Course Abstracts

guidebook

The conference agenda and session abstracts will be available on your mobile device utilizing the Guidebook application. Download Guidebook in the App Store (iOS) or Play Store (Android). Once you finish downloading the app, search for the conference or scan the QR Code to access the agenda and build your own customized schedule for the conference!

NOTE: Due to the size of this documented printed versions will **not** be provided at the conference. If you would like a hardcopy, please print one prior to your arrival at the conference.

Tuesday, October 4

Conference Tracks	Room
Construction SW	Plaza North
Program Management	Plaza South
Industrial SW	Red Carpet
Stormwater/Wastewater	Green Country
GI/LID	Great Plains

General Sessions	Century Ballroom
8:00 am - 8:45 am	
Opening Plenary and Sponsor Welcome	
David Garcia, Water Division, EPA Region 6 *Scott Thompson, Executive Director, ODEQ* *Dr. Kim Jones, Institute for Sustainable Energy and the Environment, Texas A&M University Kingsville*	
8:45 am - 9:00 am	
Welcome to the City	
Mayor Mick Cornett, City of Oklahoma City	
9:00 am - 10:00 am	
EPA Update	
Deborah Nagel, EPA HQ	
10:00 am - 10:15 am	**Break**
10:15 am - 11:15 am	
The Art of Managing Stormwater	
Barry Fagan, AL DOT	
11:15 am - 12:15 pm	
Charles River Phosphorus TMDL Development	
Newton Tedder and Mark Voorhees, EPA	
12:45 pm - 1:45 pm	**Lunch**
1:45 pm - 2:45 pm	**Room**
TX Breakout	Century Ballroom
AR Breakout	Great Plains
LA Breakout	Red Carpet
NM Breakout	Plaza South
OK Breakout	Plaza North
3:00 pm - 4:00 pm	**Room**

Developing Raw Land into a Finished Subdivision — Plaza North

Ben Kennedy, Ty Clanahan, Rausch Coleman

Our company is diligently working with the Oklahoma Department of Environmental Quality Storm Water Division to find new and innovative ways to meet water quality standards. This presentation focuses on the different BMP's being used by leading developers in the industry today. It highlights the BMP's found to be most effective throughout the different phases of development. The primary focus of this presentation is on a subdivision simultaneously undergoing home construction in the 3rd phase, and land development in the 4th phase. Some of the BMP's addressed in the presentation include barriers, swales, inlet protection devices, spill containment devices, and erosion control devices. Proper documentation and the methods found to be most effective are also discussed.

Financing Stormwater/ Floodplain Projects Through the CSWRF Program — Plaza South

Kathy Koon, Oklahoma Water Resources Board

Abstract

Interagency Coordination on Industrial Stormwater Violations — Red Carpet

Carrie Evenson, City of Norman
Rebecca Dallen, City of Oklahoma City

In June 2015, Oklahoma Department of Environmental Quality (ODEQ) received a citizen complaint alleging an unpermitted discharge from an oil/water separator at a gas station in the Oklahoma City area. Personnel from both ODEQ and the City of Oklahoma City's Storm Water Quality (OKC SWQ) group worked together to investigate and address the situation. In this presentation, we will discuss interactions between ODEQ and OKC SWQ on citizen complaints, non-compliance and illicit discharge referrals, unpermitted facilities, and fish kills. The June 2015 complaint will be used to illustrate this cooperative working relationship and to acquaint the audience with how both ODEQ and OKC SWQ conduct complaint investigations and enforcement activities. Topics to be discussed include the following:

i. Origination through citizen complaint to ODEQ
ii. ODEQ initial site visit
iii. ODEQ referral to OKC/ODEQ conclusions
iv. OKC initial site visit (NOV & Compliance Order)

v. OKC Multiple revisits
vi. 2nd NOV & Compliance Order
vii. Appeal process
viii. Show Cause Hearing/results
ix. Agreement to obtain OKC permit
x. Ongoing improvements & initial impact to site area
xi. Future Goals
xii. Current Status as of October 2016

Through this presentation, the audience will learn the benefits of interagency interactions, how a non-traditional permittee may be handled in a Phase I MS4, and the importance of perseverance despite difficult beginnings.

Tampons: A Cost-Effective Method to Detect Sanitary Sewer Infiltration in the MS4 — Green Country

Casey Nettles, Cody Whittenburg, City of Forth Worth

Established methods for detecting sanitary sewer infiltration of the storm sewer system have many drawbacks. Among them are: time required for incubation, cost of analysis, and cost of equipment. Proxy indicators of sanitary sewer infiltration, such as testing for the presence of caffeine, share some of these drawbacks. However, optical brighteners, a common additive of detergent cleaners, are proposed as an indicator of sanitary sewer infiltration that overcomes theses drawbacks. Initial work by other researchers requires use of a fluorometer to analyze a grab sample. Because optical brighteners fluoresce under ultraviolet (UV) light, a UV light box can be employed to determine the presence of optical brighteners on sample media. Investigators deploy unbleached cotton sample media at various MS4 outfalls where prior E. coli sources were inconclusive. After drying sample media, the presence of optical brighteners are used to suggest a sanitary sewer infiltration into the MS4. Subsequent remote camera inspection of the storm and sanitary sewer systems indicate sanitary sewer pipe failure. Efforts eliminate of a source of pollution. Research into methods for field deployment of sample media is described. This includes: sample processing, media exposure time, and detection limits. Methods demonstrate a tool for illicit discharge detection and elimination (IDDE). Sample media is inexpensive and readily available. This, combined with the lack of any chemical reagents needed for sample processing and analysis, allows multiple samples to be taken at a very low cost. If used in conjunction with more traditional bacteriological testing, greater efficiencies are realized. Investigators are able to distinguish that elevated bacteria levels are likely sourced from sanitary sewer infiltration as opposed to other sources (e.g., wildlife, pet waste).

Design Thinking: Focusing on End User to Improve Green Infrastructure Functionality and Performance — Great Plains

Anthony Kendrink, Construction EcoServices

Low-impact development (LID) is an economical and effective strategy for protecting and restoring coastal water quality by preventing polluting stormwater runoff and reducing peak-flow discharge. It does this by mimicking a site's natural surface water and groundwater hydrology. LID has become increasingly popular in Texas, Oklahoma, and Louisiana where it is used to reduce detention volume, maximize land for development, and improve water quality. The most significant barrier to implementing this design approach is premature sedimentation during construction and lack of maintenance.

Design thinking is a concept that focuses on the end user and their capabilities for long-term maintenance of water quality systems. Lessons learned and feedback from the designers, contactors, and maintenance contractors must be incorporated into the overall design process, creating a constant feedback loop that strive to improve functionality. A valuable lesson that is a direct result of this design approach is reducing the risk of Green Infrastructure (GI) systems. Permeable pavement and bioretention systems can easily become clogged during construction. Even if they are adequately protected from sedimentation, lack of maintenance can cause these systems to go into bypass after 1 or 2 years. In order to reduce the risks of failure, designers can use performance-based specifications that make these water quality systems "contractor proof". Harris County and The City of Dallas have already implemented performance specifications in their LID Design manuals, and more and more areas of the country are favoring this design approach.

