Agenda
Green Transportation Infrastructure Workshop
North Central Texas Council of Governments
August 24, 2021 | Zoom Meeting

9:30 AM  Welcome and Workshop Introduction
Shawn Conrad, Principal Transportation Planner, NCTCOG
Sydnee Steelman, Transportation Planner, NCTCOG

9:35 AM - OVERVIEW OF GREEN INFRASTRUCTURE RESOURCES
11:05 AM

Resources and Opportunities

Economic and Environmental Benefits of Stewardship Tool
Kate Zielke, Principal Transportation Planner, NCTCOG

RISE Coalition
Tamara Cook, Senior Program Manager, NCTCOG

Transportation integrated Stormwater Management (TriSWM)
Tamara Cook, Senior Program Manager, NCTCOG

Overview of the EPA Green Infrastructure Program and Available Resources

Brent Larsen, Section Chief, US EPA Region 6
Nelly Smith, State and Tribal Programs Chief, US EPA Region 6

Session Q&A

11:05 AM – LOCAL EXAMPLES AND IMPLEMENTATION STRATEGIES
12:00 PM

Drainage and Stormwater

Bioswales: City of Lewisville Old Town Project
Sagar Medisetty, Traffic Engineer, City of Lewisville

Rain Gardens: City of Dallas Beckley/Commerce St intersection Green Street Project
Don Raines, Senior Planner, City of Dallas

Rain Gardens: Elm Street Streetscape Improvements
Christina Turner-Noteware, City Engineer, City of Dallas

Session Q&A

12:00 PM – Lunch
1:00 PM
LOCAL EXAMPLES AND IMPLEMENTATION STRATEGIES (Cont.)

2:25 PM – Pavements and Surfaces

Silva Cells: Sundance Square Plaza in Fort Worth and San Jacinto Plaza, Rockwall
Brenda Guglielmina, Account Manager, DeepRoot Consulting

Permeable Pavements: The Green at College Park, Arlington
David Hopman, Associate Professor at the University of Texas at Arlington

Lighting

LED Lighting: City of Arlington LED Streetlights Conversion
Oscar Valle, Public Works Operations Supervisor, City of Arlington

Solar Lighting: Bus Shelter Solar Lighting, Trinity Metro
Sandip Sen, Service Implementation Manager, Trinity Metro

Session Q&A

2:25 PM – CLOSING

2:30 PM – Wrap-Up/Final Thoughts
Defining Green Transportation Infrastructure

Development and transportation infrastructure techniques that connect environmental elements to transportation networks and management.
Need for Green Infrastructure

Purpose: Development can have various effects on the environment such as depletion of natural resources, increased erosion and flooding, decreased air quality, and more. Green infrastructure aims to lessen these effects through sustainable project elements.

Benefits:

**Reduces**
- Costs
- Urban heat stress
- Consumption of natural resources
- Erosion and risk of flash floods
- Waste

**Improves/Increases**
- Air quality
- Pedestrian safety
- Public health
- Water quality
- Groundwater recharge
- Aesthetics and build communities
- Economic development
Types of Green Infrastructure

- Cool pavements
- Permeable pavements
- Native plants and vegetation
- Energy-efficient lighting
- Renewable-energy lighting
- Recycled construction materials
- Recycled trail materials
- Structural support for trees
- Bioretention and infiltration practices
NCTCOG Green Infrastructure Resource Guide

Provides resources for professionals in assessing choices for integrating green infrastructure projects into transportation projects.

Covers lighting, stormwater, native plants, green trails, local examples, and cost estimates.

Available at www.nctcog.org/greeninfrastructure
Resource Guide Case Study Examples

Red Oak Creek Trail in Cedar Hill: Use of permeable trail surfaces

Merritt Road in Rowlett: Application of a low maintenance stormwater control design

Historic Handley Urban Village Streetscape in Fort Worth: Rehabilitated sidewalks using green infrastructure
Financial Aspects of Green Infrastructure

- Guide contains cost/benefit analysis for each type of green infrastructure

- Implementation can potentially reduce the costs of:
  - Land acquisition
  - Built capital (equipment, installation)
  - Operation
  - Repair and maintenance
  - External (off-site, imposed on others)
  - Infrastructure replacement (potential for longer life of investment)

- Example table shows breakdown of each project element and estimated cost
Promoting the Economic Benefits of Green Infrastructure

Green Transportation Infrastructure Virtual Workshop
August 24, 2021
Economic & Environmental Benefits of Stewardship Tool (EEBS)

“ We look at environmental programs as the right thing to do, but we look at them as a cost. How do we measure the return on investment of this work? ”
Goals in Developing EEBS

User-friendly online tool

Preliminary information for policy and decision-making

Qualitative and quantitative benefits of stewardship
Stakeholders, Project Review Committee

Cities of Dallas, Denton, Fort Worth, and Cedar Hill
NCTCOG
Tarrant Regional Water District
Texas Parks & Wildlife Department

“Barriers to green infrastructure”

“Need for financial data”

“Need for public education”

