

DuPage County Stormwater Management Program

National Ordinance Review Technical Memorandum

December 2009

DuPage County Stormwater Management Program

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1. Introduction and Objective of Technical Memorandum

Economic growth and suburban development result in large swaths of land being converted from natural land cover to area modified landscape, resulting in the creation of vast acreage of imperviousness, which increases the volume and rate of stormwater runoff, decreases the time of concentration and the open spaces that provide for natural hydrologic functions. This modification to watershed hydrology, referred to as hydromodification, reduces the recharge of groundwater, destabilizes the streams, and degrades receiving water quality and ecosystem function.

Early approaches to managing stormwater runoff focused on conveying flows away from developed areas and into streams, ponds and lakes, however, it is generally recognized that additional measures are needed to protect the health, safety and welfare of the public and to preserve the aquatic environment for future generations. Subsequent approaches addressed flood discharges through the use of detention basins and stream armoring, but time has shown these measures to be insufficient and at times exacerbate the degradation of natural and beneficial functions. The general trend in managing stormwater has progressed from an initial focus on stormwater runoff quantity control, to the control of pollution loads in runoff, and more recently adding a focus on natural ecosystem protection and preservation as was intended by the Clean Water Act. This approach has been implemented to a greater degree in some municipalities and regions of the nation than others. Our understanding of modern day stormwater management requirements has continued to evolve so rapidly that even recent development may not comply with the latest understanding of how best to preserve and protect the natural environment.

DuPage County continually reviews and updates its stormwater management program and is in the process of reviewing stormwater related ordinances to incorporate the most current understanding of the science of stormwater management. The County also wants to revise the ordinances to enhance the implementation of the stormwater program. Success needs to incorporate science, through a process based approach, behind stormwater management, achieve community involvement and compliance, and legal ramifications for existing and anticipated conditions. To meet these objectives, the County is conducting a review of successful stormwater management programs that are based on the state of the science and practice, and that demonstrate community awareness and support in meeting program goals.

This technical memorandum provides a basic description of the existing understanding of stormwater management, an overview of other stormwater management programs and recommended approaches for amending the County's stormwater legislation and ordinances. The overview of other stormwater management programs preselected 20 programs of merit from across the nation, which were subsequently reduced to a subset of 12 programs by the steering committee for a more detailed review and analysis. The programs were reviewed for the following categories of interest:

- Stormwater management including water quality and water quantity
- Restoration and protection of sensitive areas, natural areas and open space
- Development

- Redevelopment
- Erosion and sediment control
- Floodplains
- Wetlands
- Roadways

When describing the relative merits of the stormwater management programs, this memorandum focuses on the ordinances, approaches used to implement the ordinances and how the agencies manage their programs for success. A separate document will provide a summary of each stormwater program that was reviewed.

The remainder of the memorandum is organized as follows:

Section 2. Overview of the DuPage County Stormwater Program

Section 3. State of the Science of Stormwater Management

Section 4. Overview of Stormwater Program Literature Search and Interviews

Section 5. Review of Successful Stormwater Management Programs

Section 6. Recommendations

Section 7. Going Forward

2. Overview of DuPage County Stormwater Program

The enabling legislation and the Countywide Stormwater Plan create the administrative structure from which Authority is granted. The Stormwater Committee acts as a gate keeper for the Authority granted to the County Board. The Stormwater Committee waives enforcement of some or all provisions of the Ordinance, turning over all enforcement of the ordinance, and in some cases all review. The Communities enforcement is by “grant of petition”, which can be revoked for significant or repeated failure to enforce or implement the provisions of the Ordinance.

- **Permits.** Permits are issued by the Administrator in a waiver community, and by the Director in a non-waiver community. In partial waiver communities, the review and inspection of special management areas is reserved for the County, and a permit cannot be issued for a project site with a special management area
- **Complaints.** Complaints about the enforcement by a community are made to the Committee, and a process of investigation and review is spelled out which can result in revoking waiver status and returning all review and enforcement to the County within the waiver communities jurisdiction.
- **Administration.** The Stormwater Committee has the responsibility for policy and direction of the Ordinance, except in waiver communities where the Oversight committee as defined in the Communities petition has that role. The ordinance defines two roles, a “Director” who has overall Administrative responsibility for implementation of the Ordinance and specific duties in addition to those of Administrator, and an Administrator in each Waiver Community.

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- **Appeals.** Appeals of interpretation are heard by the Committee or the oversight Committee. An appeal of the Committee's decision can be made to the County Board. In case of technical dispute, the matter can be referred to a "Watershed Basin Committee" for an opinion.

3. State of the Science of Stormwater Management

This section provides an overview of stormwater practices that: are known or accepted to be effective; that have scientific backing but are not widely accepted; that still need more study; and where cooperation and outreach between municipalities, developers and the public are necessary to coordinate successful implementation.

3.1. Stormwater Management Including Water Quantity and Water Quality

3.1.1. Quantity and Rate of Flow

The conversion of natural areas to suburban and urban development generates stormwater runoff that creates major concerns for human health and safety and for the environment. Improper planning and management can lead to flooding that threatens human life and property. The increase in the forces in open channels resulting from decreased times of concentration, larger volumes and higher flow rates to streams and ponds is a major source of environmental degradation. In fact, the US Environmental Protection Agency (USEPA) treats excess stormwater discharge as a pollutant.

While stormwater quantity control has historically focused on the reduction of flood threats from the larger, less frequent storms that inundated wide floodplains and roadways. Floods of this magnitude are infrequent. For example, the 100-year storm that the Federal Emergency Management Agency (FEMA) has chosen to base the National Flood Insurance Program (NFIP) on is defined as the rainfall event that has a 1 percent chance of occurring in any given year. Highway departments often use the 25-year storm or 10-year storm (i.e. the rainfall event that has a 4 percent or 10 percent chance of occurring in any given year, respectively) as the design flood upon which to base road designs in order to avoid unacceptable risks of flooding.

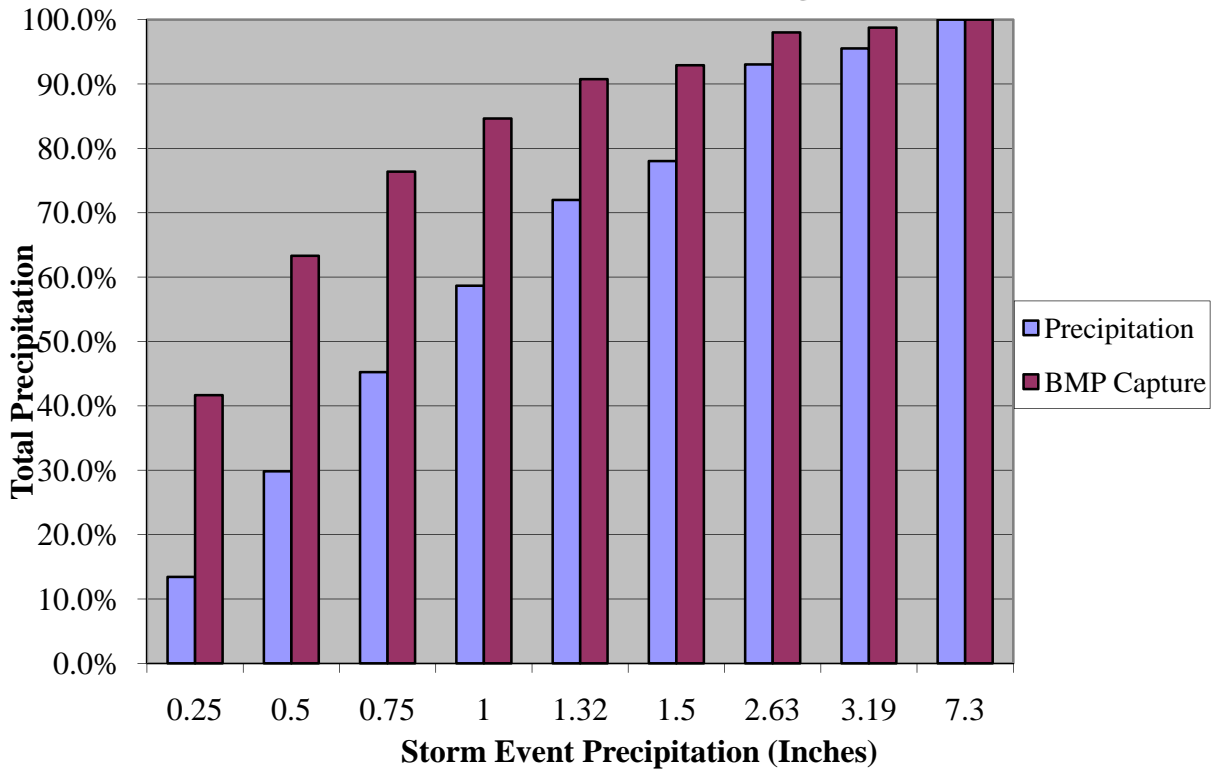
The intent of the federal Clean Water Act is to preserve and restore natural water systems to meet water quality standards for the designated uses of the water body. Some evidence suggests that the smaller precipitation events create the greatest stormwater-related degradation to natural water bodies; affecting both the quantity and quality (see Section 3.1.3, Quality, for further discussion) of the receiving waters. Impervious surfaces affect the hydrologic response to precipitation and generate larger volumes of runoff that flow rapidly through sewers and swales to streams where they contribute to bank erosion and habitat degradation. These stormwater flows also wash pollutants from impervious surfaces to wetlands, streams and lakes. Many communities are now managing the smaller and more frequent precipitation events for environmental and aesthetic benefits and the larger and less frequent precipitation events for flood control to protect human property and infrastructure. Managing the smaller storm events typically includes the temporary capture of initial stormwater runoff. This initial capture provides a method for reducing the peak flows to roads, curbs, sewers, and streams. It also, once captured, provides an opportunity to remove pollutants carried by stormwater runoff.

Some of the more recently developed approaches to manage stormwater runoff focus primarily on the retention of runoff volume. A major benefit of this volume approach is that the design of many of the best management practices (BMPs) that manage smaller storm events can be simplified using volume capture approaches. The BMPs involved are referred to as Low Impact Development; Environmental Site Design; or Green Infrastructure. These BMPs work best when several are integrated together to conform to unique site characteristics. An example of how the volume approach is applied is demonstrated using data presented in Figure 1 for the Washington, DC metropolitan area. Figure 1 represents precipitation data from Reagan National Airport that is on the Potomac River, which forms the southern boundary of the District of Columbia. The precipitation data represents the annual average volume of rainfall and the BMP capture data represents the average annual volume of rainfall managed by a stormwater BMP. This figure indicates that:

- Storm events with a precipitation of 1.32 inches and less account for 72 percent of the total volume of average annual precipitation.
- A BMP that captures up to the first 1.32 inches of precipitation from all storm events will treat 91 percent of the total volume of average annual precipitation.
- In the District of Columbia, 1.32 inches represents $\frac{1}{2}$ of the two-year storm event; the above two relationships have been demonstrated at several locations within the Mid-Atlantic Area.

The runoff from storm events more frequent than the 2-year storm play a significant role in recharging groundwater and wetlands, and determining the stability of streams. It is thought that if these smaller flows can be managed to maintain predevelopment conditions, the aquatic ecosystems will retain a higher functional state.

**Figure 1. Summary of Storm Event Data For Reagan National Airport
Period of Record is 5/1/1948 through 2/1/2006**



While the volume of capture is important for designing the size of BMPs, there still is a need to manage the rate of discharge to receiving streams. Several approaches were found to be used across the nation. Santa Clara County, California and Fairfax County, Virginia have guidance that bases the allowable discharge on the erosion potential that can be borne by the receiving channel. Santa Clara County developed continuous simulation models to evaluate allowable stresses for the streams in their area. From this, they have developed an approach to determine the detention requirements such that the erosion potential does not exceed that which the channel can convey in a stable form. Fairfax County created an outfall assessment based on shear stress that is used to determine the characteristics of discharge that can be conveyed without leading to erosion of the receiving channel. However, in Fairfax County this is a fall back provision for instances where development would otherwise not be permitted due to existing channel instability.

Various stormwater management approaches are in use with the predominant methods for managing the quantity of stormwater runoff generated at developed areas falling into the following three categories:

- **Regional Approach:** Diversion of flows to a centralized location for treatment by larger regional best management practice such as stormwater ponds.

- **Distributed Approach:** Capture and collection of runoff close to where precipitation first accumulates using numerous smaller practices distributed across the landscape such as bioretention facilities and green roofs.
- **Preservation Approach:** Preventing or reducing the creation of stormwater runoff above predeveloped conditions by preserving green open space, retaining natural ground contours, and minimizing development of sensitive areas such as groundwater recharge zones, steep slopes, wetlands and riparian buffers.

These approaches are not mutually exclusive and one or all three can be employed at a given developed area with success. The objective of stormwater management is to replicate the predevelopment hydrology to the extent practicable after a site is developed. The local ordinances will determine which aspects of the predevelopment hydrograph are to be replicated. While past practices have attempted to convey flows away as quickly as possible, the goal for preserving the natural hydrology includes maintaining groundwater and replicating the volume and rate of runoff from a site to match predeveloped conditions where predeveloped represents a pre-determined set of circumstances.

The difference among the three approaches above is where, on a site, runoff is measured. A centralized or regional approach might measure runoff from an entire developed area of many acres or at a subwatershed level with flows upstream of the centralized BMP being far less regulated. A distributed approach would measure runoff at smaller catchment areas, typically sub-acre in size. Preservation of green and sensitive areas attempts to retain runoff at a natural condition at the point of precipitation impact with the ground. Each of the three approaches can be successful if proper design guidance and long term maintenance are provided.

Another area of change in managing stormwater quantity has been the growth in the use of long term modeling that uses actual continuous data. This modeling approach uses monitoring data from precipitation gauges or stream discharges. While always a preferred approach, continuous modeling had not been widely used previously due to: a lack of continuous long term data, difficulty in setting up and evaluating modeling files, and local design manuals that specify single-event, hypothetical rainfall design storm approaches for simulating stormwater runoff because of the previous two shortcomings. Long-term data are now available from many locations including most regional airports and stormwater software packages have taken advantage of great leaps in computer processing capabilities to develop pre- and post-processors to create and interpret stormwater models. One other concern that is raised is that the design industry is unfamiliar with continuous stormwater modeling and that continuous modeling is unnecessarily cumbersome for the goals of site scale stormwater management design.

3.1.2. Maintenance

Stormwater management facilities lose effectiveness if they are not properly maintained. Several reasons that lead to inadequate maintenance include:

- Inadequate funding
- A lack of knowledge or skill with proper maintenance procedures
- A lack of knowledge that a facility is present
- A lack of knowledge of who has the responsibility for maintenance

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- Inadequate inspection and/or enforcement to track and ensure that maintenance occurs

The Municipal Separate Storm Sewer System (MS4) general permits require that all stormwater management facilities be inspected regularly and that the party responsible for maintenance be prompted to maintain the practices. The municipality may have to perform maintenance if the responsible party does not perform their responsibilities, but is often reimbursed for this effort by billing the responsible party for expenses. Alternative approaches for ensuring proper maintenance include the following:

- Requiring responsible parties to provide funding for maintenance as part of the design and construction approval process
- Requiring responsible parties to contract with an acceptable vendor that will provide regular and appropriate maintenance
- Municipalities taking over maintenance of all or certain types of stormwater management facilities whether on public or private property

Seattle's Stormwater Program is notable for the proactive approach it employs for encouraging and enforcing adequate maintenance. As summarized on the EPA's Stormwater Case Studies WebPage (http://cfpub.epa.gov/npdes/stormwater/casestudies_specific.cfm?case_id=17):

“The City of Seattle regularly inspects all privately owned stormwater detention, treatment, and conveyance systems in the city. Under the Seattle Municipal Code (Chapter 22.800), owners of private drainage systems are responsible for maintaining the systems to ensure that they continue to function over the long term.

Property owners are notified with a letter in advance of the inspection and are welcome to accompany the inspector. The facility is inspected for high sediment levels, missing or broken components, and drainage issues. Within two weeks of the inspection, a letter is sent to the property owner with a report detailing any problems and explaining how the facility needs to be maintained or repaired. The city also provides a list of drainage contractors and information on best management practices (BMPs) for stormwater drainage systems. In addition, the city provides checklists for how to inspect and maintain many different types of facilities on its Web site.

Site reinspections occur 60 days after the follow-up letter and report. If compliance is not achieved during that time, a Notice of Violation, which may result in a \$300 fine for each day the violation continues, may be issued. The city also coordinates with the property owner to inspect after a drainage contractor has completed any work and before the contractor has been paid to ensure that the job was performed adequately.”

Further review of Seattle's Stormwater, Grading, and Drainage Control Code, recently amended and enacted on September 30, 2009, shows that the penalties for non-compliance have been substantially increased. Also present are the following items to achieve adequate maintenance within its limits:

- Memorandum of Drainage Control. The owner(s) of the site are required to sign a "memorandum of drainage control" that has been prepared by the Director. The memorandum is a condition

required for issuance of any permit or approval for which a drainage control plan is required, and must be filed with the County Recorder's Office so as to become part of the real property records. It includes among other things an agreement that the owner(s) shall inform future purchasers and other successors and assignees of the existence of the drainage control facilities and other elements of the drainage control plan, the limitations of the drainage control facilities, and of the requirements for continued inspection and maintenance of the drainage control facilities

- The code lists civil violations subject to a maximum civil penalty of up to \$5,000 per day for non-compliance. Procedures for issuance of notices of violation are clearly stated, with provisions for referral to the City Attorney for enforcement.