BMP Case Study: Bioretention

The City of Fort Worth is constructing a new Field Operations Facility using Low Impact Development and GI. The original design used high risk BMPs used to manage stormwater runoff from an 11-acre site. The City decided to value engineer the high risk BMPs with High Flow Biofiltration systems which increased reliability and reduced the footprint of the filtration bed, resulting in more than $60,000 of cost savings in construction and maintenance. This project will demonstrate how Design Thinking can be used to cut construction costs, reduce the risks associated with GI, improve system reliability and resilience and maintenance simple for the end user.

BMP Case Study: Permeable Pavement

The City of Houston and Harris County have strict detention requirements, forcing developers to rely on conventional detention ponds which increase development costs and lower lot yield. The engineers

for Eastern Commons used an innovative approach for stormwater detention through the use of Permeable Articulating Concrete Blocks (PACB/M) and a High Performance Biofiltration System (HPBMS). By integrating the use of Green Infrastructure and conventional underground detention, the end user increased their lot yield, improved water quality, and prevented downstream flooding.

4:00 pm - 5:00 pm	Room

Interdepartmental Cooperation to Identify Planned Construction Activity within a MS4 — Plaza North

Eric Mason, Teressa Cooper, City of Forth Worth

The TPDES Construction General Permit is issued by the Texas Commission on Environmental Quality (TCEQ). It establishes regulations for the minimization of stormwater pollution from constructions sites. Both large construction sites (disturbing more than 5 acres) and small construction sites (disturbing between 1 and 5 acres) must be permitted. Fort Worth amended its ordinance to require all construction sites larger than one acre to apply for a separate, city-issued grading/fill permit. Environmental review and approval requires submission of a Stormwater Pollution Prevention Plan (SWP3), Notice of Intent (as required), construction site notice, and grading and erosion control plans. Multiple departments review project grading/fill permit applications before a permit is issued. Interdepartmental collaboration occurs between the following departments: Planning and Development, Water Utilities, Transportation & Public Works (Stormwater/Floodplain Management), and Code Compliance (Environmental Management). Through this collaborative process, progress has been made to assure all required reviews are complete. Components are integrated through engineering criteria and standard specifications, and staff across departments remains aware of projects. MS4 stormwater construction inspectors work closely with code enforcement officers to identify unpermitted fill and grading sites. Sites may be obscure or environmentally-sensitive (i.e., located along streams or drainage channels), so identification is important to ensure proper management and MS4 compliance. The process of requiring grading/fill permits has been a bridge between many departments, each with its own needs and requirements. Interdepartmental review fosters cooperation and leads to better regulatory compliance and customer service in Fort Worth.

Increasing Your Drainage Utility Fee, A Practical Discussion — Plaza South

Howard Redfearn, City of Mansfield

Local governments responsible for implementing a Stormwater Management Program are always looking for avenues of funding. The City of Mansfield in Texas has had a Drainage Utility Fee in place since 1996. The original purpose was to provide revenue to complete detailed flood studies for all waterways with an existing FEMA floodplain. Over time, the needs placed on this revenue have grown, and it has been amended on multiple occasions. This presentation will be a short history of those changes, justifications, and a detailed discussion of the most recent drainage utility fee increase completed in November of 2015. The discussion will include laying the groundwork for the fee increase, determining amount of increase needed (including planning for future expenses), selling the increase to management, and dealing with the fall out once the increase hits the books.

Industrial Stormwater Success Stories: From Clueless to Superstars — Red Carpet

Kerri McCabe, ADEQ

My presentation will focus on actual inspection cases where sites and operators were grossly out of compliance; but as a result of a thorough inspection, facilities gain a better understanding of permit conditions and achieve compliance ("before and after" scenarios). It will track a few inspections from start to finish, but incorporate common violations or misunderstandings of the general permit (IGP, MSGP), which ranges from SWPPP completeness, outfall location and sampling, to effective structural/non-structural control measures. The information will be applicable to all states within Region 6.

There will be a handful of inspection cases provided; and during the presentation, general information regarding the IGP/MSGP will be provided. This will tie in an educational aspect for new regulatory personnel and current permit holders. Also, it will complement the Industrial Stormwater 101 course provided at the conference.

Stormwater-Wastewater Nexus: Compliance Planning to Avoid Enforcement — Green Country

Stefanie Albright, Nathan Vassar, Lloyd Gosselink Rochelle & Townsend, PC

This presentation will outline the increasing interconnected nature of stormwater and wastewater issues for the regulated community. Similar issues in Water Quality compliance, planning, and enforcement provide important lessons as communities consider ongoing and future permitting and compliance challenges. The presentation will examine recent trends in enforcement, and will also outline tools that regulators have provided that may assist the regulated community in their efforts to support compliance while funding improvements in a responsible (and affordable) manner.

Urban Stormwater as Art- — Great Plains

The Aesthetic Value of Stormwater Treatment Design

Qing Luo, Michael Holmes Oklahoma State University

Sustainable stormwater management approach can be done through many practices, including rain gardens, bioretention areas, bioswale, permeable paving, etc. The various practices have been done in many parts of the United States and internationally. This paper uses built urban projects in the northwestern region of the USA and international wide as case studies to introduce how to turn a stormwater conveying from an engineering process to artwork. The conclusion is sustainable stormwater management projects can be designed as visually pleasing creations to showcase the image of the city, and educate the public to raise awareness of sustainability.

5:00 pm - 7:00 pm **Exhibit Hall**

Vendor Reception

Wednesday, October 5

Conference Tracks	Room
General Session	Century Ballroom
BMPs	Plaza North
Program Management	Plaza South/Green Country
Stormwater Management	Red Carpet
GI/LID	Kiamichi
GI/LID Project Competition	Century Ballroom
Stormwater 101 Field Inspections	

8:30 am - 10:30 am **Room**

2016 EPA Region 6 Outstanding GI/LID Project Competition: Presentations to the Judges — Century Ballroom

8:30 am - 11:45 am

Stormwater 101

City of Oklahoma City and ODEQ

Construction stormwater field inspections

8:30 am - 9:30 am **Room**

Healthy Landscapes and Soils Promote Clean Water & Healthy Streams — 18th Century

Kyle Wright, USDA NRCS

The cause and effect relationship that frequently occurs in watersheds as well as the connectivity between the different areas on the landscape will be discussed. How many of the problems we face in stream and riparian areas are actually being caused by issues occurring further up the slope in upland area. Special emphasis will be placed on the connectivity and complexity of these issues.

The importance of healthy soils will be discussed. The health of these soils and their microorganisms should be an integral part of every project. As we work to improve the health of the ecosystems around us we need to be mindful of the health of the soils below our feet as these are the very foundation our work stands upon.

