Innovative Transportation Stormwater Management:
Green Infrastructure in Road Projects

March 6, 2014

Speakers:

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- **Marcel Tchaou**, FHWA
- **Susan Jones**, FHWA
- **Kelly Karll,** Southeast Michigan Council of Governments
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Transcript:

Slide: Innovative Transportation Stormwater Management: Green Infrastructure in Road Projects

Emily Ashton
All right, everyone. We're going to go ahead and get started. We have most people here. So good afternoon. Welcome to today's webcast titled Innovative Transportation Stormwater Management: Green Infrastructure in Road Projects. This webcast is sponsored by EPA's Office of Wastewater Management and the Federal Highway Administration's Office of Project Development and Environmental Review. My name is Emily Ashton, and I'm an ORISE fellow with EPA's Green Infrastructure and Stormwater Program. And I'll be moderating today's webcast along with my colleague, Eva Burke. Thank you for joining us.

Slide: Logistics

Before we get started on our presentations, I'd like to go over a few housekeeping items. First, we'll have a question and answer session after the last two presentations today. To ask a question, simply type your question in the "Questions" box on your control panel and click the "Send" button. If your control panel is not showing, click on the small orange box with the white arrow to expand it. You don't need to wait until the Q and A periods to submit your questions. Since there are a large number of participants today, we encourage you to ask your questions early. We'll try to answer as many questions as possible. However, due to the high number of participants, unfortunately not all questions will be answered. However, please feel free to contact the speakers after the webcast. Speaker contact information will be available at the end of today's presentation.

If you have any technical issues, such as audio problems, please click on the "Questions" box to the right of your screen, type your issue, and press the "Send" button. We'll do our best to troubleshoot these issues. You can also call the GoToWebinar support number listed on the

screen here, 800-263-6317, and give the assistant our conference ID number, also listed here on the screen. Lastly, we'd like to remind you that the views and materials presented by our speakers today are their own and do not necessarily reflect those of EPA or the Federal Highway Administration.

Slide: Webcast Agenda

So, what are we going to cover today? Today, we're going to be talking about green infrastructure in road projects. Roads can convey a variety of pollutants into our waterways and can increase the volume and velocity of stormwater generated. Green infrastructure techniques are one solution that can be used to reduce and treat stormwater runoff.

So now I'd like to kick off today's webcast by introducing our lovely speakers. First up, we'll hear from Rachel Herbert, an environmental scientist with EPA's Office of Wastewater Management, and Susan Jones, a highway engineer from the Federal Highway Administration's Office of Project Development and Environmental Review. Then we'll hear from Marcel Tchaou, a civil engineer from the Federal Highway Administration's Office of Project Development and Environmental Review. Then we'll head over to Kelly Karll, who is a senior civil engineer from Southeast Michigan Council of Governments, also known as SEMCOG. We'll lastly hear from Bryan Wagner, environmental policy and program manager at Illinois Tollway.

Slide: Now to our speakers!

So with that, I'm going to hand it over to Rachel, Susan, and Marcel.

Rachel Herbert
Slide: Green Infrastructure

Thanks, Emily. So Susan, Marcel, and I have been working together on a lot of different projects. And so Susan and I just wanted to start out giving a very quick, high-level overview about green infrastructure and provide some examples to offer up some things that you can think about as you go about doing your everyday work.

Slide: A Few Quick Stats

So a few quick stats that we thought we'd start off with. There are over four millions miles of public roads in the United States that governments at all different levels are responsible for. And as you can see, most roads are owned at the local level by counties, townships, towns, and municipalities. But there are still a fair number that are owned by state departments of transportation, and, of course, the federal government owns a small number in parks and other locations. We know that we also have over three and a half million miles of streams and rivers in the United States, and the intersection of these roads and rivers, as you know, is quite common. So stormwater management is an important consideration as projects are built and developed and as roads are continued to be operated and maintained. We also know that urban stormwater is a leading source of impairment and that development of roads and other impervious areas can have impacts and add to water quality problems if not appropriately addressed.

Slide: Pollutants & Sources in Highway Runoff

So pollutants in stormwater from roads can come from a wide variety of sources. Pollutants like metals such as copper, zinc, iron, cadmium, chromium, nickel, and particulates and sediments, and the sources range from the vehicles themselves to chemicals used in rights-of-ways, like salts and even to fertilizers and to paving material products, too, and even the paints that are applied for the lane markings. So as you're going about thinking about planning your roads and pulling things together, there's obviously a large variety of locations and sources to consider.

Slide: Other Impacts

So there obviously are other impacts that can come from imperviousness, as well. The excess volume and velocity of stormwater from roads and other imperviousness can also cause streams to be down cut and eroded, releasing sediments and really altering the physical characteristic of the waters. And sadly, the pictures here are becoming all too common. The excess stormwater can obviously also impact the roadway infrastructure itself, as you can see in the picture on the bottom right. In this example, concrete walls have failed, and we even see examples of bridges that have been washed away and other failures, as well, from the erosivity of the water.

Slide: Historic Practices & Future Needs

So just to kind of lay out where we kind of are at this moment, which I think most of you will be familiar with – once the slide advances – historically, the focus of designs have been on controlling, really, the peak flow of water and moving this water off of roads and to nearby rivers and waters as quickly as possible. We've a lot of times used gray infrastructure, including culverts and pipes, and really just to try to, like I said, move the water quickly. But the infrastructure that's needed now is a little bit different. We have a lot of infrastructure in our country that's in need of replacement and repair, and there really are few communities that can pay to foot the bill and get all these infrastructure replaced or repaired. So what we really need is more resilient and affordable solutions that can meet a lot of objectives at once. And green infrastructure is one solution that can help to achieve this, to help create more livable and resilient communities by really helping to alleviate the stress on our sewer systems, help address localized flooding, and create infrastructure that is able to withstand more intense weather events.

Slide: A Few Green Infrastructure Examples

So just to kind of put things in perspective of, when I say green infrastructure, what I'm thinking of, green infrastructure, from my perspective, is using plants and soils and natural processes that soak up and store stormwater. Green infrastructure is an integrative approach that reduces pollutants and hydrologic impacts and can provide cost effective opportunities to control stormwater at its source, prevent water quality degradation in healthy waters, help restore impaired waters, and provide a lot of other benefits like flooding mitigation and air quality and a lot of more. And it can really be something that's at a site level, like the example shown on the right, or it could be more regionally based. And I think that others will have examples of that. So you can see on the right that there are a lot of practices being used around the country, and some are impervious pavers that can be used in parking lots and park-and-rides and things like that, rain gardens or bio-retention cells, curb bump-outs with

vegetation in the road rights-of-way, and oxbow features, which we recently learned about, that are being used in arid locations to help better manage stormwater.

So on that note, I'm going to turn it over quickly to Susan, and she's going to give you some examples.

Susan Jones

Slide: Nannie Helen Burroughs Great Street, Washington, DC

Now, the partnership between EPA and Federal Highways to tackle green infrastructure is not new. For instance, back in 2005, the Green Highways Partnership was initiated by the US EPA and the Federal Highway Administration out of realization that building safe, sound transportation systems and protecting and sustaining a clean and healthy environment were not mutually exclusive, particularly in light of the common denominator, which is serving the public good. And so one of the projects that occurred is Nannie Helen Burroughs Avenue in northeast DC, which is a one and a half mile long, minor arterial, multi-modal corridor that accommodates regional commuters, transit riders, local auto travel, pedestrians, and bicyclists. Nannie Helen Burroughs runs roughly parallel to Watts Branch, which is the largest tributary to the Anacostia River within the district, with a drainage area of almost four square miles. Now, this corridor is definitely super gray. It had, you know, curb, gutters, sidewalks. It was commercially mixed with lots of residential. So it had very little greenery. But this project was funded by the American Recovery Reinvestment Act, and the ARRA also established the TIGER program, which Marcel is going to talk more about later, which fosters innovative multi-modal and multi-jurisdictional transportation projects that promise to significant economic and environmental benefits to an entire metropolitan area, region, or nation.

