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 - 11:05 AM **OVERVIEW OF GREEN INFRASTRUCTURE RESOURCES**

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 – 12:00 PM **LOCAL EXAMPLES AND IMPLEMENTATION STRATEGIES**

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 – 1:00 PM **Lunch**

1:00 PM – 2:25 PM **LOCAL EXAMPLES AND IMPLEMENTATION STRATEGIES (Cont.)**

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 – 2:30 PM **CLOSING**

Wrap-Up/Final Thoughts

NCTCOG Green Transportation Infrastructure Workshop

AUGUST 24, 2021 | ZOOM MEETING

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

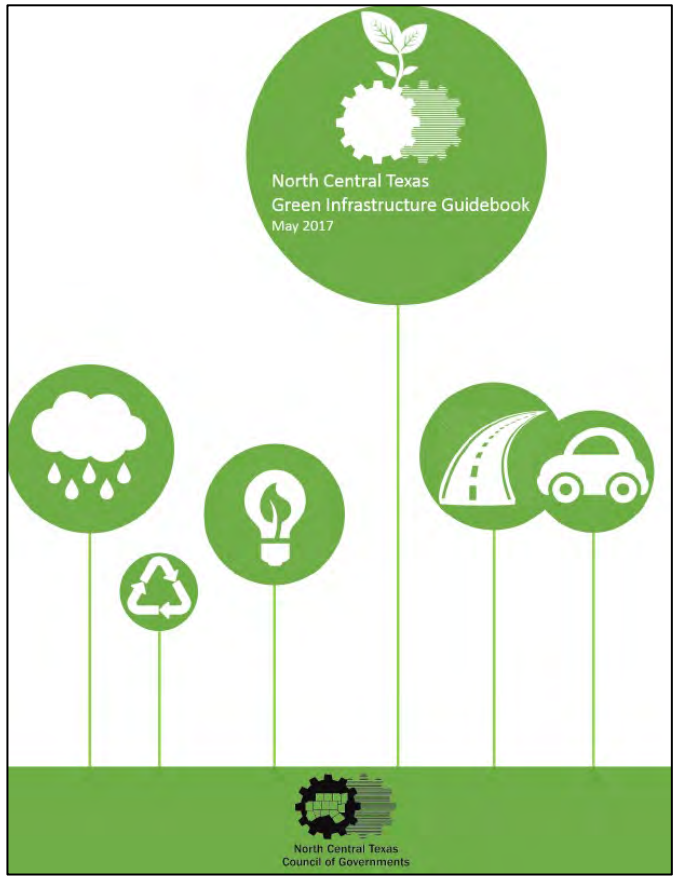
Improves/Increases

- 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

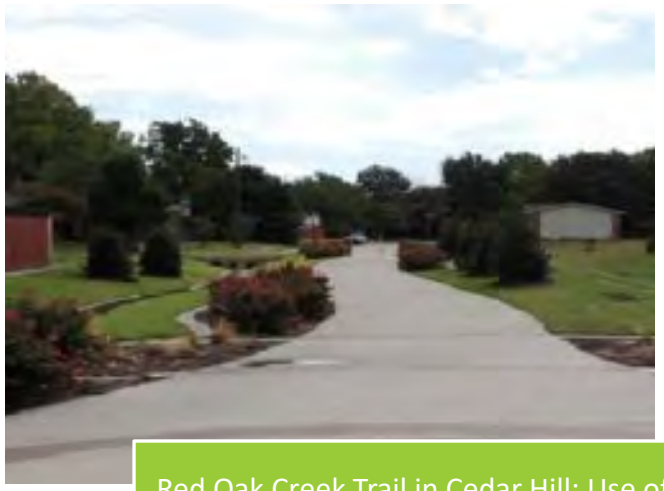


Provides resources for professionals in assessing choices for integrating green infrastructure projects into transportation projects

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

Table 13. Cost Estimate Details for Permeable Pavements.

Components/Activities	Cost Estimates
Excavation	$1.10-$2.25/ft²
Hydraulic restriction layer	30-mil liner: $0.35/ft² Concrete barrier: $12/ft²
Permeable pavement materials	Porous asphalt $2/ft², porous concrete $6/ft², pervious interlocking concrete pavers $3/ft², plastic grid pavers $2.50/ft²
Bedding layer	Washed sand (2-inch layer): $0.20/ft² No. 8 aggregate (min. 2 inches thick): $0.22/ft² No. 57 stone (min. 6 inches to 1 foot): $0.83-$1.67/ft²

Source: *San Antonio River Basin Low Impact Development Technical Design Guidance Manual,* Appendix G, 2013.

Promoting the Economic Benefits of Green Infrastructure

Green Transportation Infrastructure Virtual Workshop

August 24, 2021

Economic & Environmental Benefits of Stewardship Tool (EEBS)

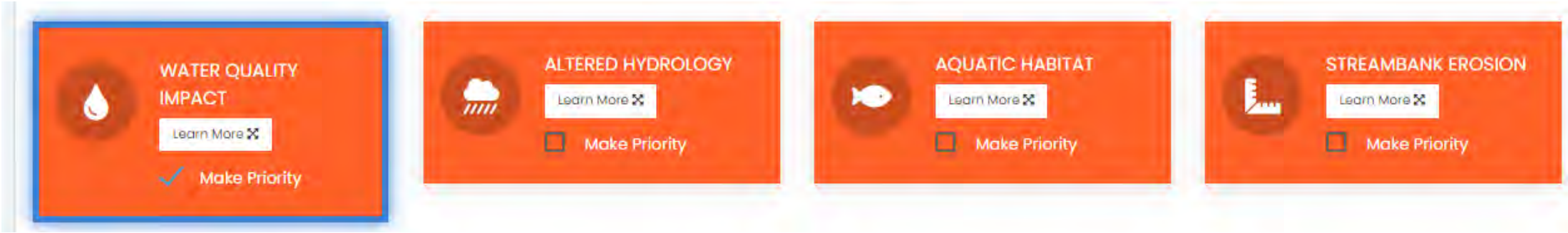
“ We look at environmental programs as the right thing to do, but we look at them as a cost. How do we measure the return on investment of this work? ”

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

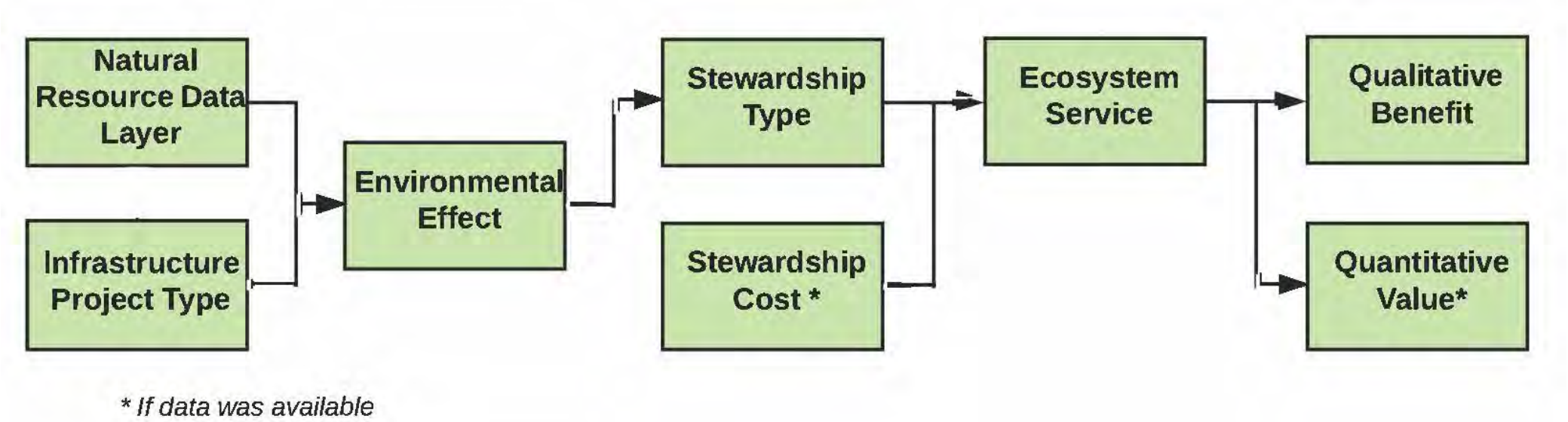
"Barriers to green infrastructure"