“Need to include green infrastructure in planning phase”
Tool Concept Map

* If data was available
Economic Data

Table 1-3: Quantified Benefits: Tool Inputs on Economic Benefit

<table>
<thead>
<tr>
<th>Environmental Benefit</th>
<th>Economic Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater Management</td>
<td>$1,000 - $1,100</td>
<td>$/Acre Impervious/Year</td>
</tr>
<tr>
<td>Water Quality (Nitrogen) 1</td>
<td>$1 - $10</td>
<td>$/Pound</td>
</tr>
<tr>
<td>Water Quality (Phosphorus) 2</td>
<td>$1 - $10</td>
<td>$/Pound</td>
</tr>
<tr>
<td>Water Quality (TSS) 2</td>
<td>$6</td>
<td>$/Ton</td>
</tr>
<tr>
<td>Recreation 3</td>
<td>$3 - $25</td>
<td>Per Visit Benefit to Recreator</td>
</tr>
<tr>
<td>Energy Savings 4</td>
<td>$0.1165</td>
<td>$/kWh</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>$300 - $500</td>
<td>$/Street Tree/Year</td>
</tr>
<tr>
<td>Air Quality (PM2.5) 3</td>
<td>$7.36 - $19.85</td>
<td>$/Pound</td>
</tr>
<tr>
<td>Air Quality (NOx) 3</td>
<td>$4.59 - $11.54</td>
<td>$/Pound</td>
</tr>
<tr>
<td>Air Quality (SO2) 3</td>
<td>$3.67 - $18.40</td>
<td>$/Pound</td>
</tr>
<tr>
<td>Habitat, Terrestrial</td>
<td>$100 - $750</td>
<td>$/Acre/Year</td>
</tr>
<tr>
<td>Habitat, Wetland/Riparian</td>
<td>$500 - $11,400</td>
<td>$/Acre/Year</td>
</tr>
<tr>
<td>Pavement Maintenance Costs</td>
<td>$3.50 - $17</td>
<td>$/Tree/Year</td>
</tr>
</tbody>
</table>

Note: Health benefits from air quality are included in the air quality values.
1/ Derived from the residential stormwater fees in Fort Worth and Dallas
3/ Sources: (Hansen, Mills, Stoll, Freeman, & Hankamer, 1990; Bergstrom & Cordell, 1991; Loomis, 2005). All values are adjusted for inflation to 2018 dollars using the Consumer Price Index
4/ Based on the average marginal charge for electricity in Dallas in July 2018 (TexasElectricityRatings.com, 2018)
5/ Derived from (Wang & Santini, 1995). The most recent data available were for the Dallas metro area population and air pollutant concentrations. Values were adjusted to 2018 dollars using the Consumer Price Index.

Table 1-1: Quantified Benefits

<table>
<thead>
<tr>
<th>Type of Environmental Impact</th>
<th>Economic Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater Runoff 1</td>
<td>$1,000 - $1,100</td>
<td>$/Acre Impervious/Year</td>
</tr>
<tr>
<td>Water Quality 2</td>
<td>$1 - $10</td>
<td>$/Pound</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>$1 - $10</td>
<td>$/Pound</td>
</tr>
<tr>
<td>Recreation 3</td>
<td>$3 - $25</td>
<td>Per Visit Benefit to Recreator</td>
</tr>
<tr>
<td>Urban Heat Island 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetland/Riparian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terrestrial Habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Quality 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Particulate Matter: 12.5 - 50.9 Annual Pounds/Acre of Tree Canopy Removed/Year
Nitrogen Dioxide: 4.5 - 12.5 Annual Pounds/Acre of Tree Canopy Removed/Year
Sulfur Dioxide: 1.8 - 6.2 Annual Pounds/Acre of Tree Canopy Removed/Year

2/ Source: (Li, Barrett, Rammohan, Olivera, & Landphair, 2008). Ranges are similar to the pollutant loads found in other studies of urban runoff in North Central Texas (Banks, 2008; U.S. Geological Survey, 1998). Note that bacteria contamination is also a pollutant of concern in many area waterbodies, but it is not related to transportation.
3/ Derived from (The Trust for Public Land, 2017; City of Plano, 2017; Dallas Park & Recreation, 2017; Dallas Park & Recreation, 2018).
EEBS Demonstration

http://eebs.nctcog.org
Draw Project Boundaries
Define Project Type and Size
Review Potential Environmental Effects

- Total Acres: 218.2
- Feet of Streams: 7494
- Acres Flood Zone: 51.1
- Acres Wetlands: 1.4
- Acres Aquatic: 56.0
- Acres Tree Canopy: 21.4
- Acres Terrestrial: 136.3
- Acres Urban: 25.3

Some datasets may overlap causing sum total of acres to be greater than actual total of acres.

Your project may affect a resource that may require regulatory compliance. Stewardship options provided may not meet the necessary requirements. Further coordination with regulatory agencies and mitigation may be required.
Explore and Prioritize Potential Environmental Effects

4. Potential Environmental Effect of Your Project

These numbers represent the environmental cost of one acre of transportation project if no stewardship efforts are implemented. The transportation project may be larger or smaller than one acre, affecting this cost. Not all environmental costs are represented here, only those that could be quantified for the North Central Texas region. Therefore, the project may have additional environmental costs.

- Water Quality Impact
  - Learn More
  - Make Priority

- Altered Hydrology
  - Learn More
  - Make Priority

- Aquatic Habitat
  - Learn More
  - Make Priority

- Streambank Erosion
  - Learn More
  - Make Priority

- Heat Island Effect
  - Learn More
  - Make Priority

- Terrestrial Habitat
  - Learn More
  - Make Priority

- Vegetation Removal
  - Learn More
  - Make Priority
Learn More About Potential Environmental Effects

Potential Environmental Effect of Your Project

**Terrestrial Habitat**

Transportation projects can adversely affect species and habitat diversity and abundance. Effects include:

- Habitat conversion.
- Habitat fragmentation.
- Disruption of animal and plant migration/dispersal corridors.
- Animal behavioral changes resulting from light or noise pollution.
- Animal fatalities from vehicle collisions, and
- Reduced habitat quality resulting from reduced air and water quality.

Interviews with local experts at Texas Parks and Wildlife Department indicate that effects are location- and species-specific, but that in general, severe transportation-related effects are likely those related to terrestrial habitat conversion and fragmentation (particularly resulting from transportation enabling new or more intense development of areas).