3.1.3. Quality

The quality of stormwater released to receiving waters can be improved with the properly selected stormwater BMPs. Sediment, biological contaminants and nutrients have been the most prevalent pollutants to be listed in state and municipal regulations. The implementation of Total Maximum Daily Loads (TMDL) to restore impaired waters has greatly expanded the pollutants of concern to other chemical constituents and to include constituents that some municipalities may not have considered such as trash and temperature. A problem with the management of water quality is that practices have differing effectiveness for certain pollutants so that one practice may be effective at removing pollutant loads for one pollutant but not several others that may be of concern. Additionally, long term monitoring demonstrates that various practices are less effective at removing pollutants from stormwater than previously believed. Thus the practices installed years ago are now determined to remove a smaller volume of pollutant loads than previously thought.

The ASCE/USEPA International Stormwater BMP Database has been collecting BMP monitoring data for over a decade and has found that BMPs do not function entirely as anticipated. Of particular concern is the practice used in most BMP manuals of assigning percent removal efficiency for each BMP. The BMP Database, as explained in the International Stormwater BMP Database FAQs (<http://www.bmpdatabase.org/Docs/FAQPercentRemoval.pdf>), documents that the removal efficiency of BMPs is directly related to the concentration of pollutants in the stormwater that enters the BMP and the design of the BMP. Additionally, many BMPs have a minimum concentration below which they will not remove pollutants. Using the percent removal approach, design manuals may prescribe which BMPs must be used in specific situations. This practice not only removes the flexibility of BMP selection and design based on unique site characteristics, it also may be permitting property owners to take more credit for pollutant removal than the BMP can actually deliver. This could imply that BMPs have been selected that meet target loads such as those set for TMDLs, but subsequent monitoring may well determine that pollutant loads are higher than projected and thus stream impairments are not being redressed.

A recent change in California water quality BMPs raised an interesting outcome. California decided to require that Low Impact Design practices using small distributed BMPs be the preferred approach towards controlling stormwater derived pollution. This unfortunately means that San Jose, which had used high density development around transportation oriented centers as a form of environmentally sensitive design that reduces traffic impacts, has now created what California considers to be an aggravated stormwater impact. San Jose and other communities may still come to the same high density designs for transportation

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oriented developments, but their planners have now been made aware that stormwater is another important consideration that must be factored into the land use plan.

3.2. Restoration and protection of sensitive areas, natural areas and open space

The most natural method for reducing the quantity of stormwater and pollutant loads in runoff is to preserve open space and natural areas. Sensitive areas, like riparian buffers, groundwater recharge zones and steep slopes, are the preferred natural areas for preservation. Some sensitive areas are also protected by federal or state requirements like wetlands and perennial stream channels. The protection of these areas has been shown to reduce the deleterious effects of stormwater runoff and pollutant loading, and to preserve natural spaces that promote biodiversity and that support perennial groundwater elevations that approach predevelopment conditions. Many communities provide maps of sensitive areas that are to be preserved and protected. These maps are used by developers to define the areas that are to be preserved and sensitive watersheds that must be protected because they support sensitive ecosystems or drain to sites used as drinking water sources.

While sensitive areas are often protected from development, incentives are offered by some stormwater programs for developers that permanently set aside additional natural areas. In essence, these credits may allow the developer to remove the natural areas from the overall site calculations of stormwater volume that must be treated as part of the plan permit approval process. Montgomery County, Maryland, which uses this approach, also has a program to restore a percentage of existing impervious development across the municipal boundaries to compensate for past development practices that do not meet existing stormwater standards or achieve desired stormwater standards. Maryland started this approach in the previous 5-year MS4 permit cycle requiring that at least 10 percent of the impervious area of large MS4s be restored and the next permit cycle is requiring that at least another 10 percent of impervious area be restored. The US EPA has been touting this program as an example that they would like to see implemented elsewhere, although its cost and benefit have yet to be fully evaluated.

Stormwater design standards are also being used to require that development preserve and restore the predevelopment hydrology to the extent practicable. For example, the District of Columbia has established design standards for the Anacostia Watershed (one of the top ten most polluted rivers in the nation) that are designed to restore the river in part by requiring that, as feasible, the first inch of rainfall be infiltrated to restore groundwater flows, and runoff from the two-year storm event be treated for pollutant loads and retained or detained as practicable. The District's environmental design standards for the Anacostia River watershed require the District's rights-of-way as well as new development to use green infrastructure to meet these standards. For buildings, this implies the use of green roofs and catchment systems that recycle stormwater rather than simply detaining it for gradual release to sewers. The City of Chicago requires that at least ½ inch of runoff be infiltrated and is considering raising this to 1 inch since most new development has been able to exceed this requirement.

The preservation or restoration of natural open areas is an active area of research. The benefits of riparian restoration, stream restoration and wetland creation/restoration are areas under study by a number of state and municipal agencies. These studies support restoration as a means to mitigate stormwater impacts, but the effectiveness of various restoration designs continues to be debated as different studies provide

promising but sometimes incomplete pictures of the relationship of benefits to costs. These uncertainties temper the use of some restoration practices on a broad scale, or at least suggest that it is wise to permit flexibility of restoration design that considers site characteristics and takes advantage of lessons learned from previous designs and studies.

The uncertainties in knowing how best to select and design BMPs to protect high quality streams led Montgomery County, Maryland to develop a program with the following administrative elements:

- Construction sites proposed within the watershed of sensitive streams were required to provide redundant erosion and sediment control practices
- The County reviewed the proposed plans, required changes as appropriate and approved the plans before construction could begin
- Monitoring of the receiving stream was required during and for a year or more afterwards to determine the effectiveness of the practices at preventing sediment loads into the streams and the impact and recovery rate on the aquatic benthic invertebrates
- If it was found that the erosion and sediment control practices were not as effective as expected, and if they were constructed and maintained properly, then Montgomery County treated it as a learning process to improve the design requirements for future development; they did not require the developer to revise or retrofit the existing developed areas even if they did not meet design expectations

3.3. Development

New development applies to the construction of green space and typically infill development and is obligated to meet the most current stormwater requirements. As stormwater programs become more progressive in protecting the environment, the newer developments are constructed with more environmentally friendly practices than older development.

The newer MS4 permits continue to ratchet up the requirements for municipalities to improve their management of stormwater including addressing pollutant loads and increased runoff from existing development. Municipalities are finding that these increased requirements are costly and are taking actions to put the burden of sustainable and environmentally sensitive stormwater management on the developers. The municipality may be responsible for restoring environmental degradation for past development that did not satisfy present day water quality standards, but implementing environmentally sensitive stormwater standards for future development is seen as the most viable approach over the long term. Economically vibrant communities also find that developer's decisions to build do not seem to be influenced by stormwater management requirements. For this reason, communities have been revising their stormwater requirements to incorporate environmentally sustainable standards that seek to maintain post development runoff characteristics at predevelopment conditions using approaches described in Section 3.1. However, this might be a concern if smaller MS4s within a larger MS4's boundary implement more lenient stormwater development standards.

Post construction impacts to receiving waters is an active field of research because, as mentioned in Section 3.1, past design standards have tended to create stormwater facilities that provide less management than anticipated. These active studies work to determine:

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- Which BMPs work best in which conditions
- How design can improve the effectiveness of a BMP
- How will long term operation and maintenance of the BMP affect its performance (this is both a technical and an administrative issue as maintenance is more important for some practices than others and maintenance can be difficult and expensive to enforce, such as when small facilities are located on private property)
- How communities can balance carrot and stick approaches towards compliance by mixing stormwater credits and outreach with enforcement actions that contain fines and other penalties

3.4. Redevelopment

Redevelopment provides an opportunity to provide stormwater management to sites that most likely were developed with less stringent stormwater requirements. A typical redevelopment regulation is to require the new development to provide the current stormwater regulations to that part of the impervious area that is greater than the existing impervious area. This means that a site that redevelops without increasing the total impervious area would not be required to add stormwater management above that present at existing conditions. Other communities require that a part of the old impervious area be managed to current standards or that at least water quality improvements are provided but not necessarily stormwater quantity requirements. This approach is taken because communities want older underutilized areas to be redeveloped to revitalize aging communities, which revitalizes the economic engine. The argument is that even some additional stormwater management is an improvement over existing conditions.

The drawback with not requiring redeveloped sites to fully comply with the same standards as new development is that degradation from older sites will not be undone. Therefore ultimate restoration of impaired receiving waters will require a community to either 1) set stormwater management standards that cause new development to more than compensate for their impacts or 2) spend community resources.

Some communities have considered partial waivers or credits for Brownfields redevelopment or high density development at Transportation Oriented Development sites. Each community has unique criteria and will decide for themselves what is best in the long term for their constituents.

Redevelopment policies can be as much a technical as a political/ economic decision for municipal leaders. Requiring redevelopment to meet existing stormwater standards may be a desirable goal. If the municipality decides that it is reasonable to meet these standards, but is aware that the extra costs might inhibit redevelopment of underutilized areas, then incentive programs can be developed. The incentives do not need to increase municipality costs as they can involve:

- Granting permission for the redeveloper to increase building height and thereby useable floor space
- Municipal improvements to the older roadways of the neighborhood using green infrastructure – the older roadways are likely not managed to existing stormwater standards and the improved appearance of the rights of way will provide a “sense of place” that can improve property values and promote additional redevelopment of neighboring underutilized properties
- Some form of payment in kind to support the design, construction or maintenance process
- Other incentives that are appropriate for that municipality

Planning departments typically have staff and resources to determine the level of benefit that a property can achieve based on the economy, building design flexibility, surrounding property condition, proposed municipal improvements and other factors that govern the profits and risks that the landowner and construction firm would realize. This can be used on a case by case basis for special situations to prompt full compliance with stormwater requirements for redeveloped properties that have unique disincentives.

3.5. Erosion and sediment control

Sediment-laden runoff from construction operations can cause temporary problems to stream stability, aquatic habitat, flooding, navigation, stormwater facility maintenance, and water quality. In most cases, the primary reason that erosion continues to be a problem is that too few inspectors are available to enforce erosion and sediment control regulations that already exist.

The available technologies are well documented in the backup material that the USEPA created in support of the various levels of enhanced control that they released as part of their December 2008 proposed effluent limitation guidelines for the construction industry (see materials provided at <http://www.epa.gov/guide/construction/>). The final effluent limitation guidelines were released in December 2009 and can be found at the same link.

According to the website, EPA is phasing in the numeric limitation over four years to allow permitting authorities adequate time to develop monitoring requirements and to allow the regulated community time to prepare for compliance with the numeric limitation. Beginning on August 1, 2011 all sites that disturb 20 or more acres of land at one time are required to comply with the turbidity limitation. On February 2, 2014 the limitation applies to all construction sites disturbing 10 or more acres of land at one time. These sites must sample stormwater discharges and comply with a numeric limitation for turbidity. The limitation is 280 NTU (nephelometric turbidity units).

Erosion is a key pollutant source that triggers the requirement for development of TMDLs. Because of the sediment load and associated substances such as phosphorus and, at some contaminated sites, petroleum products and polychlorinated biphenyls (PCBs). Like most forms of pollution, the cost to the municipality to remediate the streams, ponds and lakes in the future can be greater than the cost to require the developer to use proper erosion and sediment control measures.

3.6. Floodplains

Floodplain management typically differs from water quantity control in that water quantity control addresses more frequent runoff events and flood plain management is typically based on FEMA's National Flood Insurance Program (NFIP), which ties the concern to the 100-year event. This is typical of NFIP participating communities across the country. It should be noted that minimum compliance with model floodplain ordinances, while sufficient to maintain one's status as a participating community, does not provide a sustainable level of protection from flooding because of the lack of consideration for the impact that development has to flood discharges. Because development is typically regulated on a case by case basis, the impact at the watershed scale creates a cumulative increase in downstream flooding. Additionally, a community's legislative boundaries may not incorporate the upper reaches of the watershed so more lenient floodplain management polices upstream can increase flood risk downstream

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and it is generally the development community that benefits from the more lenient floodplain management policies at the expense of the local government. While development can provide economic growth, communities overlook the long term impacts to government that result from repetitive flooding such as infrastructure damage, economic downturn following severe flooding, and demands of the community to rectify flooding of streets, homes and businesses that built in areas previously outside of the floodplain boundary but that are now in the existing boundary because upstream development increased flood stages.

A number of communities have evaluated the cost–risk relationships of following the minimum requirements of the NFIP compared to more aggressive polices and have decided to implement more aggressive and long-term financially defensible approaches such as the following:

- Development cannot increase the flood elevation (NFIP allows development to infringe on the floodplain as long as it does not increase the water surface elevation in the floodway more than 1 foot)
- The flood boundary on the Flood Insurance Rate Map that is used to limit development along floodplains is delimited using projected stormwater runoff from ultimate development (NFIP allows the floodplain boundary to be based on existing development)
- Base the floodplain boundary that communities use to limit development on the 500-year storm (the 0.2 percent annual chance of occurrence) or some flood event greater than the 100-year storm

The Association of State Floodplain Managers (ASFPM), along with a number of other floodplain agencies and organizations has been promoting a more comprehensive approach to floodplain management in recent years. This approach, referred to as No Adverse Impact (NAI) tries to take a more holistic look at the natural and beneficial functions of floodplains and seeks to provide resources to enable communities to establish management approaches that are above and beyond the NFIP model ordinance. For communities with established, proactive stormwater management regulations, many of these goals are often met or can be met with minimal effort. An incentive that is available to municipalities to be more proactive is provided through the Community Rating System (CRS), which is a point-driven system that can enable communities to be eligible for significant reductions in flood insurance premiums for their residents. Large communities with a mature stormwater regulatory system, like DuPage County, are often eligible for greater reductions than they are aware, based on their existing stormwater management approaches.

Vermont has recently adopted a floodplain management approach that is unique in that it establishes the floodplain, not through water surface elevations alone, but through a merger of floodplain management and geomorphology. Instead of establishing the floodplains based on a static understanding of where channels are when the study is conducted, Vermont establishes a floodplain corridor that relates to the belt width of the stream, thereby allowing it to meander in a natural pattern without being constrained by development impacts.

3.7. Wetlands

Natural wetlands serve many beneficial functions for water quality, flood control, riparian preservation and protection, and aquatic habitat. Natural wetlands are forbidden to be used directly as stormwater treatment facilities but they do provide that benefit holistically when distributed across a watershed.

Wetlands are protected by federal and state regulations though that protection has not been consistently applied. All wetlands provide benefits, although cases have been made that some smaller or isolated wetlands serve little benefit. Removing wetlands and replacing them with manmade wetlands has been a prevalent practice, however it is recognized that constructed wetlands are not as effective as a natural wetland for several reasons: they take time to establish the full benefits that they ultimately may achieve, design or construction may not follow the guidance available, they may not be maintained until the wetland is well established, or the site chosen for the wetland may not be appropriate and the wetland, when it fails, is not replaced by another wetland in a more appropriate location. Because of these limitations, manmade wetlands are most always required to be built larger in surface area (a ratio of two to five or more) than the natural wetland that is being removed.

Natural wetlands also serve as habitat for wildlife that is beneficial to homeowners, as a seed source for naturalizing areas, and as an aesthetic quality that can increase neighboring property values. Therefore, both for stormwater management and environmental enhancement, wetlands should be preserved as practicable. Wetland design manuals should be developed for communities that follow the best available technologies and that are written to specifically deal with the various site conditions within the municipality. This wetland design manual will be useful for restoring wetlands as well as for wetland replacement when natural wetland destruction is considered by the municipality, US Army Corps of Engineers and other reviewers as unavoidable.

3.8. Roadways

Roadways are a critical component of stormwater management due to their large impervious footprint and because they cross streams, degrading their stability. Rights-of-way consist of the road, sidewalks, medians and typically stormwater management features and open space associated with shoulders and buffer areas. In cities, roadways account for over a quarter of the total impervious area. Historically, older roads do not adequately manage runoff, instead allowing it discharge directly to receiving waters which leads to stream and aquatic habitat degradation. Because of the large impervious areas involved, the volume and peak discharge from these road systems can contribute to stream degradation. For this reason, federal programs such as the Safe, Accountable, Flexible, Efficient, Transportation Equity Act, a Legacy for Users (SAFETEA-LU) provide funding to restore receiving waters from older roadways that are repaired or replaced using federal dollars.

Roads include a narrow but lengthy open space and maintenance can be expensive. Road maintenance crews frequently limit their services to mowing, maintaining slope and bank stability of roads and ponds, and clearing sediments from pond forebays. Departments of transportation typically do not have staff trained to maintain more elaborate stormwater management facilities like green infrastructure, infiltration basins or underground systems that promote groundwater recharge or detain water for which the costs would be prohibitive. However, they may allow communities to place more complex stormwater facilities within their rights of way if the communities agree to maintain and repair the facilities.