Slide: Nannie Helen Burroughs Great Street, Washington, DC – Stormwater solutions which support sustainable urban design

Now, DDOT, DC Department of Transportation, has also incorporated many environmentally friendly features in the design to address stormwater management: water quality, energy consumption, and also urban heat island effect in tree coverage. Some of the proposed LIDs considered in this project included permeable pavement, vegetative filter strips, bioswales, street trees, and bio-retention cells. Now, this example of this project with EPA and Federal Highway partnership incorporating green infrastructures for a transportation project is very successful, and we want to see more of these projects in the future, this combination of EPA, Federal Highway, and, of course, your state DOTs. I'm going to turn this back to Rachel.

Rachel Herbert

Slide: Integration of Green Infrastructure into Plans

Thanks, Susan. So I just want to – as you saw, Susan just talked a little bit about a successful stand-alone project, but you can also consider integrating green infrastructure in projects that you may already have planned, like capital improvement projects. And I just wanted to give you one quick example. In Lancaster, Pennsylvania, they recently performed a screening level analysis that suggests that green infrastructure can be a cost effective solution to stormwater management with a lot of different benefits for their community, especially when integrated into their planned improvement projects. And in this example, in the combined sewer system area, the cost for a stand-alone green infrastructure project would have been $94.5 million, but

because they considered integrating it into planned improvement projects, they were able to reduce that cost to 51.6 million. And you can see, the box on the right, the benefits. And the benefits within that combined sewer system area were $120 million, and you can see that there were other benefits, as well, that are more on a city-wide basis that are listed for energy, air quality, climate change, and then other qualitative benefits were also shown that weren't able to be specifically quantified.

Slide: Integration of Green Infrastructure into Plans (Cont'd)

So then I just wanted to leave on one parting note -- and I know that this slide hasn't loaded yet – but really, we have people on the phone today, listening in, from a wide variety of backgrounds. And we have a lot of different ways that you can consider incorporating green infrastructure. And in light of the potential cost savings and the benefits associated with green infrastructure, I really challenge you to consider ways to incorporate green infrastructure into your transportation plans, whether they be the metropolitan transportation plans which span out 20 years or more, or the near-term plans, like the transportation improvement or state transportation improvement plans, that have projects that are planned and feasible. And so with that, I just want to thank you and turn it over to Marcel.

Marcel Tchaou

Slide: FHWA and Green Infrastructure

Thank you, Rachel. Hi, everyone out there. I'm sure everybody is enjoying the nice weather coming out, depending on where you are. I think Chicago – I don't know if Chicago they're enjoying the nice weather, but I think the nice weather is coming around.

Slide: The Federal Highway Administration (FHWA)

Anyway, what I wanted to talk about is green infrastructure from the perspective of Federal Highway. Federal Highway is one of the 12 modes within the US Department of Transportation, and our core mission is to administer the federal aid and the Federal Lands Highway Program at headquarters and the state divisions. And our mission is improve the mobility of highways through national leadership and innovative program delivery. And in fulfilling its mandate, Federal Highway focuses on safety, environmental stewardship, efficiency, and reliability.

Slide: Green Infrastructure (1)

Now, green infrastructure – let's talk about green infrastructure. I know today you've heard a lot about green infrastructure. Wherever you go, you see that, the sign on many buildings. In the fall of 2012, we have, at the White House, what they call a think tank meeting on green infrastructure. And at the conclusion of the meeting, what came out is that the name green infrastructure in today's environment is very broad and can be misleading. And there's no single definition across the different nations.

Slide: Green Infrastructure (2)

Now, green infrastructure today can mean different things. Now, green infrastructure could mean stormwater best management practices, habitat crossings, fish passage, vegetation restoration, use of recycled materials, and the list goes on.

Slide: Table

Now, let's consider here this table that I pulled together here. If you see a forest and wetlands -- I know many people are getting rid of forest and wetlands, but is that a green infrastructure? Yes. And the equivalent gray infrastructure would be like water filtration facility. Let's take mangroves and sea walls. Let's take coral reefs, breakwater and groins; natural flood plains, dikes and canals; wetlands and tertiary water treatment facility. This is just to show a little bit, when we start going to the idea of green infrastructure, we can really go all over the place.

Slide: Green Infrastructure In Transportation

Now, green infrastructure and transportation – in transportation we see green infrastructure in a wider perspective of sustainability. Now, there's a publication co-authored by Federal Highway called Leaner and Greener. I would really encourage everyone to download that, if you haven't already, and read it. It's very great. You see many perspectives of green infrastructure from Federal Highway. So the Federal Highway have the DOTs to accomplish the sustainability objectives.

Slide: The Greener Side of Gray

Now, the greener side of gray, Federal Highway is required to be a proactive steward of the environment and continuously look for opportunities to be creative. Let's say, when a project comes up, let's say replacing the culvert with – we could consider AOP, aquatic organism passage, stormwater best management practices, new alignment, or what has become retrofits. We always want to do something to really bring the greener side of gray.

Slide: Sustainability Initiatives (1)

Now, the sustainability initiatives, you have ecological -- it's an ecosystem approach to developing infrastructure. You have INVEST tool, and then you have also the PEL, planning and environmental linkages.

Slide: Sustainability Initiatives (2)

I have – the information I've given you here are just the tip of the icebergs. I really encourage you to go into – to go to those links, and you can read more about what we do. And you also have the Sustainable Highways Initiative. I know Susan mentioned that -- go there, and you can see a lot context sensitive solution, CSS, and there you have livability. Now, I know that there was a time when people think that highway, Federal Highways, all the work we do, we are just engineers building roads from point A to point B. That we call logical (inaudible). No, we do more than that.

Slide: Funding Sources (1)

Here are some federal funding sources, and I really encourage you to go to the TIGER website. The TIGER website – TIGER is a discretionary funding that will just authorizes, reauthorize. It's – TIGER, what it means, the Transportation Investment Generating Economic Recovery. It's a discretionary grant program that provides a unique opportunity for the DOTs to invest in road, rail, transit, and port projects. And I think now, in this round, there's up to 35 million available in new grant money. And if you go to the TIGER website, you can see all of the activities available for – I mean eligible for funding. Now, one thing that I would really stress out here is that new eligibility, they're planning to encourage multiple projects to work within the same corridor, engaging in programmatic mitigation, to make the project more efficient and improve the outcome for the community. That is something new. That one, as you read, it was not there before. They just brought that programmatic mitigation. And also, any new project that is authorized also comes with eligibility for green infrastructure.

Slide: Funding Sources (2)

Other funding sources, you have the TAP, the Transportation Assistance Program, SHRP2, and Eco-logical. And as I said, I really encourage all of you to go to websites to see the different – to gather the information and see the eligibilities.

Slide: Ongoing Stormwater Research Initiatives

Now, the ongoing stormwater, we have (inaudible), and I think there will be training on that coming that might happen (inaudible) some of you might have seen the training, the Stochastic Empirical Loading Dilution Model. And then we have the National Synthesis on Potential Sources, Fate and Transport, and Potential Effects of Chloride in Surface and Ground Water. And we also have – we also determined a set of practices and collections for stormwater best management practices. And we also have – we have a Feasibility Study for Development of Framework for Stormwater Quality Banking. And we also have the Watershed Resources Registry also going on now.

Slide: Speaker Contact

And I think – all right. So if you have any questions, we have the different contacts. Just contact us. Thank you, Rachel, and I'll turn back to Emily.

Emily Ashton

Slide: Ongoing Stormwater Research Initiatives

Thanks, Marcel. I just wanted to point out, I know we've had a lot of questions about the slides are a little slow to load, but we actually have quite a number of participants on today. So if you can just bear with us, they are taking a little while to load. Hopefully, everyone can keep up. I really apologize about that, but we'll do our best to kind of pause.

Slide: Poll 1 – How many people are viewing this webcast?

So now I would actually like to run a poll on the audience. We'd like to see how many people are actually watching the webcast in your location. So we're going to send that poll out right

now, if you can just take a second to answer that. If everyone can participate, that would be great, and then we will get to our next speaker.

All right, everyone, it looks like we have a good percentage of people that voted in that poll. We thank you very much for that.