Each acre of terrestrial habitat converted could result in one acre of reduced terrestrial habitat.
Identify Potential Stewardship Options

- Bioswales
  - Water Quality, Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value
- Riparian Plantings/Wetland Restoration
  - Water Quality, Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value, Recreation, Air Quality
- Detention Ponds
  - Water Quality, Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value, Recreation
- Nature Tree Plantings
  - Water Quality, Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value, Recreation, Air Quality
- Wildlife Corridor
  - Biodiversity, Aesthetic Value
- Dark Skies
  - Aesthetic Value, Recreation, Biodiversity

View Details
Explore Costs and Benefits of Stewardship Options

Detention Ponds

Detention ponds capture and store stormwater in a pond year-round, or during or after a storm event. The stormwater is then released at a controlled rate and location. Depending on the type of pond, stormwater pollutants may be filtered, settled, infiltrated, or otherwise reduced before it is released.

[Diagram showing cost and value for detention ponds]
Narrative Details on Costs and Benefits

Cost Range

Detention ponds are estimated to cost $15,600 to $46,000 per acre.

Stormwater Benefits (Water Quantity/Quality of Runoff)

Reducing stormwater volume can reduce the capacity requirements for this infrastructure, saving costs. Detention ponds can reduce the amount of runoff flowing into stormwater management systems and can reduce costs of stormwater management by approximately $1,000 to $1,100 per acre per year.

Stormwater runoff, with its pollutant loads, adversely affects surface water quality. Detention ponds may increase the water quality of runoff from transportation projects and may thus increase water quality in streams, rivers, and other waterbodies. Reduced nutrients in North Central Texas waterways may result in cost savings to jurisdictions that may otherwise have been required to reduce nutrient discharges. For each acre of detention pond, the annual value of pollutant reduction is $9 to $212 for sediment removal, $27 to $101 for sediment removal, and $0 to $724 for phosphorous removal.

For each acre of detention ponds, there may be a total annual stormwater benefit of $1,030 to $22,060.

Enhanced water quality can also provide value in a variety of other ways including:

- Human health and wellbeing from drinking water and household water supplies.
- Improved recreational and aesthetic values to people who live, work, shop, and play near streams, rivers, and other waterbodies. Support for habitat and species dependent on clean water. This directly increases the intrinsic value to people of species and habitats. This indirectly supports commercial and recreational fisheries and other wildlife-dependent activities.

Aesthetic Benefits

As detention ponds provide a moderate benefit by increasing the presence of water bodies in an area, they have the potential to provide aesthetic value to nearby residents, businesses, and visitors.

Other Health and Social Benefits

Detention ponds may provide moderate physical and mental health benefits resulting from their greenspace or presence of aquatic features. Presence of greenspace or aquatic features may result in greater outdoor physical activity because of an increased or perceived increase in scenic value (aesthetics, access, convenience). This may result in improved physical activity and health, including:

- Social ties
- Recreation opportunity
- Lower body mass index
- Reduced mortality
- Less stress and obesity
- Increased perceived health
Compile and Print Report

Note: You may also download individual files for each stewardship option on our Stewardship Information page.
Contacts

Kate Zielke, Principal Transportation Planner (concept questions)
817-608-2395
kzielke@nctcog.org

Brian Geck, Communications and Technology Supervisor (technical questions)
817-608-2361
bgeck@nctcog.org
North Texas Regional Integration of Sustainability Efforts (RISE) Coalition

The Regional Integration of Sustainability Efforts (RISE) Coalition works to engage interested local governments in peer-exchange opportunities to support sustainability and environmental initiatives.

Purpose:

1. Align regional partner initiatives
2. Leverage regional resources and share best practices
3. Provide networking and capacity building opportunities
4. Identify funding opportunities for projects
5. Provide mentorship
6. Collaborate on regional sustainability projects and initiatives

Website: https://www.nctcog.org/envir/development-excellence/rise-coalition
RISE Coalition Current Focus Topics

Guided by an annual Work Program

Current focus on four key topic areas

Under Development:
- First regional greenhouse gas inventory
- Emission reduction strategy toolkit for local governments
- FY2022: Urban heat island emphasis; developing an equity working group; continuing to grow membership; and continuing existing projects (GHG Inventory and Toolkit)

Website:
https://www.nctcoq.org/envir/development-excellence/rise-coalition
Membership in the RISE Coalition

Membership Structure:
• Voting Members
• Non-Voting Members
• Participants

Quarterly in-person meetings are posted on the NCTCOG Environment & Development Events Calendar and on the RISE Coalition website.

RISE Coalition guided by Bylaws.

Please visit the RISE Membership page to learn more.
• https://www.nctcog.org/envir/development-excellence/rise-coalition/rise-membership

Current Membership
• City of Carrollton
• City of Cedar Hill
• City of Dallas
• City of Denton
• City of Farmers Branch
• City of Fort Worth
• City of Lewisville
• City of Plano
• Tarrant Regional Water District

Officers
• Chair – Pharr Andrews, Senior Climate Coordinator, City of Dallas
• Vice-Chair - Katherine Barnett, Sustainability and Customer Initiatives Manager, City of Denton
Get Involved

Next RISE Coalition Meeting
Friday, October 15, 2021
9:30 – 11:30 a.m.
RSVP Here: https://www.nctcog.org/envir/events

NCTCOG’s Free E-Mail Lists and Committee Updates
https://www.nctcog.org/stay-informed?ext=
https://www.nctcog.org/envir/mail

RISE Website:
https://www.nctcog.org/envir/development-excellence/rise-coalition
https://www.nctcog.org/envir/committees/regional-integration-of-sustainability-efforts-ris
Contact Information

Tamara Cook, AICP, LEED Green Associate
Senior Program Manager
NCTCOG Environment and Development Department
tcook@nctcog.org
(817) 695-9221

TriSWM
Carolyn Horner, AICP
Senior Environment and Development Planner
NCTCOG
chorner@nctcog.org
(817) 695-9217

RISE Coalition
Brian Salvesen
Planner I
NCTCOG Environment and Development Department
bsalvesen@nctcog.org
(817) 695-9212
Green Transportation Infrastructure Workshop

Tamara Cook, AICP
NCTCOG Environment and Development

August 24, 2021
What is iSWM?

• iSWM stands for integrated Stormwater Management.