Planners and stormwater managers have offered plans to narrow roads, use green open space rather than concrete capped medians and build sidewalks on one side of the road rather than both for less walked areas. The reduced impervious cover can result in less stormwater runoff. However, road widths and sidewalk requirements are not set for environmental reasons but for human safety and transportation.

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These requirements may be established by federal and state agencies and can require extensive effort to revise. Still many communities have been successful and these changes reap great rewards when considering the reduction in stormwater runoff, the decrease in road surface to construct and maintain, and the decrease in storm sewer construction costs. As an example of a dramatic move to achieve these goals, the State of Maryland recently revised stormwater design requirements to promote the use of green infrastructure along roadways and required that all municipal ordinances that regulate street and sidewalk dimensions be revised to accommodate these changes. Other communities have worked with their community transportation and planning agencies to update ordinances. Some communities are finding that they receive less state support for road construction and maintenance and have considered taking over all roadway operations, which would then allow them to set roadway designs and place BMPs in road rights-of-way without the threat of loss of state funding.

As TMDLs set limits on permissible pollutant loads that can be released to receiving waters, roadways and other transportation related structures like parking lots are being targeted for enhanced stormwater management, which includes reducing impervious area to decrease stormwater runoff and includes their retrofit to detain water and retain pollutants. These pollutants of concern include trash, temperature, ice treatment agents like salt and sand, metals from brake pads and nutrients and pesticides from open spaces. Treatment of roadway runoff is an active area of research with municipalities, states (Caltrans has developed a lot of particularly thorough research in this area in recent years) and the federal government involved in studies on how to monitor stormwater quantity and quality, the selection and design of stormwater facilities that provide the most effectiveness, and street and parking lot designs to reduce the volume of stormwater that leaves the roadway.

4. Overview of Stormwater Program Literature Search and Interviews

A precursory nationwide search of stormwater programs was conducted to identify up to twenty programs that demonstrated successful implementation based on science and effectiveness within the municipality and community stakeholders. The objective was to identify programs that have been developed and implemented that are at the forefront of sustainable and environmentally sensitive stormwater management. The success or failure of implementation of the programs is valuable as it provides feedback on adjustments that should be considered when developing programs for DuPage County.

The precursory list was culled down to twelve that received further review including an interview with the stormwater program manager(s). The initial list of twenty was developed out many potential candidates by selecting those that provided an overview of the eight categories of interest identified by DuPage County and that had general characteristics that were similar to the County. These characteristics included the administration of a large MS4 program that contained one or more small MS4s and an MS4 that was a large city or adjacent to a large city.

In addition, the top twenty were to contain MS4s that represented programs across the nation and that included programs moderately bigger and smaller than DuPage County. Although the stormwater programs did not all demonstrate successful or innovative approaches towards dealing with each of the

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eight categories of interest, the case would be provided for each category by no less than two of the programs (i.e., at least two programs showed a successful or innovative approach towards dealing with floodplains, at least two for sensitive areas, etc.).

The list of 20 stormwater programs was as follows:

1. Chicago, IL
2. Denver, Co
3. Lenexa, KS
4. Wisconsin
5. Eugene, OR
6. Portland, OR
7. Seattle, WA
8. King County, WA
9. Austin, TX
10. Gwinnett County, GA
11. Baltimore, MD
12. Fairfax County, VA
13. Montgomery County, MD
14. Prince George's County, MD
15. Stafford County, VA
16. Maryland
17. Philadelphia, PA
18. Charlotte-Mecklenburg, NC
19. Contra Costa County, CA
20. Santa Clara County, CA

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The final list of twelve stormwater programs was determined after the literature search of the initial twenty highlighted the relative strengths and unique approaches towards dealing with one or more of the eight categories of interest to DuPage County for this study. Several programs demonstrated similar approaches so the final twelve contained programs that had one or more of the characteristics of DuPage County, represented programs across the nation, demonstrated innovation, and had a longer record of success and were known to provide input to other communities interested in their program. The final twelve stormwater programs that received additional review were:

1. **Baltimore, MD.** Has a redevelopment program that will be further revised to address upcoming MS4 permit renewal requirements. They also have a long history of developing sound watershed and subwatershed scale management plans.
2. **Chicago, IL.** Chicago's stable leadership and focus on defensible practices for stormwater management based on science have resulted in a measured and steady application of progressive innovative approaches on a large scale. This has included the green roofs program, green alley program, and incentives for development, redevelopment and infill development. The proximity of Chicago and the successful implementation of the programs offer DuPage County good opportunities to learn from proven programs applied in a setting similar in environment.
3. **Charlotte-Mecklenburg, NC.** This City/County cooperative continues to progressively develop leading edge approaches for floodplain management and water quantity/quality management. Over 15 years of dedicated stormwater funding has been applied towards conducting studies, evaluating BMP strategies and defining modeling strategies to continually improve their stormwater program.
4. **Lenexa, KS.** Lenexa provides a suburban perspective to growth next to a larger highly urban city (Kansas City). It is requiring onsite BMPs to reduce stormwater runoff and retain open space. However, these stormwater management approaches are also offered by other programs reviewed here. Lenexa was selected, in part, because it is a small community in the Midwest with some similar characteristics to DuPage County.
5. **Philadelphia, PA.** Philadelphia Water Department has been aggressively implementing programs to apply green infrastructure such as green roofs, bioretention facilities, green streets, green sewers and increased open space. They also have a redevelopment policy that requires partial, but not full, compliance with new development stormwater requirements. The programs and model ordinance are offered to neighboring communities in response to State requirements for improved stormwater management, revitalization interests and a desire to improve the quality of the city streams so they serve as amenities rather than stormwater and sewage discharge portals.
6. **Portland, OR.** Portland has implemented and tested the ability of their stormwater designs using onsite BMPs and low impact development concepts to the point that at least one community has been built with no net increase in stormwater runoff. Their program includes the management of industrial, commercial, residential, and roadway runoff as new development and retrofit of existing developed areas. In this highly urban city, they consider predeveloped conditions to be the same as undeveloped so that redevelopment must comply with all the same stormwater requirements as new development. They have a well regarded stormwater program nationally and are used to dealing with requests from other communities for advice and support.
7. **Seattle, WA.** This ultra urban city has used green infrastructure to retrofit existing developed areas so successfully that some of their projects, such as the SEAS street project, have become examples presented worldwide. They have established approaches, policies, ordinance and guidance manuals

on working cooperatively with developers and commercial/residential stakeholders to develop green infrastructure projects with an aesthetic appeal, to achieve high levels of hydrologic control and water quality enhancement, and to provide regular maintenance and retrofits to achieve long-term goals. Seattle also has a flexible roadway design policy based on location and use.

8. **Montgomery County, MD.** This program is innovative in how it approaches the determination of whether a stormwater problem exists and how they determine the causal agents. The approach has always been to monitor the aquatic ecosystem first and to then determine if water quantity, water quality or another cause is degrading a stream reach, but generally only after the aquatic ecosystem shows signs of stress. There is also a stream protection strategy for more pristine waters that involves the application of redundant sediment control practices; and they have a development policy that focuses on preservation of open space and farmland. Their recent approach has been to use onsite controls and stream restoration practices.
9. **Prince George's County, MD.** Prince George's County was one of the earliest communities to establish a dedicated stormwater funding source. They have successfully applied this fund to progressive research that included the development of the "rain garden" concept and the development of the USEPA guidance document on designing low impact development practices. They have a close working relationship with USEPA on leading stormwater management practices and with FEMA on floodplain management and levee maintenance. They have developed several tools to improve stormwater development procedures and numerous public outreach and education programs.
10. **Santa Clara County, CA.** Santa Clara County was one of the communities to develop a stormwater program using leading practices well before it was required by the state or federal governments. They have a well funded program with a long history of research and public outreach to support the various approaches that have been successful or that required some modification to be more successful. They conducted modeling to develop criteria for selecting and sizing onsite BMPs to protect streams and mimic predevelopment hydrology at post development sites. They also provide studies and implementation experience on erosion and sediment control programs and development/redevelopment programs.
11. **Stafford County, VA.** Stafford County has required onsite low impact development approaches to the maximum extent practicable while most other communities only recommend this approach. They have worked with the state to develop acceptable practices for designing these practices on a large scale and still be able to obtain county and state permits for innovative practices. They have developed ordinances, property owner agreements, design and construction procedures, and other policy infrastructure and public outreach and education material to address successes and failures as the program has matured.
12. **Maryland.** Maryland developed a stormwater design manual in 1999 and 2000 that has been used as a template for several other states. Maryland began updates to its model ordinances and the stormwater design manual in 2007 that offer some of the latest approaches in to the design of BMPs based on mimicking predeveloped hydrologic conditions. This includes groundwater recharge, open space preservation, and development standards. One program, the City of Baltimore, is a large MS4 with a history of good stormwater management that has recently reorganized their management structure so that the department that manages the MS4 program also has control of the design and construction. This change in stormwater program structure yields a program that is more flexible and that ties stormwater program implementation with the department responsible for stormwater program reporting and oversight.

5. Review of Successful Stormwater Management Programs

A further review of the twelve stormwater programs selected by the by the County was conducted, either in person or by telephone, with the stormwater program manager, generally the person responsible for managing the MS4 permit. In most cases two or more people from the municipality were present. The additional municipal attendees tended to represent floodplain management and natural resources programs.

5.1. Review Process

An overview of the objective of the program review meeting was provided verbally and by e-mail to each municipality. An e-mailed brochure contained a list of the questions and topics of discussion for the meeting. The brochure is presented at the beginning of Appendix A. A summary of the interviews for each of the 12 communities and the responses of a similar interview with DuPage County are provided in Appendix A. Pertinant information obtained through research conducted prior to or after the interviews is also included.

5.2. Overview of Program Characteristics

The responses of each program interviewed can be found in Appendix A. This section will provide a general overview of the responses and highlight several responses that demonstrate points that we feel are of value to DuPage County as they move forward with reviewing and updating their stormwater program. The responses will first focus on the categories of interest and then on the approaches, changes and successes that the interviewees said they experienced in developing and implementing their stormwater programs.

Stormwater Quantity

- There is a strong commitment to require Low Impact Development (including Green Infrastructure and Environmentally Sensitive Design) to the MEP.
- The definition of Maximum Extent Practicable (MEP) is often not provided but where programs appear to demand stricter enforcement, MEP is taken to mean that LID will be provided unless the permit applicant can demonstrate that it cannot be used, and it will be implemented partially where full compliance is not feasible.
- A volumetric approach was used for most programs either by specifying a volume to infiltrate and/or detain or by requiring the capture and management of the volume of runoff at post development that exceeded predevelopment runoff. A capture volume of from 1 inch up to roughly the storm event that would cause 90 to 95 percent of all annual precipitation was generally specified.
- The City of Baltimore noted that the state of Maryland's definition of MEP did not include costs so the County was considering using cost as an exemption to MEP that would allow them to propose innovative designs that are not explicitly permitted by the state for difficult sites.
- The City of Chicago requires that ½ inch of stormwater runoff be infiltrated. They had thought that a 1 inch infiltration requirement would be too difficult to obtain. They now find that developing

sites regularly exceed the 1/2 inch infiltration requirement and are considering increasing the minimum requirement to 1 inch.

- A few communities permitted waivers or fee-in-lieu options to opt out of the onsite LID requirements.
- Many appeared to offer credits for green space or green infrastructure that eased the LID on site requirements.

Stormwater Quality

- BMP design requirements are related to the pollutants of concern, total impervious area, and criteria such as designated capture volume and BMP pollutant removal efficiencies.
- Common pollutants of concern are sediments, phosphorus and/or fecal pathogens.
- Some programs target only sediment loads with the expectation that the BMPs designed to remove sediment loads will also remove other pollutants of concern. Others consider that the BMPs that manage the required stormwater quantity will remove the pollutants of concern.
- TMDLs are being written into the MS4 permits and are expanding the pollutants of concern to include chemical contaminants, trash, temperature and other pollutants not typically included in municipal stormwater ordinances.
- Communities vary on whether the property owners or the community maintain the BMPs. Typically the property owner is to maintain their BMPs.
- The City of Chicago considers stormwater quantity as a quality practice because over 99 percent of the City is on combined sewers. However, they will update the ordinance to recognize stormwater quality requirements for those few locations (such as bridges) that discharge to the river.

Restoration / Protection of Sensitive Areas

- Protection typically is obtained through development setbacks and riparian buffers.
- Some programs offer credits if permanent protection is proffered for sensitive green space.
- During each five year MS4 permit period, Maryland is requiring each MS4 program to “retrofit” at least 10 percent of the untreated impervious area in the municipality.
- Some programs specify certain watersheds as higher quality and require greater stormwater protections.

Development / Redevelopment

- Most programs require new development to meet all stormwater management requirements.
- For new development, some programs classify predevelopment conditions as existing conditions (which might be woods, graded field, gravel parking lot, etc.). Others classify predevelopment as woods in good condition regardless of existing conditions.
- Some programs require predeveloped sites to meet new development requirements. More typically, others require that redevelopment sites partially comply with new development.
- Charlotte-Mecklenburg allows redevelopment sites to use the highest impervious cover that had existed at a site for the past five years. This allows a property owners to tear down an otherwise underutilized building and replace it with green space; as long as they redevelop within five years, they are allowed to claim the total impervious area that was at the site before the building was razed which limits the level of stormwater management that they are obligated to provide.

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- The City of Baltimore wrote a detailed Chesapeake Bay Critical Area manual that they incorporate into their critical area ordinance and update every 6 years.

Erosion and Sediment Control

- Programs follow the state requirements.
- Some programs are more aggressive than others at enforcing these requirements.
- Some programs reduce the number of inspectors during economic downturns, which reduces their ability to enforce erosion and sediment control compliance.

Floodplains

- Programs generally require greater requirements than the minimum FEMA NFIP requirements.
- Some do not recognize a floodway so no increase in water surface elevations are allowed within the floodplain.
- Some manage their floodplains to future development conditions to recognize that waivers and unregulated programs upstream will invariably increase flood elevations.
- Charlotte-Mecklenburg has developed a future land use 100-year floodplain on their Flood Insurance Rate Maps.
- The City of Lenexa willingly allows new development the option of a fee-in-lieu of method to help fund their regional approach for floodplain management. They much prefer that property owners implement and maintain green infrastructure to manage the smaller storm events even if it means that space is not available to manage flood causing storm events onsite.
- Santa Clara Valley recommends that vegetated buffer strips be incorporated on the 100-year flood boundary.

Wetlands

- Programs typically manage to the state and US Army Corps of Engineers requirements.
- Some communities are more aggressive at preserving and protecting wetlands within the framework of existing requirements.
- DuPage County protects all wetlands including isolated wetlands not directly connected to Waters of the US.

Roadways

- Design standards and the use of roadways and rights of way for stormwater management show the greatest variability of all categories of interest discussed in the interviews.
- Some allow narrow roads or green infrastructure on their rights of way; others are still grappling with how to deal with road runoff.
- Montgomery County, Maryland is the first program in the country to require that all road repaving projects incorporate green infrastructure.
- Seattle and Portland target certain redeveloping and new development areas for green infrastructure along rights of way.
- The City of Chicago uses storm sewer inlet restrictors to detain stormwater on the roadways thereby reducing the combined sewer overflows.

IDDE

- Most all programs have an illicit detection program in operation though several are just getting it operational.
- Most have enforcement capabilities that include fines.
- Some use cross trained inspectors to check for illicit connections.

Processes for Developing and Implementing Stormwater Program Changes

- Changes involve many government entities and members of society so the process should take time and be inclusive of a broad representation of stakeholders.
- Coordination among government agencies, particularly those responsible for implementing and enforcing changes, is paramount to success.
- Change should be reasonable, justified and equitable.
- Training of stakeholders, primarily engineering firms responsible for design, operation and maintenance, must occur early and frequently to jump start revised programs.
- While meetings to determine what and how changes should be made must be inclusive of government and society representatives, the participants in the ordinance development meetings should be selected and committed to a long-term process – the participants are selected to represent their constituents (government, business, property owners, homeowners, religious organizations, chamber of commerce, etc.) and membership in the meetings is by selection and not open to all.
- It is important that ordinances be backed up by well developed supporting regulations and guidance documents. Portland and Stafford County are two examples where these supporting materials were not available when the ordinances were changed and their program got off to a slow and difficult start. There also is the concern that BMPs placed in the early days with poor supporting guidance will have been built to less effective standards.
- A strong facilitator, good meeting notes made available to all participants, and periodic recording of individual participants' positions on issues is important. Be aware that participants may represent groups that can cause their representative to change their position.
- Some communities maintain standing committees permanently and others develop special committees just for dealing with ordinance changes.
- Different interpretations of ordinances, regulations and design guidance will occur. A mechanism must be in place for the government to develop clarifying guidance for all to use. Position papers posted to a public web site can meet this objective, with future revisions to guidance incorporating these positions.
- Portland took two years to develop their stormwater ordinances.
- City of Lenexa took a survey and found that 80% of the community considered water quality control a “quality of life” issue. They were able to pass a dedicated stormwater program fund with the support of 78% of the community.
- Charlotte-Mecklenburg generally allow 18 months for a new committee to just discuss “what is the problem” before they begin to discuss ordinance and regulatory changes.