Slide: Innovative Transportation Stormwater Management: Green Infrastructure in Road Projects

Now we'd like to head over to Kelly Karll from Southeast Michigan Council of Government. Kelly is a professional engineer with SEMCOG. Kelly has over 20 years of stormwater experience, including watershed planning and stormwater design and construction. Her work at SEMCOG primarily focuses on green infrastructure planning and implementation, including working to integrate stormwater into the transportation planning processes. So now we'd like to head over to Kelly. Kelly, are you there?

Kelly Karll
Yes I am, thank you, Emily.

Emily Ashton
Go ahead and take it away.

Kelly Karl
Thank you, Emily. As Emily mentioned, I work for the Southeast Michigan Council of Governments, often referred to as SEMCOG.

Slide: SEMCOG Region

SEMCOG is a regional planning organization representing the seven highlighted counties here on this map. We are the designated regional transportation agency and responsible for developing the long-range transportation plans. We are also actively involved in local watershed groups and work closely with the state agencies on phase two permitting activities, in addition to regional planning efforts. SEMCOG was established in 1968 as a regional planning partnership in southeast Michigan. We are accountable to local governments who join as members, and funding for SEMCOG is provided by federal and state grants, contracts, and membership dues.

Slide: Great Lakes Corridor

The yellow area in this diagram highlights the Great Lakes Watershed. We're located along the Great Lakes Corridor, and our region includes the cities of Detroit, Ann Arbor, and Port Huron. The region's population is about 4.7 million, covering around 4600 square miles. Portions of our region are adjacent to Lake Huron, Lake Erie, and the connecting channels, including the St. Clair River, Lake St. Clair, and the Detroit River.

Slide: Today's Discussion

The goal today is to give you some ideas about how we're addressing green infrastructure in our region and making the connections to our transportation system. Specifically, I'll highlight

our recently green infrastructure vision. I'll also highlight our recently completed Green Streets grant in addition to a few projects that are integrating specific opportunities into the roadway planning process.

Slide: Green Infrastructure Vision

To get started, SEMCOG has just completed the Green Infrastructure Vision for Southeast Michigan. The project was one component of the Sustainable Communities funding from HUD. One chapter is dedicated to green infrastructure in transportation for the region.

Slide: 4 Photos

Within our region we define green infrastructure to include our natural areas, such as wetlands and woodlands,

Slide: Photos of Green Infrastructure

in addition to constructed green infrastructure, such as rain gardens, bioswales, and grow zones. An important theme throughout our Vision is that green infrastructure is really a network of all of these elements and needs to be managed as a system.

Slide: Economic Benefits Commercial

One of the highlights from our Green Infrastructure Vision is a chapter on the economic value of green infrastructure. This didn't include a detailed economic assessment in our region, but rather included a compilation of studies that addressed the value of green infrastructure. One of the topics we've found that is closely tied to roadways is the connection of landscaping in commercial areas. Studies have demonstrated that consumers spend more time and money and return more frequently to stores with higher amounts of tree canopy along their street frontages. Rental rates have also been shown to be up to seven percent higher in commercial areas with quality landscaping.

Slide: Green Infrastructure Vision Chapters

The chapters for the entire Vision are shown here. I'm going to focus on how we incorporated water quality and transportation into the overall Vision. So first of all, the purpose of the Vision was, for the first time ever, to benchmark what we have, vision where we want to go, and develop regional policies on how to get there.

Slide: Southeast Michigan Land Cover

So in order to benchmark existing green infrastructure, we digitized the land cover for the entire region into the five main categories you see here. We also have building footprints for the region. While the level of impervious cover may seem small, the outer parts of our region are less developed, and we also have a lot of agricultural land use.

Slide: Impervious Cover Benchmark

The impervious cover was then further categorized into buildings and roadways, with the remainder attributed to parking lots and driveways. These percentages represent the general breakdown of impervious cover across the entire seven-county region.

Slide: Transportation Network

As the regional transportation agency, we then further mapped and benchmarked all of the major roadways. These generally included the major arterial and collector roads, which can be under local, county, or state jurisdiction. This allowed us to quantity exactly how much right-of-way area is under the various transportation jurisdictions.

Slide: Benchmarking Roadway Land Cover

So within that roadway network right-of-way area, there's about 87 square miles of impervious cover and 46 square miles of open space. The open space provides a basis with which to further evaluate opportunities for green infrastructure.

Slide: Map

So this map shows the multiple watersheds and sub-watersheds within our region. From a water quality standpoint, we evaluated all of the sub-watersheds within the eight main watersheds you see here. We identified all of those sub-watersheds with impervious cover greater than ten percent. Then, with the land use and the land cover data, we were able to identify priority areas of opportunity for green infrastructure implementation. With that we focused on quantifying all of the roadways, publicly owned property, riparian corridors, and parking lots, both publicly owned and privately owned, within these sub-watersheds.

Slide: Visioning Where We Want to Go

So in addition to benchmarking what we have, we spent considerable time gathering input on visioning where we want to go. This included significant huddling around maps to really study opportunities at the local level. We held six task force meetings over two and a half years and many sub-committee meetings. We convened nine stakeholder visioning sessions last summer, with over 300 people attending, over 850 people responded to an online survey, and over 70 elected officials were polled during a SEMCOG general assembly.

Slide: Where Should Green Infrastructure be Located?

So how does this relate to roadways? Well, the results of the visioning sessions and online poll demonstrate that people are interested in implementing green infrastructure along roadways.

Slide: Green Infrastructure and Water Quality

While this may be as simple as street trees, it was also reflected as making the connection to improve water quality. In fact, in both the stakeholder visioning sessions and the public poll, protecting water quality was ranked as the most important benefit of the green infrastructure network. This validates that Michigan is the Great Lakes state, and our residents value and

want to protect this resource. It also further connects green infrastructure to our rivers and lakes.

Slide: Transportation GI Opportunities

So with the benchmark data and the visioning results, we've developed a first cut across the region of roadways to further evaluate for green infrastructure implementation. Our transportation chapter details the types of opportunity that could be available within the right-of-way areas and are listed here. As an example, within the city of Detroit, there's about 20 square miles of vacant land and another 20 square miles of needed demolitions. That is 40 square miles within the 140-square-mile jurisdiction of the city. Much of this area aligns with the Detroit future city planning efforts and can be transformed into green infrastructure. This can include redirecting runoff from larger roadways and the large scale green infrastructure techniques outside of the typical road right-of-way. Finally, SEMCOG's traffic models have identified over 700 miles of roadways that could potentially be downsized. In other words, we have more lanes in traffic, and there are opportunities to further evaluate areas that could go, for example, from five lanes to three lanes or four lanes to three lanes.

Slide: Implementing the Vision - Reduce the Impacts of Roads

We have talked about benchmarking and we have – benchmarking what we have and visioning where we want to go. Now I'd like to talk a bit about implementing the Vision and reducing the impacts of roads. A few of our regional policies are listed here.

Slide: Green Streets Grant - EPA GLRI Funding

One of the projects we were working on while we were developing the Green Infrastructure Vision was our Green Streets grant funded through the EPA GLRI. This project consisted of SEMCOG passing through funding to four of our member counties to implement green infrastructure along roadways.

Slide: Grant Outcomes

The overall project consisted of managing runoff from about 160 acres, the majority of which was roadways. About 30 acres of green infrastructure techniques were constructed, including grow zones and bio-retention areas. Outcomes included reducing annual sediment load by about 27,000 pounds, along with about 20 million gallons in runoff reduction. Finally, we published a document called the Great Lakes Green Streets Guidebook that includes about 26-case studies of roadway green infrastructure projects within the Great Lakes Watershed.

Slide: Oakland County Campus: Background

The largest green infrastructure project funded through this grant was implemented by Oakland County and included extensive conversion of turf areas to grow zone areas within the county campus. Many of their goals focused around addressing ongoing drainage problems in addition to reducing long-term maintenance costs. The top photo is an aerial of the campus area, and the bottom photo is typical of some of the problems they wanted to address with green infrastructure. Much of the roadway network within the campus area drains via sheet flow to these large open areas.