• iSWM is a regional program administered by the North Central Texas Council of Governments (NCTCOG)

• iSWM is a tool that helps our local governments meet or exceed state and federal requirements for stormwater management.

• http://iswm.nctcog.org/
Why iSWM?

Reduce Flooding
Designs based on the iSWM program mean that a community can handle stormwater more effectively and with fewer flooding impacts.

Protect Property Values
iSWM reduces the potential for erosion by addressing streambank protection during design, protecting properties and infrastructure along creeks and rivers.

Improve Water Quality
iSWM techniques give a community new tools to improve water quality, thereby reducing costs and protecting residents.

Meet State/Federal Regulations
NCTCOG has worked to make iSWM compatible with existing state and federal regulations.

Reduce Operation Costs
iSWM methods emphasize sustainable, natural systems which can reduce maintenance and result in a lower lifetime cost of ownership.

NCTCOG Technical Assistance
The North Central Texas Council of Governments is here to provide free technical assistance to communities implementing iSWM strategies.

http://iswm.nctcog.org/

Rayzor Ranch
http://iswm.nctcog.org/
Implementing iSWM

Certification Guidance
Documents that guide local governments in adopting and implementing the iSWM Program and in developing a comprehensive stormwater management program.

Criteria Manual
The iSWM Criteria Manual for Site Development and Construction contains criteria that cities and counties may use as a component of their stormwater management related development regulations.

Technical Manual
The iSWM Technical Manual is referenced by the iSWM Criteria Manual and provides the technical details to meet the requirements established by each community in their iSWM Manual.

City of Roanoke
Bioretention Facility
http://iswm.nctcog.org/
North Texas iSWM Communities

iSWM Gold Certified
• Celina

iSWM Silver Certified
• Corinth
• Denton
• Frisco
• Fort Worth
• Grand Prairie
• Irving
• Kennedale
• Plano – Newest Certified Community!
What is TriSWM?

• Transportation integrated Stormwater Management (TriSWM) Appendix

• Developed as an appendix to the integrated Stormwater Management (iSWM) Criteria Manual for Site Development and Construction

• Available for use by cities, counties, engineers, private developers, contractors and transportation agencies in the planning and design of stormwater management for streets, roads, and highways

Provides strategies to aid local governments and the private sector to:

• Design roads and highways with stormwater impacts in mind

• Address and mitigate the adverse impacts of development on runoff

• Implement stormwater controls to meet the TriSWM planning and design approach

• [http://iswm.nctcog.org/what-is-triswm.html](http://iswm.nctcog.org/what-is-triswm.html)
TriSWM Goals

1) Provide planning and design guidance framework for incorporating effective stormwater management practices into the street and roadway project development process.

2) Encourage greater uniformity in developing plans for stormwater management systems that meet the following goals:
   • Control runoff within and from the site to minimize flood risk to people and properties.
   • Assess discharges from the site to minimize downstream bank and channel erosion.
   • Reduce pollutants in stormwater runoff to protect water quality and assist communities in meeting regulatory requirements.
3.2 TriSWM Water Quality Protection

3.2.1 Water Quality Treatment Level Criteria

- In assessing the need to incorporate post-construction water quality control measures into street and highway construction projects, the quality of receiving waters is to be considered along with projected traffic volume for the facility.
- Of many variables that affect the quality of runoff from a roadway (rainfall characteristics, traffic type, surrounding land use, etc.), average daily traffic volume (ADT) is a determining factor for which data is readily available.
- Federal Highway Administration studies concluded that greater pollutant levels in stormwater runoff could be anticipated where traffic volume exceeds 30,000 ADT.
- TriSWM uses 30,000 vehicles per day (VPD) as the threshold between low volume and high-volume roadways and the corresponding level of post-construction stormwater quality treatment required.
Points for TriSWM Implementation in the iSWM Certification Application

TriSWM Resources

iSWM Website: http://iswm.nctcog.org/

TriSWM Website: http://iswm.nctcog.org/what-is-triswm.html


Standard Drawings and iSWM Resources

**Division 1000: Erosion and Sediment Control** is being updated with 20 iSWM details, including:

- Sack Gabion Check Dam
- Filter Tube Check Dam
- Excavated Stone Outlet Sediment Trap
- Bermed Stone Outlet Sediment Trap
- Sediment Basin with Overflow Riser
- Pipe Slope Drain
- Filter Tube Curb Inlet Protection
- Wire Weir Curb Inlet Protection
- Curb Rock Sock On-Grade Curb Inlet Protection
- Filter Tube Area Inlet Protection

- Area Inlet Protection Excavated Impoundment
- Area Inlet Protection Filter Barrier
- Temporary Erosion Control Blankets
- Permanent Turf Reinforcement Mats
- Velocity Dissipation Device
- Dewatering Controls
- Concrete Washout Containment
- Grouted Rock Rip-Rap
- Stream Trash Catch/Screen
- Trash Rack Catch/Screen

**Division 6000: Storm Water Control** is being updated with major changes to Curb Inlet and Curb Inlet Recess drawings. Details for Storm Drain Pipe Collars for Field Connection and Subdrains-Pavement Subgrade are also being added.

Fifth Edition Public Works Construction Standards updated in 2017

- Standard Drawings are currently undergoing update: [https://www.nctcog.org/envir/committees/public-works-council/standard-drawings-subcommittee](https://www.nctcog.org/envir/committees/public-works-council/standard-drawings-subcommittee)

iSWM Technical Manual Resources Update:

- Site Development Controls: [http://iswm.nctcog.org/technical-manual.html](http://iswm.nctcog.org/technical-manual.html)

https://www.nctcog.org/envir/public-works/construction-standards
Overview of EPA’s Green Infrastructure Program
Discussion Topics

- Recent Federal Regulations
- What’s EPA doing?
- EPA Resources
Water Infrastructure Improvement Act (WIIA)

- Created an Office of the Municipal Ombudsman
- Amended the CWA to codify and define integrated planning (IP)
- Required a report to Congress on permits and enforcement actions with IPs
- Defined green infrastructure and formalized EPA’s Green Infrastructure Program in the CWA.