Healthy soils can improve infiltration and water holding capacity, which reduces the potential for excessive runoff, and in turn reduces erosion. Additionally these waters move slowly through the soil profile and seep into our creeks and streams as return flow or move further through the profile into aquifers. As an added bonus, water that is filtered through soil is much cleaner that water that runs off the surface. Additionally, healthy soils are integral to a properly functioning nutrient cycle. Active diverse populations of soil microorganisms work to cycle nutrients from organic matter into a form that is readily available for plants at the time that they need them.

MS4 Program Evaluations-Observations from National Field and Office-based Assessment Efforts — Plaza South

Bobby Jacobsen, PG Environmental

For the past several years, much progress has been made assessing MS4s across the country under EPA's National Enforcement Initiative. As a contractor to EPA, PG Environmental and Eastern Research Group (ERG) have supported numerous field and office-based MS4 evaluation efforts throughout the United States. As the universe of MS4s continues to grow and permit limitations continue to evolve, it will be beneficial to streamline efforts to assess MS4 programs. During this session, PG/ERG will describe its traditional onsite MS4 inspection approach, as well as recent desktop-based assessment efforts conducted in several regions. During the presentation we will highlight several observed MS4 program implementation trends and discuss ideas for future assessment efforts.

Use of Benchmark Monitoring Results to Prioritize Industrial Stormwater Inspections — Red Carpet

Teressa Cooper, Casey Nettles City of Forth Worth

Benchmark monitoring is performed by permitted industrial facilities to assess the effectiveness of stormwater pollution prevention plans. As of 2016, there are 125 permitted facilities within the City of Fort Worth required to complete annual sampling for benchmark parameters. Using an online database, Fort Worth is able to maintain records of benchmark monitoring results. The database is also used to track all inspections, violations and corrective actions for

each permitted facility. In order to enhance Fort Worth's industrial compliance program, benchmark monitoring results and inspection outcomes from 2013-2015 are compared. Analysis seeks to determine if benchmark results are useful indicators of permit violations to aid in prioritizing inspections. Inspection reports for facilities that exceed at least one benchmark parameter are reviewed. If inspection violations are noted, the type of violation is categorized to allow trend analysis by exceedance type. Types of inspection violations include the following categories: best management practices, good housekeeping, periodic inspections, quarterly City of Fort Worth- Industrial Stormwater Abstract 2 visual monitoring, records, and training. To determine if distributions of categorical variables, benchmark exceedances and/or inspection violations in each of the 6 categories differ significantly from one another, a chi-square test is performed. The strength of the relationship between permit violations and benchmark monitoring exceedances is determined by the value of the correlation coefficient (Pearson's r). Results from this statistical test may allow staff to prioritize inspections based on previous inspection history and benchmark monitoring results allowing maximum utilization of limited resources for industrial inspections.

What You Need to Know to Construct A Green Infrastructure Practice: Green Infrastructure Construction and Inspection — Great Plains

Troy Dorman, Tetra Tech

Design of Green Infrastructure or Low Impact Development (LID) practices is only the first step inmanaging stormwater runoff. If the practices are not properly constructed and maintained they will not function as they are designed. Maintenance of green infrastructure and LID practices has been widely discussed however, little guidance has been provided on properly constructing or inspecting the construction of green infrastructure or LID practices. There are many variables, including construction practices and material delivery, that can have a significant impact on the performance and function of green infrastructure practices. For example, compaction of the subgrade can have a significant impact on infiltration and overall performance of bioretention areas and permeable pavement and should be avoided. Materials used in construction can also have a significant impact. It is important to have a trained person onsite who can determine if the gravel used in the drainage layer has been washed and free of fines and if the bioretention soil media contains the amount and quality of organic material specified in the construction documents.

This presentation will give a brief overview of the proper phasing of construction, inspection of materials upon delivery, a multitude of proper construction practices, and field testing and verification to ensure green infrastructure and LID practices are properly constructed and function as they are designed. The focus will be on specific construction mistakes that have been observed to be made consistently by contractors and how inspectors and resident engineers can prevent those mistakes from occurring on their projects. Simple metrics that contractors and inspectors can use to verify that the materials that are delivered, including the bioretention soil media, drainage stone, pervious concrete, pervious asphalt, and mulch, meet the specifications required in the construction documents. Methods for field verification and testing, including testing the infiltration of the subgrade and a simple test to verify the infiltration capacity of pervious concrete or porous asphalt will also be presented along with a schedule of when the acceptance testing and verification should be performed. The combination of proper construction techniques, materials that meet construction specifications, and field verification and testing should result in green infrastructure and LID practices that perform and function as they are designed.

Tetra Tech, in cooperation with NC State University staff, has developed a program for the San Antonio River Authority (SARA) to train and certify contractors in the construction of green infrastructure and LID practices. This presentation will be based on materials used to develop SARA's program and condensed to the time allotted. Case studies from construction projects across the country will be incorporated to provide specific examples of lessons learned, the impacts of improper construction techniques, and how to ensure that the practices function as they are designed.

9:30 am - 10:30 am — **Room**

Sediment Retention Best Management Practice for the Tijeras Arroyo Watershed, Albuquerque, New Mexico — Plaza North

L. Brad Sumrall, Weston Solutions Inc.

The Middle Rio Grande Valley, which includes Albuquerque, New Mexico, is regulated under a Watershed Based MS4 permit issued in December of 2014. This permit has specific provisions requiring development and implementation of sediment management programs for all of the 16 permittees within the watershed. The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), as one of the permittees, continues to develop and construct flood control and storm water quality structures throughout the City to address MS4 permit requirements. The Tijeras Arroyo, located along the southern border of the City, flows westward from the

Sandia Mountains and discharges into the Rio Grande. Encompassing over 100 square miles of semi-developed watershed, this arroyo generates large quantities of sediment due to its sparse vegetative cover, particularly from within the confines of Kirtland Air Force Base and the Sandia National Laboratory complex, a Department of Energy managed facility. Weston Solutions has designed a large scale sediment retention structure capable of capturing up to 50,000 cubic yards of material that is typically generated on an annual basis. The design was verified through both computer based digital modeling and a 1:60 scale physical model constructed at the University of New Mexico Hydraulics Laboratory. The physical model results clearly demonstrate the system efficiency and hydraulic behavior of this multiple basin system capable of handling the 100-year design storm and the Standard Project Flood required for U.S. Army Corps of Engineers certification. This presentation will report the results of the digital modeling produced in Flo2D® and the physical model operation at various flow rates. The project is scheduled for construction in the fall of 2016, after the local monsoon flood season.

