Center for Environmental Excellence by AASHTO
Stormwater Management White Paper

Connecting the DOTs through Collaboration in Stormwater Management

Proceedings from the
2014 National Stormwater Practitioners Meeting

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U.S. Department of Transportation
Federal Highway Administration

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
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This document summarizes the discussions of the participants who presented/spoke as individuals and may not necessarily represent their agency's views or positions. In addition, the contents of the document do not necessarily represent the views or positions of AASHTO, the Center for Environmental Excellence by AASHTO, FHWA, or Michael Baker International.

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Acronyms and Abbreviations

AASHTO	American Association of State Highway Transportation Officials
ACHP	Advisory Council on Historic Preservation
ACWA	Association of Clean Water Agencies
ASCE	American Society of Civil Engineers
BMP	Best Management Practice
Caltrans	California Department of Transportation
CPESC	Certified Professional in Erosion and Sediment Control
CWA	Clean Water Act
DNREC	Delaware Department of Natural Resources and Conservation
DOT	Department of Transportation
DSSR	Delaware Sediment and Stormwater Regulations
DURMM	Delaware Urban Runoff Management Model
ECOD	Ecodatabase
EPA	United States Environmental Protection Agency
ESCAN	Erosion and Sediment Control Assessment Notebook
FHWA	Federal Highway Administration
GIS	Geographic Information Systems
GPS	Global Positioning System
IDDE	Illicit Discharge Detection and Elimination
ITRD	International Transport Research Documentation
LID	Low Impact Development
LOS	Level of Service
MAP-21	Moving Ahead for Progress in the 21st Century Act
MEP	Maximum Extent Practicable
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
NCHRP	National Cooperative Highway Research Program
NDOR	Nebraska Department of Roads
NEPA	National Environmental Protection Act
NOI	Notice of Intent
NOT	Notice of Termination
O&M	Operations and Maintenance
ORISE	Oak Ridge Institute for Science and Education
PE	Project Engineer
PSR	Pollution Control Strategy
QA/QC	Quality Assurance/Quality Control
RiP	Research in Progress
RTF	Research Task Force
RWIS	Road Weather Information System
SCMS	Stormwater Control Management System
SCOE	Standing Committee on the Environment
SELDM	Stochastic Empirical Loading and Dilution Model

Acronyms and Abbreviations

SHA	State Highway Administration
SOP	Standard Operating Procedure
SPCC	Spill Prevention, Control and Countermeasure
SWIT	Stormwater Inspection Tool
SWMM	Storm Water Management Model
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TECS	Transportation Erosion Control Supervisor
TERI	Transportation and Environmental Research Ideas Database
TMDL	Total Maximum Daily Load
TRB	Transportation Research Board
TRID	Transportation Research Information Services (TRIS) and International Transport Research Documentation (ITRD)
TRIS	Transportation Research Information Services
TS4	Transportation Separate Storm Sewer System
TSR	Triennial Standards Review
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRR	Water Resources Registry

Executive Summary

At the 2014 American Association of State Highway and Transportation Officials (AASHTO) National Stormwater Practitioners Meeting, themed "Connecting the DOTs," 36 state departments of transportation (DOTs) across the country who participated received updates on stormwater regulations and learned new methods to advance DOT stormwater management programs. Topics discussed included:

- Current trends in stormwater management programs and regulations;
- Audits by federal and state regulators
- Construction contract administration;
- Asset/data management and tracking;
- Research findings and tools;
- Maintenance; and
- TMDL implementation and the watershed approach.

Key findings from these topics are described as follows:

Trends – The U.S. Environmental Protection Agency (EPA) has enhanced its rulemaking with program assistance and, the major focus areas for stormwater have shifted to include federal partnerships, education, recognition, and strengthening MS4 programs. In order to comply with permit requirements that may evolve from these changes, DOTs must be prepared to modify their stormwater programs as necessary. EPA is working with the states, sharing information, and educating permit writers to craft language appropriate for a linear, transportation separate storm sewer system (TS4). Some of the key areas for attention include:

- Funding will remain a key constraint, and the whole life cost of retrofit projects will begin to take a larger portion of the DOT operations budget.
- Assessing methods to reduce long-term operation and maintenance costs, increased project life span, and reduce capital costs for retrofit projects; and
- Use of source control options that may be appropriate for some traditional pollutants of concern.

Audits – As part of the new EPA focus, federal and state regulators are increasing their audits of DOT stormwater management programs to assess DOT compliance with stormwater NPDES permits. The best way for DOTs to prepare for these audits is to conduct a self-audit of key elements of the stormwater program focusing on construction practices, maintenance facilities and activities, and consistent program implementation statewide. The benefits of conducting a self-audit include identification of program improvements needed and staff roles and responsibilities. It is also helpful to develop an internal inspection and enforcement program to ensure compliance with requirements. Lessons learned from past EPA audits reflect the level of implementation of the stormwater program at the DOT, the level of management buy-in to the

program, improvements in the relationship between the DOT and the regulators (EPA and the state regulatory agency), and how prescriptive (or general) the NPDES permit requirements are.

Asset management – DOTs have created asset management plans as a long-range planning tool to provide a framework for understanding the remaining useful life of infrastructure and to provide the DOT with a basis to support long-term organization, operations, and asset management decisions.

Construction – Construction contract administration entails the use of the following components as part of a successful DOT construction program:

- Construction scheduling and sequencing;
- Good planning in design and establishing and complying with specifications and contracts;
- Management of sediment runoff and applying appropriate erosion and sediment controls;
- Pool funded research to evaluate construction site stormwater runoff treatment options to ensure the most effective technologies are being applied.

Maintenance – Stormwater permit compliance was discussed with respect to maintenance activities, including best management practice (BMP) inspection, tracking, and reporting concepts, winter storm management-related procedures with considerations to the region's environment, and a new development and redevelopment program designed to fund projects regionally.

TMDLs – TMDL and watershed programs require the development of a more rigorous science-based TMDL development process and consideration of the fact that DOTs are often minimal contributors to many TMDLs. Watershed scale modeling is a useful tool to help distinguish when the DOT is not a significant contributor. A watershed approach to stormwater management and stormwater credits can focus stormwater management efforts where they can effectively support watershed goals, and assist in controlling the cost to DOTs. Ideally, the states and EPA would collaborate with DOTs to implement TMDLs, and be mindful that DOTs are stakeholders in the quest in meeting the objectives of clean water.

1. Introduction

State departments of transportation (DOTs) face new and increasingly challenging and complex state and federal regulations to reduce pollution in their stormwater discharges. This document provides information presented and discussed at the National Stormwater Practitioners Meeting held in July 2014, in Washington, DC. Themed "Connecting the DOTs," the meeting provided state DOTs from across the country an opportunity to receive updates on stormwater regulations, learn new methods to advance DOT stormwater regulations, and learn new methods to advance DOT stormwater programs. Presentations provided during the national meeting and a recorded webinar are available for on-demand viewing at the Center for Environmental Excellence by AASHTO's (Center) website: http://environment.transportation.org

At this Practitioners Meeting, 36 DOTs were represented, as well as representatives of the Association of Clean Water Agencies (ACWA), United States Environmental Protection Agency (EPA), Federal Highway Administration (FHWA), and AASHTO. The meeting opening session included a welcome from District of Columbia DOT (the host DOT), FHWA, and AASHTO. The following general topics were discussed during the meeting:

- Session 1 – Current Trends in Stormwater Management Programs and Regulations
- Session 2 – EPA Audit Preparations, MS4 Permits, Lessons Learned
- Session 3 – Construction Contract Administration
- Session 4 – Asset/Data Management and Tracking
- Session 5 – Research Findings and Tools
- Session 6 – Maintenance and Water Quality
- Session 7 – TMDL Implementation/Watershed Approach

The meeting also included table-to-table discussions, a town hall session, and interactive polling session, and a project tour of the Anacostia Waterfront Initiatives water quality projects.