America’s Water Infrastructure Act (AWIA)

- Directed EPA to create a stormwater infrastructure funding task force to:
  - Identify sources of state funding for SW infrastructure
  - Identify how the source of funding affects the affordability of the infrastructure, including consideration of costs associated with financing.
  - Evaluate whether funding sources are sufficient to support capital expenditures and long-term operation & maintenance costs
- The Environmental Financial Advisory Board (EFAB) accepted the charge to form a stormwater finance workgroup

[www.epa.gov/waterfinancecenter/efab#stormwater](http://www.epa.gov/waterfinancecenter/efab#stormwater)
New EPA Resources

• Developed to help state and local transportation agencies, municipal officials, designers, stakeholders and others select, design and implement site design strategies and green infrastructure practices for roads, alleys and parking lots.

• Provides background information on street and road typologies and offers a programmatic framework to use when identifying areas that can be initially designed or later retrofitted with green infrastructure practices or systems.

• Provides a systematic process to begin reducing the impervious surface footprint of the public right-of-ways and associated off-street surface parking areas.

https://www.epa.gov/nps/green-streets-handbook
Additional EPA Resources

- The Green Infrastructure MS4 Compendium presents permitting approaches that encourage or require green infrastructure in municipal separate storm sewer systems (MS4s).
- The Saving the Rain guide was created to help congregations work through the process of enhancing their grounds by implementing green stormwater management practices.
Upcoming EPA Resources

• The Santa Fe pilot focuses on green infrastructure practices in roadway settings, including collector roads and arterial roads.

• The New Jersey Green Streets publication includes three case studies identifying the goals, design and installation, funding and challenges for each.
Newly Released Tool for Green Infrastructure

Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC) Tool, released April 2021

- **CLASIC** is an online tool that uses a life cycle cost framework to support feasibility and planning of stormwater infrastructure Program in the CWA.

https://www.epa.gov/water-research/green-infrastructure-modeling-toolkit#clasic
Green Infrastructure Webcast Series

Webcasts cover a variety of green infrastructure related topics. Visit our website to view archived webcasts and register for upcoming webcasts:

https://www.epa.gov/greeninfrastructure

2021 Webcast Schedule

- Greening Congregations (April)
- Funding Green Infrastructure (May)
- Green Streets (August)
- Operations and Maintenance (Fall)
- Federal Collaboration on GI (Winter)
Thank You

Suzanna M. Perea, perea.suzanna@epa.gov, 214-665-7217
Urban Runoff and the CWA Section 319 Program

Nelly Smith, Chief
State & Tribal Programs Section, EPA Region 6
What We Will Cover

• Clean Water Act §319 support for and role in urban projects
• Other opportunities for funding urban runoff/GI/LID projects
• Assessing eligibility for §319 funding
• Urban project success
Definitions under the Clean Water Act

‘Point sources’ regulated under CWA

• Any “discernable, confined and discrete conveyance including…any pipe, ditch, channel…[etc] from which pollutants are or may be discharged”

• Discharges must be regulated in a manner consistent with state/tribal WQS, e.g., NDPDES permits

‘Nonpoint sources’ not regulated or specifically defined

• Any source of water pollution that doesn’t meet point source definition

• Polluted runoff from rain or snowmelt carrying natural and anthropogenic pollutants to waters

• Includes: agriculture stormwater discharge and irrigation return flows

https://adventuresportsjournal.com/nonpoint-source-pollution/
The Importance of NPS Work in Urban Areas

• An array of valuable NPS projects are funded by §319 in urban areas

• These can be complemented by other funding sources that may better fit any given project
Funding Options for Urban NPS Projects

Multiple funding sources can be leveraged with §319 funds in urban areas

- State Revolving Fund (SRF)
- Other infrastructure funding
- FEMA – Hazard Mitigation
Potential Funding Sources

• Clean Water SRF for Stormwater Management
  • Range of project types
  • Eligible groups include any public, private or non-profit entity that is addressing stormwater issues

• FEMA Hazard Mitigation Grant Program
  • GI/LID projects
  • NPS projects may be eligible for FEMA funds when watershed and hazard mitigation plan goals align
§319 Program Guidelines for Urban Stormwater Runoff

Generally Eligible Activities

- Green stormwater infrastructure activities
- Watershed Planning
- Technical assistance to state and local stormwater programs
- Monitoring needed to design and evaluate the effectiveness of implementation strategies
- BMPs for pollution prevention, runoff control (not permit-required)
- Outreach and education
- Technology transfer and training
- Development and implementation of regulations, policies, and local ordinances (may apply to areas covered by NPDES permits, provided that the regulations, policies and ordinances apply to non-permitted areas as well.)
- Stormwater projects occurring outside of the NPDES permit area
Section VIII.B of §319 Program Guidelines provides framework for determining eligible uses of 319 funds in urban/MS4 areas:

“States may use § 319 funds for those urban stormwater activities that do not directly implement a final (municipal separate storm sewer system (MS4)) NPDES permit...

... may support but do not directly implement activities required by Phase I or Phase II permits, as well as activities that go above and beyond permit requirements.

In addition, states may use § 319 funds for stormwater management activities that are not subject to NPDES permitting requirements under either §§ 402(p)(2) or 402(p)(6).”
Questions to Ask When Assessing Project Eligibility for §319 Funds

• Is the proposed project/practice **required by or credited to the NPDES permit**? Does the project fund ‘gray’ infrastructure?

• Is the project/practice **distinguishable from actions being taken to comply with an NPDES permit**?