"Need for financial data"

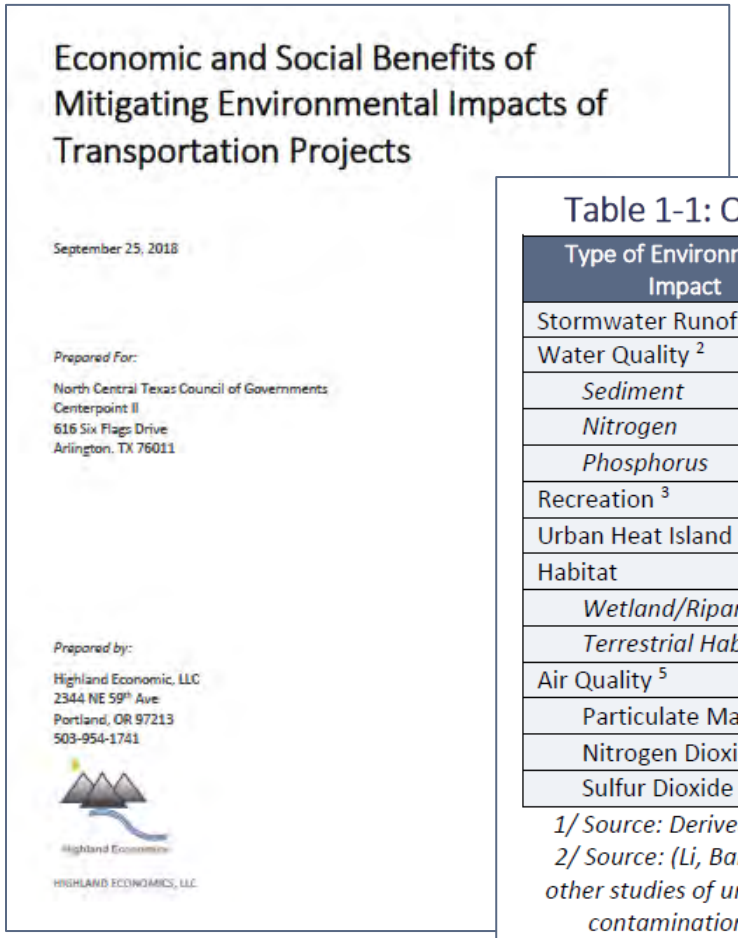
"Need for public education"

"Need to include green infrastructure in planning phase"

Tool Concept Map



Economic Data



Economic and Social Benefits of Mitigating Environmental Impacts of Transportation Projects

September 25, 2018

Prepared For:

North Central Texas Council of Governments
Centerpoint II
616 Six Flags Drive
Arlington, TX 76011

Prepared by:

Highland Economic, LLC
2344 NE 59th Ave
Portland, OR 97213
503-954-1741

HIGHLAND ECONOMICS, LLC

Table 1-1: Quantifie

Type of Environmental Impact		
Stormwater Runoff [1]		
Water Quality [2]		
Sediment		
Nitrogen		
Phosphorus		
Recreation [3]		
Urban Heat Island [4]		
Habitat		
Wetland/Riparian		
Terrestrial Habitat		
Air Quality [5]		
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

1/ Source: Derived from rainfall in the Dallas/Fort Worth area from 2008 - 2017 (National Weather Service, 2018).
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 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)

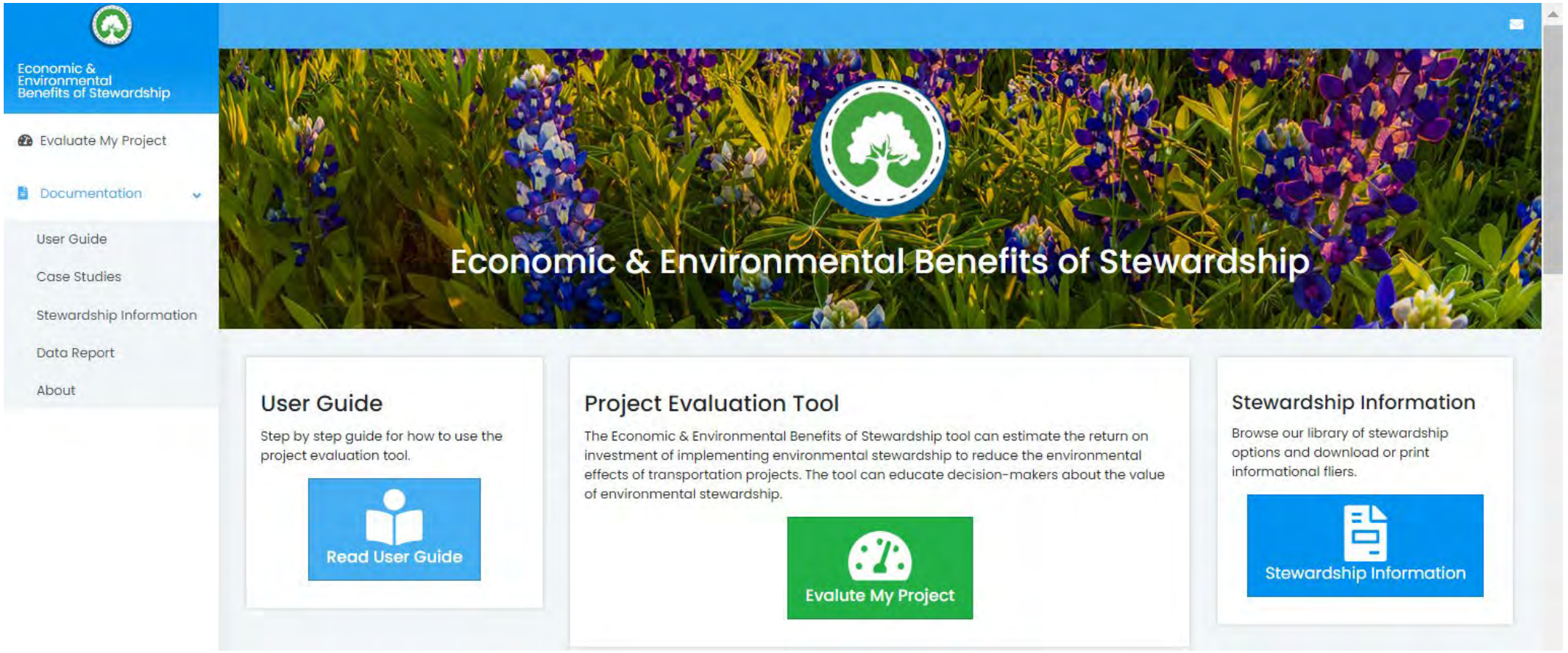
Table 1-3: Quantified Benefits: Tool Inputs on Economic Benefit

Environmental Benefit	Economic Value	Unit
Stormwater Management [1]	$1,000 - $1,100	$ / Acre impervious / Year
Water Quality (Nitrogen) [2]	$1 - $10	$ / Pound
Water Quality (Phosphorus) [2]	$1 - $10	$ / Pound
Water Quality (TSS) [2]	$6	$ / Ton
Recreation [3]	$3 - $25	Per Visit Benefit to Recreator
Energy Savings [4]	$0.1165	$ / kWh
Aesthetics	$300 - $900	$ / Street Tree / Year
Air Quality (PM_{10}) [5]	$7.36 - $19.85	$ / Pound
Air Quality (NO_2) [5]	$4.59 - $11.54	$ / Pound
Air Quality (SO_2) [5]	$3.67 - $18.40	$ / Pound
Habitat, Terrestrial	$100 - $750	$ / Acre / Year
Habitat, Wetland/Riparian	$500 - $11,400	$ / Acre / Year
Pavement Maintenance Costs	$3.50 - $17	$ / Tree / Year

