002
D29	State of Cali, San Diego Region	Order No. R9-2007-0001	2007	• Findings in: ORDER NO. R9-2007-0001; NPDES NO. CAS0108758
D30	State of Cali, San Fran Region	California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit	2007	• Findings in: TENTATIVE ORDER R2-2008-XXXX; NPDES PERMIT NO. CAS612008
D31		Ch. 9: Green Cove Basin		• Lists Green Cove Basin specific development standards
D32	Pierce County Planning and Land Services (PALS) Depart	Graham Community Plan: A Component of the Pierce County Comprehensive Plan	2006	• Provides a framework for consistent land use standards in both the urban areas and in the outlying rural and natural resource lands.
D33	Pierce County Planning and Land Services (PALS) Depart	Gig Harbor Peninsula Community Plan		• Provides a framework for consistent land use standards in the urban growth area for both Pierce County and the City of Gig Harbor.
D34	Pollution Control Hearings Board For the State of WA	Puget Soundkeeper Alliance vs. Dept of Ecology (King County)	2007	• Puget Soundkeeper Alliance's first interrogatories and requests for production of documents to King County (Phase I) and King County's answers and responses thereto
D35	King County Dept of Natural	King County, WA: Surface Water Design Manual	2005	• Contains requirements & standards for designing surface and stormwater management systems in King County

	Resources			• More long-term analysis is required to more accurately assess the effectiveness of LID and to determine long term trends.
D36	Pollution Control Hearings Board For the State of WA	Puget Soundkeeper Alliance vs. Dept of Ecology (Snohomish County)	2007	• Puget Soundkeeper Alliance's first interrogatories and requests for production of documents to Snohomish County (Phase 1) and Snohomish's objections and responses thereto
D37	Puget Soundwater Quality Action Team	Puget Sound Water Quality Management Plan	2000	• LID practices, such as using native vegetation to treat and infiltrate stormwater, provide a viable alternative to traditional development techniques. Retaining minimum forest cover and setting watershed goals for impervious surfaces helps manage the effects of development at the landscape or watershed scale. Combined, these techniques may prove to be the most effective best management practices Puget can employ.
D38	Pollution Control Hearings Board For the State of WA	Puget Soundkeeper Alliance vs. Dept of Ecology (Seattle)	2007	• Puget Soundkeeper Alliance's first interrogatories and requests for production of documents to the city of Seattle and answers and responses thereto (Phase I)
D39	The City Council of the City of Tumwater, State of WA	ORDINANCE NO. O2000-010	2002	• City council ordains that a new chapter (named Chapter 13.22, Zero Effect Drainage Discharge) be added to Section 1, Title 13, Public Services, of the Tumwater Municipal Code.
D40	Natural Resources Defense Council	Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows	2006	• Efforts in many cities have shown that green infrastructure can be used to reduce the amount of stormwater discharged or entering combined sewer systems; also cost-competitive with conventional stormwater and CSO controls. • Lists 9 cities that have used it • Recommends 3 policy steps that local decision makers can take to promote green infrastructure • Referenced on U.S. EPA website, at http://www.epa.gov/nps/lid/.
D41	City of Chicago	The Chicago Green Alley Handbook	N/A	• Promotes the City's use of best management practices within public alleyways • Outlines sustainable techniques that adjacent property owners can implement on their own commercial, industrial, and residential properties (lists 11 techniques and their benefits). • If all of Chicago's alleys were green, up to 80% of rainwater falling on these surfaces throughout the year could pass through permeable paving back into the ground. • Pilot began in 2006, handbook is undated.
D42	Herrera	Technical Memorandum	2003	•