• If the proposed practice is similar to actions required by the NPDES permit, **would the §319-funded practices go above and beyond permit requirements** or otherwise not be used to meet permit requirements?
319 Urban Success Story:
Little Rock, AR

- The City of Little Rock’s Main Street Low Impact Development program demonstrated the benefits of rain gardens and other water filtration systems using green infrastructure applications and clean water initiatives to reduce volume and velocity and improve water quality from runoff.

- **Low Impact Development** BMPs included:
  - Rain gardens with native plantings
  - Bioswales
  - Porous parking
  - Street trees (native and shady)

- **Total EPA Project Cost**: $2,651,459
Thank You

Nelly Smith, Chief, State & Tribal Programs Section, smith.nelly@epa.gov
RAIN GARDENS / BIOSWALES

MAIN STREET AND MILL STREET IMPROVEMENTS PROJECT IN OLD TOWN LEWISVILLE
Main St & Mill St Project

- Main St
  - ½ mile long TOD
  - Road diet – 3 lanes to 2 lanes
  - Complete Streets
  - Multi-modal
- Main St
  - ½ mile long TOD
  - Road diet – 4 lanes to 3 lanes
  - Complete Streets
  - Multi-modal
MAIN ST - Before & After Project

BEFORE

AFTER
RAIN GARDENS - MAIN ST & MILL ST PROJECT

- Decision made by City early on during the planning stages
  - To add rain gardens in some landscape beds
    - To meet City's Sustainability goal - one of the 9 big goals of Lewisville 2025 Vision Plan

Lewisville 2025 Vision

- Green Centerpiece
- Extending the Green
- Old Town
- Diverse and Thriving Neighborhoods
- Economic Vitality
- Identity, Place, and Communication
- Sustainability
- Strategic Moves
RAIN GARDENS IN MAIN ST & MILL ST PROJECT

30 Rain garden ‘cells’ added
What are Rain Gardens?

- Shallow, landscaped, and vegetated depressions designed to:
  - **Capture** stormwater runoff
  - **Treat**, and
  - **Provide for Infiltration** into the soil

Source: www.horstexcavating.com
Why ‘treat’ the stormwater?

- EPA states, stormwater runoff is the **leading source** of Water Pollution

- Storm water contains:
  - Pathogens
  - Bacteria
  - Chemicals
  - Heavy Metals
  - Oil
  - Fertilizers
  - Pesticides etc.

- Rain Gardens provide treatment for the ‘first flush’ event

Source: www.fairfaxcounty.gov
Purpose of Rain Garden:

- Intercept the storm water before it gets to storm inlet
- Dissipate the velocity of stormwater runoff
- Cleanse and Filter the Water - remove harmful pollutants
- Recharge the underground water table
What does a Rain Garden in Old Town Lewisville look like?
What do Rain Gardens in Old Town Lewisville look like?
What do Rain Gardens in Old Town Lewisville look like?
What do Rain Gardens in Old Town Lewisville look like?
Elements of a Rain Garden

- Curb Cuts (18” wide minimum)
- Rocks behind Curb Cut
- Vegetated Swale
- Slight Longitudinal Slope
- Well drained soils
  - 5-foot min clearance from bottom of swale to high groundwater table
- Exit for excess water
Elements of a Rain Garden (contd)

- **Curb Cut**
  - 18” Min Width
  - Spaced 10’ - 15’ Apart
  - Allow the Water to Enter the Swale
Elements of a Rain Garden (contd)

- Rocks next to Curb Cut
  - Dissipate flow from curb
  - Stop solid debris
Elements of a Rain Garden (contd)

- Vegetated Swale
  - Native Plants soak up the rain water
Elements of a Rain Garden (contd)

- Slight Longitudinal Slope
  - Allows water to continue to flow and provide coverage for the entire swale
Elements of a Rain Garden (contd)

- **Well Drained Soils**
  Consisting of a mix of
  - Top Soil
  - Sand
  - Compost

- Provides for infiltration into the ground
- Replenish the Underground Water Table
- 5' Min Separation from Bottom of Swale to Water Table

Image Source: www.tamu.edu
Elements of a Rain Garden (contd)

- **Excess Water Outlet**
  - Drain Pipe
  - Storm Inlet
  - Lewisville Used Curb Cuts downstream as outlet

Image Source: www.nacto.org/urban-street-design-guide/
Raingarden Operation (contd)

Curb cuts (18” wide) allow storm water from street to enter the swale
Raingarden Operation (contd)

Slight *longitudinal slope* keeps water moving slowly while
- Native plants soak up some water,
- Sediments get deposited
- Water percolates into soil beneath
Rain Garden Pedestrian Crossings:

Metal Grating

Concrete Step Pads
Rain Gardens at Thrive Multi-Gen Center
Rain Gardens at Thrive - RG 1

Saw Tooth Curb around the roundabout to provide for stormwater entry
Rain Gardens at Thrive - RG 2
Rain Gardens at Thrive - RG 3
CHALLENGES
Main Street is a one way street, so all cars will have to park in this direction. When people step out of their cars, they will step into the rain garden. Or balance themselves on the curb and make their way to the concrete steps.

Cars on the south side will have a similar problem.
Challenge #1 – No Mow Strip in Design

No Mow Strip Behind Curb
Challenge #1 Resolution - Raingardens

ADDED CONCRETE MOW STRIP (18” WIDE)
- To Facilitate Pedestrian Access from a Parked Vehicle to the Rain Garden Crossing for the Sidewalk
Challenge #2 – Drainage from Pvt Prop

Photo Prior to project; private property had stormwater from parking lot drain over sidewalk into street

Installed Flume under sidewalk from private property
Challenge #2 Resolution – Raingardens

Rocks Added at Flume Exit Under Sidewalk
- to dissipate Stormwater velocity & Control Erosion
Challenge # 3 Tree Species & Resolution

- Large Trees in rain garden at bottom of hill
- Contractor & Tree Supplier expressed concerns – waterlogging detrimental to Red Oak Trees
- Tree species changed to Bald Cypress – 9 Trees
Challenge #4 - washout during rains