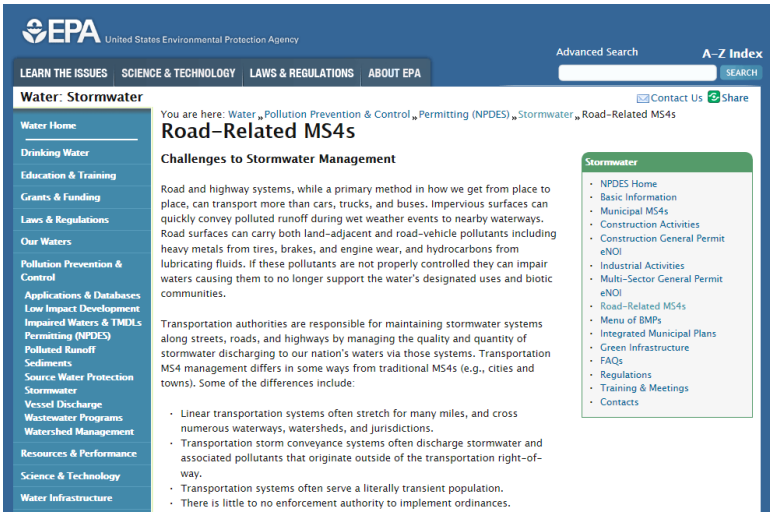
This document contains highlights of each session topic and considerations for moving forward. Key contacts of the meeting attendees and the responses from the DOTs during the polling session are provided in the Appendix. The information is presented for practitioners across multiple functional areas within a DOT organizational structure.

2. Current Trends in Stormwater Management Programs and Regulations

2.1. Highlights

In the past year, EPA has shifted the focus from rulemaking to enhanced program assistance, and lessons learned from the State DOT audits by:

- Updating its MS4 program;
- Shifting the major focus areas for stormwater to include federal partnerships, education, incentives, and recognition; and
- Strengthening MS4 programs by coordinating federal partnerships with a consistent message distributed across the country.



Recognition and incentive programs have been developed so DOTs can receive credit for their work. EPA is working with the states, sharing information, and educating permit writers to craft language appropriate for a linear, transportation separate storm sewer system (TS4). EPA has made efforts to build relationships and update its website, stressing innovation, sharing best practices information, and releasing news on emerging water quality related topics, such as asset management, climate adaptation and resiliency, etc. In 2014, FHWA and EPA co-hosted webinars on green infrastructure, roadway design and maintenance of post-construction stormwater controls. In June 2014, EPA released Post-Construction Performance Standards and Water Quality Based Requirements, a compendium of permit language across the country. EPA also highlighted the National Enforcement Initiative: Keeping Raw Sewage and Contaminated Stormwater out of Our Nation's Waters.

The following are the basic requirements for MS4 programs:

Illicit Discharge Detection & Elimination (IDDE)	• A storm sewer system map showing outfalls and locations of receiving waters • Prohibit non-stormwater discharges into the system and appropriate enforcement procedures actions • A plan to detect and address illicit discharges • Education about the hazards of illegal discharges • Determination of appropriate practices and measurable goals
Construction Site Runoff	• Code or ordinance requiring proper erosion and sediment controls • Construction site plan reviews that consider water quality impacts • Have sanctions to ensure compliance • Establish procedures for receipt and consideration of information submitted by the public • Determination of appropriate practices and measurable goals
Post-Construction Runoff Control	• Develop and implement strategies which include a combination of structural and/or non-structural practices • Ordinance requiring implementation of controls • Ensure adequate long-term operation and maintenance of controls • Determine appropriate practices and measureable goals
Pollution Prevention/ Good Housekeeping	• Develop and implement an operation and maintenance program • Train employees on how to incorporate pollution prevention/good housekeeping techniques • Determine appropriate BMPs and measurable goals for this minimum measure
Public Education/ Outreach & Public Involvement	• Distribute educational materials to the community, or conduct equivalent outreach activities • Determine the appropriate BMPs and measurable goals • Comply with applicable State, Tribal, and local public notice requirements

Current trends in stormwater management programs and regulations have been tracked and evaluated by the ACWA. Past investigations and research indicate that stormwater discharges are a source of impairment for tens of thousands miles of rivers, streams, coastal shorelines, as well as hundreds of acres of lakes, reservoirs and ponds. The National Research Council notes that roads and parking lots make up 70% of total impervious cover in urban landscapes and 80% of directly connected imperious cover. Trends in stormwater controls imposed by state regulators include:

- Regulating and reducing flow
- Performance requirements in permits
- Second generation permits regulating discharges into waters under a TMDL, which includes tighter water quality standards or may have impervious surface retrofit requirements
- Development of standards incorporating on-site retention requirements

Several state regulators have already included post construction standards in permits. Since states are focused on regulating and reducing stormwater pollution, the expected trend is to move ahead with state-level stormwater regulations in the absence of a federal rule.

There is a variety of ways to include stormwater controls into permits. There is also an interest in pursuing innovative integrated approaches.

Federal Highway Administration

To assist DOTs with stormwater programs, the Federal Highway Administration (FHWA) has been involved with stormwater models, databases, recognition programs (wetlands, watershed, and water quality awards), research contracts, liaisons and partnerships, guidance, and financial and technical assistance. Research funding has been provided for studies, such as “Determining the Feasibility of Developing a National Performance Measure Targeting Stormwater” and “Feasibility Study for the Development of a Framework for an Effective Stormwater Quality Credit/Banking/Trading System.” FHWA is in partnership with United States Geological Survey (USGS) to provide training on the Stochastic Empirical Loading and Dilution Model (SELDM) which estimates pollutant loads form highway runoff, and the “National Synthesis on Potential Sources, Fate and Transport, and Potential Effects of Chloride in Surface and Ground Water Resources of the Conterminous United States.” Further FHWA efforts include funding the Center Stormwater Community of Practice; providing liaisons between EPA, United States Army Corps of Engineers (USACE), United States Coast Guard (USCG), Advisory Council on Historic Preservation (ACHP), and United States Fish and Wildlife Service (USFWS); maintaining and populating the International BMP Database; and Maryland’s Water Resources Registry (WRR). In 2014, FHWA and EPA co-hosted two webinars: “Innovative Transportation Stormwater Management: Green Infrastructure in Road Projects” and “Roadway Design and Maintenance of Post-Construction Stormwater Controls.”