Phase I MS4 Audits: State and Local Perspectives — Plaza South

Michele Loudenback, ODEQ
Raymond Melton, City of Oklahoma City

Oklahoma Department of Environmental Quality (ODEQ) began evaluating its municipal separate storm sewer system (MS4) programs in 2006. Oklahoma has two Phase I MS4s and had 43 Phase II MS4s at the time. ODEQ began by auditing the Phase I MS4 programs and gradually brought in the Phase II MS4 programs. In November 2014, ODEQ conducted the second audit of the City of Oklahoma City's Phase I MS4 program. In this presentation, we will discuss the audit process from both the ODEQ and OKC SWQ points of view, lessons learned, and how MS4s can prepare for their own evaluations.

Economics as a Screening Tool For Green and Grey Stormwater Solutions — Red Carpet

John Williams Mikel Wilkins, John Wise, John Parker, Impact Infrastructure, Inc.

As projects get more complex, engineers must adjust to new paradigms. For example, LID, Green and Grey stormwater management solutions are often difficult to compare. A growing number of consulting engineers are choosing to apply Cost-Benefit, LCCA, and Triple Bottom Line and Resilience analysis to calculate returns on investment (Financial ROI as well as Sustainable ROI) associated with stormwater management alternatives available. The session will focus on applied experience with practical and accessible economic tools that helped engineers determine value of public benefit for a range of project stakeholders.

City of Bixy Roundabout LID — Great Plains

Jared Cottle, Bea Aamondt, City of Bixby

As part of the installation of a gravity interceptor sanitary sewer through a City Park (Bentley) and an oblique street intersection (148th& Riverview) in Bixby, the intersection was reconstructed as a single lane roundabout with Low Impact Development measures at its center. The intersection reconstruction and LID practices presented the opportunity to address:

- Traffic Safety
- Environmental and social impacts

The geometric layout of a roundabout incorporated:

- Bio-retention facility to treat storm water runoff
- Permeable pavers to reduce runoff volumes

The design considerations included:

- Subsurface soils (sandy loam) in the 148th& Riverview area (locally predominate for sites adjacent to the Arkansas River)
- First flush flows (at a 90% confidence interval) from the intersection and adjacent, fertilized Park areas are intercepted and transferred to the Bio-retention/Rain garden facility
- 100-year storm event capacity for sizing Bio retention overflow storm sewer and permeable pavers to maximize the runoff percolating back into the native, sandy soils
- Plant selection for environmental conditions, social impact, and public awareness

Post-construction performance analysis was conducted for:

- Bio-retention elements
- Permeable pavers
- Storm sewer system
- Plant selection
- Facility maintenance

10:30 am - 10:45 am — **Break**

10:45 am - 11:45 am — **Room**

Additives for Stormwater Filters: What Works, What Doesn't, and What is Still to be Learned — Plaza North

Glenn Brown, Oklahoma State University

Stormwater filters are a wide class of structures including large bioretention cells and small filter boxes. Each is designed to intercept stormwater and filter the majority of the flow volume before it is released to the receiving surface waters. While generally effective for particulates, filters have had mixed effectiveness for solutes. In some cases it has been shown that filters actually increase the concentration of nutrients. Thus, there has been a steady interest in filter media additives that will increase the retention of one or more pollutant. A somewhat bewildering range of materials have been

proposed including compost, iron filings, waste water residuals, and biochar. This presentation will review and summarize a large number of additives that have been reported in the literature and provide guidance to those considering using them. Recommendations will be solute specific and based on both contaminant transport theory and demonstrated results.

Application of Rapid Bio-Assessment in Fort Worth' s MS4 Program Plaza South

Cathy Matthews, Cody Whittenburg, City of Forth Worth

The Texas Pollutant Discharge Elimination System Phase I stormwater permit has several options from which to choose to fulfill the requirement of stormwater monitoring. One option is to participate in the Regional Wet Weather Characterization Program. Another option is to have a Representative Rapid Bioassessment Program. The City of Fort Worth participates in a Regional Wet Weather Characterization Monitoring Program through the local Council of Governments (North Central Texas Council of Government, NCTCOG). Fort Worth's individual monitoring program includes performing rapid bioassessments on representative streams within six watersheds twice per year, with a minimum of two sites per stream each sampling period. The six watersheds encompass approximately 51% of Fort Worth's jurisdictional area. On each monitored creek within the watershed, three sites are selected for sampling: an upper reach site, a mid-reach site, and a lower reach site.

Fort Worth's individual monitoring plan also includes wet weather characterization at sampling locations adjacent to or at the same location as the upper and lower reach sites of the bioassessment sample sites, depending on site characteristics. Since Fort Worth has a comprehensive bioassessment sampling regimen, the wet weather characterization sampling is reduced.

Fort Worth's bioassessment sampling consists of assessing habitat, physical and chemical parameters, and benthic macroinvertebrates. As stream conditions and resources allow, fish community assessments are conducted on the most downstream site of each sampled creek. Bioassessment sampling programs can be based on guidance documents and tailored to fit any MS4. Collecting bioassessment data as part of the stormwater monitoring program allows for better determination of the overall health of local streams.

Stormwater Management and Stormwater Quality for Green Infrastructure Linear Roadways and LID Parking Lots Red Carpet

Wililam Murphy, ASP Enterprises

We will present design, installation and maintenance information that will appeal to municipalities (esp. MS4s), consulting engineers (public and private) and contractors for a number of stormwater management and stormwater quality solutions to achieve affordable and sustainable green infrastructure (e.g. linear roadways) and low-impact development (e.g. parking lots). Introduction to creative solutions for a variety of stormwater applications. Identification of stormwater goals for urban, suburban and rural communities. Explanation of practical solutions that regulators can replicate to reduce infrastructure costs and to reduce maintenance costs while supporting water quality efforts (reduce TSS, N, P). Examples of successful projects for each of the applications presented supported by photos and project data. More in-depth technical information available upon request following the presentation.

Evaluating Low Impact Development Best Management Practies for Urban Stormwater Management: A Paired Watershed Approach Great Plains

Brandon Holzbauer-Schweitzer, University of Oklahoma

The Trailwoods neighborhood (Norman, OK) includes two instrumented watersheds (each approximately 2.5 acres) for evaluation of low impact development (LID) best management practices' (BMPs) effect on storm water quality and quantity. The control watershed, Trailwoods East (TE), utilizes traditional storm water management while the treatment watershed, Trailwoods West (TW), includes rain barrels, rain gardens and permeable pavement. The toe of each watershed includes a trapezoidal flume for determination of volumetric discharge rates, an event-activated autosampler for collection of composite storm water samples and a tipping bucket rain gauge. In addition to precipitation and discharge rates, total suspended solids (TSS), trace metals, and nutrients (nitrogen and phosphorus compounds) were monitored. To grasp an understanding of the financial impacts of LID BMP implementation a brief study on the pertinent ecosystem services was completed. This provided relevant economic knowledge that will serve as a basis of support for utilization of these sustainable practices. A total of 10 storm events were captured, with precipitation intensity ranging from 0.48 to 2.64 in/hr. LID BMPs decreased mean volumetric discharge rates by 54.05 ft3/s or 28% and maximum rates by an average of 1.24 ft3/s or 37%. Mean nitrate-N concentrations were decreased by 0.72 mg/L or 67% and mean TSS concentrations were decreased by 33.70 mg/L or 49%, when comparing TW to TE watersheds. Unexpectedly, mean dissolved reactive phosphorous (DRP) and total phosphorous (TP) concentrations increased when comparing TW to

TE watersheds by 0.02 and 0.19 mg/L respectively.