Mulch and soil washed out during rains
Challenge #4 Res - washout during rains

Berms with rocks to prevent erosion
- Around Wye Inlet,
- In advance as well
Challenge #4 Res - washout during rain

Berm with rocks to prevent erosion
Questions?
Beckley / Commerce Intersection
A Stakeholder Driven, Complete & Green Street - Pilot Project
NCTCOG Green Transportation Infrastructure Workshop

- Project Background
- Site Context
- Beckley Ave. Corridor Usage Study
- Complete Street - Diagrams
- Green Street – Diagram
- Rain Harvesting & Landscape Details
- Implementation
- Open Discussion

Beckley / Commerce Intersection
A Stakeholder Driven, Complete & Green Street - Pilot Project
Project Background

• In 2008 and 2009, The Beckley / Commerce Intersection became a flashpoint moment, where Oak Cliff and West Dallas Stakeholders demanded that the City of Dallas reject the newly redesigned Intersection pavement project (95% construction documentation set) citing their concerns for vehicular accommodation over pedestrian safety.

• City of Dallas Public Works halted the project and instead issued the (Beckley Corridor Usage Study), in order to reach a unanimous stakeholder consensus to inform the design.

• Once Stakeholder Consensus was reached, the project transitioned from a conceptual feasibility study - into a design contract, (North Beckley Improvements Project), which was in itself unusual, because the landscape architectural firm was the prime consultant and the civil engineering firm served as sub consultant.

• What emerged from the design process was the confluence of two primary guiding principles:
• Stakeholder influence – Complete Streets
• Trinity River Corridor / Sustainability influence – Green Streets and Trinity Standards.
Site Context

The Beckley / Commerce Corridor Usage Study engaged key stakeholders to understand their vision for transitioning from Commercial / Industrial to more a walkable Mixed Use Land Use pattern.
Site Context

The Trinity Overlook, was the first official public access point to the Trinity Floodplain, prior to becoming a trail head for the future trail system.

When the Trinity Overlook opened in 2008, it started a slight ‘shift’ in thinking of how this area in West Dallas could be utilized and how infrastructure should respond.
West Dallas Transit/Land Use Concept
Site Context
Beckley / Commerce – Existing Conditions 2009

Beckley Corridor Usage Study
Site Context
Beckley / Commerce – Existing Conditions  2009
Conceptual Parcel Development

- Community Stakeholders and Property Owners also provided input regarding potential impact to existing businesses, continued access, potential property acquisitions and land use development.
Complete Streets

- Community Stakeholders advocated a stronger balance of transportation modes, for pedestrian, cyclist, public transportation and vehicular modes.
- Beckley Ave. Corridor Usage Study - advanced the complete streets initiative, prior to the development of Dallas Complete Streets Plan
- City of Dallas Public Works responded by redesigning Beckley / Commerce intersection with complete and green street features.

Bike Lanes:
8' wide buffered bike lanes
Bike Boxes at intersection

Transit Stops:
Shaded boarding areas designed for Bus, Shuttle or potential Streetcar transfer.

Pedestrian oriented design features:
Pedestrian Refuge at median
Timed Pedestrian crosswalk signalization
11-6” wide shaded sidewalks
Green Streets

- Stakeholders were also supportive for advocating best practices in design, which advance new initiatives of storm water integration into the design.

- Rain Harvesting collects storm water runoff from impervious surfaces, as a primary water irrigation source for the rain gardens.

- Beckley / Commerce will advance best practices in sustainable design and demonstrate environmental stewardship.
Beckley Commerce Intersection – Complete and Green Street Concept
Proposed Street Design Plan

Complete Street - Diagrams
Pedestrian amenities:
- 11'-6" wide shaded sidewalks
- 15'-0" crosswalks with 8'-0" pedestrian refuge at the median
Pedestrian amenities:
- 11'-6" wide shaded sidewalks
- 15'-0" crosswalks with 8'-0" pedestrian refuge at the median
- Enhancement pavers and timed pedestrian traffic signalization
- 18'-0" curb radiuses
Pedestrian amenities:

- 11'-6" wide shaded sidewalks
- 15'-0" crosswalks with 8'-0" pedestrian refuge at the median
- Enhancement pavers and timed pedestrian traffic signalization
- 18'-0" curb radiuses
- (2) Transit stop boarding areas

Complete Street - Diagrams

N. Beckley Ave. Improvements

GN ALTERNATIVES
Meetings, June 15, 2011
Cyclist amenities:

- Bike lanes (5’-0” width with 3’ buffer)
Cyclist amenities:
• Bike lanes (5’-0” width with 3’ buffer)
• Marked crossings at the intersection
• Bike Boxes (left turn movements at the intersection)
Cyclist amenities:

- Bike lanes (5'-0" width with 3’ buffer)
- Marked crossings at the intersection
- Bike Boxes (left turn movements at the intersection)
- Dallas Bike Plan Signage and pavement markings
- Transition bike lanes (shared usage - with signage)
Access and Parking:

- Slip lanes and hammerheads serving existing businesses
- Driveway curb cuts serving existing businesses
- Reconfiguration of the Beckley Ramp to allow for (slow speed) two-way vehicular movement and head-in parking at the Trinity overlook.
Rain Harvesting:
- Storm water runoff mapping and calculations
- Rain Garden dimensions, anticipated storm water runoff, soil composition and plant selections were factored into the landscape design
Rain Harvesting & Landscape Details

• Rain Garden with curb and sidewalk inlets per each ‘cell’

• Soil depth and composition allow for balance for retention and percolation rate

• Designed to hold storm water for up to a 1 ½” rain event, the Internal weir system directs flow, disperses and maintains water levels.