2.2. Considerations for Moving Forward

An increasing number of impaired water bodies and the breadth of stormwater and nonpoint source discharges to water bodies continue to be a concern. In response, state regulatory agencies are beginning to change the requirements in stormwater permits. It is important for DOTs to modify their stormwater programs as permit requirements evolve. Some considerations for modifications include:

- Watershed based permitting. The regulatory and regulated community generally agree that watershed based permits may be an effective approach to improve water quality in order to provide a watershed-wide solution. Implications of this approach for DOTs will be a need for more advanced pre-project stormwater planning, and more collaboration with MS4 partners in a watershed, including collaborative programs for monitoring and construction and operation of treatment controls.
- TMDL implementation. TMDLs are becoming a significant program issue for some DOTs, particularly on the east and west coasts. It is logical to expect that DOTs in the middle of the country will experience a similar growth in TMDL requirements.
- Waters of the U.S. Rulemaking. The EPA is currently considering clarification of the Waters of the U.S. rule. The focus is on defining the 'significant nexus' for waters that are connected, but not directly to traditional regulatory waters. A potential implication of this rulemaking is that the definition of receiving water may be expanded, especially in arid areas that are dominated by ephemeral water bodies.

Funding will remain a key constraint for DOTs. The Interstate Highway System is largely complete, and integration of treatment controls into DOT infrastructure will inevitably be completed on a retrofit basis. Costs of retrofit projects are relatively high, and the whole life cost of the BMPs (including operation and maintenance) will begin to take a larger portion of the DOT operations budget. Retrofit projects will need to assess methods to reduce long-term operation and maintenance costs, increase project life span, and reduce capital costs.

Some source control options may be more appropriate for some traditional pollutants of concern, rather than removing pollutants after they become entrained in stormwater runoff. California and Washington State recently passed legislation to limit the use of copper in automobile brake pads, which have been shown as a primary source of copper in runoff in urban areas. There is preliminary interest in determining whether automobile tires are a significant source of zinc. Another pollutant that may lend itself to source control includes chlorides and the use of traction sand.

3. EPA Audit Preparations, MS4 Permits, Lessons Learned

3.1. Highlights

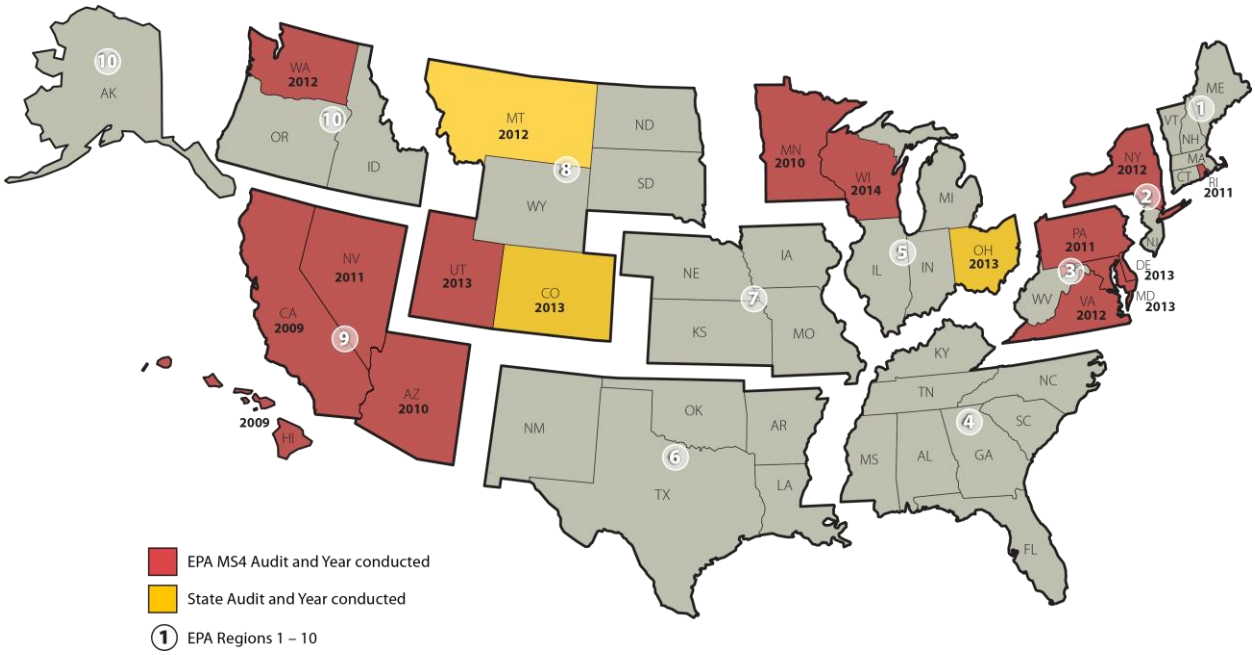
State DOTs are subject to audits of their stormwater management programs by state and federal regulators to assess compliance with their stormwater NPDES permits. These audits are generally comprehensive, examining all aspects of the DOT stormwater program, and can lead to enforcement actions if the audit uncovers deficiencies in permit compliance. The most common program elements audited are management and organization, construction program, maintenance program, non-stormwater identification and elimination (e.g., illicit discharge detection and elimination), training, program evaluation, and reporting. Other audited elements can include BMP development and implementation (structural and operational), project planning and design, non-departmental activities (e.g., airspace leases), stormwater features mapping, and public education and outreach.

Audits are usually conducted by EPA, facilitated by their consultant contractors. If an entity operates within a delegated state, the state regulatory agency also generally attends. Based on survey and interview findings, it is generally beneficial to have a representative of the state regulatory agency present during the audit. This is because the state regulatory agency staff can explain the intent of the permit provisions and provide context for implementation. It is also likely that the state regulator has knowledge of the DOT program and, as such, has approved of how the program has been implemented, either implicitly or explicitly. Phase I DOT stormwater programs are entering their 20th year of existence, and Phase II programs have been established for about eight years. Accordingly, the states and the EPA are interested in using the audit process to assess compliance, improve program performance and implementation, and enforce NPDES permit requirements. DOTs have experience in completing the auditing process and can improve their performance on future audits by incorporating audit feedback into their stormwater programs. The map below depicts the states where recent DOT audits have occurred.

Statewide Program Challenges/Solutions, including Audits, Annual Reporting, Public Education

- Resources to respond to audits, and resources in general: collecting documentation, addressing non-compliance issues from the audit
- Attrition in staff who may have experience or institutional knowledge
- Documenting what we do

DOT Audit Locations:



Lessons learned included:

- Participate and encourage participation of all staff members in the preparation, audit, enforcement responses and follow-up. Everyone will better understand permit programs and take more ownership of their roles.
- Document everything, including procedures, inspections, follow-up actions, training, etc. Make sure documentation is kept up-to-date. Have all plans and standard operating procedures (SOPs) officially approved by the state regulator. Have a document management system. Anticipate known issues in your program and audits of other permittees in your EPA region.
- Visit all sites before the audit. Provide only the requested information. Re-read your permit and stormwater management plan (SWMP), they are the standards for enforcement. Keep good notes and take photos, immediately send additional information or clarification if needed or requested.
- Have responsible staff available to participate in briefings and field inspections. Anticipate issues and be prepared to address them. Have responsible staff available to participate in briefings and field inspections. Have all potentially relevant backup material handy and accessible. Provide evidence of oversight and enforcement and pay attention to the "little things." Accompany the audit team on project site visits. Enhance your tools and techniques. Think about how the DOT will respond to questions by the auditor. Right away when receiving notice of the pending audit, determine who is going to respond, schedule appropriate times (work backwards to present time), and prepare progress reports.