Slide: Project Design

The project design focused on addressing ponding and flooding issues in large, unused mowed areas. These areas have high visibility, with over 27,000 vehicles per day traveling through here. The figures here highlight the 15 individual grow zone areas that were developed as part of this grant project, picking up the majority of the campus-wide roadway runoff.

Slide: Project Pictures (1)

Each of these areas was treated to kill off the turf grass. Drill seeding was used to install native plants in all of these areas.

Slide: Project Pictures (2)

Vegetation included a variety of native plants and took a couple of years to get established. The first year, County maintenance staff maintained the growth at about six inches, while the contractor ensured weed s were not getting established and bare areas were also getting addressed. The second year allowed for full establishment and growth of the grow zones. There was also an extensive public awareness campaign during the first year to help minimize calls to the County from people thinking that they weren't taking care of these areas.

Slide: Project Outcomes

Most importantly, this project really demonstrated how the local county can work cooperatively between departments to really transform an entire campus. In fact, the Facilities Management Team has really taken over the long-term care of these areas.

Slide: Great Lakes Green Streets Guidebook Photo

The final product of this grant was the Great Lakes Green Streets Guidebook. The Guidebook has 26 case studies of green infrastructure techniques along roadways, all within the Great Lakes Watershed.

Slide: Great Lakes Green Streets Guidebook

Additionally, the front end discusses various barriers to implementation but also stresses the importance of thinking about stormwater management early on in any project. This document is available on our website, and the link is shown here.

Slide: Collaborative Watershed & Transportation Planning

The Vision also stresses the importance of making the connection between watershed and transportation planning. In order to bridge the gap between watershed and transportation planning, we're receiving technical assistance from the EPA to answer the question, how much green infrastructure do we need to see a demonstrated improvement in water quality? We applied for assistance in cooperation with three state agencies so that they can further understand their contributions to the stormwater problem. The goal of this project is to use three sub-watersheds in a region to establish runoff reduction targets and identify opportunities for green infrastructure implementation to achieve those targets. This will include a roadway component, and we are working to focus evaluation on planned road improvement projects.

Slide: Collaborative Watershed & Transportation Planning

Finally, MDOT has received funding to do a similar project in our region. It will include defining the MDOT contribution to the stormwater problem within additional sub-watersheds, developing a planning process for them to consider and budget for stormwater early in the process, and identify specific opportunities for planned road improvement projects.

Slide: MDOT: I-75 Corridor Regional Ecosystem Framework

MDOT has also received funding to develop a conservation plan for the 20-year I75 corridor reconstruction project. Michigan Natural Features Inventory and SEMCOG are partners. While this project has just recently started, we're developing targets in priority areas for various ecological indicators which are listed here. MDOT hopes that this template will serve as a baseline for future large-scale roadway projects within the state.

Slide: MDOT: I-75 Corridor Regional Ecosystem Framework Map

The map here shows the location of this I75 project, which is located in the southeast corner of Michigan, in Monroe County, and shows the I75 corridor from the Ohio border, going 20 miles north. The primary focus of the area is hatched in blue, and the brown areas represent the sub-watershed areas that will be used for further consideration for potential wetland mitigation or even upstream stormwater mitigation for runoff reduction.

Slide: Transportation Need Vs. Revenue

So one of our regional policies within the Vision is to advocate for a revised funding structure. There are many aspects to transportation funding, but it's important to note all of the competing needs for this funding, along with the sources of revenue. As stormwater engineers, we can really talk pie in the sky about green infrastructure and the importance of it.

Slide: Road Photos

But when we're dealing with issues such as this, and when local roads departments are dealing with these issues, it's really difficult to get them to think about green infrastructure as a priority.

Slide: Transportation Revenue Shortfall

The revenue shortfall is really due to a number of factors. First, the region has experienced a declining population, which has led to a declining tax base. Additionally, higher fuel economy standards directly impact gas tax revenues, creating further revenue shortfall. So as stormwater engineers, we can't expect the transportation funding to cover green infrastructure implementation. We must move towards looking for other collaborative opportunities.

Slide: Collaborative Transportation Planning

So when we talk about collaborative transportation planning, we need to think about prioritizing where it is critical for roadway projects to incorporate green infrastructure. The target setting that we're working on will help us to prioritize green infrastructure implementation along roadways. Creating partnerships with other departments and other jurisdictions will help

identify overlapping priorities and overlapping projects. For example, we're currently exploring a county road resurfacing project within the city that also has a complete water main replacement plan by the Detroit Water and Sewage Department. This will hopefully include a green infrastructure component as part of their CSO control plan, as well. Looking at park areas to redirect roadway runoff is another activity we're working on. And finally, we're developing strong partnerships with the land banks in order to identify areas where vacant property may be utilized to potentially manage roadway runoff. There's obviously not a one-size-fits-all solution, and we're learning to think more strategically for green infrastructure implementation.

Slide: Thank You

And with that, I thank you very much, and I'll turn it back over to Emily.

Slide: SEMCOG

Slide: Illinois Tollway Stormwater BMPs: Making opportunities of challenges while meeting schedules and budgets

Emily Ashton
So, everyone, let me introduce Bryan Wagner. He's from the Illinois Tollway. Bryan began his career with Illinois Tollway in 2007 as an environmental planner. During his tenure, his primary role has been the agency's lead on 404 and 401 permitting. As part of those efforts, he has permitted over 6 billion in roadway construction and established over 900 acres of land to be protected and restored via permit irresponsible mitigation. Bryan's role will soon be transitioning to the agency's lead for sustainability efforts, which will include the development of a sustainability policy for the Tollway along with overseeing the implementation of Federal Highway's INVEST program. So Bryan, if you guys are ready, you can go ahead and take it away.

Bryan Wagner
Sounds good. Thanks a lot. Can you hear me okay?

Emily Ashton
Yes, we can hear you.

Bryan Wagner
Can you see the screen?

Emily Ashton
Yes.

Bryan Wagner
Excellent. So first and foremost, thank you for the opportunity to present some of our information and initiatives that we're doing up here in northeastern Illinois. It's appreciated, and happy to see that there's a large audience out there for it. Second, not only is it myself that's going to be talking, but also I have Jed Anderson, with Christopher Burke Engineering, who's a consultant for the Tollway, so he'll be speaking on our stormwater BMPs, and also Steven

McCracken, with the DuPage River Salt Creek Workgroup, who will be talking about a chloride offset program that's been developed.

Slide: Illinois Tollway – Key Statistics

So we can get into the meat and potatoes of things, I'll kind of run through these first several slides relatively quickly, understanding we've got a little bit lag. I'll try and provide some time for them to load. But here, first off, we've got the Illinois Tollway. So we've got people all over the country, listening in. Who are we? Where are we? Well, we're a 286-mile roadway network in northeastern Illinois, comprised of four interstates, I88, I-90, 294, and 355.

We first opened in '58 as a bypass around the city of Chicago. I believe we had about 6,000 – just under 7,000 daily vehicles at that time. Now we're up to 1.4 million. And we're a user-based fee system, so all of our projects are self-funded. We don't receive any state or federal gas taxes.

Slide: Move Illinois Program

So the Tollway in 2011 announced a new capital program. It's a 15-year $12 billion program. These projects here that are listed are the kind of meat and potatoes of the program, and it just shows you the size and scale of what they are. And I'll get into three of these, or I'll highlight three of these here as we move forward right now.

Slide: Jane Addams Memorial Tollway (I-90)

First is the Jane Addams Memorial Tollway, or I-90. We're going to be widening – we're in the process of widening and reconstructing this roadway, 62 miles of it. Project began – initial work began in 2012, and it's scheduled to be completed in 2016. We're moving from west to east on this. The western section is a little more rural, and the eastern section you get pretty much into almost the heart of Chicago. So a bit of change throughout the project. It's a $2.5 billion project. Let me move on to the next one.

Slide: Elgin O'Hare Western Access

Elgin O'Hare Western Access, it's a pretty significant project, one of regional and national significance. It's over 12 miles of new roadway that will be constructed in a pretty heavily urbanized area. It's a $3.4 billion project. We'll provide a western access to O'Hare Airport, or provide for a western access to O'Hare Airport, and it will be the agency's first all-electronic toll road.