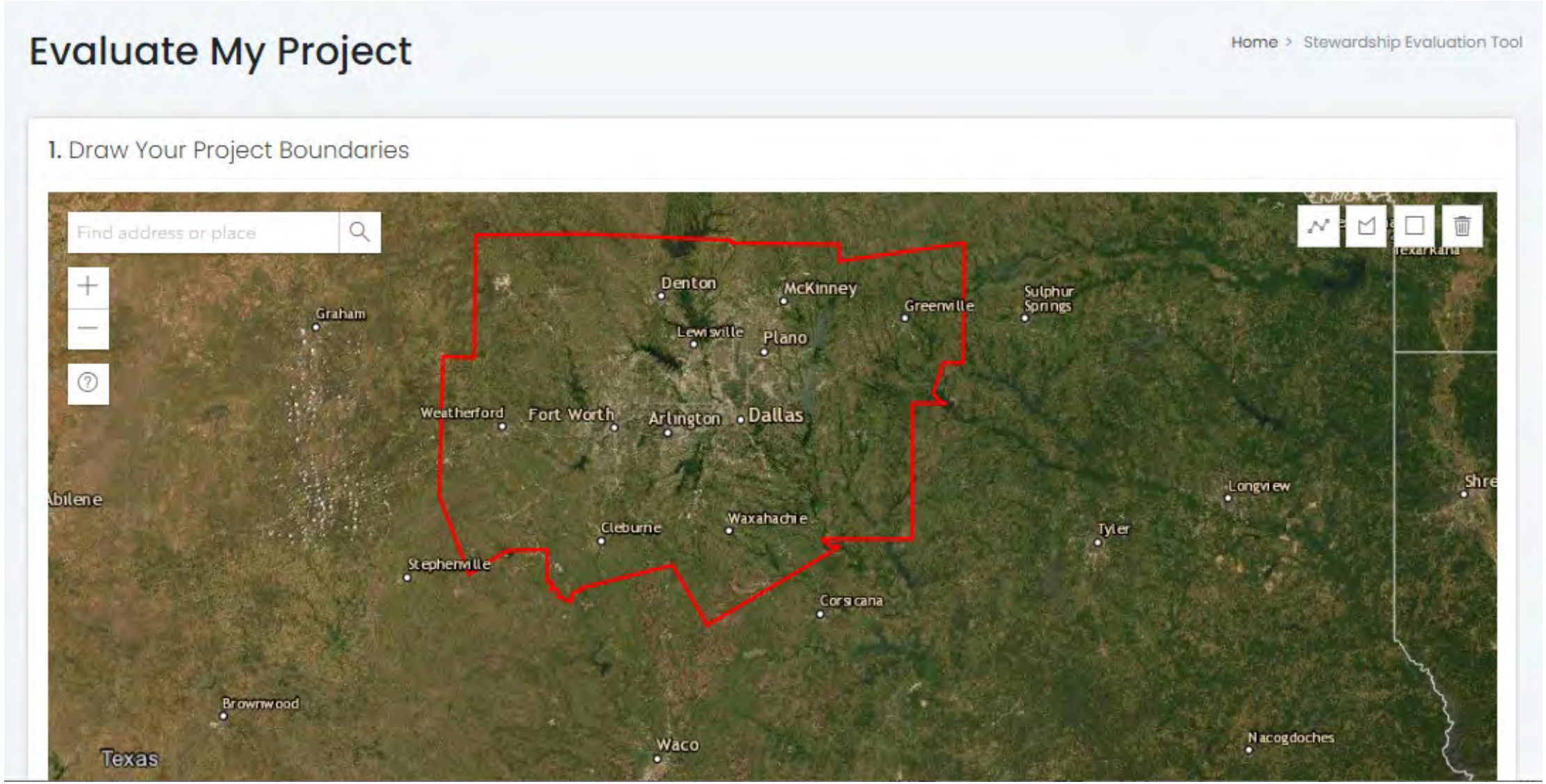
Note: Health benefits from air quality are included in the air quality values.
1/ Derived from the residential stormwater fees in Fort Worth and Dallas
2/ (U.S. Environmental Protection Agency, 2015; Natural Resource Conservation Service, US Department of Agriculture, 2010; Shaik, Helmers, & Langemeier, 2002)
3/ Sources: (Hansen, Mills, Stoll, Freeman, & Hankamer, 1990; Bergstrom & Cordell, 1991; Loomis, 2005). All values were 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 (TexasElectricity Ratings.com, 2018)
5/ Derived from (Wang & Santini, 1995). The most recent data available were used for the Dallas metro area population and air pollutant concentrations. Values were adjusted to 2018 dollars using the Consumer Price Index.