- Expect to provide documentation on policies, permits, spill response plans, and inspection records. Have a document management system and database where information about projects is stored and readily accessible, including CADD files, advertised plan sets, SWPPPs, inspection reports, maintenance activities, inspections, etc. Provide information on litter management, Adopt-A-Highway activities, and public education. Keep statewide maps that include the storm sewer system, maintenance facilities, construction sites, and BMPs.

3.2. Considerations for Moving Forward

It is recommended for DOTs to conduct self-audits (with or without notice to audit by EPA or state regulators) of key elements of the stormwater program focusing on construction practices, maintenance facilities and activities, and consistent program implementation statewide. The benefits of conducting a self-audit include identification of program improvements needed and clarifications on roles and responsibilities. Another important audit planning tool is to develop an internal inspection and enforcement program, and a process that can be used to correct deficiencies and procedures to escalate/resolve compliance problems stemming from non-responsive staff or contractors. A review of the organizational structure may be prudent to improve program compliance. Should a DOT receive notice of an audit, consult with other DOTs with audit experience and review and apply lessons learned as applicable.

Recommendations how to prepare for a DOT audit include:

- Ensuring all documentation systems are in place
- Knowledge and understanding of all systematic roles and responsibilities to ensure compliance, pushing audit responsibilities from Directors to staff engineers
- Sharing experience with other DOTs

Implementing the above measures can result in the following benefits as described by the DOTs:

- Improved preparation
- Increased focus and decreased distraction by staff
- Continuity of program delivery

Lessons learned from past audits reflect the level of implementation of the stormwater program at the DOT, the level of management buy-in to the program, the relationship between the DOT, the EPA and the state regulatory agency, and how prescriptive (or general) the NPDES permit requirements are. The Center published a briefing paper on stormwater program audits in 2014 (AASHTO, 2014), in which some of the lessons learned from past DOT audits are presented:

Do not wait— *Start preparing now*! An entity may hear informally that it is going to be audited; however, timing of the official notice may lag significantly. The entity should start working on preparation as soon as it hears from a credible source that an audit is planned or in the works. The auditors will have a large (potentially enormous) information request, which will consume a significant amount of staff time. In general, DOTs estimate from 0.1 to 0.5 person years to prepare for an audit.

***Know the weaknesses in your organization*, especially when it comes to implementation.** Many times, a single division or group is responsible for implementation of the permit, and ownership of permit responsibilities may be an issue outside of this group. Identify program areas that are not robust and make changes to correct potential issues ahead of the audit.

Admit when you are wrong, but *defend your program when you are righ*t. You do not have to take the auditor's word that you are doing something wrong. DOTs are unique and have unique program and safety constraints. The auditors are used to reviewing traditional municipal type MS4 programs and may not appreciate DOT specific issues or the nuances of your permit. Spend the time to defend your implementation of a permit element when appropriate.

Expect the possibility that *you may receive an enforcement action*. DOT experience is that some audits are conducted or perceived to be punitive. This varies from region to region and case by case. Treat the audit like a legal deposition. Bring appropriate staff to support the explanations of the implementation of your program.

Start and end with *good internal communication*. The Director and field staffs all need to know what is going to happen and what to expect during an audit. This is the time for transparency. Roles and responsibilities for permit implementation must be clearly identified and understood by the entire management team. Rather than viewing implementation of the permit as a problem for a few staff – a culture of environmental stewardship will ideally be created, similar to the culture of safety present at most DOTs.

4. Construction Contract Administration

4.1. Highlights

Three states shared their unique administrative approaches for construction stormwater compliance. DOTs methods for construction stormwater contract administration vary across the country. The following are examples of how select DOTs conduct construction stormwater compliance administration.

Ohio DOT's Incentive Based Erosion and Sediment Control Specification

Ohio DOT developed a supplemental specification that describes the basic requirements for contractor construction stormwater compliance. The approach is as follows:

- The DOT facilitates contracts and tracks BMPs installation.
- The DOT applies for permit coverage as a co-permittee with the contractor.
- SWPPP design, inspections, and revisions are listed as bid line items. The Project Engineer (PE) and a Certified Professional in Erosion and Sediment Control (CPESC) prepare the SWPPP.
- Contractors use a spreadsheet tool with predetermined BMP units and cost.
- The Contractor is required to correct deficiencies within 48 hours.

Benefits of this approach include, reduced need for staff oversight, increased flexibility, increased responsiveness, ensures compliance, and partnering between the contractor and Ohio DOT. Lessons learned include realizing the difficulty of managing with limited staff, the need to set project level contract provisions, project submittals set quality standards, training and education are essential, and it is difficult to control the contract elements (quantity and type of BMPs).

Administering the Construction Stormwater Permit in Nebraska

Nebraska Department of Roads (NDOR) is required to comply with the Construction General Permit (soil disturbance of 1 acre or more, inspections, and submittal of NOI). Construction stormwater compliance is implemented as follows:

- The Contractor obtains coverage under the Construction General permit as the co-permittee. Permit coverage does not require permitting fees. There are eight construction stormwater contractors covering the entire state.
- NDOR conducts site inspections, which includes review of BMPs, formalizing Construction General Permit requirements, review of Action Plans, and environmental stewardship.
- Site inspections consist of a Green Sheet review process, both before construction and during construction.
- Routine inspections are tiered between the project manager and the contractor, and inspections by the District Environmental Coordinator. Routine inspections are conducted monthly by District Construction or Maintenance staff and are inclusive of BMP restoration.
- An ecodatabase inspection tool auto-distributes reports from the SWPPP to the prime contractor, erosion control contractor, project manager, and a copy to the ecodatabase.
- NDOR implements the SWPPP via a temporary erosion and sediment control plan. Imminent threats are addressed within 24 hours.

- NDOR is self-regulated. A Notice of Termination (NOT) is issued upon attaining 70% vegetation coverage, and permit coverage is terminated after 180 days.

Colorado DOT Stormwater Construction Permit Compliance

Colorado DOT construction methods are typically focused on design-bid-build projects. Design-build project (contractor) or design-build projects are for large corridors. The construction stormwater permit compliance is conducted as follows:

- Compliance assurance/control is managed by the Transportation Erosion Control Supervisor (TECS), who has special certification (contractors cannot bid on jobs unless they have this certification), conducts inspections, and undergoes Erosion and Sediment Control Assessment Notebook ("ESCAN") training. Transportation Erosion Control supervisors are trained by Colorado DOT.
- NOIs are issued for 1 acre soil disturbance, and areas with 5,000 square feet or more of disturbance are reviewed by erosion and sediment control supervisors.
- Inspections occur daily, every 14 days, and monthly (by the regional water quality pollution control manager). Regional erosion control assessment teams (RECATS) are formed by the regional water quality pollution control manager and Colorado DOT headquarters water quality specialist.
- The ESCAN Program is used to assist with inspections, and includes a reports database. Colorado DOT has implemented a new liquidated damages process per specification 208.09. Failure to perform erosion control costs the contractor $875 per calendar day after a specified 48-hour period has expired.