Slide: Tri-State Tollway (I-294)/I-57 Interchange Project

And last, we have a 294/57 interchange project. This was one of the few areas in the country previously where two interstates crossed each other and didn't have a proper interchange. So in order to fix that, we've got a $720 million project, where we're constructing a full interchange and providing some improvements on the locals, as well, arterials, as well. This one is a partnership between the state DOT, IDOT, and the Illinois Tollway. I guess, to step back on who the Tollway is, we're a state agency, but we're not part of Illinois Department of Transportation. So as you can see, there's a couple phases in this project. We've got a phase

one and phase two. Phase one work started in 2012 and is going to be completed this year. And the phase two is out in the – towards the end of the program.

Slide: Move Illinois Permitting

So the main things that I wanted you to capture in those slides are the size and the magnitude of the work that we're dealing with. We've got roughly 80 miles of roadway that are being either reconstructed, widened, or newly constructed. And as I would imagine the majority of you on this webinar know, there's a fair bit of permitting that goes into that, and these are some of the highlights of that permitting process with respect to 404, 401. We've got six nationwides, two regionals, and four individuals, with a total acreage of impact of about 57, just under 57 acres. So this has been kind of dominating my life for the last two years, for better or worse. I would like to say for better.

Slide: Permitting Challenges

So some of the challenges of the program, like I highlighted, the Tollway instituted the Move Illinois program back in August of '11. This year is our biggest year in the agency's history, and we've got $1.4 billion of work scheduled. So a permitting challenge is definitely having all of my permits in time, or all the agency's permits in time, so we can move forward with the work as scheduled.

Some of the other challenges and which Jed and Steven will be talking about here the next slide and on, not necessarily wetland and waters mitigation, but at the Tollway we do some unique things in that we typically take on permit irresponsible mitigation as opposed to banking. For those of you in the mitigation world that are familiar with it, it's a bit more of a challenge than writing a check to a bank and mitigation is done. So I'll touch on this one a little bit later, as well.

Adherence to BMP requirements, the regional office of Corps of Engineers, as part of their regional permit program, requires stormwater BMPs be a part of any project that they permit under that program. And then also, they look for those same BMPs, or same level of BMPs, in individual permit process. So where, when, how many, all good questions as far as what do we need to document compliance with the regional permit program and individual permits.

And then last is 303(d) listed waters are impaired waters, TMDLs. So we're, as I mentioned a little bit ago, we're in the Chicago land region, and there are few, if any, pristine streams or rivers here. So the majority of them are listed for some type of pollutant or another for being impaired, and working through those impairments or with those impairments and in local groups to figure out ways that we can permit a project and still adhere to those listings has been a bit of a challenge. And with that, I'll turn it over to Jed, who will talk about our stormwater BMP program.

Slide: Stormwater BMP Goals

Jed Anderson

Good afternoon. As Bryan said, the Tollway has a very large program underway, and the Tollway has committed to providing BMPs and trying to be as green of a facility as they possibly can. And consequently, the Tollway asked a consultant to prepare a suite of BMPs that can be implemented on their roadways. These BMPs obviously had to be safe for the

traveling public. If there was an accident and a car did leave the roadway, there couldn't be any damage to that vehicle caused by anything that was installed. It had to be sustainable. It had to be long lived. It had to be something that the Tollway maintenance staff could maintain, could be trained, and without a lot of additional equipment required. It had to be pretty intuitive, to put it that way, for them to do. It had to have a quantifiable net benefit. It couldn't just be green washing. We wanted BMPs that could actually be shown to be beneficial to the receiving waters.

Slide: Pollutants of Concern

As part of this preparation for the BMPs and designing these, we wanted to identify those pollutants of concern.

Slide: How Pollutants are Treated?

So we had oils, total suspended solids, metals, nutrients, and chlorides.

So how are these pollutants treated? Generally speaking, oil is through soil contact, filtering, and capture. We're using absorbent materials. Total suspended solids, through filtering and settling. Metals, likewise, filtering and settling. Nutrients, we're talking like fertilizers, phosphorus, things like that, plant nutrient uptake. Really, ultimately, then the team of consultants that was involved with this decided, if we want to be effective as possible, if we want to minimize the release of contaminants from our site, really the best possible mechanism for doing that is to capture as much runoff on the site as we possibly can, so within those rights-of-way that the Tollway has. So how do we meet that goal?

Slide: Maximize Infiltration

With any structure or facility in northern Illinois you always have to provide stormwater storage, detention, or flood plain storage. Most of these facilities are not designed to maximize contaminant capture. So we wanted to try to modify these designs to maximize their effectiveness. One of those design features that was identified was infiltration, taking the water, putting it into the ground, and that way, minimizing the water that actually leaves the right-of-way. Consequently, infiltration then promotes soil contact, filtering, capture, settling, and nutrient uptake. So you can see from that list, it does treat all those pollutants concerned, other than the chlorides.

Slide: But what about the Chlorides?

So there's two programs being implemented by the Tollway, one that Steve McCracken will speak about in a minute through a program they're working with the Tollway on, but also onsite BMPs, maintenance program changes, things like that, which Bryan touched on a little bit and may also again.

Slide: Design Constraints

So again, we wanted to maximize capture. We want to have these – but we have a series of design constraints. We've got narrow waterways. Most of the right-of-ways are in urban area. It's not easy to widen them. So we've got that issue. We've got land acquisition being, even for temporary easement purposes, it's a very lengthy process. So it's not easy to acquire property

to increase the surface area that we have to place these BMPs. We're generally working, in northern Illinois, on fairly flat ground, so there's not a lot of topography. So containing it onsite is sometimes an issue. We generally have clay, silty clay soils. So again, if we're talking about infiltration, I know the first question is, well, you're not going to get a lot of infiltration. But any infiltration we get is beneficial, and we do have places where there is significant sand and gravel deposits, so we might be able to also infiltrate into those areas. But again, any infiltration, from our perspective, is beneficial because it ultimately results in a net reduction in the amount of water that leaves the site.

Slide: So…where do you do it?

So given these limitations, think about any highway. You've got miles of green space on the shoulders and the rights-of-way. So let's take that green space, and let's maximize the filtering and infiltration capabilities of those areas. So step one of a suite of BMPs – and you'll see as my presentation goes on, we decided to attack this from a lot of different directions, as many different directions as we could to minimize that runoff on the site. So the first one was let's maximize the residence time of the water that's in those swales along the right-of-way. So we're going to install bioswales.

Slide: Bioswale Types (1)

So for the I-90 project that Bryan talked about, which is 62 miles long, about half of it is urban, about half of it is very rural. So these details I'm going to show you are specifically for the rural section. Bryan, are they also for the [Off mic comment] Okay. So for the urban section they've been modified. So these three I'm going to show you are from the rural cross-section. So you'll see at the bottom – hopefully it shows up on your slide, on your screen – these are typical sections that gave the designer a guidance on where to place these. So this is – because we had something like six different engineers involved, each designing a different section of that 30-something miles of the rural section.

So in this case, Type 1 was for situations where you're less than three feet above the groundwater. So you're not going to get a lot of infiltration. It's going to be more of a wet situation. But we did have an engineered soil to capture and retain a certain amount of water below the ditch line.

Slide: Bioswale Types (2)

Type 2 was for those areas about three feet -- above three feet and below five feet above the groundwater. Again, it had engineered soil to capture and retain a certain volume of water below the ditch line.

Slide: Bioswale Types (3)

And then the last type was one where we were greater than three feet above the groundwater table, but this was a slope that was very flat. Those other two ditch lines generally had probably a one percent grade. This one would be less than .5, so basically very flat. So we added an underdrain system to it to keep it from getting too wet and soggy in there. In all cases, these areas will be planted with native vegetation.

Slide: Bioswale Design

So again, depending on the slope, where we got situations where there were one to inches of slope – or one to two percent of slope – we wanted to pond the water about eight to 12 inches deep in general in these ditch sections. On a one to two percent slope, to do that, you'd end up having a ditch check about every 25 feet. So any slope that was greater than two percent, we – there were no bioswales actually put in because of just the difficulty and the number of structures that would be required.