Overview of Community Based Public-Private Partnership (CBP3) Approach for Green Stormwater Infrastructure — Century Ballroom

Adele Cardenas Malott, EPA

11:45 am - 1:30 pm — **Lunch**

Keynote Speaker: — Century Ballroom

Dr. Anand D. Jayakaran

1:30 pm - 5:00 pm

Stormwater 101

City of Oklahoma City and ODEQ

Industrial stormwater field inspections

Field Trip A

City of Oklahoma City's Central Maintenance Facility and Household Hazardous Waste Collection Facility

Field Trip B

Trailwoods GI/LID Demonstration Project in Norman, OK

Field Trip C

Precure Nursery and LID and City of Oklahoma City Parks

Thursday, October 6

Conference Tracks	Room
General Session	Plaza Ballroom
BMPs	18th Century
Program Management	19th Century
Public Education	20th Century
Advanced Topics	Green Country
GI/LID	Kiamichi
GI/LID Design Standards	Red Carpet

8:00 am - 9:00 am — **Room**

Working in Tree Protection Zones (TPZS): What to Look for as an Inspector — 18th Century

Sarah Davis & Kathy Davis, City of Springfield, MO

Tree preservation is becoming a more common component of a good sediment and erosion control plan. In this presentation, we will discuss how to select a good candidate, what BMPs are adequate for preservation, and how to minimize the damage of the construction process. When they know what to look for, inspectors can play an important role in a successful tree preservation project.

Based on a case study in Springfield, MO, this presentation will highlight some important things to look for when dealing with tree preservation on a construction site. Trees are valuable for erosion control and stormwater management, among many other social and economic benefits, and preservation should be encouraged when reviewing Stormwater Pollution Prevention Plans (SWPPPs). In the plan review stage, look for healthy trees that do not necessarily need to be removed. Consider design changes that can be made, such as adjusting pavement material, curving sidewalks, boring to install utilities, etc. Once an ideal candidate has been selected, what best management practices (BMPs) are adequate for protecting the tree? Often the most important BMP is communication. Make sure that the site superintendent and his crew are well aware that the tree is dedicated for preservation. There is a difference between retention and preservation. Many contractors can retain trees which die off within a few years, but with proper consideration and effort, trees can be preserved. We will discuss proper installation of fencing, as well as protocols to follow when work must occur within this zone. When conducting inspections, fencing should be inspected the same as any other structural BMP. We will cover a variety of construction activities which can damage trees and discuss practices which can be used to minimize damage. On permitted sites, subcontractors should be notified of the SWPPP, including any trees which are designated for preservation. In this case study, this did not happen, resulting in damage to the tree, a 36" diameter pin oak we called "Chester". We will also cover a variety of techniques which can be utilized to remediate the damage and improve the tree's response to stress post-construction.

Of course, a certified arborist should always be consulted when making decisions regarding retention and removal, but as an inspector, you are often the feet (and hands and eyes and ears) on the ground who can make the calls which will improve the chances for long-term success.

Management of Lafayette Regional Airport MS4 Program — 19th Century

Ashely Simon, Lafayette Regional Airport

Alex Sheffield, CK Associates

The Lafayette Regional Airport (LRA) is a co-permittee with Lafayette Consolidated Government (LCG) under a Phase II municipal separate storm sewer system (MS4) permit. The LCG MS4 program received the first National Municipal Stormwater and Green Infrastructure Award for Phase II Program Management in 2015 presented by the Water Environment Federation and developed through a cooperative agreement with the U.S. Environmental Protection Agency.

LRA is a full-service regional airport with commuter and scheduled mainline air service for the City of

Lafayette, Lafayette Parish and the Acadian region. The LRA property consists of 1,300 acres, with about 600 acres located within LRA perimeter fence and includes runways, taxiways, hangars, and buildings for aviation-specific purposes. LRA also has numerous tenants conducting various commercial and industrial activities across the remaining 700 acres. LRA focuses on good housekeeping, managing soil disturbance activities, and eliminating illicit discharges. LRA accomplishes this through an education and outreach program for its employees, its tenants, and the public. LRA's efforts are supplemented by a rigorous inspection program to evaluate control measure effectiveness.

This presentation will provide an overview of the MS4 permitting program at LRA; describe the control measures utilized; review examples from the inspection program and how the inspections have demonstrably improved stormwater quality; and project how the MS4 program will emphasize construction stormwater management as the LRA embarks on a new terminal construction and infrastructure improvements over the next five years.

Public Outreach Programs in Oklahoma City (Phase I MS4) — 20th Century

Andrea Shelton & Rebecca Dallen, City of Oklahoma City

Public Outreach is a required and very beneficial component to any stormwater program. If your residents and permittees don't know what's required and expected, then they can't help you be in compliance! In this presentation, we will discuss the multiple avenues of outreach performed here in OKC, including the following:

a. Public Schools and Universities
b. Wayne Drop, our mascot
c. Neighborhood Association meetings
d. Curbs to Creeks (curb markers) program
e. Adopt-A-Street program
f. Press releases
g. Water bill inserts
h. Local festivals and events
  i. Earth Day/Earth Month
  ii. Environmental Awareness events at businesses
i. "Downstream" quarterly newsletter via email
j. COSWA (Central Oklahoma Storm Water Alliance)
i. "Everyday Environmentalist" radio ads
ii. Rain Barrel promotions
k. Newspaper ads
l. Movie theatre ads
m. Construction workshops for permittees
n. Industrial workshops for permittees
o. "Hands-on" helpful approach taken by all SWQ supervisors and staff
  i. Industrial inspectors assist with permitted facilities' employee training as requested
p. Industrial award program for outstanding permittees

Through this presentation, the audience will learn the benefits and many avenues of Public Outreach performed here in OKC, a Phase I MS4.

Utilizing Advanced Technologies for Stormwater System Mapping and Condition Assessments — Frontier

Noelle Gaspard, RJN Group

Aging stormwater infrastructure is one of the biggest challenges facing communities today. With portions of the City of San Antonio's stormwater collection system approaching 80 years old, a comprehensive understanding of the condition and location of the existing system was needed.

This presentation will provide an overview of the Pilot Phase of the Stormwater System Televising, Mapping and Condition Assessment project initiated by the City of San Antonio in 2015 and provide information about the technologies used to complete the project.