Training is the key to the effectiveness of BMP selection, SWMP preparation, water quality permit compliance for transportation professionals, NEPA compliance, stormwater compliance inspections for construction, transportation erosion control supervisor certification, and the maintenance transportation erosion control supervisor. Colorado DOT has built a BMP training facility, hired a water quality specialist, and named its Chief Engineer as "Director of Stormwater Programs."

4.2. Considerations for Moving Forward

Construction Best Practices

Recommendations how to improve construction best practices include:

- Develop performance-based seed specifications
- Conduct more research on BMP systems, such as seed or application success rates, growth regulators, and germination
- Improve time management by requiring more detailed construction schedule and sequencing
- Improve planning in design by providing more detail earlier in the process
- Improve communication and gain understanding from top management
- Educate workers on safety and risk with the incorporation of BMPs

Implementing the above measures can result in the following benefits as described by the DOTs:

- Shorter permit lengths
- Increased environmental protection
- Improved aesthetics
- Improved contract management
- Reduced costs
- Improved efficiency and time savings
- Justifiable usage of resources
- Improved communication and interaction with management and workers
- Increased public interest and involvement, including behavior changes

Incorporating Post-Construction (Treatment) BMPs into the Project Delivery Process

Recommendations to incorporate post-construction BMPs into the project delivery process include:

- Assigning a lead management position to oversee and ensure communication between workers and management during each phase of the project delivery process
- Involving maintenance personnel early in the design process and justifying the use of certain BMPs
- Incorporating state-specific standards and highlights into proposed contracts

Implementing the above measures can result in the following benefits as described by the DOTs:

- Meeting permit compliance
- Increased protection of infrastructure
- Avoidance of possible litigation from downstream users

Other Construction Program Considerations for DOTs

Offsite areas – Run-on from adjacent lands, particularly agriculture, can cause violations on the DOT construction site. Once offsite runoff is intercepted by a DOT storm drain, regulatory agencies require the DOT to be responsible for the resultant water quality and potentially increase in quantity. Monitoring inflow and outflow to document the inflow 'baseline' may be a solution.

Turbidity – Reducing turbidity from construction site runoff is a primary goal of regulatory agencies. It would be proactive for the DOT to explore the passive application of soil binders upstream of sediment controls to reduce turbidity in the effluent.

Contractors – It would be proactive for the DOT to review and update specifications and contracts to ensure that there is clear authority for the DOT to suspend work, in the event that the contractor violates the Construction General Permit.

Research – It is important for the DOT to stay abreast of the most effective stormwater runoff treatment options and technologies. A cost-effective way to do this is by pooling fund research to evaluate the effectiveness of these BMPs on an ongoing basis.

5. Asset/Data Management and Tracking

5.1. Highlights

While asset management is mainly for bridges and roads, DOTs are interested in adding stormwater infrastructure as an asset management component to better manage and prioritize system maintenance and repair. Some DOTs have created an asset/data management procedure and tracking system to include stormwater assets. Following is a discussion of some of the methodologies, systems, and software used to manage the data required for a stormwater program to be successful.

North Carolina DOT's Level of Service Ratings for Asset Management of BMPs

North Carolina DOT started an asset management program based on statutory requirements. A biennial report on maintenance conditions and costs in 2007 required performance standards of highway systems. As part of its NPDES permit compliance, the DOT was asked to evaluate new BMP inspection and maintenance needs and create an inventory of stormwater controls.

The DOT inventories and tracks various types and locations of BMPs using a newly created stormwater control management system (SCMS), in which BMPs are provided a unique identifier. It was developed by North Carolina DOT information technology personnel in North Carolina. Inspection reports are included in the SCMS and provide a level of service and ranking. Stormwater Control Inventory includes bioretention, infiltration basins, dry detention basins, level spreaders, wet detention basins, pet waste stations, filtration basins, stormwater wetlands, hazardous spill basins, swales, and other types of BMPs.

The Stormwater Control Inspection and Maintenance Manual provides guidance for inspection, reporting and recordkeeping, and information about specific control devices. Performance Measures level of service (LOS) are "A" – some aging but no deficiencies, "B" – minor deterioration and maintenance identified, "C" – moderate structural deterioration, and "D" – function is inadequate, and "F" – general or complete failure. The value in LOS ratings includes compliance accountability, asset management, and data-driven decisions. A highway performance profile is developed based on infrastructure Health Condition Scores. Performance measures are tied to staff performance and eligibility for compensation raises.

Maryland SHA's Stormwater and Drainage Asset Management Program – From Compliance Activities to an Asset Management Philosophy

Maryland State Highway Administration (SHA) has a stormwater NPDES permit that requires tracking and spatially locating stormwater facilities. The SHA Business Plan, Environmental Compliance and Stewardship in SHA, was developed and tied spending cash flow to stormwater drainage assets. Life cycle cost (planning to design, construction operations). Planning includes inspections costing $2 billion in the next 15 years, and construction of 3,500 facilities.

Planning has four phases: existing data updates for sampling, IDDE quality, new inlets and pipes, and stormwater management. The cost for a full inventory update is $400,000.

Construction methods are based on an area wide contract, bid-build, design-build, and a memorandum of understanding. Stormwater management asset conditions per district for all BMP conditions include retrofit to maintenance, requiring repair.

A stormwater management asset operations manual will be available winter 2014 for internal road crews and will provide support via electronic information. It will be map-based, using ArcGIS, eGIS, and Google Maps. Funding for the project is $21 million for 2014, on a six-year cycle for CTP federal funds.

Nebraska DOR's Tracking of Environmental Commitments

Nebraska Department of Roads (NDOR) has an Ecodatabase (ECOD) where users can identify pre-construction commitments to track and document those commitments in the system. Ecodatabase is an electronic reporting and inspection software application used to synchronize and process data. Identifying commitments consists of project setup, project review, and documentation.

The ECOD inspection tool requires software installed on user machines, and generates NDOR environmental ecosystem inspection reports tailored to each project. Emails with links, PDF attachments, report filters, reminder notifications, past due notices, etc. are sent to a list of recipients.

Report types include corrective actions, project inspections, percentage of environmental commitment inspection reports, environmental commitments compliance, corrective actions within seven days, and a threatened and endangered (T&E) species summary report.

Down the road, the tool will include maintenance facilities, environmental inspections (including tank inspections), spill prevention, control and countermeasure (SPCC), runoff control plan inspections, post-construction BMPs, and wetland mitigation site inspections and tracking.

Mississippi DOT's Stormwater Inspection Data – Collection and Management

Inspections and summaries for Mississippi DOT are developed by independent third parties. The stormwater inspection program includes determination of follow-up responsibilities, and site ratings are established then improved. System improvements are needed to manage this information and assist in recognizing issues related to these inspections.

Challenges in stormwater inspections for Mississippi DOT include addressing the needs for streamlining and large amounts of data that needs to be collected for stormwater permit compliance. The process consists of field inspections using the "smart client"- an electronic tracking tool for offline for field use and online for quality assurance/quality control (QA/QC), creating and archiving data reports, sending email notifications, performance management, and a website.