	Environmental Consultants	on Hydrologic Modeling of Natural Drainage System for High Point Revitalization		
D43	Pollution Control Hearings Board For the State of WA	Puget Soundkeeper Alliance vs. Dept of Ecology (City of Tacoma)	2007	• Puget Soundkeeper Alliance's first interrogatories and requests for production of documents to the City of Tacoma (Phase 1) and Tacoma's responses and objections thereto
D44	Pollution Control Hearings Board For the State of WA	Puget Soundkeeper Alliance vs. Dept of Ecology (Pierce County Public Works and Utility)	2007	• Puget Soundkeeper Alliance's first interrogatories and requests for production of documents to Pierce County Public Works and Utility (Phase 1) and responses thereto
D45	Univ of WA	Damages and Costs of Stormwater Runoff in the Puget Sound Region	2006	• The biological health of Puget Sound is declining, and much of that decline is a direct or indirect consequence of stormwater runoff • Degradation carries a variety of environmental, economic, and social costs. This report seeks to document some of these costs related to stormwater, providing quantification in monetary terms and qualitative costs
D46	CH2M Hill	Pierce County Low Impact Development Study	2001	• Study evaluated the potential to implement LID concepts in Pierce County by comparing conventional and LID stormwater practices used on 2 residential developments. • Costs with LID were lower (except when incorporating a rooftop collection system) • Many non-quantifiable benefits such as significant green space, a more walkable community, and increased public awareness of water quality issues.
D47	EPA	Issues & Concerns Regarding Ecology's Draft Municipal Permit	2006	• Lists 12 issues with the permit
D48	WA Dept of Ecology & EPA	Memo of Agreement Between the WA Dept of Ecology and US EPA Region 10	1989	• Establishes policies, procedures, and responsibilities pursuant to 40 CFR Part 123 and defines the manner in which the National Pollutant Discharge Elimination System will be administered by WA, the Dept of Ecology, and reviewed by the EPA
D49		PMT Briefing Paper	2006	• The issue: The permit is too prescriptive, preempting local priorities, and innovative, cost effective solutions. • Dept of Ecology found that individual review of each program would require substantial state resources and would significantly delay permit issuance for many jurisdictions. It has instead decided to establish explicit requirements for SWMPs that, when implemented, represent the reduction of pollutants to the MEP.
D50	Ann Wessel	Re: Need Your Input (email to Nancy Winters,	2005	• Ann doesn't believe that permit requirements should be lowered due to administration concerns.

		Section Manager of Water Quality Program		• Thinks that admin of Phase I permit should stay at headquarters, and most of Phase II should go to regions
D51	Ann Wessel	RE: Permit Workshop for Phase I's (email to Luanne Coachman, NPDES Municipal Stormwater Permit Coordinator)	2006	• The PCHB ruled on summary judgment that Ecology may not modify or waive permit conditions in the permit without following the process for a major permit modification (public notice, comment and opportunity for appeal)
D52	City of Seattle	City of Seattle Stormwater Code (SMC 22.800 – 22.808)	2008	• Final Draft to Dept of Ecology
D53	Richard Horner	Richard Horner Resume		• Professor at Uni of WA
D54	Richard Horner, Christopher May, Eric Livingston, David Blaha, Mateo Scoggins, Julia Tims, and John Maxted	STRUCTURAL AND NON-STRUCTURAL BMPS FOR PROTECTING STREAMS	2002	• Stream ecosystems in three different locations in the US were found to benefit from retention of watershed forest and wetland cover and wide, continuous riparian buffers with mature, native vegetation.
D55	Richard R. Horner & Cameron Chapman	NW 110TH STREET NATURAL DRAINAGE SYSTEM PERFORMANCE MONITORING	2007	• Results of Univ of WA flow monitoring at NW 110th St, with summary of Viewlands and 2nd Ave NW SEA Streets monitoring
D56	Uni of WA	Transport, Deposition, and Control of Heavy Metals in Highway Runoff		• Grassy drainage channels were shown to effectively capture and retain metals (e.g. a 60 m channel removed more than 80% of the original Pb concentration). • Mud or paved channels, however, demonstrated little or no ability in removing metals from runoff • Draining highway runoff directly to receiving waters via pipes or paved or bare channels should be avoided
D57	Hart Crowser, Inc. , WA Dep of Ecology, EPA, Puget Sound Partnership	Phase 1: Initial Estimate of Toxic Chemical Loadings to Puget Sound	2007	• The toxics study team concluded that actions to reduce the contamination of the land surface and air and actions to remove toxic contaminants from surface runoff (e.g., stormwater source control or treatment) may offer the best opportunities to reduce toxics loading in Puget Sound. • Section 5 lists specific recommendations
D58	Uni of NH Stormwater Center	Uni of NH Stormwater Center 2007 Annual Report	2007	• LIDs are solid performers; fairs well even in cold climates • Biorentention systems, tree filter, porous asphalt parking lot, sand filter, and gravel wetland have demonstrated excellent water quality treatment and peak flow reduction year round. Learn more about these systems on pages 12 through 21 of