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- Some communities developed changes with limited input from outside sources and then met with the broader community to describe and tweak the changes. Examples would be the City of Chicago and the recent Maryland changes.

Concerns and What They Would or Did Change

- Develop regulations and guidance documents in advance of the period when ordinances will become effective.
- Stormwater management ordinances should be tailored to the intent of the Clean Water Act and focus on improving fishable and swimmable goals rather than establishing metrics just because they can be measured as they may not necessarily be indicative of success.
- Flexibility is desirable but ultimate goals and objectives must be clear. When a higher authority (such as DuPage County's role in developing ordinances for other communities within the County's boundaries) established a program for others to meet, oversight and enforcement is mandatory.
- Determining if and how redevelopment requirements should differ from development requirements is an issue dealt with in several different methods. Some allow lower standards for redevelopment or for special categories such as Brownfields and Traffic Oriented Designs. Others have decided that stormwater requirements are not a part of the decision process when a company decides where to develop.
- Maryland revised their law in 2007 and stormwater design manual in 2008/2009 because several communities were not complying with the intent of the 2000 ordinance requirements.
- City of Lenexa had a green infrastructure credit program for meeting stormwater management requirements but it was little used so after two years they removed this credit option.

5.3. How Successful Programs Deal With Change

Stormwater programs must always be tracked and monitored to identify practices that are doing well, practices that can use improvement, and shortcomings that need to be rectified. Change is necessary to continue to strengthen a program. From the review of the twelve exemplary stormwater management programs, it turns out that there is not set method of dealing with change other than active recognition of the need for change and prompt action to make an appropriate change. Most stormwater programs have a process for collaboration on what is to be changed and how it should be changed. The process generally takes several years to complete due to varying opinions on how to proceed and because it takes time to observe the processes that need to be changed and to develop and pass or implement a new ordinance, regulation or guidance manual update.

While collaboration is needed to effect a change that will be supported, the participants in the collaboration process differed among municipalities. Some develop committees that include municipal, business, residential, environmental and other select members with participation to the committee limited to the preselected group. Some develop a committee only of municipal government representatives. Public feedback is obtained through public meetings or private meetings with select groups (i.e. environmental organizations, engineers and/or developers). The outcome needs to be sound scientifically, reasonable and administratively fair, and understood by the broader community as these changes most likely will require additional expense to landowners and residents.

Changes can still fail if the municipality does not continue to educate the development industry that are tasked with implementation of the changes, and the public at large that needs to understand how the changes benefit the municipality. For this reason, the municipality must maintain working relationships with businesses and design firms and have an active public involvement program that gets stakeholders engaged and sells the municipality's message. While change will not be readily accepted by all, its success is more likely when all parties understand why the change is needed and that it is applied fairly and reasonably.

6. Recommendations

6.1. County's Current Ordinance Breakdown

The current ordinances that address stormwater control are governed by the *County of DuPage, Illinois Countywide Stormwater and Flood Plain Ordinance* (Adopted as Appendix F to the DuPage County Stormwater management Plan), revised August 1, 2008 in conjunction with the *DuPage County Water Quality Best Management Practices Technical Guidance* (for inclusion into Appendix E – Technical Guidance for the DuPage Countywide Stormwater and Flood Plain Ordinance). The regulatory authority and requirements for activities that impact the discharge of stormwater are provided in Appendix F, while Appendix E provides the means to meet the regulations.

6.2. Philosophical Approaches

The success of a regional stormwater management plan depends on a number of factors that should be considered as objectively as possible. These include:

- Commitment to technical expertise of staff responsible for regulating the program (e.g. Do financial constraints lead the community to eliminate technically knowledgeable staff positions or will continued training of municipal staff be anticipated?)
- Opportunity and willingness to contract with outside expertise (e.g. If municipalities are moving toward smaller, contract management based staff, are there opportunities to contract technical reviews with outside resources?)
- Openness of state and federal regulators to allow the County to develop a unique approach (e.g. If the County pursues a progressive or experimental approach, is there likely to be a backlash from regulating authorities regarding the MS4 permit(s) or delegated authority?)
- Sources and severity of pollutants to be controlled (e.g. the effectiveness of management strategies varies significantly from pollutant to pollutant. Can the County develop a single “keystone” pollutant that provides the most bang for the buck, or will TMDLs or other water quality requirements necessitate a multi-parameter management strategy?)
- Attitude toward progressive management strategies that exists in the Community (e.g. is the development community vocal in their opposition or support of measures to protect the County's water resources?)

These issues, and perhaps others that are relevant to DuPage County, need to be evaluated in determining the desired philosophical approach to the management of stormwater. Communities across the country

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usually come to terms with their program's philosophical approach through an evolution of determining what works and what obstacles are not worth competing with. Taking the time to understand this dynamic within DuPage County can help create a manageable program that minimizes costs and time.

The goal of this exercise is to determine where the regulatory approach should lie on a sliding scale of rigidity. If the municipal staff and the development community cannot support a dynamic approach to the management of stormwater resources due to high turnover, litigation, lack of interest, lack of political will, relationship with other regulating authorities, etc., then it would be better to establish a highly prescriptive stormwater management approach. This approach would be easier to regulate, easier to communicate and justify to state and federal regulators. On the other hand, if the community maintains a highly technical staff that can work with cooperative designers to meet specific needs of larger projects, a more flexible approach may be pursued.

Both approaches have pros and cons and should be evaluated on the basis of the community in which they are being applied.

Based on past experience with administering the stormwater and flood plain management programs and in consideration of the previous section, another aspect of the development of stormwater regulations that should be considered is the need to update standards in the future. A current trend in program administration, particularly at the State level, is to maintain technical guidance in a highly dynamic format such as a web clearinghouse. This allows the regulations to be streamlined, simplifying the administrative process of regulatory revisions, while facilitating periodic updates, enhancements and new approaches that make up the tools available to the design community.

DuPage County already approaches stormwater related regulations in this way through the distinction between Appendix E and F of the Stormwater Management Plan. However, there may be opportunities to improve upon these distinctions to better support watershed based management approaches, adding management strategies or providing frequent updates to the approaches used in the County.

6.3. Ordinance Standards Contained by Progressive Communities

The ordinance standards that are contained by stormwater programs operated by the twelve exemplary communities provide a back drop for consideration by DuPage County in restructuring their stormwater ordinances.

Stormwater Management Quantity Control – The existing quantity control criteria in DuPage County (0.1 cfs/acre) is highly restrictive. In fact, this is a more stringent requirement for storage than is found in most areas of the Country. However, it is unclear what this standard is based upon and how it applies across the continuum range of runoff producing events that affect various aspects of receiving waters.

In determining the most effective approach for managing water quantity control, we need to take a step back and determine what we are hoping to accomplish and for what range of events is this portion of the regulations applicable. Simplistic, hydrology based approaches are often overly conservative from a flow rate perspective, whereas the development of a process based water quantity control standard can significantly reduce the footprint of detention facilities, but requires a more thorough site investigation.

Flood Plain Management – DuPage County currently bases their flood plain management program on the guidance provided by the Illinois Department of Natural Resources, Office of Water Resources, as do many of the municipalities in Illinois.

Stormwater Management quality control – The management of stormwater quality for a large area requires a thorough understanding of the key impairments and the processes by which they reach receiving waters and inhibit the intended use of that body of water. The current water quality standard outlined in the *DuPage County Water Quality Best Management Practices Technical Guidance* provides a thorough overview of water quality impairments and treatment, but lacks the focus to provide a meaningful approach to addressing the County’s water quality issues.

While a management approach for a single source of impairment may improve upon other impairments as a by-product, it is difficult to create a successful multi-parameter program that meets the following objectives:

- Understandable and implementable by the development community
- Understandable and implementable by the regulating authorities
- Maintains consistency in the approach throughout various development scenarios
- Addresses the needs of the receiving waters in a meaningful way

Therefore, in order for the County to create an effective water quality management strategy, the following steps are recommended. First, evaluate the known data to determine what impairment(s) are of primary concern, and to what degree are they linked together. For example, the list of impaired waters found in the *DuPage County Water Quality Best Management Practices Technical Guidance* indicates that these water bodies are primarily affected by: DO; TDS; TSS; algae; phosphorus; copper and chlorides. Of these, it may very well be that DO, TDS, TSS, algae and phosphorus are manifestations of nutrient enrichment and can be improved upon by focusing efforts toward a simple TP standard. Since a primary BMP mechanism employed to address TP includes settling, a by-product of this approach could be the significant improvement of metals, such as copper. It should be noted that while the text explains the issues associated with nitrogen impairments and these may also be a problem associated with nutrient enrichment, the steps taken to address nitrogen and phosphorus impairments are so different that it would be difficult to develop a standard that simultaneously addresses both and meets the objectives outlined above.

The second step to addressing the impairments in DuPage County requires an understanding of the sources of and the process(es) by which the pollutant(s) of concern reach the receiving waters. Many communities address pollutants as a function of the percent impervious cover that exists on a development site. However, the source of the pollutant(s) can vary significantly on a regional basis. In order to adequately address the pollutant(s), a thorough understanding of the source(s) must be made to avoid spending excessive amounts of money treating stormwater in a manner that does not achieve the intended consequences. Some sources of nutrient pollution that are often not considered include: air deposition from industrial, energy or agricultural practices; fertilizers from urban managed lawn care; and significant concentrations native to soils that erode from unstable streams and outfalls. To assume a “one size fits

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all” approach to addressing water quality impairments will likely result in unnecessary expenditures associated with development that does not improve water quality in the County.

Development and Redevelopment – New development traditionally carries the burden of implementation of current evolutions in stormwater management. However, if a community is already dealing with degraded water quality and increased flooding conditions, programs to address future development cannot be expected to improve the overall condition. Therefore, it becomes necessary to implement programs that will gradually improve the conditions associated with legacy development. This always raises the issue that if aggressive stormwater management requirements are set in place in areas of redevelopment, it will be a disincentive for redevelopment that will result in suburban sprawl.

It is important that the community’s planning process be engaged to ensure that these perceived disincentives are counter balanced by programs that make redevelopment an alternative that is attractive to the degree that this meets the County’s development goals. Some alternatives that have been well received by the development community in the past include offset credits for retrofits and improvements that can be implemented on adjacent properties to achieve a net water quality improvement goal.

Erosion and Sediment Control – Erosion and Sediment Control practices have been standardized throughout the country for most land disturbing activities, while post construction erosion and sediment control is addressed through the previously discussed sections on Stormwater Management. One of the most challenging aspects of implementing an Erosion and Sediment Control program is the cost associated with maintaining an adequate inspection staff. However, adequate inspection of construction activities may be the single most important element in the success of an E&SC program.

Current discussions and recent construction general permit modifications in California suggest that the EPA may be looking to raise the standard for mitigating construction site runoff. These changes should be monitored closely and DuPage County and the State of Illinois should try to shape them toward the needs of programs in this area of the Country.

Wetlands – One of the stated problems associated with historical development in DuPage County is the loss of wetlands and the natural water quality improvements associated with them. Constructed wetlands are generally less effective at filtering runoff due to their size and lack of interconnectedness. However, the topography and history of the County suggests that constructed wetlands may offer a useful means of improving water quality, particularly if nutrient enrichment mitigation is a stated goal.

Wetlands and streams are regulated under sections 401 and 404 of the Clean Water Act. As such, there is little need for municipalities to incorporate their protection into local ordinances as has been done in DuPage County. However, if wetlands are considered an important aspect of the County’s natural water resources, regulating them at the local level provides an opportunity to develop and maintain a database of existing resources that the County can use to better manage future impacts. This allows the County to provide an additional level of oversight, not typically provided by the Corps or the State, to prioritize the protection of the most functional wetlands.

Roadways – Transportation corridors often create problems for watershed scale management of stormwater runoff. There are several reasons for this. First, roadways and other corridors must be maintained in a safe operating condition, which necessitates rapid conveyance of stormwater away from

public access areas. Second, the nature of the linear corridors makes it difficult to incorporate large stormwater management facilities to offset the flashy runoff conditions associated with the highly impervious conveyance systems found in rights-of-way. Third, roadways are systems that convey mechanical systems, which lead to unique pollutant loading associated with oils and greases, metals, rubber and deicing chemicals in the winter. Add to this the fact that roadway development is typically managed through a different process than site development, which leads to a lack of cooperation when attempting to address these issues in a holistic manner.

Maintenance activities associated with roads constitute a large and growing percentage of roadway budgets. Therefore, it is often not feasible for roadway departments to take on maintenance intensive stormwater management facilities that require frequent inspections and/or corrective actions. With this in mind, some communities have found a way to encourage innovative or holistic stormwater management while removing the maintenance burden from the roadway agencies. This creates a symbiotic relationship that can yield significant results. Again, it is critical to evaluate the sources and processes of treatment for the pollutants of concern to develop solutions that meet the unique needs in DuPage County.

7. Going Forward

DuPage County is in the process of identifying changes that they would like to make to their stormwater program. The structure of the ordinances is still in flux but certain areas that will be addressed include development, redevelopment, roadways, and MS4 requirements such as IDDE and erosional and sediment control. The County will also need to decide how to structure the overall documents that govern the stormwater program. This includes deciding what components should be in the ordinance, regulations and guidance documents since ordinances are more difficult to pass but do carry a higher standard for enforcement, while guidance documents are easier to revise and therefore can permit a higher degree of flexibility. This flexibility allows for the guidance documents to be made more or less prescriptive in response to how successfully implementation by the community at large meets the needs and intent of the ordinances and federal Clean Water Act.

Sample ordinances are available for a number of sources including USEPA, the State of Maryland, Santa Clara Valley, and others. These sources provide examples of how others dealt with complex issues that involve both a science and politics. However, DuPage County has a committee in place that has dealt with such issues before and has the local knowledge that will be needed to create the ordinance and specify how guidance should be updated to develop a fair, equitable and defensible stormwater program that uses good science to meet the objectives of the Clean Water Act and other federal, state and local environmentally sensitive legislation. Information that could aid the committee in developing new ordinances should clarify what the perceived problems are with the current program, if those perceptions are reasonable, what are the overall goals and objectives of the County for their ideal stormwater program, what objectives are considered to be most important (don't hesitate to overreach), and what do stakeholders want. This information can be supplemented by surveys of the overall community including the government, business, residents, and environmental stakeholders. It is also important to ensure that all

DuPage County Stormwater Management Program

committee members understand the issues and feel that they have adequate knowledge to make informed decisions and to actively participate in committee discussions.

The committee should make some key decisions up front such as:

- Are they prepared to develop a program now that addresses current and future requirements of a stormwater and environmental management? This includes meeting the current state requirements as well as future obligations that can be foretold through actions being taken by USEPA regional offices that are more progressive than those of Region 5. State programs such as in California, Maryland and Virginia are responding to stricter enforcement of the federal Clean Water Act by USEPA Regions 3 and 9. States in the Northwest and Mid-Atlantic regions are responding to local requirements to protect and restore impaired natural resources such as threats to keystone species due to poor management of stormwater impacts to streams (e.g., salmon) and the Chesapeake Bay.
- What role does the County play in implementing a sound and equitable program? Would the County consider Lenexa's approach of mandating that frequent storm events (such as 90 to 95 percent of all storm events) be managed onsite while the community offer public land for managing large major flood producing storm events at regional facilities. Would the County be prepared to require similar development and predevelopment requirements with the knowledge that the County may need to provide offsetting resources to prompt redevelopment in some situations such as Brownfields?
- Does the County want a more flexible or more prescriptive approach? The County needs to determine if they can obtain adequate compliance with the intent of the ordinances and guidance from the smaller MS4 programs within the County boundaries as well as from the property owners and developers across the County. The County also needs to decide, if a flexible approach applies to the use and design of structural and nonstructural BMPs is permitted, is it prepared to provide the training to the engineering firms to obtain conformity and whether the County is prepared to support a knowledgeable permit review team capable of handling the extra review time required for designs that can contain diverse approaches.
- Does the County have the necessary resources to implement the program? Dedicated funding will be necessary for any program that requires consistent and long term obligations, such that budgets necessary to implement and sustain new programs must be available early and guaranteed, or programs can falter and even fail.
- Does the committee have the correct representatives to competently and fully address the problems and develop the ordinances? Stormwater cuts across most if not all agencies within the County. Several important categories will include roads, sewer utilities, data resources such as Geographic Information System databases and tools, legal, finance, planning, inspection, enforcement, and liaison with political decision makers. Not all of these groups need to participate in the committee, but their input will be valuable to identify and address problems and to define what data systems are available or needed to successfully implement proposed stormwater program changes.

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The committee can benefit from surveys to determine what the community understands about stormwater and what their interests and concerns are. Like Lenexa, surveys may indicate strong support for improving water quality and the willingness to dedicate more resources to achieve these goals. This can also help to develop a public outreach program and focused meetings with key interest groups such as businesses, homeowners, environmental groups, engineering firms, and state/municipal agencies.

The process will be collaborative and involve input on what others are doing, such as described in this report, and on what is supported scientifically and socially. Additional materials reviewed for this report can be provided in interactive presentations to aid the committee. Materials collected from literature searches of the interviewed communities and other sources are also being provided on the committee website.