Equipment challenges include Java, tablet functionality, maintaining GPS, and glare issues for outdoor use. Performance management includes a data archive of projects, project-reporting summaries, and geographic information systems (GIS) to project performance, confirm contractual elements, and convert potential long-term construction BMPs to post construction BMPs.

5.2. Considerations for Moving Forward

The purpose of collecting asset management information for stormwater infrastructure is to document the current state of assets (e.g., asset inventory, valuation, condition, risk) and to project long-range asset renewal (rehabilitation and replacement) requirements. An asset management plan is a long-range planning tool used to provide a framework for understanding the remaining useful life of infrastructure. It can provide the DOT with a basis to support long-term organization, operations, and asset management decisions.

Ideally, the DOT would align the asset management information with requirements from the stormwater program. The plan can then provide a vehicle to identify and prioritize water quality and flood risk management challenges, evaluate opportunities for integrating water quality and flood risk management into DOT projects and operations and maintenance (O&M) activities. The top issues to consider when collecting asset management information include:

- The reason for collecting data;
- The type and quantity of data to collect;
- Use of funding systems;
- Use of technological tools;
- The need for actionable, meaningful data that the DOT can actually use;
- How to determine what an asset consists of; and
- The level of data to collect.

Accuracy is also important. Some systems are static and some need timely updates and identifiers for BMPs. A recommendation is to pilot the program for a time and see whether the DOT needs that data, then determine whether it is cost effective.

6. Research Findings and Tools

6.1. Highlights

AASHTO's Standing Committee on the Environment (SCOE) serves many important functions, including supporting research on significant environmental issues. Each year, SCOE selects 12 to 20 environmental research topics for funding consideration. The process starts with the Transportation and Environmental Research Ideas (TERI) database. The SCOE Research Task Force (RTF) is responsible for overseeing the SCOE research process and the development of NCHRP research statements.

There are two types of research programs in NCHRP: "full" research projects that take two to three years, and from $250,000 to $750,000, and NCHRP 25-25 "quick response" projects with a duration of less than one year, and focusing on, for example, syntheses and decision support tools, for less than $100,000.

TERI is a central database for collecting, tracking and sharing new transportation and environmental research ideas and converting priority ideas into problem statements for funding consideration.

The SCOE RTF is a research advisory group composed of a Chair and members from SCOE's four subcommittees.

A list of ongoing and completed research projects is posted on TRB websites (RiP and TRID, respectively). Summaries of three current studies pertinent to stormwater management are provided below:

NCHRP 25-37: A Watershed Approach to Mitigating Stormwater Impacts

This project is examining the watershed approach to stormwater mitigation options: onsite in kind, offsite in kind, tracking/banking/offset, out of kind, and a combination of onsite and other options. The focus is on mitigating for individual transportation projects within a watershed context. Elements of the research project include identification and evaluation of data sources and tools, watershed conditions and priorities, project impacts, BMP types and effectiveness, existing offsets, trading and banking programs, DOT resources, and requirements. Ecosystem services take mitigation evaluation beyond meeting water quality requirement to how the mitigation options can support the broader functions and values of the watershed.

NCHRP 25-40: Long Term Performance and Life-Cycle Costs of Stormwater Best Management

The objectives of this research are to provide the practitioner with tools to help optimize the BMP portion of their DOT stormwater program. BMP performance and cost are key information needed to maximize program performance and plan for necessary resources for capital and long-term implementation.
This research provides operation and maintenance protocols, unit costs, and performance predictions for treatment BMPs. An objective of this research is to describe some of the primary non-structural and source control BMPs used by DOTs, and provide information to assist in improving their performance and reducing the implementation cost.

Stochastic Empirical Loading and Dilution Model – SELDM

SELDM is a runoff-quality model developed by FHWA in cooperation with USGS that is designed to estimate storm-event flows, loads and concentrations in storm flows from the upstream basin, the highway, the BMP outfall, and the receiving water downstream of the highway. SELDM uses Monte Carlo methods to produce the random combinations of input variable values needed to generate the stochastic population for each input and output variable. SELDM is designed with a BMP module that can be used to assess the potential for reducing the risk that concentrations or loads in runoff or the receiving water will exceed desired values. This robust modeling tool replaces the earlier and simpler Driscoll model.

6.2. Considerations for Moving Forward

Other recently completed or ongoing related NCHRP research includes:

1. NCHRP 25-25/83 (completed), "Current Practice of Post-Construction Structural Stormwater Control Implementation for Highways" – Provides a synthesis of practices for post-construction structural stormwater control implementation measures used by state transportation agencies with information regarding selection, design criteria, operation, and maintenance for BMPs. The report includes recent federal or state-level research programs and projects on post-construction stormwater discharge control.

2. NCHRP 25-41 (ongoing), "Guidelines for Achieving Volume Reduction for Highway Runoff in Urban Areas" – The research objective for this study is to develop guidelines to reduce the runoff volume from highway facilities in urban areas. The guidelines are divided into two subcategories: (1) methods appropriate for new construction and (2) methods appropriate for retrofit construction. A spreadsheet tool was developed as a part of this project to assist in computing volume loss by treatment practice.

   The research is considering alternative pavement systems, infiltration, and evapotranspiration methods as well as storage alternatives. Methods that are deemed technically and fiscally viable are refined with detailed design guidance for use by DOTs. Cost analysis methods are developed so DOTs can determine the relative costs between accomplishing volume reduction within the right-of-way or partnering with other entities to add volume reduction capacity to the developments that highways serve (e.g., commercial/residential areas, airports, industrial parks, etc.).

3. NCHRP 25-42 (completed) "Bridge Stormwater Runoff Analysis and Treatment Options" – This applied research project provides guidance for assessing potential water quality impacts and selecting BMPs for stormwater runoff from bridge decks and associated vehicle approaches. There is a growing concern that untreated runoff from bridges may be impacting receiving waters even though the bridge deck represents only a small fraction of the impervious area of the highway system, and there is not strong evidence to support the proposition that the quality of bridge deck runoff differs significantly from that of other highway runoff. The cost and environmental benefits of implementing stormwater controls for bridge deck runoff is reviewed and a procedure is provided for the practitioner to determine the appropriate

stormwater management practices for new and retrofit bridge projects. This project provides spreadsheet Tools for use in BMP evaluation that are identical to those developed as a part of NCHRP 25-40.

4. NCHRP Report 565 (completed), "Evaluation of Best Management Practices for Highway Runoff Control" – Provides a means for evaluating BMPs and low impact development (LID) for stormwater quantity and quality. This report discusses hydrologic methods, BMP unit processes, pollutants of concern, regulations and regulatory requirements, and BMP selection guidance.

5. NCHRP Report 728 (completed), "Guidelines to Evaluating and Selecting Modifications to Existing Roadway Drainage Infrastructure to Improve Water Quality in Ultra-Urban Areas" – Provides information on procedures for evaluating and selecting modifications to existing drainage infrastructure. The purpose of this guidance is to provide planners, designers, and engineers with a basic understanding of the technical issues of BMP selection and design as applied to ultra-urban retrofit settings. The report discusses the constraints and challenges of retrofitting in urban areas, BMP options, evaluating BMP effectiveness, sizing and design, maintenance and monitoring and capital cost information.