Summary of Project

The City had two main goals they wanted to accomplish with this project: (1) to complete a thorough field survey, video inspection and condition assessment of the storm sewer infrastructure and (2) to develop a geospatial database, using GIS, which integrates the storm sewer schematic with all supporting data. The City selected a pilot area and required that the initial pilot phase of the project be completed with an accelerated timeline of 5 months. Advances in technology have dramatically improved traditional methods for gathering data in the field – in order to complete the project within the required timeframe, innovative data collection and analysis procedures were utilized to complete the outlined tasks of the project scope.

Designing with Nature-Compost-Based BMP Designs for Green Infrastructure & LID — Great Plains

Britt Faucette, Filtrexx International

Urban planners, engineers, and architects require standard specifications and design criteria for sustainable best management practices that can be implemented in the rapidly growing fields of green infrastructure, green building, low-impact development (LID), and sustainable site development. This presentation will introduce project planners, designers, regulators, and technical professionals to these concepts through as many as 20 different organic, recycled, bio-based BMPs for construction and postconstruction stormwater management scenarios. Building on concepts of biomimicry, natural capital restoration, and ecosystem service

enhancement, attendees will learn how environmentally sustainable materials use natural processes to achieve high performance results, and how these practices can be easily designed into any plan. "Designing with Nature" will emphasize how to engage and excel in green infrastructure and building projects from concept to design to implementation. It will provide information on how the outlined BMPs fit into and contribute to LEED Green Building Credits (3.0), restore predevelopment hydrology in LID projects, meet total maximum daily load (TMDL) guidelines, and reduce development site carbon footprints. Applications include sediment control, inlet protection, slope protection, sediment trap, stormwater reduction, vegetated walls, bank stabilization, and rain garden. The presentation will also report on a USDA-ARS study which recently evaluated the performance of Filtrexx® SiltSoxx™ (compost filter socks) in reducing runoff flow transport of sediment and soluble pollutants on hill slopes, relative to conventional sediment control devices such as silt fence.

Making LID Practical with Standard Details — Red Carpet

Jennifer Wasinger, Boris Minot, Thomas Caffarel, Trey Shanks, Freese and Nichols

Low Impact Development (LID) has emerged as a highly innovative and effective approach to managing stormwater quality at the source and as a means of better mimicking natural hydrology. While many cities are excited about LID techniques, many developers and engineers are afraid of the unknown. The City of Dallas has identified the need to develop LID standard details in order to ease those fears and to ensure sound design and construction of LID applications. Freese and Nichols (FNI) in coordination with Hayden Consultants have researched several applications such as bioretention planters, bioswales, tree boxes, enhanced vegetated swales and permeable pavers. We have used that research and our interaction with several City departments to create eight standard details that provide clear implementation guidelines to contractors and engineers. Furthermore, FNI is in the process of organizing LID training workshop to further mentor the City staff in the operations and maintenance of the LID facilities. Emphasis will be put on understanding maintenance requirements and conveying the message of LID to the public.

9:00 am - 10:00 am — **Room**

How Can Urban Forest Systems Augment Your Stormwater Runoff Mitigation Program — 18th Century

Eric Kuehler, USDA Forest Service

Forests have been shown to reduce stormwater runoff and pollutant loading. Urban trees, vegetation, and the soil in which they grow collectively make up the urban forest system. Urban forests in our municipalities can be managed to help reduce urban stormwater runoff and provide additional co-benefits to improve the quality of life for residents and visitors. This presentation will detail the most current research regarding trees and stormwater runoff including volume reduction through interception and transpiration as well as effects of trees on pollutant loading. The presentation will also review case studies in Arkansas and Oklahoma that have used urban forest systems to help reduce stormwater runoff. Lastly, effective urban forest management strategies will be detailed to help stormwater managers augment their stormwater runoff mitigation programs.

TxDOT Statewide MS4 Permit — 19th Century

Adrienne Boer, TxDOT

TxDOT previously managed 34 Phase I and Phase II permits throughout the state; however, TxDOT is now moving to one statewide individual permit to cover TxDOT's regulated area for the entire state of Texas. The advantages of the statewide permit include cost savings through streamlined annual reporting, consistent program implementation statewide, and a focus on program areas in which TxDOT can be most effective. The presentation will explore the TxDOT statewide MS4 Permit, highlighting key areas of focus for the 5-year permit term and the tools being developed to meet the permit goals.

Engaging the Public in the Development of New York City's Stormwater Management Program — 20th Century

Mikelle Adgate, New York City DEP

With 520 miles of shoreline, the waterways in and around the five boroughs of New York City are among the City's greatest assets. The New York City Department of Environmental Protection (DEP) has invested billions of dollars in sewer and wastewater treatment plant upgrades and as a result, the New York City harbor is cleaner than it has been in more than a century of testing. Community outreach and public participation has been a critical component of these successes, and thousands of New Yorkers enjoy their local waterways.

On August 1, 2015, New York City was issued its first Phase I MS4 permit. Therefore, the City is now actively developing its Stormwater Management Program (SWMP), identifying measurable goals, and collaborating more than ever before in the pursuit of reducing pollutant discharges into and from its Municipal Separate Storm Sewer System (MS4).

DEP is delegated to coordinate and submit the MS4 permit deliverables to the New York State

Department of Environmental Conservation (NYSDEC), but all City agencies covered by the permit are responsible for implementation and compliance. As of April 2016, DEP has submitted two required deliverables and continues to collaborate with various City agencies to meet set deadlines.

This presentation will focus on two components of New York City's SWMP: Public Education and Outreach, and Public Involvement and Participation. The Education and Outreach portion will highlight the relevant programs, partnerships and public education and outreach initiatives defined to date, including the assessment of an inventory of existing programs to determine how MS4 information can be incorporated, as well as new initiatives being explored.

The Involvement and Participation portion will describe the strategy for involving multiple stakeholders throughout development of other SWMP components that impact design, construction, industrial, commercial, and water recreation groups. As such, the collaborating stakeholders include city agencies, state, federal, and local communities, academia, non-profit, professional, and private entities. Constant input and participation from all of these target audiences will help form the final SWMP Plan and identify measurable goals for annual reporting moving forward.

E. coli Removal by Pleurotos Ostreatus Mycofilter in Simulated Wet Environmental Pond — Frontier

Patrick Chavez, AMAFCA

Storm water quality has been a growing topic of concern for many agencies in recent years. The United States Environmental Protection Agency (EPA) considers nonpoint source pollution, including storm water runoff, to be one of the most important sources of contamination of the nation's waters. Some of the principal contaminants found in storm water runoff include heavy metals, toxic chemicals, organic compounds, pesticides, herbicides, pathogens, nutrients, sediments and salts. All of these contaminants are discharged into surface water areas without being treated. In fact, stormwater runoff has been referred to as the water quality issue of the day. Contamination of surface waters is an environmental concern for both human and ecosystem health. Bioremediation is a nonconventional method of treating stormwater. Mycofiltration is a best management practice (BMP) that has recently been introduced into the stormwater quality community. Mycofiltration is the use of fungal mycelium as a natural mitigation approach to stormwater pollution. Mycofiltration has been proven to reduce Escherichia Coli (E.Coli) in previous stormwater research studies. The current study tested the treatment effectiveness of mycofiltration to reduce the concentration of E. Coli after repeated exposure to synthetic stormwater in a simulated wet environmental pond setting. The results of this study showed: 1) that the mycofilter reduced the concentration of E.Coli at the water surface; and 2) the long-term potential of Pleurotus Ostreatus mycelium adaption in a pond setting.