Slide: Bioswale Ditch Check Evolution

So in the course of the project -- I think Bryan mentioned I294 -- they did a pilot project of I294. I think it was something like five and a half miles of bioswale that was installed. In the upper left-hand corner was a ditch check that had an orifice, a pipe that ran through the ditch check to let the water pass through once it reached that ponding level. It was decided that, as we all know, leaves litter end up in right-of-ways, Big Gulp cups end up in right-of-ways, a lot of things end up in the right-of-way that could plug that orifice. So that was abandoned for the ditch checks that are shown on the right side of the screen. So it's more of a sluice situation. Again, it's designed to pond water about eight to 12 inches deep, and then once it hits that point, it spills through that sluice down to the next one. And that's what was used on the I-90 project.

Slide: Furrows

Okay, again, we still have more green space. Now we've handled the bottom of the ditch line, but there's still more room. On the embankments, we all know that the water hits the embankment and runs down very quickly down the slope, down to the ditch line. But we could do something to that slope. We can break it up on contour. So we call them furrows. Some would call them probably level spreader swales. Essentially, they [audio breaks]

Emily Ashton
Hey, Bryan, this is Emily. We aren't hearing you. I'm not sure what happened.

Bryan, can you hear us?

Slide: Furrows Sketch

Slide: There is still more that can be done! Water Quality Volume

Bryan Wagner
These four vertical (inaudible) above that at the ditch line. There's still more we can do. Again, there is a water quality bond that we could capture. So we've got the ditch lines, we've got the infiltration through that. We've got some of the sub-base in those ditch lines. But we can still provide additional stormwater capture. That would – the term we're using here is water quality volume. It's water quality capture. Some would also call it a stay-on rate.

Slide: Stormwater Quantity

So locally, using O'Hare Airport as a guide, if you had a .6-inch rainfall, that equates to roughly 80 percent of the storms are equal to or less than that volume. A .9-inch rainfall equates to 90

percent of the storms would be at or less than that. So you can see, you can capture a fairly small rain event and end up equating to a significant number of those events. A two-inch storm, if you capture that amount, you would have roughly 98 percent of all storms in Chicago O'Hare Airport area.

Slide: Water Quality Volume (1)

For the I-90 project, it was decided, since it's a – for the rural section, it was decided that we would use a .5 or .75-inch, so three-quarters inch of rainfall event, would be the capture of the water quality volume. That translates into about an 88 percent rainfall, less than -- 88 percent are less than or equal to three-quarters of an inch.

Slide: Water Quality Volume (2)

For the Elgin O'Hare Western Access project, that project is in an existing, very urbanized area. It's on the west side of O'Hare Airport. We decided that one and a quarter inch rainfall capture would be used. So again, that correlates into about 98 percent of all events at O'Hare Airport are less than or equal to that. Again, this – theoretically there would be zero discharge from the site with lesser events, meaning zero discharge of surface water pollutants, including chlorides. We want to stress, again, this is theoretical. We had many, many technical conversations about this.

Obviously, if it rains three days in a row, your volume is probably – already been used by the rainfall events. But again, if you had a week without rain, most likely your water quality volume basin would have drained down, and you would have, technically, zero discharge in that situation. So if you averaged it over the long haul, you are going to have a very effective removal of concentrations of contaminants from the receiving bodies of water because you're going to have zero discharge in some cases.

Slide: Water Quality Volume – Where are we putting it?

So where are we putting it? Like I said earlier, part of the bioswales, it's below the ditch line in the sub-base. Within detention ponds, in many cases, it's a four-bay or its additional storage below the normal water line of the pond. Due to O'Hare and the constraints of O'Hare Airport with regards to wildlife hazard zones, the water is actually being stored in vaults or it's being stored in a stone sub-base within the detention ponds.

Slide: But wait, there's more

There's still more room. We still have – and again, we were trying to attack this from many different directions. So wherever we're below an embankment, along near a ditch line, the manholes and the catch basins were designed with open bottoms, and the sub-base to those catch basins was made deeper than normal. So the bottoms of the basins would leak out – the water would leak out into the outer lying aggregate. One thing that we had to remember to do is -- these basins would be vector truck cleaned on occasion, so there was a metal screen separating the aggregate from the catch basin so the vector truck wouldn't suck the stone up.

Slide: And finally – Native Vegetation

Finally, the Tollway previously used, essentially, salt-tolerant grass from right-of-way to shoulder of pavement. That was changed over to the first 20 feet, where you do get that highest impact of salt, and then low-profile prairie grass in the upland areas and bioswale native seed mixtures are used in the wet locations.

Some other things that were done just to maximize, again, soil water contact, underdrains that were captured – again, if we're going through urban areas -- rural areas, you're going to have quite a few underdrains. Those underdrains were cut back and day lighted about a hundred feet upstream of wetlands and waters just to have a good filtering action. In certain locations, floc logs, where we had sediment coming out, are used to minimize fines. And then, interestingly enough, with using recycled concrete, those fines in that recycled concrete can raise the pH of the water, and so shock logs, pH shock logs were installed to rebalance the pH levels in that waterway. I'm going to turn it over now to Stephen McCracken.

Slide: Chloride Offset Program

Steven McCracken
Thanks, Jed. So I'm going to be talking about the chloride offset program. I'd like to introduce the organization that worked with the Tollway on this. It's called the DuPage River Salt Creek Workgroup. I'm going to be referring to that acronym a few times during this presentation. It is a group of wastewater agencies and MS4 districts that are working to meet the goals of the Clean Water Act in some of the watersheds surrounding some of the transportation projects that Bryan described earlier.

This presentation, I'm going to be talking specifically about the Elgin O'Hare Western Access, so that's what I'm referring to in the presentation as the EOWA project. The reason we're focusing on it is the chloride offset program is most developed for that particular project, but this program will be extended to the I-90 project as that develops.

Why have a separate program for chloride? Well, a lot of the other pollutants that we're looking at are hydrophobic, meaning that they're attached to particles and correlate very well with suspended solids. Chlorides are not like that. They're a dissolved ion, so a lot of the traditional means of removing pollutants don't work with them.

Slide: EOWA And DRSCW Area Map

So this is the project area. You can see the EOWA project on the top right-hand corner. It's that horizontal T shaped, black icon. This – it goes into the area where the DRSCW works in two of its watersheds, the Salt Creek Watershed and the West Branch of the DuPage River Watershed that I have located there. Both Salt Creek and West Branch have a total maximum daily load for chloride that was approved in 2004. Additional to that, a lot of the work that we were doing was looking at getting compliance with the aquatic life goal of the Clean Water Act, and we carried out a causal analysis in 2010 which had identified chloride as being one of the major stressors stopping us from attaining the aquatic life threshold. And I've mapped out the sample points and what the aquatic life was like in those basins, how you can see it's nearly wholly failing to support that aquatic life use.

Slide: Problem Analysis

Agencies in this area have been working very aggressively during the last seven, eight years to reduce chloride. So when this program came along, we were very interested about what the chloride management would look like. So when this project was developed, we sat down with the Tollway and we did some calculations together about what it would take to make this project meet the goals of the TMDL, which, of course, is no net increase in discharge of pollutants to the listed waterway. The project looked like it was going to be putting it – and once again, these are based off certain assumptions about the severity of winter weather, the number of storms, and we used observed application rates from the Tollway and the Illinois Department of Transportation. And it appeared that EOWA would be releasing – that is what we call the ICP in this graphic -- would be releasing a little under 4,000 tons of chloride – of sodium chloride, actually – a year. And for our area, that translated to about a 1,482 tons. And once again, these estimates are based off certain assumptions.

Slide: Concept

What would it take to get to the no net increase? Well, it's a two-step process that we are putting in place. The first one is the Tollway will review their current practices and will look for areas where they can reduce the amount of salt that they're applying to the roadways while maintaining their current level of service. And that is estimated, based on our best analysis, at about 20 percent of that total we were looking at. So how are we going to deal with that remaining 80 percent of that increase? Well, the Tollway is putting in place a grant program that will be available to those communities that we're referring to as Tier 1. Those are communities that are either adjacent to or are being spanned by the – sorry, immediately upstream of the EOWA project. And what those communities would do was they would look at delivering their current level of service, but they would do it more efficiently due to training and equipment upgrades. Additionally, the Tollway and the DRSCW agreed that we would aim for a one to 1.25 offset. Part of that is just due to the inherent fuzziness of some of the figures when we're dealing with the rather chaotic discharge of chlorides due to highly variable winter weather.