6. NCHRP Synthesis 444 (completed), "Pollutant Load Reductions for Total Maximum Daily Loads for Highways" – Provides information collected on the types of BMPs currently being used by DOTs for meeting TMDL water quality goals for stormwater runoff. The synthesis includes information on BMP performance, cost and design, including information on non-structural BMPs.

7. Maintenance and Water Quality

7.1. Highlights

Stormwater permit compliance was discussed with respect to maintenance activities, including BMP inspection, tracking, and reporting concepts, winter storm management-related procedures with considerations to the region's environment, and a new development and redevelopment program designed to fund projects regionally.

Massachusetts DOT – BMP Management: Inspections, Tracking, and Documentation

Considering maintenance as a design criterion means that good maintenance starts with good design. Ease of inspection is needed to ensure effective maintenance. BMP screening and selection consider operation and maintenance to ensure compatibility with DOT standards. Other considerations include spill response, defining what constitutes maintenance, frequency of maintenance, and level of difficulty of maintenance needs, accessibility, special equipment, and safety, including confined space entry and lane closures. Massachusetts DOT does not consider underground chambers as practical BMPs due to maintenance limitations.

Design should facilitate maintenance and provide adequate banks for mowing, line forebays with paver blocks for sediment cleanout, and paving with no loose erodible soil. Maintenance tasks include source control inspection, maintenance of BMPs, tracking, and documentation to reduce load at the source. Massachusetts DOT inspection practices are outlined in the SWMP and checklists.

Maintenance programs include preventive, repair, and replacement. Maintenance thresholds are based on inspection versus scheduled cycles. Maintenance implementation is provided by in-house staff and equipment, instead of subcontractors. Maintenance as an operation includes tracking and documentation. Data is input into a tracking system, and a geodatabase is used for tracking. Maintenance as regulatory compliance translates into state regulatory program requirements and the EPA NPDES MS4 permit, along with minimum control measures.

Minnesota DOT – Salts/Chlorides

Roadway based public safety is a major factor of national interest, and Minnesota DOT strives to provide safe roads while minimizing chemical use during the winter season, when snow and ice impact travel on roadways. Minnesota DOT BMPs include proper material storage, maintaining calibrated and upgraded equipment, installing brine tanks, and performing anti-icing measures to lower the melting point of ice on the road and prevent ice particles from bonding together. Road Weather Information System (RWIS) sensors are placed in roadways, and they send information to DOT personnel so they can receive real-time information to inform appropriate techniques for optimal treatment.

Acetate is a freezing point depressant that is commonly used as an anti-icing agent to maintain clear roads. However, current research has shown that as the ice melts, the acetate, which is toxic, mixes with the runoff. There are also toxicity concerns with beet juice, which is used in conjunction with road salt to lower the effective melting point, and with corrosion inhibitors.

Salt, which is also used for deicing, causes chloride to be released into the watershed.
There are two chloride based TMDLs in Minnesota, 20 impairments of which are on the current 303(d) list for impaired streams, and 35 are proposed for the 2014 list for impaired streams and lakes. The TMDL process involves state regulations TMDLs, the permit, etc.

While it is too late for the DOT to challenge the TMDL process, triennial standards reviews (TSR) provide opportunities for the DOT to challenge the standards. Minnesota DOT is also involved in the TMDL pollutant listing process (the list of chlorides was reduced) by being part of the stakeholder group.

Colorado DOT – Updated New Development and Redevelopment Program and Maintenance of Permanent Control Measures

Colorado DOT has updated its new development and redevelopment stormwater program. Treatment controls are established to the maximum extent practicable (MEP), and a majority of the treatment occurs from regional BMPs and is funded through a statewide water quality mitigation fund, provided the DOT contributes to the fund and spends on a scheduled basis, and is considered in compliance. The mitigation fund costs $6.5 million per year. It provides for only planning, design and construction, and it is not tied to any transportation project.

Colorado DOT encourages partnering with other agencies on specific projects and investigating new impervious surface criteria. The DOT uses a regional approach consisting of water quality capture with an 80% reduction in TSS for all area draining to the BMP. The new program assists maintenance by handing many of the BMPs over to local municipalities.

A stormwater inspection tool (SWIT) is dedicated to inspections, locations, and data for the permanent BMPs. Photo documentation is developed to notify maintenance crews. The tool is being updated for use as an application for mobile devices. Control measure training is handled by a maintenance transportation control supervisor.

7.2. Considerations for Moving Forward

Maintenance Best Practices – Institutional Controls, BMP Maintenance, Challenges

Recommendations on how to incorporate maintenance best practices include:

- Regularly report to management on the MS4 and its performance in DOT business plan metrics
- Dedicate funding and resources to the development of user-friendly tools, e.g., GIS enabled tablets
- Develop a centrally located documentation system that allows maintenance and stormwater program personnel to accomplish their tasks and reports
- Encourage pollution prevention and good housekeeping
- Ensure maintenance crews know the locations of stormwater controls
- Document all plans and procedures
- Keep staff up to speed and determine whether refresher training is needed
- Share the most up-to-date information

Implementing the above measures can result in the following benefits for the DOT:

- Organizational cooperation that results in compliance
- Efficiency in performance that meets business plan and permit conditions
- Long-term savings in capital expenditures on BMPs, including functional BMPs

Chlorides and Deicers

Recommendations on how to incorporate best practices for reducing salt application include:

- Conduct more research on factors such as flow, temperature, substraits, seasonality, and downstream dilution
- Develop stakeholder groups through AASHTO and state forums regarding salt loading to waterways
- Standardize application rates and salt management practices, e.g., RWIS, closed-loop controllers, pre-wetting, consulting the Winter Severity Index, maintaining covered storage, and using inspectors during winter storms

Implementing the above measures can result in the following benefits as described by the DOTs:

- Enable the DOT to execute winter maintenance to provide a safe and efficient transportation network for maintenance and the public
- Enable the DOT to share responsibility for salt loading and not be held as the primary chloride contributor/source of salts causing impairment

8. TMDL Implementation/Watershed Approach

8.1. Highlights

For both practical and environmental reasons, it is essential that stormwater management strategies look beyond the project site and away from complex compliance requirements. The discussion on TMDL implementation and the watershed approach included implementation in Maryland of the Water Resources Registry (WRR), a tool that can support a watershed approach, Caltrans' new approach to TMDLs in a large, diverse state with a complex regulatory environment, and Delaware's fee-in-lieu program for stormwater mitigation.

Caltrans' Statewide TMDLs – A New Way of Doing Business

Caltrans is currently named in 84 state TMDLs, and this number is expected to double in the next five years. The DOT MS4 permit is enforced by nine Regional Water Quality Control Boards, each with different requirements, often for the same TMDL pollutant. For example, sediment TMDLs in three regions is approached differently in each region. The old way of doing business was a three-pronged approach, rooted in retrofits, institutional controls, and public education. The current practice is based on models and by pollutant, has an objective compliance measure based on the greatest water quality benefit per dollar, and has flexibility in its implementation.