Appendix A. Summary by Community of Stormwater Program interviews

Interview Brochure Template

DuPage County Stormwater Management Program

DuPage County Would Like To Learn How Your Community Developed And Implemented Ordinances To Established Your Successful Stormwater Program

DuPage County, Illinois is located adjacent to Chicago and Cook County and takes an active role in managing its floodplains and watersheds by developing a legal and technical framework based on good science and forward thinking ordinances and guidance. The County has a Large Municipal Separate Storm Sewer System (MS4) and contains a number of small MS4 communities that implement their program requirements as a participant to the County's Large MS4 permit. DuPage County has established a technical committee of municipal representatives that are focusing on reviewing and revising several wet weather flow related ordinances. As part of the review process, the County is interested in the lessons learned by other communities that have implemented progressive stormwater programs. The interest is predominately in successful implementation and adaptation of stormwater programs, specifically the ordinances, but lessons learned in difficulties encountered are also sought.

Michael Baker Jr., Inc. has been selected to interview 12 municipalities and states nationwide that were selected because of their long and continuing management of the wet weather environment using technically defensible approaches that have successfully navigated interrelated, and sometimes contradictory, objectives for sustaining the natural environment and community interests. The 8 key categories that we are interested in are as follows:

1. Stormwater management including water quality and water quantity
2. Restoration and protection of sensitive areas, natural areas and open space
3. Development
4. Redevelopment
5. Erosion and sediment control
6. Floodplains
7. Wetlands
8. Roadways (this is purely related to stormwater management, such as the regulation of percent imperviousness or the use of road rights-of-way for best practices, and not a stand along road design ordinance)

We would like to discuss the ordinances that your community has developed or is updating in these categories. We would like to meet with you, and other community staff that you think necessary, in one meeting if feasible. We ask that you invite the appropriate participants or help us to identify the participants so we can organize the meeting. Following are questions that we would have to frame our discussion:

1. When did the ordinance become effective?
2. What new changes were introduced? What were the overall objectives of the ordinance (i.e., reduce flooding, not inhibit redevelopment, practical approach for maximizing pollutant removal, delegating mandates to a more easily adapted guidance document, etc.)?

3. How were business, engineering, environmental, public, and other interests involved in the process leading up to the development of the ordinance and what were their comments?
4. What was the reaction of these interest groups following implementation?
5. What additional steps and resources have been used to successfully implement the intent of the ordinance (local regulations, guidance documents, public education and outreach, training sessions with maintenance or design firms, etc.)?
6. Do you feel that the ordinance has been effective in meeting the intent?
7. What changes, if any, are being considered
8. What sources have you used to define the best science available and to develop ordinances?
9. Globally, we also are interested in the structure of the ordinances. How did the various key categories get divided into separate ordinances and what has been deferred to separate regulations and guidance documents rather than explicitly mandated in an ordinance?
10. Do you partner with other MS4 communities to implement your MS4 permit requirements? How has the interaction been successful for all parties and what areas require more effort than others to create success?

Summary by County of Stormwater Program Information

The following pages include tabular results of the National Ordinance Review broken down by agency. The first table is meant to be used for side by side comparison of all programs. The second set of tables is meant to be used to individually review each program.

Dupage County National Stormwater Ordinance Update - National Stormwater Program Review Table

	Municipality	Stormwater Quantity	Stormwater Quality
1	City of Baltimore	The City feels that they have not done all that is possible to implement Environmentally Sensitive Design (Maryland's new term for Low Impact Development and Green Infrastructure). Disturbing 5,000 or more SF of impervious area is the trigger for complying with stormwater quantity regulations. The City currently is regulated by the 2000 Maryland Stormwater Design Manual and will adopt new ordinances within a year, as required by Maryland, to meet the 2007 Stormwater law and recent updates to the Manual and regulations.	Control 1-inch storm on 50% of impervious cover on site. The Water Quality Volume (denoted as the WQv) is the storage needed to capture and treat the runoff from 90% of the average annual rainfall (~1.7-inch and smaller storm events). Refers to updates to the 2000 Maryland Stormwater Design Manual.
2	Portland	Must have 2 in/hr infiltration Have three different submittal approaches - simplified for total impervious area <10,000 SF, presumptive for total impervious >10,000 SF and takes site specifics into consideration, performance is for sites that can't fall under simplified or presumptive and are usually for unique sites If an on site BMP is not practicable, the developer can pay \$2.76/SF for unmanaged impervious area to City fund. This fee is pro-rated for political reason as it costs the City \$12 to 13/SF. Facilities are privately owned. Flow control depends on downstream conditions: surface water, combined sewer, etc.	Must have 2 in/hr infiltration. If on site BMP not practicable, can pay \$2.76/SF for unmanaged impervious area to City fund. Pro-rated for political reason as it costs City \$12 to 13/SF Facilities are privately owned
3	City of Chicago	Volume control is the green part of the program - minimize IA or do BMP Green roofs and permeable pavement are considered non-impervious. Release rate to control 100 yr storm event via Maximum Release Rate Control Chart. Volume Control to capture first 1/2" or reduce impervious surface by 15%.	Water quality was stripped from the draft ordinance City considered water quantity a quality program since >99% of the City is combined sewer.
4	City of Lenexa	Apply APWA standard. Require detention for the 1-yr and 10-yr events. They provide regional detention and stream maintenance for 100-year storm and charge a capitol fee in lieu of forcing individual sites to provide 100-year detention.	Have full time water quality specialist who does chemical/biological monitoring. Water quality event is 1.37" storm, so that must be treated and maintained onsite with BMPs.
5	Santa Clara Valley Urban Runoff	Large MS4 jointly managed with other large urbanized areas that discharge to the San Francisco Bay. They are in the process of negotiating a San Francisco Regional Permit and their existing large MS4 permit has been extended while the new permit is being developed. The new permit will be more prescriptive and add more LID. They recommend using continuous simulation modeling rather than discrete design storm modeling for determining the stormwater management to be implemented for on site control, off site control and in stream control. They have flow charts for different situations and different outfalls to aid the design process.	They have BMPs separated into six categories as follows: (1) erosion control, (2) runoff and runoff control, (3) sediment control, (4) active treatment systems, (5) good site management, and (6) non stormwater management. BMPs should be used to the MEP. They have a water quality monitoring program to measure program effectiveness.
6	Montgomery County, MD	Complies with the current state requirements. Started quantity control in 1971 as part of the sediment control ordinance that was managed by the Montgomery County Soil Conservation District. Worked out arrangements with the state's attorney to obtain approval for the 1971 ordinance. This remained in place until the 1983 state sediment requirement. The state passed the 2000 changes and the county complied in 2002. The state requires different storage requirements for different functions - recharge, channel protection(1 year, 24 hour), overbank flood protection and extreme flood volume.	Under Maryland NPDES permit. The Water Quality Volume (denoted as the WQv) is the storage needed to capture and treat the runoff from 90% of the average annual rainfall. This takes into consideration impervious cover, multiple drainage areas, offsite drainage areas, sensitive streams, BMP treatment, structural practices, peak discharge, and extended detention.
7	Seattle	4 volumes, final draft - source control, construction stormwater, flow control, water quality, enforcement provisions. Depending on project size and type and outfall, they require flow control or treatment. Size triggers are 2000 & 5000 SF.	Depending on project size, type and outfall, they require flow control or treatment. All projects are to use green infrastructure to the MEP. Treat and infiltrate 91% of Water Quality Design Volume.
8	Charlotte-Mecklenburg	City develops SWM, County develops FPM. They are open to detention being done in BMPs. Different requirements for different parts of the city. 3 areas. Volume control is 1-yr, 24-hr storm, rate control is based on downstream and ranges from 2 yr to 100 event.	Developers can choose from 10 BMPs. BMPs for single family residences will be publically maintained once they've been shown that they are working. LID has been initiated in Huntsville and there is a separate ordinance for them. TSS and Total Phosphorus removal varies by 3 areas of city. TSS removal 85% and phosphorus removal 70%.
9	Stafford County, VA	They require LID to the MEP. To get this accepted as meeting all state stormwater requirements, they got state approval for full LID implementation to be considered as meeting the state's adequate outfall requirement that requires detailed analysis to ensure that stormwater runoff from development or redevelopment will not lead to receiving stream instability. Must keep the 10 year release rate the same for flooding, the 1 year, 24 hour release rate the same for channel erosion, and use LID design. Must have overflow path for 100 year event.	Uses USEPA and Prince George's County, Maryland LID design manuals to take credit for pollutant removal. Three levels of LID design are recognized by the County - full, partial, and limited. Development must utilize LID to the MEP.
10	Prince George's County, MD	LID now accepted by state as providing quantity control; previously the state made it difficult for LID designs to obtain quantity control though they did get credit for quality control. Had problem with public perception when one residential development went full LID at county request and major storm caused lotic, ponding in yard swales that lasted 2 days. To quell residential concerns, the developer retrofit the entire area with storm sewer pipes.	Design LID and other appropriate applications to meet state requirements. An active study area is the use of bioretention, green streets, and other environmentally sensitive design practices.
11	Maryland	ESD/LID to MEP MS4s require frequent inspection so this creates shift in county resources to inspection and public education. Different storage requirements for different functions - recharge, channel protection(1 yr, 24 hr), overbank flood protection and extreme flood volume.	The Water Quality Volume (denoted as the WQv) is the storage needed to capture and treat the runoff from 90% of the average annual rainfall. Takes into consideration impervious cover, multiple drainage areas, offsite drainage areas, sensitive streams, BMP treatment, structural practices, peak discharge, and extended detention.
12	Philadelphia	Green sewer program for CSOs. Green infrastructure a push. Channel Protection requirement: Detain and release runoff from Directly Connected Impervious Area at a maximum rate of 0.24 cfs per acre in no less than 24 hours and no more than 72 hours. Soon Philadelphia will be divided into several different areas with different requirement for flood control volume.	Management of the first one inch of runoff from all Directly Connected Impervious Areas within the limits of earth disturbance is required.
13	DuPage County	Has has successful program since 1992. Not currently linking detention requirements or permit requirements with downstream receiving conditions	Have included IDDE, E&SC, BMPs, but could be implemented better. Pollutants are treated as surrogates, so they attempt to limit the pollutant of concern. They currently do not have a phosphorous limit. Some concern regarding contaminating groundwater by implementing stricter volume control.

Dupage County National Stormwater Ordinance Update - National Stormwater Program Review Table

Municipality	Restoration / Protection of Sensitive Areas	Development / Redevelopment	E&SC
City of Baltimore	Follows the Chesapeake Bay Critical Area Act, which has to be updated every 6 years by state mandate. Their Critical Area Management Program is geared towards restoration, and includes a Sensitive Areas Management Plan. The City has maintained a guidance manual for implementing the Chesapeake Bay Critical Area Act requirements. The manual was less detailed in previous years and the City found that they spent much time with developers on interpretation of intent. They now have the manual as part of a City ordinance. This has required then to revise the manual to be more descriptive of requirements and procedures so they do not have to "officiate" over what is meant by the manual. If there is a disagreement over the manual, the City develops a position paper that is posted on their website. The position papers would be incorporated into the manual, as appropriate, at the next update.	Considering identifying sites with potential for green infrastructure as part of redevelopment. Looking at a banking system for the green infrastructure retrofits that they now do when repaving roads. They are looking for a grant to support green infrastructure retrofits of a highway system for either green space or bioretention. Disturbing 5,000 SF of impervious area is the trigger.	They follow state requirements. Their biggest issue has been the inspection of utility jobs such as sewer pipes and similar linear projects.
Portland	Separate ordinance from stormwater management Have environmental zones. Different requirements for new development and redevelopment. Redevelop requirements: disturbed area must not be expanded. New requirements: table indicating maximum disturbed area ranging from 2500-5000 SF depending on zone. All setbacks 30-50 ft from edge of water depending on watershed, temporary disturbance must be replanted so 90% growth is back within 1 year.	Built out so all is redevelopment	Separate program. Measures must be in place to keep all sediment and pollutants onsite prior to upslope work beginning. Oct 1-Apr 30 stabilization is in 2 days, May 1-Sept 30, stabilization is 7 days. BMPs spelled out in Erosion Control Manual.
City of Chicago	Restoration protection is not a problem except for the Calumet area that has Calumet Design Guidelines. Calumet Design Guidelines require the following: site draining to Combined Sewer or existing sewer ditch system must have BMPs, and release rate will be determined by downstream capacity - if none, then site required to detain 5.8 in, 100 yr, 24 storm. Site draining to Lake Calumet, Calumet River or Indian Creek must use BMPs and green infrastructure, wet detention a must and based on 2-yr, 24-hr storm with max release rate of 0.04 cfs/acre. All sites must have 30 ft setback from roads, where prairie and overstory and intermediary trees are required. 20 ft setback from side and rear of property, prairie and overstory tree required every 65 ft. 30 ft. setback from Lake Calumet or Calumet river for non-dependent use. All runoff must go through BMP before discharging to waterway. Curb breaks in parking lots required every 13' to allow water into island prairie plantings.	All development is redevelopment	
City of Lenexa	Have rigorous stream setback ordinance based on ultimate development for 100-year flood boundary. This FPB corresponds to 2/3 of city. No new structures allows in this zone and redevelopment must meet floodplain requirements - elevate to BFE+1. 10% of City green space is related to setbacks.	Development: Adopted APWA for ordinance in 2004 Created BMP manual (on KC Chapter's website) Redevelopment or modifying site for higher density use: BMP manual applies	Have E&SC ordinance and staff with inspectors. Apply APWA control standard. Stabilization required after 14 days.
Santa Clara Valley Urban Runoff	Recommend that commercial development provide open space over 50% of a site. Recommend using incentives and flexibility to promote conservation of stream buffers, forest, meadows, and other areas of environmental value. Recommend that a vegetated buffer system include the 10 year floodplain.	San Jose had promoted ultra urban development but these area will now be penalized per new LID policies from the state. Brownfields and Transit Oriented Development are areas where the communities are seeking exemptions from the state stormwater requirements.	Recommend using California Stormwater Best Management Practice Handbooks for construction and guide for Stormwater Pollution Prevention Protection (SWPPP).
Montgomery County, MD	Four sensitive subwatershed areas are called out for special protection and monitoring of BMPs. Anyone can petition to have another area included as a special protection area.	Has incentives for redevelopment. They used to require that redevelopment either remove 50% of the existing impervious area or provide treatment for that 50% of impervious area. Since 1983, the county has the same requirements for development and redevelopment; which is to meet the full water quality and channel protection requirements. With the new Maryland 2007 stormwater law and the resultant ordinances that they must adopt within a year, it may now be difficult to maintain the same standards for development and redevelopment without some form of waivers.	Exposed soil must be stabilized within 7 days for slopes of 3:1 or steeper; within 14 days for all else. No sediment is to be allowed to run off-site.
Seattle	Code used to require flow control standard that included peak runoff modeling; this has been switched to the modeling of continuous hydrograph series. State adopted the Growth Management Act to protect riparian and other sensitive areas. Listed certain basins for special treatment such as classifying existing conditions as forested when determining stormwater management requirements. This covers 35% of City. 1/3 of city is covered by combined sewers and stormwater design is regulated for peak flows.	Built out, all redevelopment now. Depending on the watershed, there are different requirements. The State's Department of Ecology requires forested condition be met for certain "listed" creeks, which affects 35% of the city.	Had a large number of slope failures a few years ago. Statewide initiative required regulations for slopes greater than 40% and higher than 10 feet. Department of Ecology's new guidance says there are 18 BMP elements, all of which must be used. Stabilization after 2 days during October to April and after 7 days from May to September.
Charlotte-Mecklenburg	Open space required on a sliding scale from 15%-25%, can be co-located with stream buffers, but ball fields do not count. Must be trees - result of give and take during ordinance process. Stream buffers range from 30-50 ft.	Predevelopment existing conditions: - have maps going back 30 years - sites can be torn down, grassed, rebuilt so they could keep worst case scenario - now provide SWU fee credit for woods/good as existing condition - working with planning department for ultra-urban redevelopment since SWM can be very costly	Have separate ordinance. Plan requirement beings when disturbing greater than 1 acre. Should not disturb more than 20 acres at one time. Stabilization required 21 days after disturbance. Inspect measures once per week.
Stafford County, VA	Stream buffers are considered an integrated management practice .	Redevelopment does not need to do full LID design.	Generally follows Virginia Erosion and Sediment Control Handbook. Requires construction phasing. Requires 2-year storm event to be designed for in all construction channels,
Prince George's County, MD	The County has developed GIS coverages that define sensitive areas for development and for protection and restoration. This includes, wetlands, stream buffers, steep slopes, highly erodible soils, groundwater recharge areas, and areas inappropriate for standard onsite septic disposal systems.		
Maryland	10+% restoration of impervious areas per MS4 permit cycle	Strive for woods/good as predevelopment design condition; require it for redevelopment of areas that discharge to impacted streams	Use 1994 Maryland Specifications for Soil Erosion and Sediment Control.
Philadelphia		Reducing impervious within the limits of earth disturbance by 20% between the predevelopment and post-development condition exempts the flood control volume requirement.	Mandatory if disturbance is over 5000 SF. Plan implemented and kept onsite between 5000 and 15000 SF. Plan must be approved if over 15,000 SF.
DuPage County		No current difference between development and redevelopment. They would like to explore relaxed requirements for redevelopment. They are not interested in considering waivers on brownfields.	Current regulations are compliant with the state regulations, but are not very straightforward. Interested in updating the terminology and other aspects to more closely align with the State procedures.