Slide: Project Area and Tier 1 Municipalities

This is a blow-up of the EOWA project and those Tier 1 communities. These are the communities, once again, immediately upstream or adjacent to the EOWA project, and you can see the EOWA there is in the chevroned icon. A couple of things to note here, this is simply not a math offset. We're not just looking at taking the total amount of chloride entering that watershed and then offsetting it at 1.25. What we're actually doing is we're boiling it down to a finer resolution than that, as you can see. Just to the south running parallel to the roadway, there is another river there. That is Spring Brook. It's a tributary to Salt Creek. That particular – we're dealing with it on a sub-watershed level, so we're looking at how much extra – what's the marginal increase in pollutants being released to that waterway, and then we're looking to offset that chloride increase at that level. So we're dealing with a much finer resolution as opposed to just trying to offset the total tonnage.

Additional items to note is that some of those communities do spill outside of our area. As you can see there, Elk Grove Village and Bensenville with that description. Those communities are looking at – speaking specifically about Bensenville -- producing a uniform level of service so that they will be looking at putting together a plan to deal with that offset for the whole village.

And obviously, in this particular case, it's not an issue because that also – the area outside of Salt Creek Watershed also corresponds to the EOWA footprint. The last item to note here is that the Tollway is in no way dictating the level of service that these villages will offer. What we are looking to do is to make targeted investment to allow them to deliver a more efficient winter operation which will maintain their current level of service. That level of service detail rests completely at the village's discretion.

Slide: Activities

So how do we achieve these offsets? Well, this is done in a number of ways, and I've set these out here, through one to nine. These are in increasing level of sophistication as we move up, and there's a couple of them there that I want to pay particular attention to. Number two, salt spreader calibration, is a large one, and that's simply taking existing equipment and making sure that it's properly calibrated to apply whatever compounds we're using. I'm also going to look in a little more detail at number four and number nine, which is pre-wetting and anti-icing.

Slide: Treated Vs. Untreated Salt at 25 mph with a Conveyor System (Pre-wetting)

This is a graphic which was produced by the Michigan DOT in 2012. It corresponds to a lot of other studies that have been done by departments of transport, and it's looking at a pre-wetted compound being applied to the road versus an on-treated compound. And when I say treated, that means pre-wet. And essentially, that's the application of a liquid to the solid prior to it going on the road. And this could be done at the Public Works Department, actually in the yard, or it can be done at the tailgate of the vehicle.

As you can see here, we have a much higher, about a 15 percent – I'm sorry. The columns that we're looking for the salt to be in are the zero-to-four-feet column. That's an eight foot column. It's four feet either side of the exit point on the vehicle. And that is really where you want the salt to remain.

As you can see here, we can have about 15 percent more of the salt remained on that surface when it was a pre-wetted material. As we move to the outer part – as we move away from those columns, it becomes less and less effective. As you can see there, when we get out to 12 to 24 feet, the pre-wetted compound, none of the salt was found, at 25 miles an hour, to have reached that part of the road, but about seven percent of the salt on the on-treated compound was present.

So right away, what this graphic shows is you could drop your application rate in the region of 15 to 20 percent. You'd eliminate a lot of that salt ending up in your curb or your swale area, and you would actually maintain the level of service, have approximately the same amount of salt actually on the driving surface, which is where it's needed for safety purposes.

Slide: Anti-icing (liquids applications)

The other BMP that was being used to hit these goals is anti-icing. This is different to the previous one. This is direct application of liquid to the road prior to the storm, and that's a critical point. This is not done during a storm or after a storm. This is done prior to the storm. And it's done like this to stop ice from bonding to the pavement. This essentially eliminates a lot of the call-outs that municipalities have. For example, if there's icing on the road and it doesn't bond to the pavement, vehicles can still safely drive on that surface. So that means

you don't need to have a full scale call-out of your anti-icing operation. This mechanism has been shown to make reductions in actual salt use by in the region of 40 percent.

Slide: Evaluation

This slide is to take into account that this year, over this winter, we've been setting baselines for each of those Tier 1 communities and for the Tollway, looking at current practices and documenting it clearly so we can see what kind of reductions we enact over the next five years. The other thing is villages, of course, are gearing up to document for the Tollway what their training and – developing their plan for how they're going to draw on those grant funds. And the final part is the DRSCW and the Tollway are collaborating and putting together an in-stream monitoring program. This would use continuous conductivity monitoring to look at the amount of chlorides. So we set the baseline this year, which maybe was an excellent or very poor choice, depending on your point of view, and then that monitoring will sort of allow us to evaluate how well the program acted or how will it performed. And with that, I am going to hand back over to Bryan. Thanks for your attention.

Slide: Other Design Initiatives

Bryan Wagner
All right. Thanks, Steve. Thanks, Jed. I appreciate it. Steven was keeping track of time, and he was right on ten minutes, so good job. I know we're pushing it to the limit here. I don't know of any other way to really function than pushing it to the limit, being in the type of work environment that we've been in, but I'll kind of move through these relatively quickly and try and summarize everything.

So the challenges and opportunities, early in my – the title of the presentation was challenges and opportunities. So challenge number one is permit schedules to meet the overall program schedule. By May of this year, anticipate having the final individual permit for the scheduled work at this time. Therefore, we will allow for about $6.6 billion of work over the next five to ten years.

Secondly there, establishment of new partnerships. With every large program or even small program project, you're going to face challenges. So don't try and tackle those yourself. Look for partners. And with the Move Illinois program, we've established four formal partnerships with agencies here in the region via inter-governmental agreements, and those are for wetland mitigation -- I'll touch on that here in a second -- one Memorandum of Understanding with the DuPage River Salt Creek Workgroup for the chloride offset program, and then the other opportunity that's been provided to us is that we now have a uniform suite of BMPs for our designers to choose from and for Tollway maintenance to maintain.

Slide: Move Illinois Environmental Efforts

So some of the highlights of the Move Illinois program, our environmental highlights, just so it's not green washing, these things are actual practices. So by the completion of the program and completion of the Elgin O'Hare and I-90, we'll have 67.2 miles of bioswales throughout the system. We'll have 5.7 miles of those in-line infiltration boxes where we don't have the right-of-way to construct a bioswale. We'll have approximately 130 new acres of stormwater detention. You know, Jed talked about the Elgin O'Hare Western Access, the water quality volume being

a little bit higher there. Water quality volume is a little bit higher there because, one, it's an ultra-urbanized area. And two, there's some flooding concerns. So that higher water quality volume and this additional detention will help abate any potential flooding from the roadway.

The 3,000 tons of salt offset is specifically for the – or reduction or offset -- is specifically for the Elgin O'Hare. I-90, we're going to be implementing a similar practice, and then it's pretty well known that, once we start seeing the results of these new adopted practices, we'll institute them system-wide. So not only will there be 3,000 tons of salt removed from the DuPage River Salt Creek watersheds, but compound that from a 286-mile roadway network and improving our – one of our operations and reducing chlorides system-wide.

And then the last environmental effort there is – earlier, I said we had just under 57 acres of wetland and waters impact. Now, granted, we don't need 755 acres of wetland mitigation, but to offset those 57 acres of impact, we will be protecting and restoring approximately 755 acres of land, and those 755 acres will largely – by and large, probably about 90 percent of them, be going to the local forest districts via those IGAs that I talked about, so just over a square mile of land.

Slide: On Time and On Budget

So how do we do this? How do we get on time and on budget projects of this scale and magnitude? Number one, from the get-go, anticipate challenges when planning. I know we like to think that this one will be easy. They're never easy. Anticipate challenges. Know they're going to be there. Define those challenges early, and convey that to your management so you can get buy-in from them. You know, there was a question earlier on, how do you convey BMPs and the importance of them to your management? By and large, it's permit compliance. So if you don't want to be sued or open yourself up to potential of being sued, then don't do them. But if you want to be a good steward of the environment and ensure that you're following all applicable laws and regulations, well, you institute them. So define those challenges, convey that to your appropriate management, and make sure they understand what they are at an early time in the process.