• An overflow inlet is provided at the lower cell, designed to receive storm water above ;
Rain Harvesting & Landscape Details

- Rain Garden Design needs to prioritize functionality first before aesthetics
- A combination of the right organic material, pH levels, soil and aggregate and profile layering.
- Larger aggregate, below the choke layer, should provide improved percolation flow towards the perforated pipe at the base.
Rain Harvesting & Landscape Details

- Concept of 'stair stepped' planter beds with 22'-0" Tree spacing
CONCEPTUAL DESIGN ALTERNATIVES

Stakeholder Meetings, June 15, 2011

- Bald Cypress
- Side oats Gramma
- Gulf Muhly
- Switch grass
- Little Bluestem (Median)

Native Plants chosen for their endurance and mitigation qualities more floodplain than drought tolerant due to inundation abilities and low oxygen levels.

- Rain Garden soil composition will provide substantial organic nutrition and optimal conditions for storm water percolation.

- While it is anticipated that this Landscape Plan is self-sufficient, during drought conditions or extreme heat, additional irrigation will be necessary in order to assure survival.

Rain Harvesting & Landscape Details
Landscape Details – Dallas Bike and Trinity Wayfinding Signage
Landscape Details – Trinity Street and Pedestrian Lighting
Concept
As envisioned in 2012
After
Implementation completed in 2019
Implementation

Site Furnishings, Timed Signalization, Pedestrian Refuge, Enhanced Crosswalks and Special Pavement
Implementation

Transit Stops, Buffered Bike Lanes. Rain Gardens and Details
Open Discussion

Beckley / Commerce Intersection
A Stakeholder Driven, Complete & Green Street - Pilot Project

Don Raines Jr. – Senior Planner
City of Dallas, Planning & Urban Design
don.raines@dallascityhall.com
Presentation Overview

- Project Location
- Background
- Reconstruction Concept
- Sidewalk Paving
- Planting Beds & Rain Gardens
- Lighting
- Maintenance
- Post Construction Photos
  - Shortly After Construction
  - Several Years After Construction
  - Current Day
- Summary
Background

- Broad one-way street with limited sidewalk area and very little landscaping
- Eclectic area in transition from service industries (residential/restaurant/clubs)
- Desire by residents and owners to make more pedestrian friendly and add enhancements
- Impervious area with downstream stormwater capacity constraints
Reconstruction Concept

- Change from one-way to two-way street
- Increase sidewalk areas in front of businesses
- Parallel parking areas
- Enhanced crosswalks at intersections
- Stormwater conservation through pervious pavement, amended planters and rain gardens
- Increase landscaping
- Enhance pedestrian accommodations
  - Sidewalk Dining
  - ADA Access
  - Bicycle Access
- Lighting
Sidewalk Paving

- Utilized Broom finished concrete band and walk section next to buildings
  - Allows for expansion/remodel of shop fronts
  - Diffused runoff
- Pavers used for accent bands along parallel parking, at intersection bulb-outs and main intersections
  - Accent colors and patterning
  - Transition slope from walk to curb section
Sidewalk Paving

- iSWM/LID Application – Larger sized permeable pavers at intersection bulb-outs or between drives for trees
  - Runoff is treated – TSS captured
  - Irrigation reduced by partial retention
  - Canopy shading is provided – healthy roots
  - Aesthetic
Planting Beds & Rain Gardens

- Heavy compacted urban “dirt” and old road subbase at new planter areas
- Traditionally bring in topsoil and amend dirt at surface for planting at beds
- Planter Beds
  - Urban “dirt” remediation to “soil”
Planting Beds

• iSWM/LID Application: Planter Beds – Healthy Soil
• Removed road subbase down to natural subsoils
• Ripped subsoils deeply
• Amended soils in stratified layers
  • Topsoil
  • Expanded Shale
  • Mature/Finished Compost
• “Soil” structure restored for planting
• Permeability/Infiltration increased
Plant Material

- Native Plants
  - Adapted to regional rain provisions
  - Adapted to dry and wet/immersed locations
  - Deeper roots for drought tolerance/less irrigation
  - Deep roots provide more infiltration
Rain Gardens

• iSWM/LID Application – Used depressed areas for rain gardens where possible
  • Runoff captured and treated (phytoremediation)
  • 85% rain gardens infiltrating, subdrainage added to 10% rain gardens due to subsoil issues
  • Irrigation reduced
Lighting

• Changed from High Pressure Sodium to Metal Halide
  • Provide fuller color range of light to all colors of buildings, plantings, pavements, restaurant foods served in outdoor dining areas
• Modify pole and add reflector
• Deliver lighting where needed
  • Provide light levels for heavy night use in district
  • Security, retail visibility, sidewalk and roadway pavement surfaces

Existing fixture with 16’ metal pole and no reflector

New fixture with 13’ spun concrete pole, reflector, and banner arms
Maintenance

- Maintaining landscaping after construction is complete and allow for establishment
  - Provided two year maintenance contract (held plant replacement warranty)
  - Deep Ellum Foundation took maintenance responsibility after the two year maintenance contract
  - Use of deeply amended soils, rain gardens and permeable pavers for potable water reduction for irrigation
Post-Construction Photos – Shortly After Construction
Post-Construction Photos – Several Years after Construction
Post-Construction Photos – Current Day
Post-Construction Photos – Current Day
Summary

• Project Elements
  • Extensive Landscaping/Rain Gardens
  • Wide, Upgraded Sidewalks
  • ADA Accessibility
  • Traffic Calming/Indented Parking
  • Enhanced Traffic Calming Crosswalks
  • Added landscape/pedestrian paving bulb-outs
  • Designated concrete walkway adjacent to buildings
  • Permeable pavers over structural soil for tree planting root development
  • iSWM/LID

• Challenges
  • Choose the Correct Material for the Correct Location
  • Maintenance Agreement w-Deep Ellum Foundation
  • Citizen Complaints
Elm Street, Good Latimer Expressway to Exposition Avenue

Green Transportation Infrastructure Workshop
August 24, 2021

Chris Turner-Noteware, P.E.
City Engineer
Department of Public Works
City of Dallas
Session Q&A