Modeling, Design, and Construction of a Commercial Low Impact Development Retrofit — Great Plains

Troy Dorman, Tetra Tech

The San Antonio River Authority is at the forefront of watershed sustainability in the San Antonio River Basin. Through education, outreach, design competitions, an LID technical manual, and most recently a project to codify LID for the City of San Antonio, SARA has led the advancement of LID on many fronts. SARA's commitment to sustainability extends to their facilities throughout the region as evidenced by their program to construct and monitor LID stormwater control measures (SCMs). SARA has constructed a rain garden at their technical annex to capture and infiltrate roof runoff. A recent reclaimed water tank and pump station site included a bioretention area to capture and treat the 90th percentile storm from the impervious surfaces. The most visible project is a retrofit of SARA's headquarters office located on the San Antonio Riverwalk. Even though there are no specific treatment requirements in San Antonio, SARA has collected water quality samples to identify pollutants that could be washed into the river. Tetra Tech is designed this first of its kind project in San Antonio which targets specific pollutants of concern. The project which is located in a historic district and an overlay zoning district required meetings with City ofSan Antonio development Services, the Office of Historic Preservation, and the City Arborist. This session will

1. Explore the modeling and optimization analysis that led to three alternative plans.
2. Discuss the design process that adapted to internal organizational preferences and met city codes.
3. Show construction inspection practices that ensured a successful project.
4. Talk about the monitoring plan that was implemented as part of the 319 grant funding for the project.

Life's a RAINGarden, Ya Dig?: The Development of City of Dallas LID Standard Details — Red Carpet

Jennifer Smith, Hayden Consultants, Inc.

Low Impact Development (LID) is becoming increasingly desirable in large metropolitan areas with increasing impervious surfaces and water quality issues. In metropolitan areas that are almost

completely built-out, opportunities to incorporate LID are often limited to urban retrofit projects. The City of Dallas, the 9th largest city in the U.S. with a population of 1.3 million and covering 385 square miles, is no different. In order to encourage the use of LID elements in design and construction, the City of Dallas decided to create a set of standard LID details. These city-wide standard details may be utilized by consulting engineers, city staff engineers, and contractors to uniformly transform the metroplex by incorporating additional pervious surfaces to improve storm water conveyance and quality. The scope to develop eight (8) LID standard details includes a training workshop for City of Dallas staff, as well as maintenance and review checklists for each detail to cover design review and inspection during construction. The project team, led by Hayden Consultants, Inc., chose the following LID elements for which to develop standard details: Bioswale, Curb-side Planter, Mid-Sidewalk Planter, Intersection Curb-Extension (Bulb-Out), Mid-Block Curb-Extension, Enhanced/Vegetated Swale, Tree Box Filter (Single), Tree Box Filter (Series), and Public Signage. All 8 details will be featured on a Placement Diagram to illustrate how each LID element interacts with typical right-of-way surroundings. Each detail is described on its own sheet(s) with each sheet including a plan, profile, and section views of the entire LID feature, as well as the design components relevant to the detail.

Specifications are also provided for each detail which include the purpose of the LID feature, designer guidelines, general notes, construction notes, and design components to be designed by the engineer. The specifications are designed to meet local integrated Storm Water Management (iSWM) requirements. iSWM is a program developed by the North Central Texas Council of Governments (NCTCOG) to provide requirements for water quality protection and flood mitigation. Although parameters are provided, the project engineer is required to design each LID feature to suit the requirements of each project. These details are shown to meet local standards and create more innovative stormwater approaches rather than traditional curb and gutter.

As recommended in the Institute for Sustainable Infrastructure (ISI) Envision Rating System, Hayden consulted with City of Dallas engineers about relevant community needs, goals, and issues. Discussions with a stormwater maintenance company and City of Dallas project managers from various departments included lessons learned, successes and failures from previous projects involving LID elements. Of the projects Hayden reviewed, the recent project on Elm Street in the art and entertainment neighborhood of historic Deep Ellum in Dallas was reconstructed as a green street project. Upon reviewing construction plans and walking the completed green street, Hayden determined important lessons learned and areas for improvement for the new LID standard details.

The construction and management training course is underway and will be presented to all City staff involved in LID design, construction, and maintenance in the Summer of 2016.

10:00 am - 10:15 am	**Break**
10:15 am - 11:15 am	**Room**

Erosion Control Methods — Plaza North

Beyond Silt Fence

Trish Morris, Ideal Homes

Controlling sediment on active job sites is nothing new. However, the way we can control unwanted run off is. Many people feel if they slap up some silt fence their problems are solved, but as we have seen especially in Oklahoma this is not the case. Silt Fence is quickly beat up by the Oklahoma wind and can be costly and time consuming to keep maintained. There are many items on the market that we, at Ideal Homes are proving to be much more effective, both in time and in money savings. Over the last few years we have been experimenting with products such as compost, compost filled socks, Flexamat, and Durawattle, just to name a few. These products have already proven in many cases to outperform silt fence and let's be honest they also look much more appealing than silt fence. This presentation would take you though many of our test cases and how we are using these products to improve our neighborhoods as they are being built in.

I have A GIS and Asset Data, Now What? — 19th Century

Tristan Nickel, RJN Group

You have a GIS database that gives you a visual representation of your assets supported with asset attribute data. What next? How can you use this valuable information to develop a cost effective approach to a maintaining sustainable infrastructure. RJN Group, Inc., utilizing the Innovyze InfoMaster product, leverages existing GIS and asset attribute data (manhole and pipe size, age, material, condition, etc.) and applies sophisticated predictive analytics to build realistic capital asset management-based capital plans.

An effective infrastructure planning tool supports critical decision making to ensure that the "right" pipes/assets are selected for rehabilitation at the right time. RJN has worked closely with clients including the City of Fort Smith, Metropolitan Sewer District of Greater Cincinnati, and the City of San Antonio to build programs that utilize a quantitative grasp of factors likely to induce failure to formulate a targeted approach for rehabilitation, repair and renewal

planning. Our approach uses a customized six-step process to build a valuable asset management tool that can drive our client's ongoing capital planning. The ultimate goal is to provide the intel to ensure that the budgets are spent where they are needed. Our process involves setting up a database, importing inspection data/field data, conducting "consequence of failure" and "likelihood of failure analyses", performing risk analysis and building a "decision tree" process that will result in comprehensive action plans.