Create work groups. One thing – a typical practice for us as part of our programs and larger initiatives is that we go out and meet with advocacy and resource groups to hear what their concerns are. By and large, in this area, with respect to the highway, it's stormwater and the treatment of stormwater and chloride. So by working with those resource agencies and advocacy groups, we're able to establish partnerships with the DuPage River Salt Creek Workgroup that will help us offset tons of chlorides being introduced to our watersheds on an annual basis.

Establish conservative planning budgets. That's pretty key because you establish those budgets early on and make sure they're conservative, and then it limits your risk of overruns in the future.

Ensure that you've got win/win scenarios. So in the case with the DSRCW, it's a win/win scenario in that we are helping that group further their mission in improving and protecting the water quality of the streams in their area, and then also it's a win for us in that we, number one, we're getting our permit in time for construction so we don't have delays. But then, number two, we will be finding ways to reduce our usages and save money in the long run. With the intergovernmental agreements, those are win/win scenarios. With the wetland mitigation, we

design our wetland mitigation sites with public use in mind and construct them as such. So there's trails on them; there's restroom facilities that don't impact the mitigation. And then we provide that, along with the restored land, to the local forest preserve districts for use of the land – win/win scenario.

And then the last is, from our experience, larger programmatic changes assist in minimizing budgets down the road in the long run. So Jed mentioned, in the first slide that Emily had, there is a picture of the north tri-state bioswales along I294. That was a retrofit project that we did about five years ago or four years ago. And the cost of that project was pretty high because it was a retrofit. Now, with making these programmatic changes and implementing these on a system-wide basis as part of our normal construction contract, we're not seeing any cost differences due to this different type of ditch than what you had in the past. They're out there grading, regardless. They're going to be seeding, regardless. It's just a little different type of grading. It's a little different type of seed. And so, yeah, we're not seeing large impacts there.

Slide: Thank You

And I believe that's it. And if I can, I'll go back and address one comment that – or question that came in earlier about water getting to sub-base. So the leaky infiltration boxes that we have, we're designing those in areas where we have sand and gravel seams that abut the sub-base or come up close to it. So we don't have water just pooling in those areas. So those infiltration boxes are being designed with connecting to those seams and for water to move away from that roadway foundation as quick as possible. So that sums it up for us. Thank you very much for the opportunity to highlight our initiatives, and I'd love to answer any questions.

Slide: Speaker Contacts

Emily Ashton
Okay. So in the last about ten minutes here, we are going to do a Q and A. I'm going to open the line back up to Bryan and company and Kelly, and Rachel, Marcel, and Susan are also here. So the first question I'd like to ask Kelly and Bryan is: "Have either of you had projects that involve off-site mitigation?" And let's go Bryan first and then Kelly.

Bryan Wagner
Yes, the majority of our projects are, I guess, what you would technically say or call off-site mitigation. And I think that's been at least the directive or direction that the agencies, the regional and federal offices have been going, as well. We don't really want a mitigation project -- at least the Tollway doesn't really want a mitigation project directly adjacent to its road. We understand that the water quality and the environmental agency most hospitable to (inaudible), and in trying to achieve the performance standards that are necessary to get mitigation sign-off, we typically go off site. So that's where we do our partnerships, with the local resource agencies being the forest preserve districts. In northeastern Illinois, or in Illinois in general, forest preserve districts have – or each county has a forest preserve district or a conservation district. And they're there to preserve and protect land, and they're pretty significant groups throughout the region. So we partner with them for our off-site mitigation, and we do permit irresponsible off-site mitigation for our projects, typically.

Emily Ashton
Thanks, Bryan. Kelly, do you want to – do you have anything to add about projects with SEMCOG that have involved off-site mitigation?

Kelly Karll
We haven't been involved with specific construction projects with off-site mitigation, but I would add that, as part of the phase two program, the new permit is going to include opportunities to do off-site runoff reduction opportunities, and that's something that we're working with our members on to look at where some of those opportunities might exist, where roadways won't be able to do it within their own road right-of-way.

Emily Ashton
Great. Thanks, Kelly. We had another question for Bryan and Steven. A lot of folks were finding the chloride reduction program very interesting. There was a lot of questions on it. One question that was asked was: "Does this program also reduce the movement of metals from the roadway into the environment?"

Steven McCracken
I'll hazard an answer at that. No, I would say the BMPs described by Jed would be the ones that would principally deal with metals. Metals are often bind up in small micron total suspended solids. I think that's the main area that we'd be capturing the metals. The program itself is mainly just aimed at a source reduction of chlorides. I'm not aware that there's – there's some arsenic, et cetera, which is, of course, a type of metal. There's usually not the clumping agent with sodium chloride, but it's not really a significant portion of it.

Emily Ashton
Okay, great. Thanks, Steven. Another question we had – I'm trying to get as many as possible in here from the audience – a lot of people were asking about maintenance. So I wondered, "Does anyone have any lessons learned in terms of maintenance in the right-of-ways?"

Bryan Wagner
Yes, we do. So with our original bioswale project on 294, on that one we partnered with a local forest preserve district, Cook County Forest Preserve District, and were utilizing their land for those bioswales. As part of that project and partnership, we have certain performance standards that we have to meet for those bioswales. So there's a fair bit of maintenance that – I say fair, but there's some vegetative performance standards that have to be achieved on that project specific that are beyond the capabilities of our roadway maintenance staff. And I would argue – I would imagine that they're beyond the capabilities of most typical roadway maintenance staff in that it requires specific plant ID and knowing how to treat certain invasives, what time of the year, when to do it, things along those lines.

With respect to actual physical maintenance of bioswales, largely what we're seeing and anticipating is that, once you see the system isn't functioning anymore as far as moving water along – granted, it's at a slower rate than it was. It's still designed to convey water. Once that water is permanently ponded, you're going to have sediment build-up in some location, and then you just simply go in there and (inaudible) those sediments and replant and – yeah, essentially replant and blanket that area, seed blanket, plug, whatever it may be that area. And that's kind of the basic maintenance approach to them.

With respect to long-term maintenance, I don't know if it was necessarily implied in that question or not, but as part of the north tri-state project, we have a contract with the state geologic survey, the Illinois State Geologic Survey, and they're doing water quality and quantity monitoring of the bioswales. And they'll be doing that for an unknown amount of time. By contract right now and agreement, it's a five-year process or a five-year period in which they're doing it. But we're really interested to know how long these things function to their design capabilities. So we'll keep them under contract for an indefinite amount of time, having them conducting long-term monitoring of them to see, okay, when do these bioswales or these systems essentially reach their kind of "saturation point" and are no longer functioning as designed? Presumably, it's kind of once they sediment -- fill with sediment, but is there some other trigger that occurs? So long-term maintenance is, I guess, to be determined. Worst case scenario is you go back in and reconstruct one, excavate those soils out and reconstruct. A lifetime for that or timeframe for that, another good question. I would anticipate it being under 15 years. But all to be determined.

Emily Ashton
Thanks. I wanted to bring it back to Kelly if you had some additions to the maintenance question.

Kelly Karll
As it relates to the grow zones that we were talking about, if you're going to do something along those lines, make sure you have a contractor maybe for a couple of years past the installation, like the native plant contractor, to come out and ensure that all the areas get established and you're not getting a lot of invasive species coming in and they can take care of those. And, you know, open counties really learned that -- they've maintained that contractor at the same time the facilities folks are learning to take care of everything themselves.

Emily Ashton
Okay. Great. Thanks, Kelly. So we're almost out of time. I think I'm going to go ahead and wrap it up here. I want to thank Rachel and Marcel, Susan, Kelly, Bryan, Jed, and Steven for joining us today and all of our participants for listening in and really hanging in there. We really appreciate it. And we're going to follow up about having a re-recording, and we'll let you know. I also wanted to thank our participants who registered for their input on the future webcasts because we're really going to use this list that you provided to explore future topics for this series. And with that, I'm going to go ahead and end the webcast for today. We really thank you for joining us.