Dupage County National Stormwater Ordinance Update - National Stormwater Program Review Table

Municipality	Floodplains	Wetlands	Roadways	IDDE
City of Baltimore	Development or other changes within the floodplain must maintain a 0-foot rise in the floodway.			Has Pollutant Source Tracking Program to detect illicit discharges. There is a screening program for system that have exhibited potential illicit connections. Testing and GIS are used to aid in identifying sources. A pilot of this program has begun.
Portland	Separate program Must elevate to BFE+2 ft, except Columbia River which is BFE+1 ft. No construction or filling in floodway allowed unless can demonstrate no increase in BFE. Johnson Creek is most flood prone, in this basin there must be balanced cut and fill below the BFE in floodway and fringe.	State regulations Most wetlands have been destroyed in City	Street improvements triggered when there is private property development Improvements must have SWM in ROW 2 year warranty before City takes ownership	They have an industrial stormwater program. Discharge requirements are part of their city code. Illicit connections have 72 hours to coordinate to legalize connection. Authorized for inspection and sampling. Written or oral notification of violation accepted, enforcement includes written notification, stop work order, require new connection to control discharge, institute civil actions or take other appropriate action
City of Chicago			Require restrictors (0.15 cfs) on sewers to keep flow temporarily on streets to reduce CSOs; Green Alley Program: All alleys must have filter strip down middle or full porous pavers Supposed to manage garage flow as well Outflow is supposed to be reversed crown pitched towards streets	2009 Regulations document has chapter regarding IDDE. The City will send a letter to the party to legitimize their connection by a certain date and disconnect it if they don't.
City of Lenexa	Growth pays for growth (cooperation between Lenexa Economic Development Council and Chamber of Commerce) to evaluate BMP Manual and fee. They provide regional detention and stream maintenance for 100-year storm and charge a capitol fee in lieu of forcing individual sites to provide 100-year detention. They still need BMPs. They sell it because green infrastructure saves up front infrastructure costs and regional fee mans no 100 year detention. Have not given vortechncs type as high a rating as green infrastructure. Have rigorous stream setback ordinance based on ultimate development for 100-year flood boundary. This FPB corresponds to 2/3 of city. No new structures allows in this zone and redevelopment must meet floodplain requirements - elevate to BFE+1. 10% of City green space is related to setbacks. No critical infrastructure in 500 yr floodplain.		Public facilities are meeting level of service, and applied to large arterial streets. They have separated street from landscape contracts since road contractor wants to get in and out and landscape contractors can stay with a project a few years.	Illicit Discharge Ordinance in place. It includes notification, disconnection, inspection and detection, release reporting and cleanup, and enforcement.
Santa Clara Valley Urban Runoff	Recommend that vegetated buffer systems include the 100 year floodplain.	Recommend using incentives and flexibility to promote conservation of wetlands. Recommend that vegetated buffer system include the 10 year floodplain.	Recommend that residential streets be designed for the minimum required pavement width based on traffic volume, total length of new residential streets be reduced by examining street layout, number of cul de sacs be reduced and incorporate landscaped areas to reduce impervious cover. Promote safe, integrated bikeways and pathways, sidewalks only on one side of street, parking codes should be revised to lower requirements where mass transit is available or enforceable shared parking arrangements are made.	They developed performance standards including making sure inspectors are trained and formalizing co-permittee referral system. When a violation occurs, contact the party and inform them, begin enforcement procedures if appropriate, and continue inspection until violation has ceased. Document incidents annually.
Montgomery County, MD	More restrictive than FEMA. Uses a 30 acre drainage area for their hydrologic calculations and mapping.	Follow state requirements, which are avoidance and minimization as a typical approach.	Montgomery County Council voted unanimously to adopt guidelines that ensure that streets are designed with all users in mind- pedestrians, bicyclists, transit riders and drivers. The law also requires that county roads minimize polluted stormwater runoff. Environmental groups forced vegetative systems on road rights of way (ROWs). The regulations are the first in the country to mandate use of "green streets" techniques to reduce roadway runoff. The green streets approach uses specially-designed planting areas to capture and treat polluted rainwater that runs off roadways. Green streets techniques have long been used on a demonstration basis, but Montgomery County would be the first to require that they be used in all roadway projects.	They have an illicit connection detection and elimination program. They have six stations set up instream to detect discharges.
Seattle	Follows minimum FEMA minimum regulations in general. Residential development can increase the base flood elevation by no more than 2 feet and nonresidential by no more than 1 foot. Critical development is to be out of the floodplain whenever possible.	State adopted the Growth Management Act and made communities adopt ordinances for critical areas, which is contained in a different portion of the city code and deals with riparian corridors and wetlands. Buffers vary from 0 to 200 feet depending on the quality of the wetland.	If construction area is over the 10,000 SF threshold then a stormwater facility is needed. Department of Ecology granted WDOT an exception for road related projects. Seattle copied that based on project type – trail, road, sidewalk, etc. Designated receiving waters have different flow control requirements. Seattle adopted some green stormwater infrastructure requirements, but did not want to take away development rights.	Illicit discharges are part of the city code. If they have a reason to suspect illicit discharge, they may sample and recover the cost in the enforcement proceedings. If it occurs regularly, they may do continuous monitoring at cost to the violator.
Charlotte-Mecklenburg	Maps no older than 5 years Strongly resist levees FIRMs show 100-year existing and 100-year ultimate but not 500-year		County does not maintain roads, 90% maintained by municipality and rest by state	Ordinance regarding IDDE. They have authority to inspect. When violation occurs, they notify, and have the ability to fine up to \$5,000/day along with other civil penalties.
Stafford County, VA	Must elevate residences to the bank full elevation plus 3 feet. No water surface rise is allowed for buildings proposed for development in the floodway.	Have Wetlands ordinance.	Working with VDOT on BMPs in ROWs, narrow streets, etc.	Have Stormwater Pollution and illicit discharge in the County Code. Enforcement involves notification, fine is \$250 civil penalty and \$1000/day if the violation continues. Violator is responsible for testing, cleaning up, and proper disposal of illicit material.
Prince George's County, MD	No rise in water surface elevation is allowed when building in the floodway.		Inter-County difficulties in getting desired changes in roadway widths, removal of curbing, and reduction of sidewalks to reduce impervious area as desired by the County's LID stormwater management objectives. Gradual changes to street designs were made. Big changes are now required by the state's revised stormwater laws and design manual.	The County has an IDDE program that includes monitoring of outfalls and a hot line for reporting suspected illicit discharges.
Maryland			Established environmentally sensitive design (which incorporates Low Impact Development) as a primary approach for managing stormwater from development. This process includes changes to road designs to reduce impervious area and capture stormwater close to its source of runoff. All municipal and other community ordinances are required to update their existing ordinances that address infrastructure and development practices, like roads, to fully permit implementation of the new state stormwater requirements.	
Philadelphia				
DuPage County	Current ordinance does a good job with floodplain regulation. Need to ensure that the new ordinance is clear on when FEQ model is required and when regulatory model is required. They do not currently map the ultimately built out floodplain, but do consider future development for their FEQ models.	More restrictive than Federal requirements. They regulate all wetlands, even ones under the threshold or the non-jurisdictional wetlands that USACE does not regulate. Would like to offer credits for maintaining wetlands, and want to preserve their control over the quality of wetlands, not just quantity.	Transportation department is currently using the NIPC standard detention method. They also deduct existing pavement from the required calculation for detention. Would like to consider permeable pavement and other void space systems under roads, but are looking to ensure that these requirements are consistent with other parts of the nation.	

Dupage County National Stormwater Ordinance Update - National Stormwater Program Review Table

Municipality	What they do	What they would change	Ordinance / Regulations / Guidance structure
City of Baltimore		Stormwater management regulations need to be tailored to the ultimate goals of the water quality standards to ensure cost effectiveness for restoration. The Maryland regulations are not yet up to this goal. A significant best management practice used by the City to meet obligations under their MS4 permit for restoration and protection of watersheds is stream valley restoration. The City considers this to be a win-win successful management practice that is cost effective. They have been conducting studies to improve the general recognition that stream restoration delivers benefits.	
Portland	Took two years to develop ordinance City's overall objective is water quantity, quality, infiltration and discharge	Putting out ordinance was a political risk Did not have design aspects and permits Backlash from developers, City employees and other sectors partly because there were not many reference points in 1999 Inspectors were disgruntled having something thrust on them Would have done more intensive training if they could do it again Recommend up front involvement with plan review and inspection team Development community went along because Portland is a good investment Have not had to increase education lately because planners, engineers, etc. know what the City expects	Science has not changed much. Relied on Seattle, western Washington and California. Ordinances are different for stormwater, floodplains, erosion and open space. Have their own MS4 but partnered with several communities; developed similar standards and continue to coordinate with them.
City of Chicago	Did a lot of lunch talks with local firms Did a lot of work up front at several stages (interest group reviews) and had mild reaction to ordinance changes Some hot button issues were: deed issue with realtors 1/2" vs. 1" retention O&M BMP complaints water quality	Recent changes included: Performance oriented volume control Permit application process and how long permits are good for Changes under consideration: preliminary data show that most properties are exceeding volume control so this may be increased Add water quality for non-MWRD sources (i.e., bridges)	One legislation with four components: Volume control (retain 1/2" of precipitation over all IA) Rate control (use Chicago method or install 0.15 cfs restrictor) Erosion control (follow IL Urban Manual) O&M (O&M plan stays with site and is property owner's responsibility to implement; Council would not make it part of the deed) Performance oriented instead of prescriptive 3 documents: ordinance, regulations and manual (only ordinance requires Council approval). They have a 2009 Stormwater Manual, 2009 Regulations for Sewer Construction and Stormwater Management, and a Calumet Design Guidelines document.
City of Lenexa	Use Vision process (to 2020) Community was 80% for water quality control as a quality of life issue Passed sales tax of 0.8% in 1998 for 5 year program with 78% of votes ("rain to recreation") Created SWU in 2000 at \$2.50/home/month and now at \$6.50/home/month Tried SWU credits for green infrastructure for 2 years but did not do much so they dropped it Lenexa was 1/3 built out when the ordinance became effective	Monitoring redevelopment to determine standards effectiveness: for example, may retrofit old basins possibly in lieu of new BMPs	Adopted APWA for ordinance in 2004 Created BMP manual (on KC Chapter's website). APWA Section 5600 Storm drainage Systems and Facilities for KC Chapter is also adopted in City Code.
Santa Clara Valley Urban Runoff			California had not provided much guidance until recently. They had allowed the regions to operate independently. California now has sustainability policies. Regions have used the MS4 permits as a method for getting programs to do what they want as opposed to providing model ordinances. San Jose has promoted ultra urban development but these areas will now be penalized per the LID policies from the state. Communities are seeking exemptions for Brownfields and Transit Oriented areas.
Montgomery County, MD		Developers would like to change open space regulations to allow open areas that are graded and seeded to count as green space but County will not allow this.	They use executive legislation rather than ordinances because it is easier to modify.
Seattle	Source control, construction stormwater, flow control and water quality, enforcement provisions		4 volumes, final draft form – source control, construction stormwater, flow control and water quality, enforcement provisions. Should become effective in December 2009.
Charlotte-Mecklenburg	Takes stance that it is spend money now or spend it later. Good food helps with the long stakeholder committee process Needed strong facilitator Had backsliding issues so good notes helped keep stances on record		Have stormwater manual and BMP manual.
Stafford County, VA	Developed design manual after the fact so community slow in implementing LID practices.		
Prince George's County, MD		Concerns with state approval process. Although they were kept informed of the process proposed by the state, the state developed some prescriptive approaches around the least stringent processes used by some counties. This creates problems for Prince George's such as defining when those in the mid-development process might be required to redevelop plans to comply with the new ordinances.	
Maryland	Provided training courses on the intent and application of new state stormwater management requirements following the publication of the 2000 Maryland Stormwater Design Manual. They are expected to conduct similar training programs now that the 2000 Stormwater Law, updated design document and sample municipal ordinances are available. They already met with the municipalities during the development and roll out of the program to solicit response and informed cooperation.	The state developed a Maryland Stormwater Design Manual in 2000 for all communities to follow. It provided objectives, guidance and ordinances that were to be implemented. Compliance was inadequate by some communities so the state passed the 2007 Stormwater Management Act that established stricter, less flexible, compliance requirements and updated the Stormwater Design Manual with more environmentally sensitive requirements. Communities within the state were obligated to approve to have the requirements of the ordinances passed within one year of the completion of the design manual and example ordinance development by the state.	State law, state Stormwater Design Manual and sample ordinances are provided.
Philadelphia			
DuPage County	Overall objective was to make water quality better, to make ordinance meet the NPDES phase II requirements. Two years ago, they beefed up ordinance to meet EPA construction sediment control.		

Dupage County National Stormwater Ordinance Update - National Stormwater Program Review Table

Municipality	Steering Committee Composition and Approach	Concerns with current ordinance / regulations
City of Baltimore		Will comply with Maryland's new regulations. Problems with compliance are the short time to comply (one year to adopt new ordinances), and the vagueness of some requirements. For example, the state specifies that regulations are to be implemented to the Maximum Extent Practicable (MEP) but does not include cost in the MEP determination. The City then wonders if cost can be a factor that provides leeway to use more effective approaches such as infill or allowing some small projects to pay into a fund that provides stormwater services?
Portland	Very large advisory committee that includes the mayor and commissioners; morphed into watershed advisory committee Portland has 5 watersheds.	Ordinance is a success but the quality of the built facilities could be better. They are looking to improve their BMP design.
City of Chicago	Not much external input for best science available. Jeff Wickencamp was biggest non-Chicago employee contributor.	They are planning to add water quality, and raise the volume control limits. They are preparing a separate water quality ordinance. They had previously taken the stand that volume control was the same as quality control since 99% goes to the combined sewer. New water quality regulations will be for non-MWRD discharging sites, i.e. bridge and road runoff that drains to the river.
City of Lenexa	APWA review included engineers. The City's process was threaded through all departments and they coordinated up front with interacting departments. They worked with developers for BMP manual and ended up narrowing street width to compensate for BMP cost, but had to coordinate that with the roadway and fire department. They could not stop people from wanting cul-de-sacs, so those were allowed to stay. They hired education outreach specialist and hold a water fair every year and held a rain barrel painting parade to keep citizen's involved.	They are looking to update their redevelopment standards.
Santa Clara Valley Urban Runoff		
Montgomery County, MD	Have informal group that meets made up of the Maryland Department of the Environment and Maryland Department of natural Resources, County(transportation, Department off Environmental Protection and Department of Planning Services) and USACE. 2002 was last county ordinance update. Before making the updates, the county met with environmental groups, builders and others to implement the state standards. Typical agreement was that stormwater management was not impediment to development. County attorney took a year to resolve issues with State attorney. Environmental groups much more active now than in past. Had quarterly training sessions with consulting engineers - met one on one with engineering firms rather than holding group workshops.	Timing is bad because of economy and because they only have one year to comply with the new state law/regulations. There are concerns with interpretation of some requirements, such as how it could conform with the level of restoration that the county currently has for redevelopment.
Seattle	They worked with the minimum standards set out by the Washington Department of Ecology. They held 28 public meetings to keep public informed about discussions with the DOE. They didn't want technical standards driving landuse policy, so developers were happy with that. Internal staff were involved in process and it was vetted through primary departments such as planning, engineering, etc.	They want to adopt some floodplain regulations regarding standards for level of service to convey flows in certain problem areas.
Charlotte-Mecklenburg	A stakeholder committee was established for each major ordinance, not just anyone could join Consisted of development industry, 18 month process of "what is problem" before they get to regulation discussions Engineer designers, real estate industry, universities, and other that were considered lead stakeholders One approach has been to divide County into subwatersheds	
Stafford County, VA		
Prince George's County, MD	Standing committees	State followed their ordinances as requirements for statewide implementation, but the development process is a concern that they will challenge (or ignore?)
Maryland	Others feel that state only talked with environmental groups then hammered these ordinances out to make backsliders comply with intent of the more flexible 2000 design manual/ordinances. Those that already complied find that some of their proactive approaches are now dysfunctional with prescriptive approaches now required by state. State requires approval of ordinances in 1 year.	A recent law addressed the state's concern that not all communities were implementing the stormwater ordinances and following the stormwater design manual is intended and required. The programs also were not meeting state pollutant load goals for reducing impacts to the Chesapeake Bay.
Philadelphia		
DuPage County	Certain groups have become extremely powerful. The Mayors and Managers council has become very powerful. Nothing happens without its approval. Env groups have been friendly but not particularly vocal. DuPage gets along well with them. Small special interest groups feel there is too much regulation.	Addressing conflict of interest, auditing the communities, imposing fines for violations, addressing drain tiles, enhancing BMP regulations. In the past single family home and commercial sites under 1 acre and car washes were exempt as public policy.