EEBS Demonstration

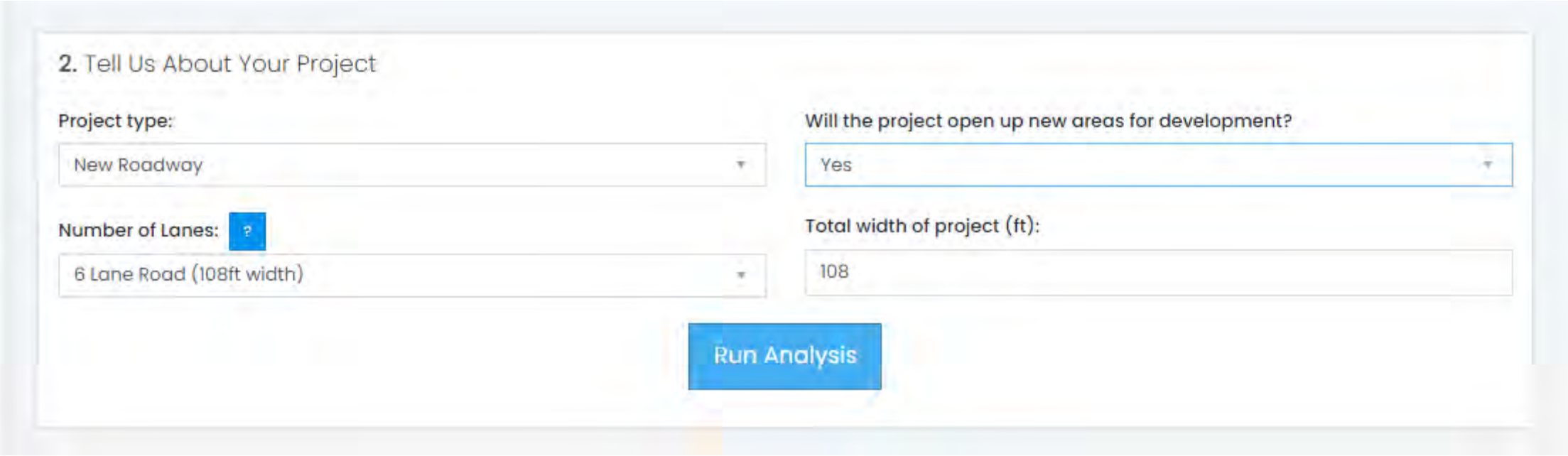
http://eebs.nctcog.org



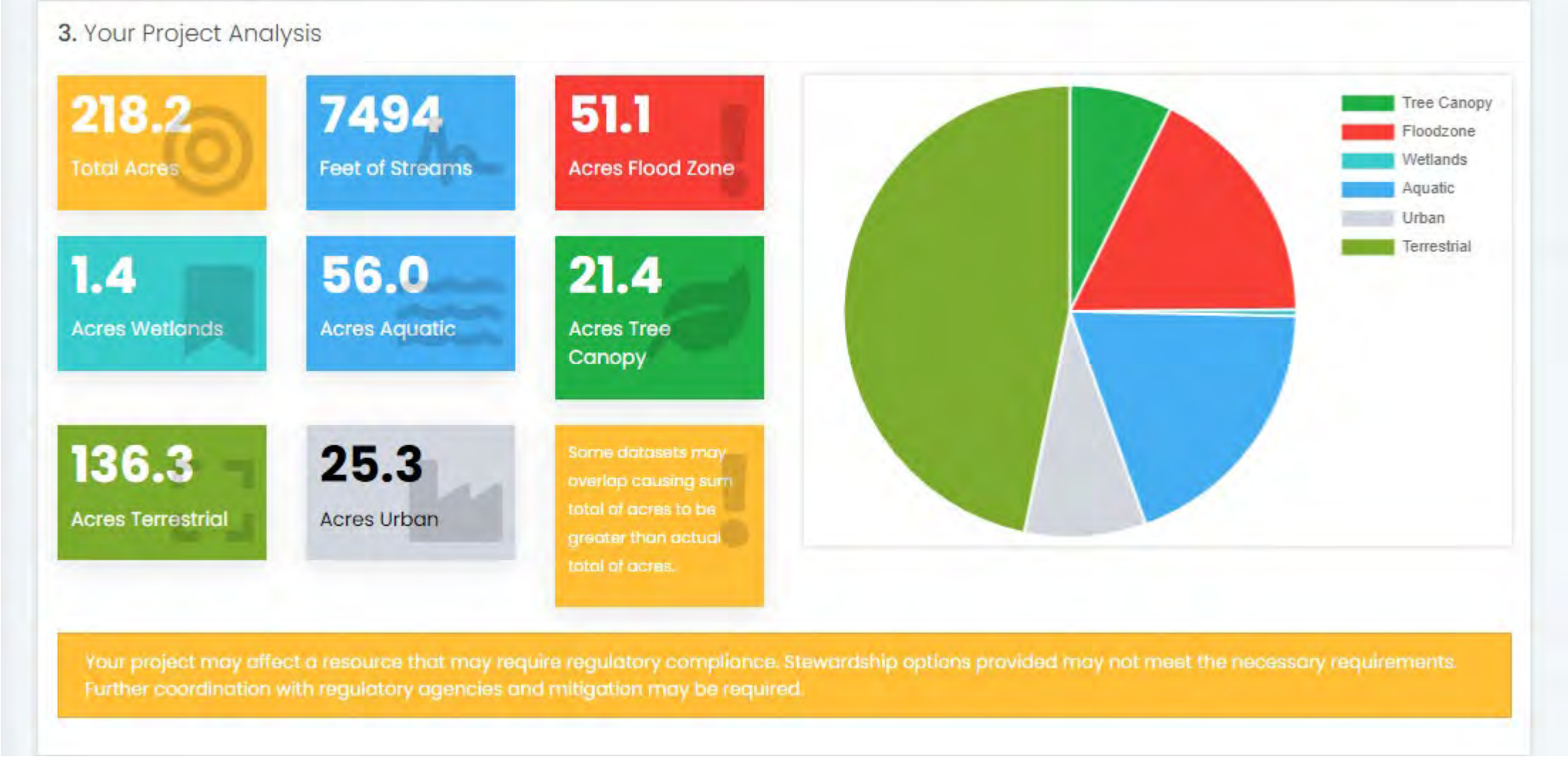
Draw Project Boundaries



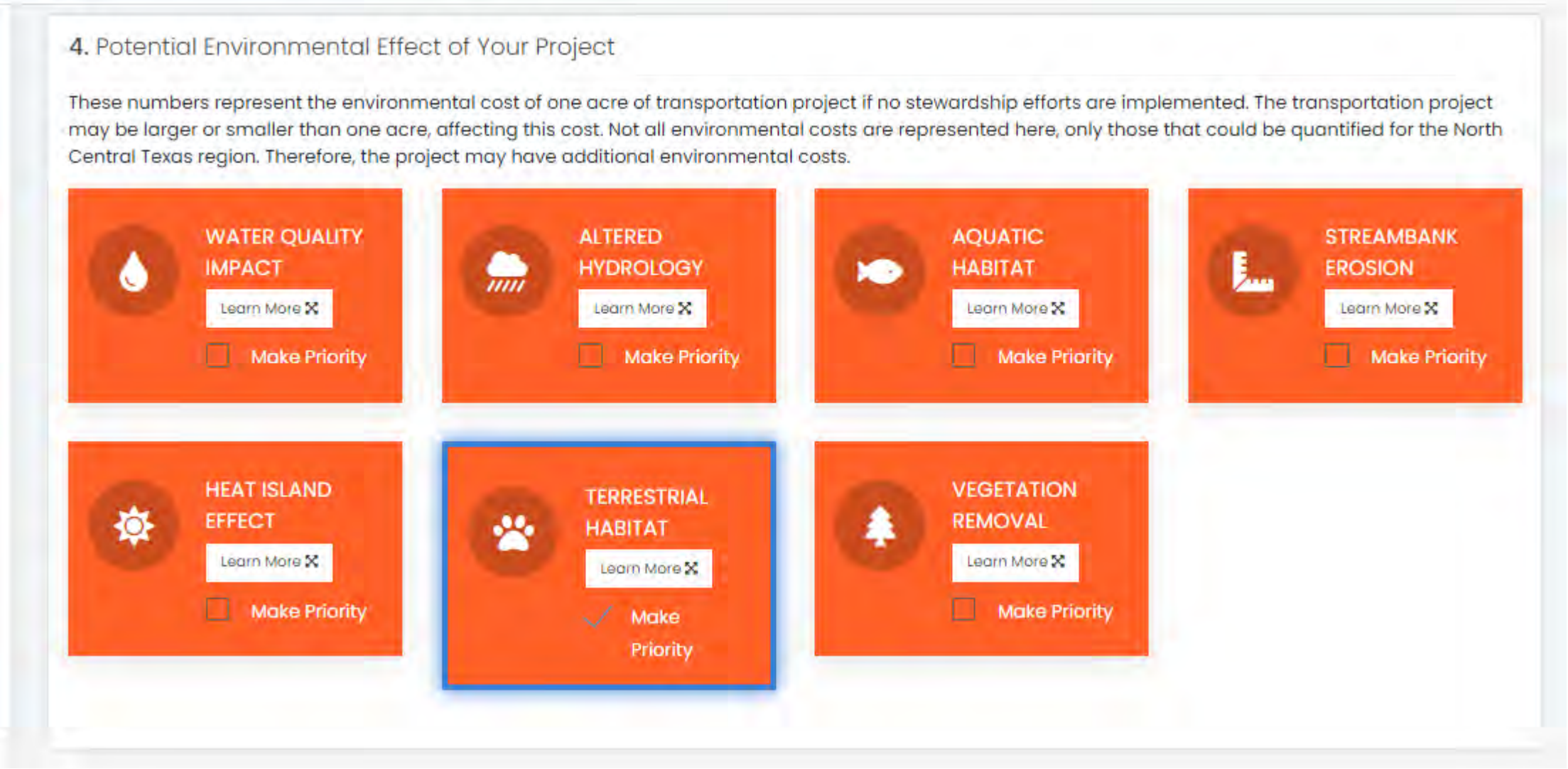
Define Project Type and Size



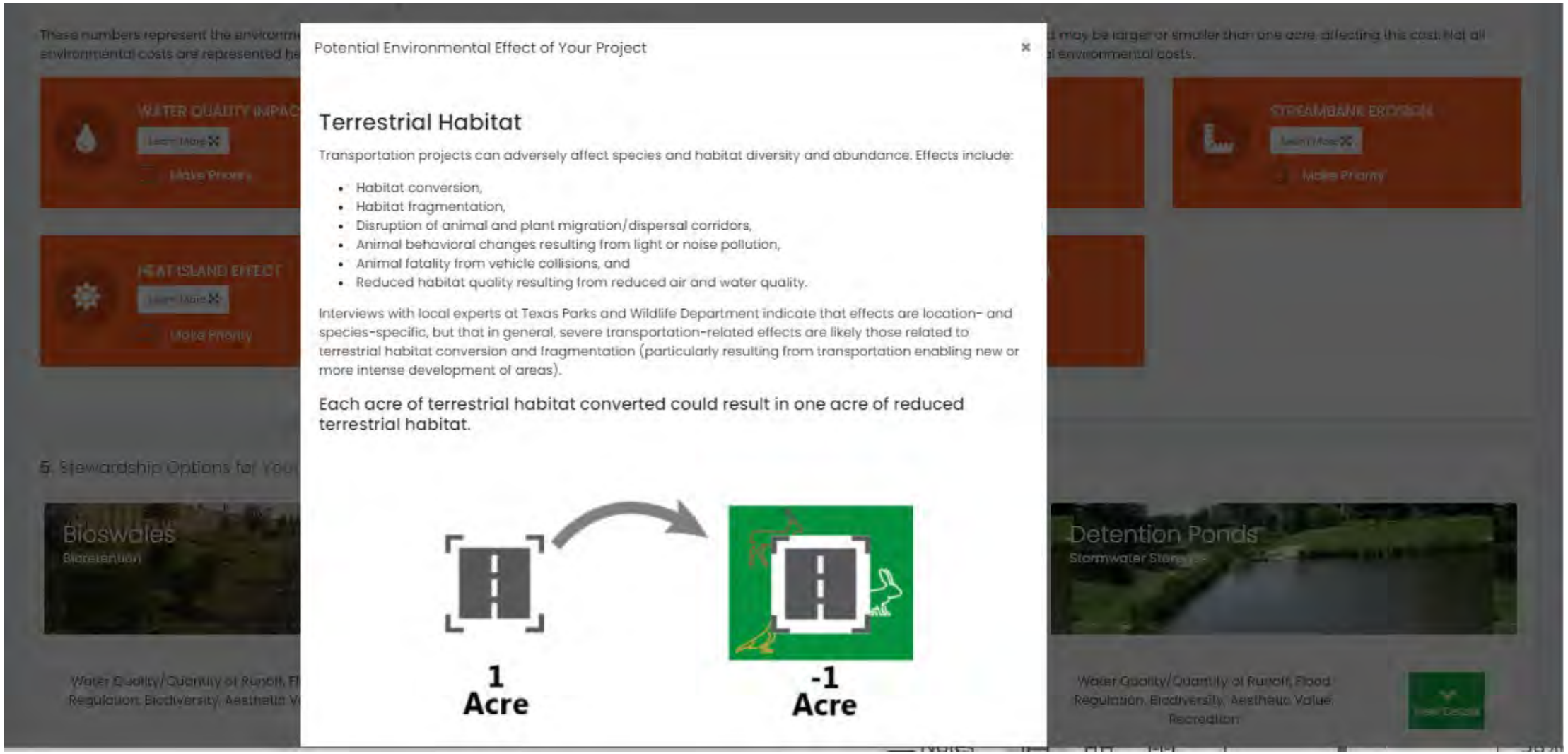
Review Potential Environmental Effects



Explore and Prioritize Potential Environmental Effects



Learn More About Potential Environmental Effects



Identify Potential Stewardship Options

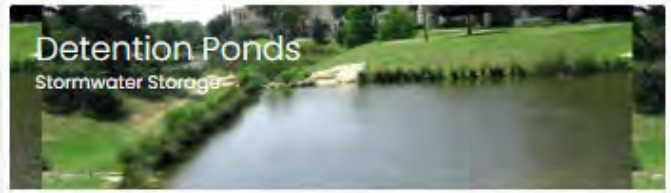
5. Stewardship Options for Your Project

Water Quality/Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value

View Details

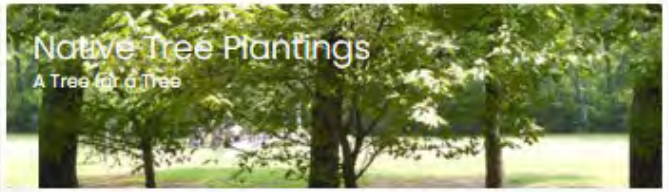
Water Quality/Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value, Recreation, Air Quality

View Details



Water Quality/Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value, Recreation

View Details



Water Quality/Quantity of Runoff, Flood Regulation, Biodiversity, Aesthetic Value, Recreation, Air Quality

View Details

Biodiversity, Aesthetic Value

View Details

Aesthetic Value, Recreation, Biodiversity

View Details

Explore Costs and Benefits of Stewardship Options

6. Stewardship Option Details

Detention Ponds

Detention ponds capture and store stormwater in a pond year-round, or during/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.

Narrative Details on Costs and Benefits

Cost Range

Detention ponds are estimated to cost $15,600 to $48,400 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 $6 to $212 for sediment removal, $27 to $10,027 for nitrogen 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 $12,060.

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 habitat. This indirectly supports commercial and recreational fisheries and other wildlife-dependent activities.

Aesthetic Benefits