My paper will discuss each of the six steps and the tasks and decisions involved in each process step and how the clients are involved each step of the way. We will present the key aspects of each step. Setting up the database involves importing the GIS data, but also requires client involvement to identify the level and complexity of "data" needed to drive the "failure analyses". Attention must also be focused on understanding what additional asset inspection data is available, whether it is needed for analyses, and/or what may be needed for future analyses.

Once the databases are established the quantitative analysis begins. The "consequence of failure" analysis will present the potential "what ifs" for an asset failure. Where the impact of the failure would be felt, who would be impacted and how wide spread the failure could be. In other words, if the asset were to fail how bad would it be? This step can be as complex or as simple as is needed to meet client objectives. The "likelihood of failure" analysis quantifies the factors that could CAUSE an asset to fail. Criteria such as the age and material of the asset, the condition of the asset, location of the asset, and maintenance records of the asset will be assessed.

Using the "consequence and likelihood of failure" data, the risk analysis ranks each asset line by line providing a foundation to develop the Decision Tree that will guide all maintenance and rehabilitation actions.

You have the GIS data and asset attribute data. The question is, are you ready to take the next step and use its valuable information to build a solutions-based tool to assist with your capital planning?

Solving the Sediment Dilemma: Successful Construction Site Outreach to a Difficult Audience — 20th Century

Thomas Lawrence, WQM

Construction site pollution prevention is not hard to understand, nor difficult to do, yet runoff from construction sites has been identified as one of the primary sources of pollution Statewide. Current municipal NPDES permits place a primary emphasis on public education and outreach, while also requiring pollution prevention from construction sites. Education is also included in many industrial NPDES permits, as well as other types of permits.

Municipal NPDES program managers agree that great success is achieved by utilizing effective public education and by coordinating education with other activities such as enforcement. This integrated approach was utilized with a focus on construction sites, resulting in a noticeable increase in the proper use and maintenance of construction site EPSC measures, as well as creating a positive relationship between regulator and regulated.

This presentation will cover construction site educational and outreach approaches that have proven effective in actual environmental education outreach campaigns. The variety of examples of campaigns that worked will provide the attendees with ideas for cost-effective approaches that they can use to address specific issues within their community. Additionally, tips for evaluating a campaign's effectiveness and some examples of campaign approaches that did not work will be discussed.

Using Fly Ash to Retain Phosphorous and Heavy Metals in Stormwater Filters — Frontier

Glenn Brown, Oklahoma State University

Class C fly ash, a byproduct of coal fueled electrical power plants has been proposed to enhance pollutant retention in stormwater filters. Fly ash contains significant amounts of the metal oxides CaO, Al2O3, and Fe2O4. Those oxides will react with phosphorous to form relativity insoluble minerals, thus reducing the pollutant concentration in the effluent. Two USEPA 319(h) funded projects, administrated by the Oklahoma Conservation Commission and the Oklahoma Secretary of the Environment, have designed, constructed and quantified the long-term performance of fly ash amended filters in 10 BRC in Oklahoma built in 2007. Analysis has included RCRA screening, laboratory batch sorption and column experiments, 3-D flow and transport modeling, construction sampling, field hydraulic testing, and core and water sampling after seven years. Cores samples have been subject to total acid digestion, water extraction, Mehlich 3 extraction and X-ray absorption near edge structure analysis (XANES). Results of this work suggest that, with minor qualifications, fly ash should be given strong consideration for expanded use in stormwater filters.

Micro to Macro: Green Infrastructure in the Gulf South — Great Plains

Margaret Robinson, Eric Leshinsky, Asakura Robinson Co.

Margaret and Eric will present representative projects of various scales, owners and budgets to illustrate the

breadth to which green infrastructure can be successfully applied to our changing environment. Lessons learned from project types including roadways, schools, civic and municipal facilities, residences, commercial developments and park spaces will be detailed. Green infrastructure BMP's designed for these project types include bioswales, rain gardens, green roofs, rainwater harvesting systems, permeable paving, and vegetated swales; alone and combined into treatment trains. Larger, macro-level implementations of great importance as next steps in the green infrastructure movement include regional park sites, land bank sites, detention basin systems, master planned communities, flood-prone neighborhoods and high-density mixed use districts. Macro-level systems include conservation and mitigation of wetlands, water bodies, forests and prairies. Project clients and stakeholders range from City, County, State and Federal agencies to non-profit and private developers. All projects include multi-disciplinary teams that layer expertise in engineering, design and ecology. Budgets range from modest, micro interventions to monumental, district levels systems. The importance of looking at green infrastructure opportunities at multiple scales and in a myriad of project types will be stressed and illustrated through case studies, lessons learned and a progression of project scales: from micro to macro. Projects to be highlighted include the South Central Waterfront District Vision Framework Plan for City of Austin. This plan provides a development framework for implementing green infrastructure on a district level over 118 acres and 31 ownership parcels in a prime re-development area just south of downtown Austin along the south shore of Lady Bird Lake. A second example of a district level approach to green infrastructure is the Academy Park neighborhood structural and non-structural drainage infrastructure plan located on the east side of New Orleans. This 15 block area of this neighborhood was devastated following Hurricane Katrina and continues to subside and flood at great frequency. The City is preparing stormwater hazard mitigation plans for 6 areas. Including Academy Park, across the city through funding by the EPA's Hazard Mitigation Grant Program. Additional projects of district level and individual sites to be highlighted include Mandell Park, Bagby Street, Meador Library, Fire Station 90, MD Anderson Park, and Willow Waterhole Access Plan in Houston, TX, Gannoway Park in Sugar Land, TX, and Grand Central Park in Conroe, TX.

Reducing the Cost of Green Infrastructure Through Dynamic Systems Design — Red Carpet

Hilary Noonan, Syntax Land Design, LLC

The engineering attributes of soil should be understood as a dynamic system. The engineering qualities of that dynamic system are far greater than a simple triangle of soil types. Soil systems include both chemical and biological aspects of the soil matrix. Using dynamic design principles can both increase infiltration rates faster than plant development would indicate and reduce the cost of green infrastructure through the use of native soils rather than engineered soils in most cases. When engineered soils must be used they can function as dynamic systems only when we understand those systems better and put in place the constituents and catalysts that will continue to support the system after construction. Cost-effectiveness is achieved in both cases by reducing budgets for both construction and maintenance of green infrastructure while improving efficiency in terms of infiltration rates, pollution mitigation, turbidity issues and plant maintenance. Case studies and examples will be used to illustrate the constituents of a dynamic soil system, the approach of a dynamic systems design process and the effects of using that approach on design issues. Representative budgets will illustrate cost efficiency.

11:15 am - 12:15 pm	**Room**
Federal, State, and Local Enforcement: You Do What Now? *Steve Gilrein, Deputy Director, Compliance Assurance and Enforcement Division, EPA Region 6* *Plus State and Local Representatives*	Plaza Ballroom

12:15 pm - 12:30	**Room**
General Session: 2017 Conference Planning, Q&A	Plaza Ballroom