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City of Baltimore	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	The City feels that they have not done all that is possible to implement Environmentally Sensitive Design (Maryland's new term for Low Impact Development and Green Infrastructure). Disturbing 5,000 or more SF of impervious area is the trigger for complying with stormwater quantity regulations. The City currently is regulated by the 2000 Maryland Stormwater Design Manual and will adopt new ordinances within a year, as required by Maryland, to meet the 2007 Stormwater law and recent updates to the Manual and regulations.
Stormwater Quality	Control 1-inch storm on 50% of impervious cover on site. The Water Quality Volume (denoted as the WQv) is the storage needed to capture and treat the runoff from 90% of the average annual rainfall (~1.7-inch and smaller storm events). Refers to updates to the 2000 Maryland Stormwater Design Manual.
Restoration / Protection of Sensitive Areas	Follows the Chesapeake Bay Critical Area Act, which has to be updated every 6 years by state mandate. Their Critical Area Management Program is geared towards restoration, and includes a Sensitive Areas Management Plan. The City has maintained a guidance manual for implementing the Chesapeake Bay Critical Area Act requirements. The manual was less detailed in previous years and the City found that they spent much time with developers on interpretation of intent. They now have the manual as part of a City ordinance. This has required then to revise the manual to be more descriptive of requirements and procedures so they do not have to "officiate" over what is meant by the manual. If there is a disagreement over the manual, the City develops a position paper that is posted on their website. The position papers would be incorporated into the manual, as appropriate, at the next update.
Development / Redevelopment	Considering identifying sites with potential for green infrastructure as part of redevelopment. Looking at a banking system for the green infrastructure retrofits that they now do when repaving roads. They are looking for a grant to support green infrastructure retrofits of a highway system for either green space or bioretention. Disturbing 5,000 SF of impervious area is the trigger.
E&SC	They follow state requirements. Their biggest issue has been the inspection of utility jobs such as sewer pipes and similar linear projects.
Floodplains	Development or other changes within the floodplain must maintain a 0-foot rise in the floodway.
Wetlands	
Roadways	
IDDE	Has Pollutant Source Tracking Program to detect illicit discharges. There is a screening program for system that have exhibited potential illicit connections. Testing and GIS are used to aid in identifying sources. A pilot of this program has begun.
What they do	
What they would change	Stormwater management regulations need to be tailored to the ultimate goals of the water quality standards to ensure cost effectiveness for restoration. The Maryland regulations are not yet up to this goal. A significant best management practice used by the City to meet obligations under their MS4 permit for restoration and protection of watersheds is stream valley restoration. The City considers this to be a win-win successful management practice that is cost effective. They have been conducting studies to improve the general recognition that stream restoration delivers benefits.
Ordinance / Regulations / Guidance structure	
Steering Committee Composition and Approach	

City of Baltimore	Stormwater Program Interview Responses
Concerns with current ordinance / regulations	Will comply with Maryland's new regulations. Problems with compliance are the short time to comply (one year to adopt new ordinances), and the vagueness of some requirements. For example, the state specifies that regulations are to be implemented to the Maximum Extent Practicable (MEP) but does not include cost in the MEP determination. The City then wonders if cost can be a factor that provides leeway to use more effective approaches such as infill or allowing some small projects to pay into a fund that provides stormwater services?

Portland	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	<p>Must have 2 in/hr infiltration</p> <p>Have three different submittal approaches - simplified for total impervious area <10,000 SF, presumptive for total impervious >10,000 SF and takes site specifics into consideration, performance is for sites that can't fall under simplified or presumptive and are usually for unique sites</p> <p>If an on site BMP is not practicable, the developer can pay \$2.76/SF for unmanaged impervious area to City fund. This fee is pro-rated for political reason as it costs the City \$12 to 13/SF.</p> <p>Facilities are privately owned.</p> <p>Flow control depends on downstream conditions: surface water, combined sewer, etc.</p>
Stormwater Quality	<p>Must have 2 in/hr infiltration. If on site BMP not practicable, can pay \$2.76/SF for unmanaged impervious area to City fund. Pro-rated for political reason as it costs City \$12 to 13/SF</p> <p>Facilities are privately owned</p>
Restoration / Protection of Sensitive Areas	<p>Separate ordinance from stormwater management</p> <p>Have environmental zones. Different requirements for new development and redevelopment. Redevelop requirements: disturbed area must not be expanded.</p> <p>New requirements: table indicating maximum disturbed area ranging from 2500-5000 SF depending on zone. All setbacks 30-50 ft from edge of water depending on watershed, temporary disturbance must be replanted so 90% growth is back within 1 year.</p>
Development / Redevelopment	<p>Built out so all is redevelopment</p>
E&SC	<p>Separate program. Measures must be in place to keep all sediment and pollutants onsite prior to upslope work beginning. Oct 1-Apr 30 stabilization is in 2 days, May 1-Sept 30, stabilization is 7 days. BMPs spelled out in Erosion Control Manual.</p>
Floodplains	<p>Separate program</p> <p>Must elevate to BFE+2 ft, except Columbia River which is BFE+1 ft. No construction or filling in floodway allowed unless can demonstrate no increase in BFE. Johnson Creek is most flood prone, in this basin there must be balanced cut and fill below the BFE in floodway and fringe.</p>
Wetlands	<p>State regulations</p> <p>Most wetlands have been destroyed in City</p>
Roadways	<p>Street improvements triggered when there is private property development</p> <p>Improvements must have SWM in ROW</p> <p>2 year warranty before City takes ownership</p>
IDDE	<p>They have an industrial stormwater program. Discharge requirements are part of their city code. Illicit connections have 72 hours to coordinate to legalize connection. Authorized for inspection and sampling. Written or oral notification of violation accepted, enforcement includes written notification, stop work order, require new connection to control discharge, institute civil actions or take other appropriate action</p>
What they do	<p>Took two years to develop ordinance</p> <p>City's overall objective is water quantity, quality, infiltration and discharge</p>

Portland	Stormwater Program Interview Responses
What they would change	Putting out ordinance was a political risk Did not have design aspects and permits Backlash from developers, City employees and other sectors partly because there were not many reference points in 1999 Inspectors were disgruntled having something thrust on them Would have done more intensive training if they could do it again Recommend up front involvement with plan review and inspection team Development community went along because Portland is a good investment Have not had to increase education lately because planners, engineers, etc. know what the City expects
Ordinance / Regulations / Guidance structure	Science has not changed much. Relied on Seattle, western Washington and California. Ordinances are different for stormwater, floodplains, erosion and open space. Have their own MS4 but partnered with several communities; developed similar standards and continue to coordinate with them.
Steering Committee Composition and Approach	Very large advisory committee that includes the mayor and commissioners; morphed into watershed advisory committee Portland has 5 watersheds.
Concerns with current ordinance / regulations	Ordinance is a success but the quality of the built facilities could be better. They are looking to improve their BMP design.

City of Chicago	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	Volume control is the green part of the program - minimize IA or do BMP Green roofs and permeable pavement are considered non-impervious. Release rate to control 100 yr storm event via Maximum Release Rate Control Chart. Volume Control to capture first 1/2" or reduce impervious surface by 15%.
Stormwater Quality	Water quality was stripped from the draft ordinance City considered water quantity a quality program since >99% of the City is combined sewer.
Restoration / Protection of Sensitive Areas	Restoration protection is not a problem except for the Calumet area that has Calumet Design Guidelines. Calumet Design Guidelines require the following: site draining to Combined Sewer or existing sewer ditch system must have BMPs, and release rate will be determined by downstream capacity - if none, then site required to detain 5.8 in, 100 yr, 24 storm. Site draining to Lake Calumet, Calumet River or Indian Creek must use BMPs and green infrastructure, wet detention a must and based on 2-yr, 24-hr storm with max release rate of 0.04 cfs/acre. All sites must have 30 ft setback from roads, where prairie and overstory and intermediary trees are required. 20 ft setback from side and rear of property, prairie and overstory tree required every 65 ft. 30 ft. setback from Lake Calumet or Calumet river for non-dependent use. All runoff must go through BMP before discharging to waterway. Curb breaks in parking lots required every 13' to allow water into island prairie plantings.
Development / Redevelopment	All development is redevelopment
E&SC	
Floodplains	
Wetlands	
Roadways	Require restrictors (0.15 cfs) on sewers to keep flow temporarily on streets to reduce CSOs; Green Alley Program: All alleys must have filter strip down middle or full porous pavers Supposed to manage garage flow as well Outflow is supposed to be reversed crown pitched towards streets
IDDE	2009 Regulations document has chapter regarding IDDE. The City will send a letter to the party to legitimize their connection by a certain date and disconnect it if they don't.
What they do	Did a lot of lunch talks with local firms Did a lot of work up front at several stages (interest group reviews) and had mild reaction to ordinance changes Some hot button issues were: deed issue with realtors 1/2" vs. 1" retention O&M BMP complaints water quality
What they would change	Recent changes included: Performance oriented volume control Permit application process and how long permits are good for Changes under consideration: preliminary data show that most properties are exceeding volume control so this may be increased Add water quality for non-MWRD sources (i.e., bridges)

City of Chicago	Stormwater Program Interview Responses
Ordinance / Regulations / Guidance structure	<p>One legislation with four components: Volume control (retain 1/2" of precipitation over all IA) Rate control (use Chicago method or install 0.15 cfs restrictor) Erosion control (follow IL Urban Manual) O&M (O&M plan stays with site and is property owner's responsibility to implement; Council would not make it part of the deed) Performance oriented instead of prescriptive</p> <p>3 documents: ordinance, regulations and manual (only ordinance requires Council approval). They have a 2009 Stormwater Manual, 2009 Regulations for Sewer Construction and Stormwater Management, and a Calumet Design Guidelines document.</p>
Steering Committee Composition and Approach	<p>Not much external input for best science available. Jeff Wickencamp was biggest non-Chicago employee contributor.</p>
Concerns with current ordinance / regulations	<p>They are planning to add water quality, and raise the volume control limits. They are preparing a separate water quality ordinance. They had previously taken the stand that volume control was the same as quality control since 99% goes to the combined sewer. New water quality regulations will be for non-MWRD discharging sites, i.e. bridge and road runoff that drains to the river.</p>

City of Lenexa	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	Apply APWA standard. Require detention for the 1-yr and 10-yr events. They provide regional detention and stream maintenance for 100-year storm and charge a capitol fee in lieu of forcing individual sites to provide 100-year detention.
Stormwater Quality	Have full time water quality specialist who does chemical/biological monitoring. Water quality event is 1.37" storm, so that must be treated and maintained onsite with BMPs.
Restoration / Protection of Sensitive Areas	Have rigorous stream setback ordinance based on ultimate development for 100-year flood boundary. This FPB corresponds to 2/3 of city. No new structures allows in this zone and redevelopment must meet floodplain requirements - elevate to BFE+1. 10% of City green space is related to setbacks.
Development / Redevelopment	Development: Adopted APWA for ordinance in 2004 Created BMP manual (on KC Chapter's website) Redevelopment or modifying site for higher density use: BMP manual applies
E&SC	Have E&SC ordinance and staff with inspectors. Apply APWA control standard. Stabilization required after 14 days.
Floodplains	Growth pays for growth (cooperation between Lexana Economic Development Council and Chamber of Commerce) to evaluate BMP Manual and fee. They provide regional detention and stream maintenance for 100-year storm and charge a capitol fee in lieu of forcing individual sites to provide 100-year detention. They still need BMPs. They sell it because green infrastructure saves up front infrastructure costs and regional fee mans no 100 year detention. Have not given vortechncis type as high a rating as green infrastructure. Have rigorous stream setback ordinance based on ultimate development for 100-year flood boundary. This FPB corresponds to 2/3 of city. No new structures allows in this zone and redevelopment must meet floodplain requirements - elevate to BFE+1. 10% of City green space is related to setbacks. No critical infrastructure in 500 yr floodplain.
Wetlands	
Roadways	Public facilities are meeting level of service, and applied to large arterial streets. They have separated street from landscape contracts since road contractor wants to get in and out and landscape contractors can stay with a project a few years.
IDDE	Illicit Discharge Ordinance in place. It includes notification, disconnection, inspection and detection, release reporting and cleanup, and enforcement.
What they do	Use Vision process (to 2020) Community was 80% for water quality control as a quality of life issue Passed sales tax of 0.8% in 1998 for 5 year program with 78% of votes ("rain to recreation") Created SWU in 2000 at \$2.50/home/month and now at \$6.50/home/month Tried SWU credits for green infrastructure for 2 years but did not do much so they dropped it Lenexa was 1/3 built out when the ordinance became effective
What they would change	Monitoring redevelopment to determine standards effectiveness: for example, may retrofit old basins possibly in lieu of new BMPs
Ordinance / Regulations / Guidance structure	Adopted APWA for ordinance in 2004 Created BMP manual (on KC Chapter's website). APWA Section 5600 Storm drainage Systems and Facilities for KC Chapter is also adopted in City Code.

City of Lenexa	Stormwater Program Interview Responses
Steering Committee Composition and Approach	APWA review included engineers. The City's process was threaded through all departments and they coordinated up front with interacting departments. They worked with developers for BMP manual and ended up narrowing street width to compensate for BMP cost, but had to coordinate that with the roadway and fire department. They could not stop people from wanting cul-de-sacs, so those were allowed to stay. They hired education outreach specialist and hold a water fair every year and held a rain barrel painting parade to keep citizen's involved.
Concerns with current ordinance / regulations	They are looking to update their redevelopment standards.

Santa Clara Valley Urban Runoff	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	<p>Large MS4 jointly managed with other large urbanized areas that discharge to the San Francisco Bay.</p> <p>They are in the process of negotiating a San Francisco Regional Permit and their existing large MS4 permit has been extended while the new permit is being developed. The new permit will be more prescriptive and add more LID. They recommend using continuous simulation modeling rather than discrete design storm modeling for determining the stormwater management to be implemented for on site control, off site control and in stream control. They have flow charts for different situations and different outfalls to aid the design process.</p>
Stormwater Quality	<p>They have BMPs separated into six categories as follows: (1) erosion control, (2) runoff and runoff control, (3) sediment control, (4) active treatment systems, (5) good site management, and (6) non stormwater management. BMPs should be used to the MEP. They have a water quality monitoring program to measure program effectiveness.</p>
Restoration / Protection of Sensitive Areas	<p>Recommend that commercial development provide open space over 50% of a site. Recommend using incentives and flexibility to promote conservation of stream buffers, forest, meadows, and other areas of environmental value. Recommend that a vegetated buffer system include the 10 year floodplain.</p>
Development / Redevelopment	<p>San Jose had promoted ultra urban development but these area will now be penalized per new LID polices from the state. Brownfields and Transit Oriented Development are areas where the communities are seeking exemptions from the state stormwater requirements.</p>
E&SC	<p>Recommend using California Stormwater Best Management Practice Handbooks for construction and guide for Stormwater Pollution Prevention Protection (SWPPP).</p>
Floodplains	<p>Recommend that vegetated buffer systems include the 100 year floodplain.</p>
Wetlands	<p>Recommend using incentives and flexibility to promote conservation of wetlands. Recommend that vegetated buffer system include the 10 year floodplain.</p>
Roadways	<p>Recommend that residential streets be designed for the minimum required pavement width based on traffic volume, total length of new residential streets be reduced by examining street layout, number of cul de sacs be reduced and incorporate landscaped areas to reduce impervious cover. Promote safe, integrated bikeways and pathways, sidewalks only on one side of street, parking codes should be revised to lower requirements where mass transit is available or enforceable shared parking arrangements are made.</p>
IDDE	<p>They developed performance standards including making sure inspectors are trained and formalizing co-permittee referral system. When a violation occurs, contact the party and inform them, begin enforcement procedures if appropriate, and continue inspection until violation has ceased. Document incidents annually.</p>
What they do	
What they would change	
Ordinance / Regulations / Guidance structure	<p>California had not provided much guidance until recently. They had allowed the regions to operate independently. California now has sustainability policies. Regions have used the MS4 permits as a method for getting programs to do what they want as opposed to providing model ordinances.</p> <p>San Jose has promoted ultra urban development but these areas will now be penalized per the LID policies from the state. Communities are seeking exemptions for Brownfields and Transit Oriented areas.</p>
Steering Committee Composition and Approach	

Santa Clara Valley Urban Runoff	Stormwater Program Interview Responses
Concerns with current ordinance / regulations	

Montgomery County, MD	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	Complies with the current state requirements. Started quantity control in 1971 as part of the sediment control ordinance that was managed by the Montgomery County Soil Conservation District. Worked out arrangements with the state's attorney to obtain approval for the 1971 ordinance. This remained in place until the 1983 state sediment requirement. The state passed the 2000 changes and the county complied in 2002. The state requires different storage requirements for different functions - recharge, channel protection(1 year, 24 hour), overbank flood protection and extreme flood volume.
Stormwater Quality	Under Maryland NPDES permit. The Water Quality Volume (denoted as the WQv) is the storage needed to capture and treat the runoff from 90% of the average annual rainfall. This takes into consideration impervious cover, multiple drainage areas, offsite drainage areas, sensitive streams, BMP treatment, structural practices, peak discharge, and extended detention.
Restoration / Protection of Sensitive Areas	Four sensitive subwatershed areas are called out for special protection and monitoring of BMPs. Anyone can petition to have another area included as a special protection area.
Development / Redevelopment	Has incentives for redevelopment. They used to require that redevelopment either remove 50% of the existing impervious area or provide treatment for that 50% of impervious area. Since 1983, the county has the same requirements for development and redevelopment; which is to meet the full water quality and channel protection requirements. With the new Maryland 2007 stormwater law and the resultant ordinances that they must adopt within a year, it may now be difficult to maintain the same standards for development and redevelopment without some form of waivers.
E&SC	Exposed soil must be stabilized within 7 days for slopes of 3:1 or steeper; within 14 days for all else. No sediment is to be allowed to run off-site.
Floodplains	More restrictive than FEMA. Uses a 30 acre drainage area for their hydrologic calculations and mapping.
Wetlands	Follow state requirements, which are avoidance and minimization as a typical approach.
Roadways	Montgomery County Council voted unanimously to adopt guidelines that ensure that streets are designed with all users in mind-pedestrians, bicyclists, transit riders and drivers. The law also requires that county roads minimize polluted stormwater runoff. Environmental groups forced vegetative systems on road rights of way (ROWs). The regulations are the first in the country to mandate use of "green streets" techniques to reduce roadway runoff. The green streets approach uses specially-designed planting areas to capture and treat polluted rainwater that runs off roadways. Green streets techniques have long been used on a demonstration basis, but Montgomery County would be the first to require that they be used in all roadway projects.
IDDE	They have an illicit connection detection and elimination program. They have six stations set up instream to detect discharges.
What they do	
What they would change	Developers would like to change open space regulations to allow open areas that are graded and seeded to count as green space but County will not allow this.
Ordinance / Regulations / Guidance structure	They use executive legislation rather than ordinances because it is easier to modify.