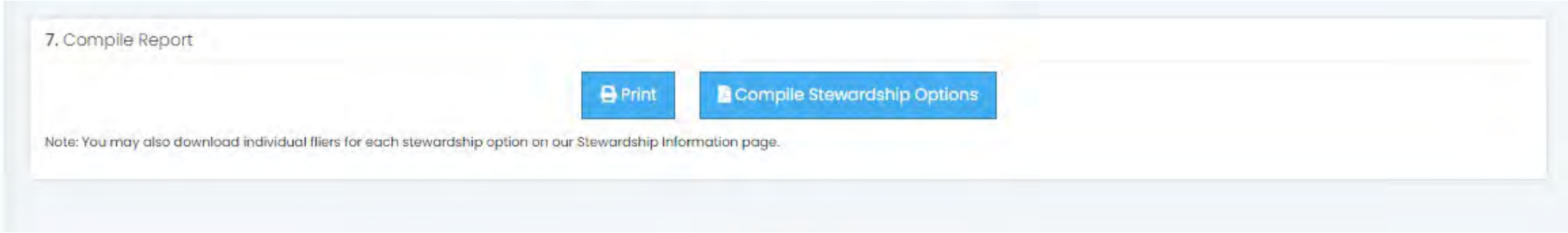
As detention ponds provide a moderate benefit by increasing the presence of water bodies in an area, they have the potential to provide aesthetic value to nearby residents, businesses, and visitors.

Other Health and Social Benefits

Detention ponds may provide moderate physical and mental health benefits resulting from their greenness or presence of aquatic features. Presence of greenness or aquatic features may result in greater outdoor physical activity because of an increase 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



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.nctcog.org/envir/development-excellence/rise-coalition

Regional Emissions Assessment

Emissions Impact Analysis and Mitigation/Adaptation Strategy Toolkit

Urban Heat Island Reduction Strategy Analysis

Food Diversion and Waste Reduction Programs

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

North Central Texas Council of Governments

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.

Learn More

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.

Learn More

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.

Learn More

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:

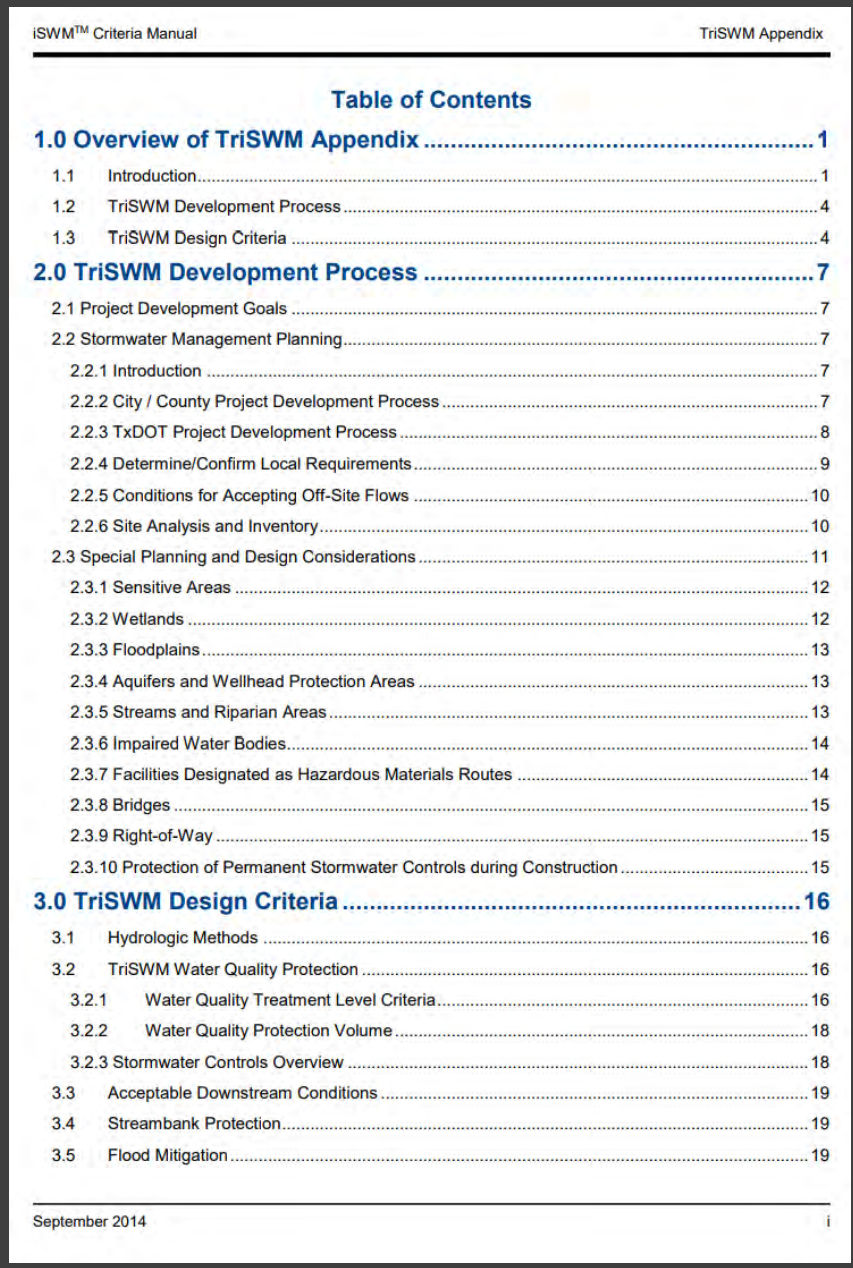
- Design roads and highways with stormwater impacts in mind
- Address and mitigate the adverse impacts of development on runoff
- Implement stormwater controls to meet the TriSWM planning and design approach
- http://iswm.nctcog.org/what-is-triswm.html

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.



iSWM™ Criteria Manual — TriSWM Appendix

Table of Contents

TriSWM integrated Stormwater Management (TriSWM) Appendix (NCTCOG)

TriSWM Design Criteria

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.