				report.
D59	US Dept of Commerce	Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the SR 167 Extension, Puyallup to SR 509, Puyallup River and Hylebos Creek (HUC, 171100140599, Lower Puyallup River), Pierce County, Washington	2007	• Enhanced treatment via compost amended soils, biofiltration swales, detention ponds, constructed wetlands, ecology embankments, or deep fill infiltration, is proposed for 9/10 threshold discharge areas
D60	Richard Horner	INVESTIGATION OF THE FEASIBILITY AND BENEFITS OF LOW-IMPACT SITE DESIGN PRACTICES ("LID") FOR VENTURA COUNTY		• Using 6 representative development project case studies, Richard investigated the practicability and relative benefits of the Clean Water Act NPDES permit's LID requirements. The results showed that • (1) LID site design and source control techniques are more effective than conventional best management practices in reducing runoff rates; • (2) Effective Impervious Area can practicably be capped at three percent, a standard more protective than that proposed in the draft permit; and • (3) In five out of six case studies, LID methods would reduce site runoff volume and pollutant loading to 0 in typical rainfall scenarios.
D61	Richard Horner	Initial Investigation of the Feasibility & Benefits of Low-Impact Site Design Practices for the San Fran Bay Area		• Using 6 representative development project case studies, Richard showed that: • (1) LID site design and source control techniques are more effective than conventional best management practices in reducing runoff rates; • (2) in each of the case studies, LID methods would reduce site runoff volume and pollutant loading to 0 in typical rainfall scenarios
D62	Derrick Booth	Derrick Booth Resume		• President and Senior Geologist of Stillwater Sciences
D63	Benjamin O. Brattebo, Derek B. Booth	Long-term stormwater quantity and quality performance of permeable pavement systems	2003	• Four commercial pervious asphalt products proved effective at pollution removal and volume reduction over six years with little wear. Long-term degradation of water quality performance "modest," but not "problematic." • Virtually all rainwater infiltrated through the permeable pavement and infiltrated water had significantly lower levels of copper and zinc than the direct surface runoff from the asphalt area • Motor oil was detected in 89% of samples from the asphalt runoff but not in any water sample infiltrated through the permeable pavement

D64	Derrick Booth and Jen Leavitt	Field Evaluations of Permeable Pavement Systems for Improved Stormwater Management	1999	• Numerous benefits exist for permeable surfaces, but questions about their long term performance still remain • Results not uniformly favorable when comparing asphalt control to permeable products.
D65	Thomas Holz	Thomas Holz Resume		• Has over 40 years experience in water resources related projects
D66	President Obama	Obama Executive Order: Federal Leadership in Environmental, Energy, and Economic Performance	2009	• Sec. 2(d)(4) directs agencies to implement forthcoming stormwater management guidance.
D67	US EPA	Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act	2009	• Issued pursuant to Section 14 of Obama Executive Order. • Requires federal developments over 5,000 square feet to achieve pre-development hydrology. • Compliance is achieved by infiltration of 95% of runoff or alternative calculation. • Recommends LID practices as the likely means of compliance.
D68	National Academy of Sciences	Urban Stormwater in the United States: Report in Brief	2009	• Freeway, industrial, and commercial areas can be very significant sources of heavy metals, and their discharge significance is usually much greater than their land area indicates. New approaches are needed to stormwater management.
D69	US EPA	Bioretention Applications; EPA Document # EPA-841-B-00-005A	2000	• Two case studies demonstrating the potential to use integrated management plans (IMPs) in the design of new parking facilities and as retrofits for existing parking facilities. • Inglewood Demonstration Project: The bioretention retrofit was a more cost-effective way to filter pollutants than many proprietary devices designed to treat the same volume of runoff. Also offers the ancillary benefit of aesthetic enhancement. • Florida Aquarium: The parking areas controlled by IMPs showed a significant reduction in runoff volume and peak runoff rate.
D70	US EPA	Field Evaluation of Permeable Pavements for Stormwater Management (Olympia, WA); EPA Document # EPA-841-B-00-005B	2000	• Study demonstrating the potential benefit of permeable pavement systems to restore soil infiltration functions in the urban landscape • Project benefits: elimination of stormwater ponds, demonstration of water quality benefits, lower maintenance
D71	US EPA	Street Storage for Combined Sewer Surcharge Control (Skokie & Wilmette, IL); EPA Document # EPA-841-B-00-005C	2000	• Case study describes the use of street storage and catch basin modifications to reduce the rate of runoff entering combined sewer systems (CSSs). • Project benefits: elimination of surcharge, community acceptance, cost savings