Montgomery County, MD	Stormwater Program Interview Responses
<p>Steering Committee Composition and Approach</p>	<p>Have informal group that meets made up of the Maryland Department of the Environment and Maryland Department of natural Resources, County(transportation, Department off Environmental Protection and Department of Planning Services) and USACE.</p> <p>2002 was last county ordinance update. Before making the updates, the county met with environmental groups, builders and others to implement the state standards. Typical agreement was that stormwater management was not impediment to development.</p> <p>County attorney took a year to resolve issues with State attorney.</p> <p>Environmental groups much more active now than in past.</p> <p>Had quarterly training sessions with consulting engineers - met one on one with engineering firms rather than holding group workshops.</p>
<p>Concerns with current ordinance / regulations</p>	<p>Timing is bad because of economy and because they only have one year to comply with the new state law/regulations. There are concerns with interpretation of some requirements, such as how it could conform with the level of restoration that the county currently has for redevelopment.</p>

Seattle Stormwater Program Interview Responses	
Topic	Information
Stormwater Quantity	4 volumes, final draft - source control, construction stormwater, flow control, water quality, enforcement provisions. Depending on project size and type and outfall, they require flow control or treatment. Size triggers are 2000 & 5000 SF.
Stormwater Quality	Depending on project size, type and outfall, they require flow control or treatment. All projects are to use green infrastructure to the MEP. Treat and infiltrate 91% of Water Quality Design Volume.
Restoration / Protection of Sensitive Areas	Code used to require flow control standard that included peak runoff modeling; this has been switched to the modeling of continuous hydrograph series. State adopted the Growth Management Act to protect riparian and other sensitive areas. Listed certain basins for special treatment such as classifying existing conditions as forested when determining stormwater management requirements. This covers 35% of City. 1/3 of city is covered by combined sewers and stormwater design is regulated for peak flows.
Development / Redevelopment	Built out, all redevelopment now. Depending on the watershed, there are different requirements. The State's Department of Ecology requires forested condition be met for certain "listed" creeks, which affects 35% of the city.
E&SC	Had a large number of slope failures a few years ago. Statewide initiative required regulations for slopes greater than 40% and higher than 10 feet. Department of Ecology's new guidance says there are 18 BMP elements, all of which must be used. Stabilization after 2 days during October to April and after 7 days from May to September.
Floodplains	Follows minimum FEMA minimum regulations in general. Residential development can increase the base flood elevation by no more than 2 feet and nonresidential by no more than 1 foot. Critical development is to be out of the floodplain whenever possible.
Wetlands	State adopted the Growth Management Act and made communities adopt ordinances for critical areas, which is contained in a different portion of the city code and deals with riparian corridors and wetlands. Buffers vary from 0 to 200 feet depending on the quality of the wetland.
Roadways	If construction area is over the 10,000 SF threshold then a stormwater facility is needed. Department of Ecology granted WDOT an exception for road related projects. Seattle copied that based on project type – trail, road, sidewalk, etc. Designated receiving waters have different flow control requirements. Seattle adopted some green stormwater infrastructure requirements, but did not want to take away development rights.
IDDE	Illicit discharges are part of the city code. If they have a reason to suspect illicit discharge, they may sample and recover the cost in the enforcement proceedings. If it occurs regularly, they may do continuous monitoring at cost to the violator.
What they do	Source control, construction stormwater, flow control and water quality, enforcement provisions
What they would change	
Ordinance / Regulations / Guidance structure	4 volumes, final draft form – source control, construction stormwater, flow control and water quality, enforcement provisions. Should become effective in December 2009.
Steering Committee Composition and Approach	They worked with the minimum standards set out by the Washington Department of Ecology. They held 28 public meetings to keep public informed about discussions with the DOE. They didn't want technical standards driving landuse policy, so developers were happy with that. Internal staff were involved in process and it was vetted through primary departments such as planning, engineering, etc.
Concerns with current ordinance / regulations	They want to adopt some floodplain regulations regarding standards for level of service to convey flows in certain problem areas.

Charlotte-Mecklenburg	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	City develops SWM, County develops FPM. They are open to detention being done in BMPs. Different requirements for different parts of the city. 3 areas. Volume control is 1-yr, 24-hr storm, rate control is based on downstream and ranges from 2 yr to 100 event.
Stormwater Quality	Developers can choose from 10 BMPs. BMPs for single family residences will be publically maintained once they've been shown that they are working. LID has been initiated in Huntsville and there is a separate ordinance for them. TSS and Total Phosphorus removal varies by 3 areas of city. TSS removal 85% and phosphorus removal 70%.
Restoration / Protection of Sensitive Areas	Open space required on a sliding scale from 15%-25%, can be co-located with stream buffers, but ball fields do not count. Must be trees - result of give and take during ordinance process. Stream buffers range from 30-50 ft.
Development / Redevelopment	Predevelopment existing conditions: - have maps going back 30 years - sites can be torn down, grassed, rebuilt so they could keep worst case scenario - now provide SWU fee credit for woods/good as existing condition - working with planning department for ultra-urban redevelopment since SWM can be very costly
E&SC	Have separate ordinance. Plan requirement beings when disturbing greater than 1 acre. Should not disturb more than 20 acres at one time. Stabilization required 21 days after disturbance. Inspect measures once per week.
Floodplains	Maps no older than 5 years Strongly resist levees FIRMs show 100-year existing and 100-year ultimate but not 500-year
Wetlands	
Roadways	County does not maintain roads, 90% maintained by municipality and rest by state
IDDE	Ordinance regarding IDDE. They have authority to inspect. When violation occurs, they notify, and have the ability to fine up to \$5,000/day along with other civil penalties.
What they do	Takes stance that it is spend money now or spend it later. Good food helps with the long stakeholder committee process Needed strong facilitator Had backsliding issues so good notes helped keep stances on record
What they would change	
Ordinance / Regulations / Guidance structure	Have stormwater manual and BMP manual.
Steering Committee Composition and Approach	A stakeholder committee was established for each major ordinance, not just anyone could join Consisted of development industry, 18 month process of "what is problem" before they get to regulation discussions Engineer designers, real estate industry, universities, and other that were considered lead stakeholders One approach has been to divide County into subwatersheds
Concerns with current ordinance / regulations	

Stafford County, VA	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	They require LID to the MEP. To get this accepted as meeting all state stormwater requirements, they got state approval for full LID implementation to be considered as meeting the state's adequate outfall requirement that requires detailed analysis to ensure that stormwater runoff from development or redevelopment will not lead to receiving stream instability. Must keep the 10 year release rate the same for flooding, the 1 year, 24 hour release rate the same for channel erosion, and use LID design. Must have overflow path for 100 year event.
Stormwater Quality	Uses USEPA and Prince George's County, Maryland LID design manuals to take credit for pollutant removal. Three levels of LID design are recognized by the County - full, partial, and limited. Development must utilize LID to the MEP.
Restoration / Protection of Sensitive Areas	Stream buffers are considered an integrated management practice .
Development / Redevelopment	Redevelopment does not need to do full LID design.
E&SC	Generally follows Virginia Erosion and Sediment Control Handbook. Requires construction phasing. Requires 2-year storm event to be designed for in all construction channels,
Floodplains	Must elevate residences to the bank full elevation plus 3 feet. No water surface rise is allowed for buildings proposed for development in the floodway.
Wetlands	Have Wetlands ordinance.
Roadways	Working with VDOT on BMPs in ROWs, narrow streets, etc.
IDDE	Have Stormwater Pollution and illicit discharge in the County Code. Enforcement involves notification, fine is \$250 civil penalty and \$1000/day if the violation continues. Violator is responsible for testing, cleaning up, and proper disposal of illicit material.
What they do	Developed design manual after the fact so community slow in implementing LID practices.
What they would change	
Ordinance / Regulations / Guidance structure	
Steering Committee Composition and Approach	
Concerns with current ordinance / regulations	

Prince George's County, MD	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	LID now accepted by state as providing quantity control; previously the state made it difficult for LID designs to obtain quantity control though they did get credit for quality control. Had problem with public perception when one residential development went full LID at county request and major storm caused lotic, ponding in yard swales that lasted 2 days. To quell residential concerns, the developer retrofit the entire area with storm sewer pipes.
Stormwater Quality	Design LID and other appropriate applications to meet state requirements. An active study area is the use of bioretention, green streets, and other environmentally sensitive design practices.
Restoration / Protection of Sensitive Areas	The County has developed GIS coverages that define sensitive areas for development and for protection and restoration. This includes, wetlands, stream buffers, steep slopes, highly erodible soils, groundwater recharge areas, and areas inappropriate for standard onsite septic disposal systems.
Development / Redevelopment	
E&SC	
Floodplains	No rise in water surface elevation is allowed when building in the floodway.
Wetlands	
Roadways	Inter-County difficulties in getting desired changes in roadway widths, removal of curbing, and reduction of sidewalks to reduce impervious area as desired by the County's LID stormwater management objectives. Gradual changes to street designs were made. Big changes are now required by the state's revised stormwater laws and design manual.
IDDE	The County has an IDDE program that includes monitoring of outfalls and a hot line for reporting suspected illicit discharges.
What they do	
What they would change	Concerns with state approval process. Although they were kept informed of the process proposed by the state, the state developed some prescriptive approaches around the least stringent processes used by some counties. This creates problems for Prince George's such as defining when those in the mid-development process might be required to redevelop plans to comply with the new ordinances.
Ordinance / Regulations / Guidance structure	
Steering Committee Composition and Approach	Standing committees
Concerns with current ordinance / regulations	State followed their ordinances as requirements for statewide implementation, but the development process is a concern that they will challenge (or ignore?)

Maryland Stormwater Program Interview Responses	
Topic	Information
Stormwater Quantity	ESD/LID to MEP MS4s require frequent inspection so this creates shift in county resources to inspection and public education. Different storage requirements for different functions - recharge, channel protection(1 yr, 24 hr), overbank flood protection and extreme flood volume.
Stormwater Quality	The Water Quality Volume (denoted as the WQv) is the storage needed to capture and treat the runoff from 90% of the average annual rainfall. Takes into consideration impervious cover, multiple drainage areas, offsite drainage areas, sensitive streams, BMP treatment, structural practices, peak discharge, and extended detention.
Restoration / Protection of Sensitive Areas	10+% restoration of impervious areas per MS4 permit cycle
Development / Redevelopment	Strive for woods/good as predevelopment design condition; require it for redevelopment of areas that discharge to impacted streams
E&SC	Use 1994 Maryland Specifications for Soil Erosion and Sediment Control.
Floodplains	
Wetlands	
Roadways	Established environmentally sensitive design (which incorporates Low Impact Development) as a primary approach for managing stormwater from development. This process includes changes to road designs to reduce impervious area and capture stormwater close to its source of runoff. All municipal and other community ordinances are required to update their existing ordinances that address infrastructure and development practices, like roads, to fully permit implementation of the new state stormwater requirements.
IDDE	
What they do	Provided training courses on the intent and application of new state stormwater management requirements following the publication of the 2000 Maryland Stormwater Design Manual. They are expected to conduct similar training programs now that the 2000 Stormwater Law, updated design document and sample municipal ordinances are available. They already met with the municipalities during the development and roll out of the program to solicit response and informed cooperation.
What they would change	The state developed a Maryland Stormwater Design Manual in 2000 for all communities to follow. It provided objectives, guidance and ordinances that were to be implemented. Compliance was inadequate by some communities so the state passed the 2007 Stormwater Management Act that established stricter, less flexible, compliance requirements and updated the Stormwater Design Manual with more environmentally sensitive requirements. Communities within the state were obligated to approve to have the requirements of the ordinances passed within one year of the completion of the design manual and example ordinance development by the state.
Ordinance / Regulations / Guidance structure	State law, state Stormwater Design Manual and sample ordinances are provided.
Steering Committee Composition and Approach	Others feel that state only talked with environmental groups then hammered these ordinances out to make backsliders comply with intent of the more flexible 2000 design manual/ordinances. Those that already complied find that some of their proactive approaches are now dysfunctional with prescriptive approaches now required by state. State requires approval of ordinances in 1 year.
Concerns with current ordinance / regulations	A recent law addressed the state's concern that not all communities were implementing the stormwater ordinances and following the stormwater design manual is intended and required. The programs also were not meeting state pollutant load goals for reducing impacts to the Chesapeake Bay.

Philadelphia Stormwater Program Interview Responses	
Topic	Information
Stormwater Quantity	Green sewer program for CSOs. Green infrastructure a push. Channel Protection requirement: Detain and release runoff from Directly Connected Impervious Area at a maximum rate of 0.24 cfs per acre in no less than 24 hours and no more than 72 hours. Soon Philadelphia will be divided into several different areas with different requirement for flood control volume.
Stormwater Quality	Management of the first one inch of runoff from all Directly Connected Impervious Areas within the limits of earth disturbance is required.
Restoration / Protection of Sensitive Areas	
Development / Redevelopment	Reducing impervious within the limits of earth disturbance by 20% between the predevelopment and post-development condition exempts the flood control volume requirement.
E&SC	Mandatory if disturbance is over 5000 SF. Plan implemented and kept onsite between 5000 and 15000 SF. Plan must be approved if over 15,000 SF.
Floodplains	
Wetlands	
Roadways	
IDDE	
What they do	
What they would change	
Ordinance / Regulations / Guidance structure	
Steering Committee Composition and Approach	
Concerns with current ordinance / regulations	

DuPage County	Stormwater Program Interview Responses
Topic	Information
Stormwater Quantity	Has has successful program since 1992. Not currently linking detention requirements or permit requirements with downstream receiving conditions
Stormwater Quality	Have included IDDE, E&SC, BMPs, but could be implemented better. Pollutants are treated as surrogates, so they attempt to limit the pollutant of concern. They currently do not have a phosphorous limit. Some concern regarding contaminating groundwater by implementing stricter volume control.
Restoration / Protection of Sensitive Areas	
Development / Redevelopment	No current difference between development and redevelopment. They would like to explore relaxed requirements for redevelopment. They are not interested in considering waivers on brownfields.
E&SC	Current regulations are compliate with the state regulations, but are not very straightforward. Interested in updating the terminology and other aspects to more closely align with the State procedures.
Floodplains	Current ordinance does a good job with floodplain regulation. Need to ensure that the new ordinance is clear on when FEQ model is required and when regulatory model is required. They do not currently map the ultimately built out floodplain, but do consider future development for their FEQ models.
Wetlands	More restrictive than Federal requirements. They regulate all wetlands, even ones under the threshold or the non-jurisdictional wetlands that USACE does not regulate. Would like to offer credits for maintaining wetlands, and want to preserve their control over the quality of wetlands, not just quantity.
Roadways	Transportation department is currently using the NIPC standard detention method. They also deduct existing pavement from the required calculation for detention. Would like to consider permeable pavement and other void space systems under roads, but are looking to ensure that these requirements are consistent with other parts of the nation.
IDDE	
What they do	Overall objective was to make water quality better, to make ordinance meet the NPDES phase II requirements. Two years ago, they beefed up ordinance to meet EPA construction sediment control.
What they would change	
Ordinance / Regulations / Guidance structure	
Steering Committee Composition and Approach	Certain groups have become extremely powerful. The Mayors and Managers council has become very powerful. Nothing happens without its approval. Env groups have been friendly but not particularly vocal. DuPage gets along well with them. Small special interest groups feel there is too much regulation.
Concerns with current ordinance / regulations	Addressing conflict of interest, auditing the communities, imposing fines for violations, addressing drain tiles, enhancing BMP regulations. In the past single family home and commercial sites under 1 acre and car washes were exempt as public policy.