Implementation of TMDL requirements is allowed through retrofit, credit for treatment of area beyond post-construction treatment requirements, cooperative implementation with other jurisdictions, and more. Watershed management requires coordination, with a compliance credit tracking of 1,650 compliance units per year for projects, maintenance activities, and cooperative implementation, based on a TMDL implementation framework by pollutant category. Caltrans receives credit for treating beyond project post-construction requirements, and for efforts in pervious areas within the right of way. Caltrans created a web-based tracking tool to house TMDL requirements and all MS4 permit requirements and compliance credits achieved.

The Watershed Resources Registry: An Innovative, Collaborative Approach to Improving Regulatory Streamlining, and Achieving Sustainable Watershed Restoration and Protection (Participants: USACE, EPA, FHWA, Maryland SHA, Maryland Department of Transportation, US Fish and Wildlife Service, Maryland Environmental Service, Maryland Department of Natural Resources, Green Highways Partnership, and Maryland Department of Planning)

A collaborative approach created the WRR, a national/regional pilot that grew out of the Green Highways Partnership and the Maryland SHA proposal for the Route 301 project, the first green highway project. WRR is a framework and GIS-based tool. It integrates regulatory programs, guides resource planners, saves time and money, increases program effectiveness, screens for preferred actions, and maximizes watershed benefits. It is transparent, predictable and reliable.

The uniqueness of the WRR lies in its use of GIS tools and regulatory input from other agencies, such as USACE, USFWS, EPA, and others. It provides for an increase of regulatory and non-regulatory program integration in the watershed approach, referencing Clean Water Act Sections 401, 404, 402, 303(d), and 319.

The interagency partnering objectives include:

- Integrate watershed data from multiple agencies and programs in a single database;
- Increase regulatory and non-regulatory program integration via the watershed approach; and
- Streamline and improve regulatory effectiveness and resource planning by minimizing redundancies in decision making.

Delaware DOT – Debits and Credits make Dollars and Sense

Delaware Sediment and Stormwater Regulations (DSSR) involve volume-based management over a 1-, 10-, and 100-year stormwater return period. Many water bodies in Delaware are impaired. Delaware DOT has current TMDL obligations in the Inland Bays Watershed as per a Pollution Control Strategy (PCS). There will be future TMDL obligations enforced through NPDES Permits. If the requirements to achieve infiltration are met per (DSSR), then the DOT will automatically meet TMDL requirements. Using the watershed approach, new regulations can apply in-project trading in each watershed as based on outfalls. A fee in-lieu option will be available if costs exceed $10 per cubic foot of treated runoff volume. Money would be paid to DNREC at a price of $18 per cubic foot of treated runoff volume. Accounting is computed by DURMMv.2 banking, which is based on volumetric accounting on a per watershed basis.

8.2. Considerations for Moving Forward

Watershed/TMDL Programs – Challenges and Solutions

Key challenges for incorporating watershed/TMDL programs include:

- The need for a more rigorous science-based TMDL development process
- DOTs are not always a significant contributor, but may be treated as one
- Runoff from other land uses draining to and through the DOT right-of-way becomes the DOT's responsibility
- Understanding how to undertake an effective watershed-based TMDL modelling strategy that integrate transportation inputs

Future needs for DOTs:

- Watershed scale modeling for TMDL development that incorporates transportation inputs
- Stormwater credits/banking
- Alternatives to infiltration BMPs

Recommendations on how to incorporate watershed/TMDL best practices include:

- Develop a process to distinguish between when the DOT is and is not a significant contributor
- Establish partnerships with regulators. Ideally, state regulatory agencies and EPA would collaborate with DOTs to implement (and not just create) TMDLs

- Develop alternative strategies (e.g., source control, regional watershed programs, etc. to manage impaired waters

Implementing the above measures can result in the following benefits for the DOT:

- DOTs are stakeholders for clean water
- Increased confidence that public money is spent wisely (increased accountability)
- Collaborative work with other watershed stakeholders, which leads to mutually satisfying results and dissemination of lessons learned

Appendix A: Presentations, Reference Websites, and Attendee Contacts

The following presentations are available on the Center's website.

- Session 1: Current Trends in Stormwater Management Programs and Regulations
  - Stormwater Updates – Rachel Herbert, EPA
  - FHWA: Current Trends in Stormwater – Susan Jones, FHWA
  - Current Trends in Stormwater Programs and Regulations – Julia Anastasio, ACWA
- Session 2: EPA Audit Preparations, MS4 Permits, Lessons Learned
  - MS4 Audit Preparation, White Paper and Tools Overview – Scott McGowen, Caltrans
  - Delaware DOT Audit – Marianne Walch, Delaware DOT
  - EPA Audits – Leigh Waite, Arizona DOT
  - EPA Audit Experience and Lessons Learned – Jerry Chaney, Utah DOT
- Session 3: Construction Contract Administration
  - Ohio Construction Contract Administration for stormwater – Hans Gucker, Ohio DOT
  - Administering the Construction Stormwater Permit in Nebraska – Ron Poe, Nebraska DOR
  - Colorado Department of Transportation – Tom Boyce, Colorado DOT
- Session 4: Asset/Data Management and Tracking
  - Stormwater Inspection Data Collection and Management – Chad Wallace, Mississippi DOT
  - North Carolina DOT: Level of Service Ratings for Asset Management of BMPs – Craig Deal, North Carolina DOT
  - Stormwater Management and Drainage Assets Maintenance Program – Cornelius Barmer, Maryland SHA
  - Tracking Environmental Commitments During Construction – Gabe Robertson, Nebraska DOR
- Session 5: Research Findings and Tools
  - National Stormwater Practitioner's Meeting: Overview of Research – Ken Stone, Washington State DOT
  - A Watershed Approach to Mitigating Stormwater Impacts Scope and Status of NCHRP 25-37 – William Fletcher, Oregon DOT
  - NCHRP Project 25-40 Long Term Performance Life Cycle Costs of Stormwater Best Management Practices – Nick Tiedeken, Minnesota DOT
  - The Stochastic Empirical Loading and Dilution Model (SELDM) for Stormwater-Quality Risk Analyses – Greg Granato, U.S. Geological Survey
- Session 6: Maintenance and Water Quality
  - Planning and Designing for BMP Management – Henry Barbaro, Massachusetts DOT
  - Winter Storm Management – Nick Tiedeken, Minnesota DOT
  - Colorado DOT's Updated New Development and Redevelopment Program and Maintenance of Permanent Control Measures – Tom Boyce, Colorado DOT

- Session 7: TMDL Implementation / Watershed Approach
    - Caltrans Stormwater Permit – Scott McGowen, Caltrans
    - The Watershed Resources Registry (WRR) – Dominique Lueckenhoff, EPA; Ralph Spagnola, EPA; and Michael Herzberger, Maryland Environmental Service
    - Debits and Credits makes Dollars & Sense – Vince Davis, Delaware DOT

Reference Websites

- Center for Environmental Excellence by AASHTO Stormwater Management Community of Practice State-of-the-Practice Reports
- Center for Environmental Excellence by AASHTO Stormwater Management Practitioner's Handbook
- Road-Related MS4s
- MAP-21 – Moving Ahead for Progress in the 21st Century Act
- Post-Construction Performance Standards and Water Quality-Based Requirements: A Compendium of Permitting Approaches
- Green Infrastructure
- Transportation and Environmental Research Ideas (TERI)
- Research in Progress (RiP)
- Research Information Database (TRID)

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