Table 3.1 Post-Construction Water Quality Treatment Levels

Traffic Volume	Receiving Water / Riparian Area Susceptibility		
	Minimal	Moderate	High
Low (<30,000 VPD)	Level I	Level I	Level II
High (>30,000 VPD)	Level I	Level II	Level III

Once the treatment level requirements have been established for the project, select practices or structural stormwater controls in accordance with the appropriate category. Section 3.8 and the *Site Development Controls Technical Manual* contain selection, pollutant removal effectiveness, and design information for the structural controls listed.

Treatment Level I

Select one or more of the following practices and/or structural controls:

- Program of Scheduled Pollution Prevention Practices
  Municipal pollution prevention/good housekeeping practices such as street sweeping, storm drain inlet cleaning, and proper application of landscape chemicals
- Off-site Pollution Prevention Activities/Programs
  Route stormwater runoff to new or existing watershed-level BMPs (i.e. regional detention, Dallas CBD sumps, etc.) identified in the entity's MS4 Permit / Stormwater Management Program
- Grass Channels
- Filter Strips
- Gravity (Oil-Grit) Separator
- Proprietary Structural Controls
- Porous Concrete / Modular Porous Paver Systems

Treatment Level II

Select one or more of the following practices and/or structural controls:

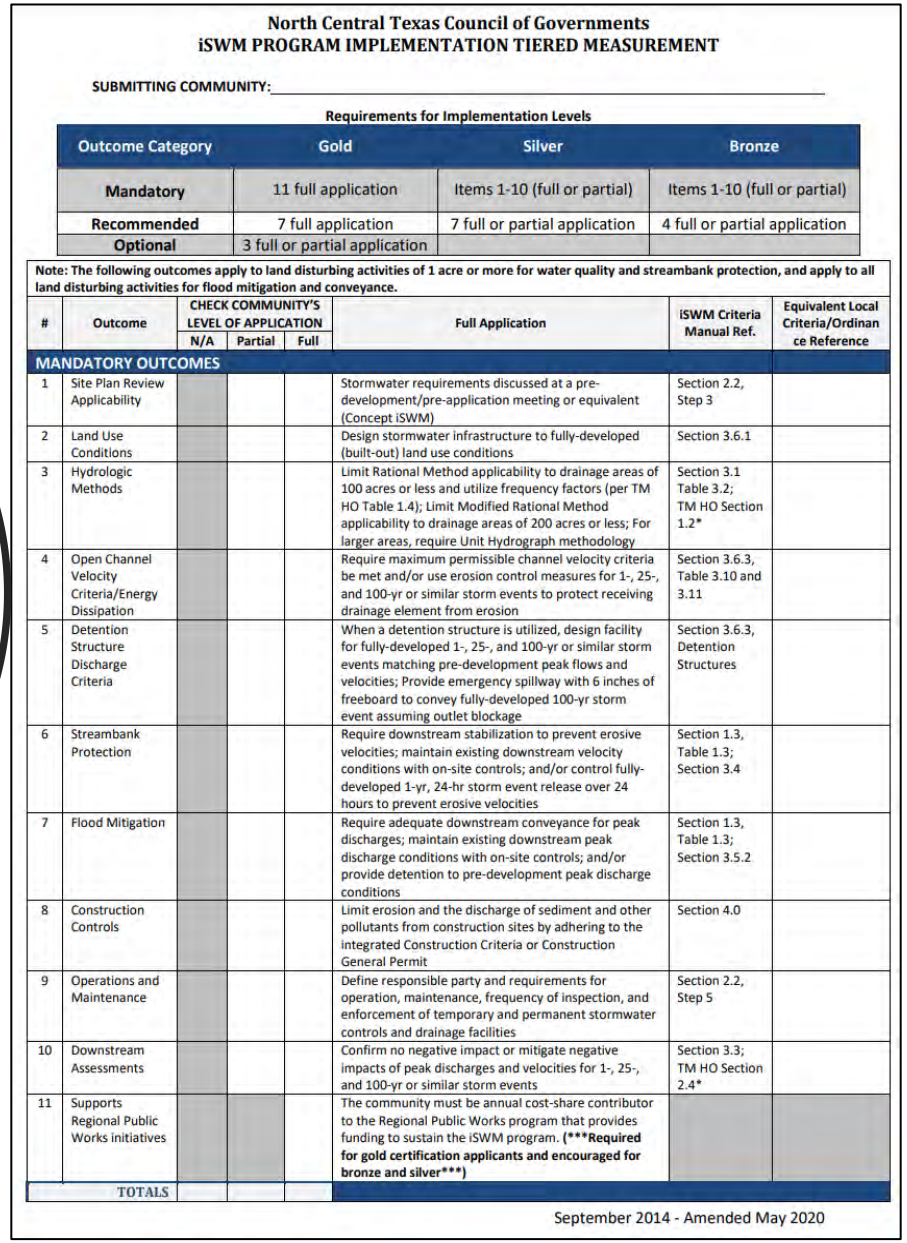
- Enhanced Swales
- Bioretention Areas
- Dry Detention / Extended Detention Dry Basins
- Supplement with any BMPs identified in Level I

Treatment Level III

Select one or more of the following practices and/or structural controls:

- Organic Filter
- Sand Filter
- Underground Sand Filter
- Infiltration Trenches
- Stormwater (Wet) Ponds
- Stormwater Wetlands
- Alum Treatment Systems (used as pretreatment in conjunction with wet pond)
- Supplement with any BMPs identified in Levels I and II

Points for TriSWM Implementation in the iSWM Certification Application



North Central Texas Council of Governments
iSWM PROGRAM IMPLEMENTATION TIERED MEASUREMENT

SUBMITTING COMMUNITY:_____

Requirements for Implementation Levels

Outcome Category	Gold	Silver	Bronze
Mandatory	11 full application	Items 1-10 (full or partial)	Items 1-10 (full or partial)
Recommended	7 full application	7 full or partial application	4 full or partial application
Optional	3 full or partial application		

Note: The following outcomes apply to land disturbing activities of 1 acre or more for water quality and streambank protection, and apply to all land disturbing activities for flood mitigation and conveyance.