D72	US EPA	Vegetated Roof Cover (Philadelphia, PA); EPA Document # EPA-841-B-00-005D	2000	• Demonstration project installed on roof of Fencing Academy of Philadelphia. • Project benefits: runoff reduction, air & water quality improvement, aesthetics, energy conservation.
D73	Richard Horner	THOUGHTS FOR WASHINGTON DEPARTMENT OF ECOLOGY'S CONSIDERATION OF LOW IMPACT DEVELOPMENT		
D74	Natural Resources Defense Council	Stormwater Strategies: Community Responses to Runoff Pollution (website access only, no file attached). http://www.nrdc.org/water/pollution/storm/chap12.asp	2001	• Part of a 1999 report; Ch 12 was added specifically on LID • 7 benefits of LID: effective, economical, flexible, adds value to the landscape, achieves multiple objectives, follows a systems approach, makes sense
D75	Portland City Council	City Council Resolution and Exhibit A, Portland Green Streets Policy (website access only, no file attached). http://www.portlandonline.com/Auditor/Index.cfm?a=155819&c=28044	Adopted 4/18/2007	• Finds that stormwater from private properties and streets is 60-70% of all stormwater, and that CSO flow must be decreased by 60 million gallons per year through 2011. • City stormwater manual ranks infiltration BMPs highest, where conditions allow. • City Council directs city agencies and dept's to implement attached Green Streets policy.
D76	University of New Hampshire Stormwater Center	2009 Biannual Report	2010	• Summary evaluations of 9 different stormwater treatment systems for ability to improve runoff water quality and reduce quantity • LID approaches can be both more effective in treating stormwater runoff and even less expensive to install than those that rely on curbs, pipes, and ponds • Cities like Portland, OR already seeing economic benefits of LID
D77	Jay Landers (Civil Engineering News)	Test Results Permit Side-by-Side Comparisons of BMPS	2006	• Compares a variety of stormwater management practices under identity test conditions • Results indicate green infrastructure approaches generally remove highest levels of key contaminants
D78	Philadelphia Water Dept.	A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds	2009	• Results indicate that green infrastructure approaches provide a wide array of important environmental and social benefits to the community absent in traditional infrastructure approaches
D79	Susan Downing Day and Sarah	Managing Stormwater for Urban Sustainability Using Trees and	2008	• Presents a stormwater system that uses structural soils (engineered tree soils) that both detain stormwater and allow tree root growth in confined

	Dickinson (VT Tech)	Structural Soils		urban spaces more closely mimicking the natural water cycle than traditional stormwater management technique
D80	US EPA	Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure EPA-841-F-10-004	2010	• Presents the common trends in 12 local governments that developed and implemented stormwater policies to support green infrastructure
D81	US EPA	Green Jobs Training: A Catalog of Training Opportunities for Green Infrastructure Technologies	2010	• This catalog identifies a wide variety of training opportunities to satisfy the growing demand for the specialized skills required in wet weather management using green infrastructure