#	Outcome	CHECK COMMUNITY'S LEVEL OF APPLICATION N/A	Partial	Full	Full Application	iSWM Criteria Manual Ref.	Equivalent Local Criteria/Ordinance Reference
MANDATORY OUTCOMES							
1	Site Plan Review Applicability				Stormwater requirements discussed at a pre-development/pre-application meeting or equivalent (Concept iSWM)	Section 2.2, Step 3	
2	Land Use Conditions				Design stormwater infrastructure to fully-developed (built-out) land use conditions	Section 3.6.1	
3	Hydrologic Methods				Limit Rational Method applicability to drainage areas of 100 acres or less and utilize frequency factors (per TM HO Table 1.4); Limit Modified Rational Method applicability to drainage areas of 200 acres or less; For larger areas, require Unit Hydrograph methodology	Section 3.1 Table 3.2; TM HO Section 1.2*	
4	Open Channel Velocity Criteria/Energy Dissipation				Require maximum permissible channel velocity criteria be met and/or use erosion control measures for 1-, 25-, and 100-yr or similar storm events to protect receiving drainage element from erosion	Section 3.6.3, Table 3.10 and 3.11	
5	Detention Structure Discharge Criteria				When a detention structure is utilized, design facility for fully-developed 1-, 25-, and 100-yr or similar storm events matching pre-development peak flows and velocities; Provide emergency spillway with 6 inches of freeboard to convey fully-developed 100-yr storm event assuming outlet blockage	Section 3.6.3, Detention Structures	
6	Streambank Protection				Require downstream stabilization to prevent erosive velocities; maintain existing downstream velocity conditions with on-site controls; and/or control fully-developed 1-yr, 24-hr storm event release over 24 hours to prevent erosive velocities	Section 1.3, Table 1.3; Section 3.4	
7	Flood Mitigation				Require adequate downstream conveyance for peak discharges; maintain existing downstream peak discharge conditions with on-site controls; and/or provide detention to pre-development peak discharge conditions	Section 1.3, Table 1.3; Section 3.5.2	
8	Construction Controls				Limit erosion and the discharge of sediment and other pollutants from construction sites by adhering to the integrated Construction Criteria or Construction General Permit	Section 4.0	
9	Operations and Maintenance				Define responsible party and requirements for operation, maintenance, frequency of inspection, and enforcement of temporary and permanent stormwater controls and drainage facilities	Section 2.2, Step 5	
10	Downstream Assessments				Confirm no negative impact or mitigate negative impacts of peak discharges and velocities for 1-, 25-, and 100-yr or similar storm events	Section 3.3; TM HO Section 2.4*	
11	Supports Regional Public Works initiatives				The community must be annual cost-share contributor to the Regional Public Works program that provides funding to sustain the iSWM program. **(***Required for gold certification applicants and encouraged for bronze and silver***)**		
	TOTALS						

September 2014 - Amended May 2020

North Central Texas Council of Governments
iSWM PROGRAM IMPLEMENTATION TIERED MEASUREMENT

RECOMMENDED OUTCOMES							
12	Conveyance Limits				25-yr fully-developed design storm or higher for: streets, roadway gutters, storm drain pipe systems, inlets on-grade and parking lots; 100-yr fully-developed design storm event for: drainage in the right-of-way, drainage easements, and road low points	Section 3.6.2	
13	Storm Drain Velocity Criteria				Limit velocity in pipes with minimum and maximum values to prevent clogging and erosion	Section 3.6.1, Table 3.8	
14	Spread Criteria				Flow spread limits for various street classifications for 25-yr storm event or higher	Section 3.6.2, Table 3.7	
15	Freeboard Criteria				Minimum of 1 foot of freeboard provided for the fully-developed 100-yr storm event for culverts and detention structures; Minimum of 2 feet of freeboard for bridges for fully-developed 100-yr storm event	Section 3.6.3	
16	Finished Floor Elevations				Minimum of 1-foot above fully-developed 100-yr storm event water surface elevation or 2-feet above effective FEMA base flood elevation	Section 3.7	
17	Water Quality Protection				Require integrated site design practices; treat the water quality volume; and/or enact regional water quality programs	Section 1.3, Table 1.3; Section 3.2	
18	Drainage and Floodplain Easements				Required for all drainage systems that convey stormwater runoff across property boundaries and must include sufficient area for operation and maintenance of the public drainage system	Section 3.7	
	TOTALS						
OPTIONAL OUTCOMES							
19	Open Channel Stability Criteria				Design includes low-flow channel	Section 3.6.3	
20	Detention Downstream Timing Analysis				Confirm detention does not exacerbate peak flows in downstream reaches	Section 3.5.2, Option 3	
21	Conservation and Utilization of Natural Features and Resources				Ordinances encourage preservation of natural resources such as riparian buffers and/or natural open space areas and utilization of natural design features for stormwater conveyance	Section 3.2.2; TM PL 2.2.1**	
22	Lower Impact Site Design Techniques				Ordinances encourage reducing limits of clearing and grading and limiting impervious cover per integrated site design practices	Section 3.2.2; TM PL 2.2.2**	
23	TriSWM				Incorporate practices for improving water quality of runoff from public rights-of-way	Appendix A of the iSWM Criteria Manual	
	TOTALS						

*TM HO = iSWM Technical Manual, Hydrology Section **TM PL = iSWM Technical Manual, Planning Section

Tier Level Applied For: ☐**GOLD** ☐**SILVER** ☐**BRONZE** Note: (Gold applicants must be annual contributors to the Public Works program)

Print Name and Title of Local Stormwater Authority _____ Contact Phone Number and Email _____

Signature of Local Stormwater Authority _____ Date _____

For IIS Review Board Use Only:

Date of Submittal:_____ Date of Request for Additional Information:_____
Date of Approval:_____ Date Additional Information Received:_____
Approved Tier Level:_____ Date Informational Letter Sent:_____

September 2014 - Amended May 2020

http://iswm.nctcog.org/Documents/iSWM_Implementation_Tiered_Measurement.pdf

TriSWM Resources

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

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

TriSWM Appendix:
http://iswm.nctcog.org/Documents/TriSWM_Appendix_Final_9-18-14.pdf

TriSWM Brochure:
http://iswm.nctcog.org/Documents/TriSWM_Brochure_10-17-2018.pdf

Transportation *integrated* Stormwater Management (TriSWM)

The Transportation *integrated* Stormwater Management (TriSWM) Appendix of the *integrated* Stormwater Management (iSWM) Criteria Manual for Site Development and Construction is 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.

The purpose of TriSWM is to provide planning and design guidance and a framework for incorporating effective and environmentally sensitive stormwater management practices into the street and roadway project development process and to encourage a greater uniformity in developing plans for stormwater management systems that meet the following goals:

- Provide safe driving conditions
- Minimize downstream flood risk to people and properties
- Minimize downstream bank and channel erosion
- Reduce pollutants in stormwater runoff to protect water quality

Source: Freese & Nichols

TriSWM discusses 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

Why TriSWM?

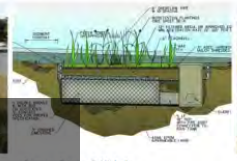
- Runoff from streets and highways may contain pollutants that can impact streams and lakes and must be addressed under state regulations
- Streets create a significant amount of impervious area and additional runoff
- To create common stormwater management criteria across the region

Source: Wikimedia Commons, Michael Pereckas

Pollutant	Primary Sources of Pollutants in Street and Highway Runoff
Particulates	Pavement wear, vehicles, atmosphere, maintenance, snow/ice abrasives, sediment disturbance
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer use, sediments
Metals	Gasoline, diesel, tire wear, lubricating oil and grease, bearing wear, atmospheric fallout, auto body rust, brake linings wear, engine parts wear
Sodium, Calcium	De-icing salts, grease
Chloride	De-icing salts
Sulphate	Roadway beds, fuel, de-icing salts
Petroleum	Spills, leaks, blow-by motor lubricants, antifreeze, hydraulic fluids, asphalt surface leachate
Pathogenic bacteria	Soil litter, bird droppings, trucks hauling livestock/stockyard waste

Adapted from Kobringer, N. 1984. Sources and Migration of Highway Runoff Pollutants – Executive Summary. FHWA/RD-84/057. Federal Highway Administration.

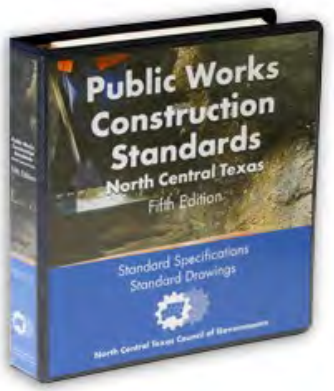
Source: Dunaway Associates



Source: Freese & Nichols

TriSWM Brochure (NCTCOG)

Standard Drawings and iSWM Resources



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

Sack Gabion Check Dam	Area Inlet Protection Excavated Impoundment
Filter Tube Check Dam	Area Inlet Protection Filter Barrier
Excavated Stone Outlet Sediment Trap	Temporary Erosion Control Blankets
Bermed Stone Outlet Sediment Trap	Permanent Turf Reinforcement Mats
Sediment Basin with Overflow Riser	Velocity Dissipation Device
Pipe Slope Drain	Dewatering Controls
Filter Tube Curb Inlet Protection	Concrete Washout Containment
Wire Weir Curb Inlet Protection	Grouted Rock Rip-Rap
Curb Rock Sock On-Grade Curb Inlet Protection	Stream Trash Catch/Screen
Filter Tube Area Inlet Protection	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

iSWM Technical Manual Resources Update:

- **Site Development Controls:** http://iswm.nctcog.org/technical-manual.html
- **iSWM Construction Controls:** http://iswm.nctcog.org/Documents/technical_manual/Construction_Controls_10-2019.pdf
- **Construction Controls Standard Details:** 20 iSWM schematics are now standard details (updated 2018/2019): http://iswm.nctcog.org/Documents/technical_manual/Addendum_Construction_Controls_2021.pdf

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

Signed
January 14, 2019 

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.

https://www.congress.gov/115/plaws/publ436/PLAW-115publ436.pdf

America's Water Infrastructure Act (AWIA)

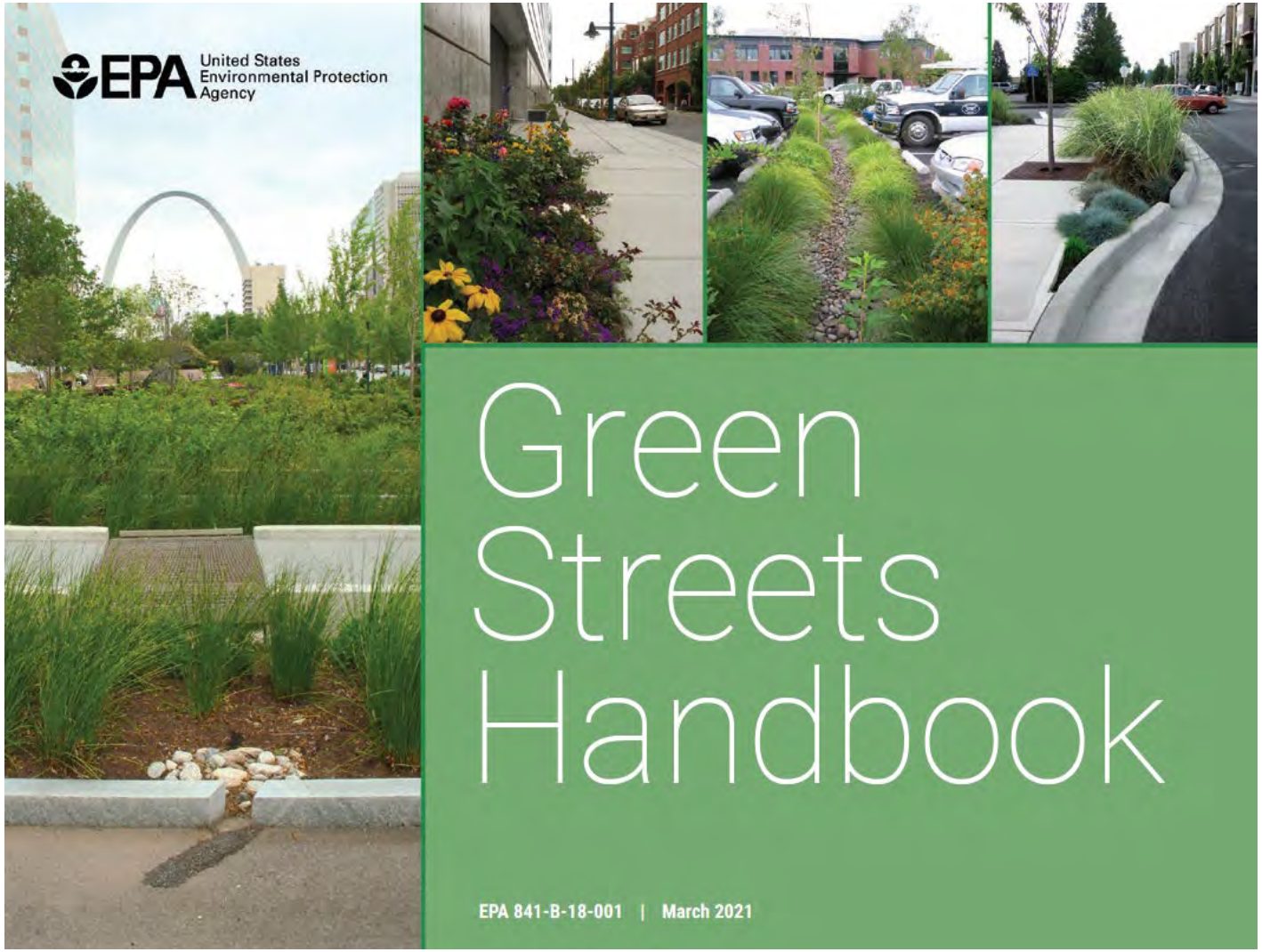
Signed
October 23, 2018

- 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

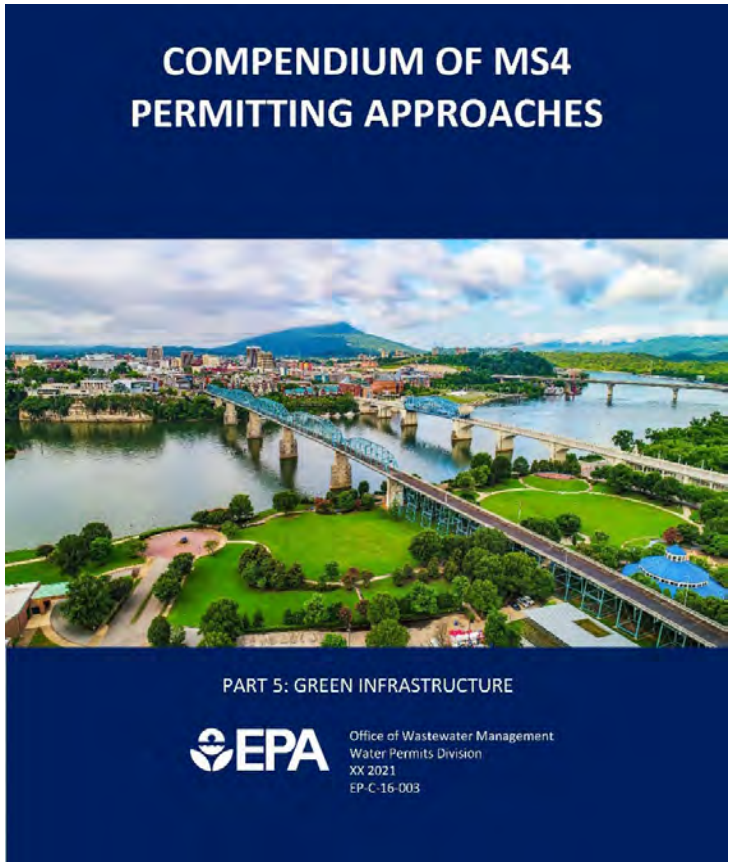
New EPA Resources

- 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 rad 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



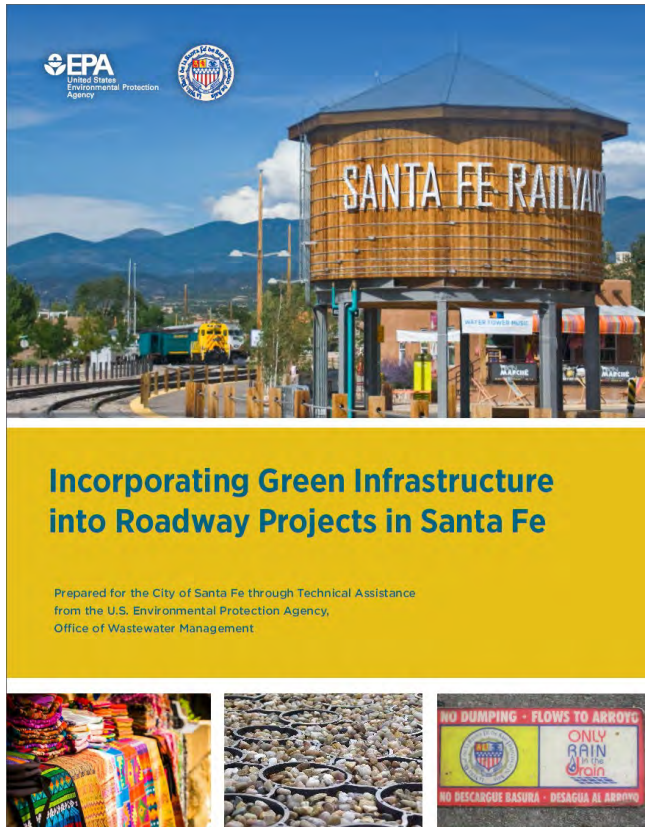
https://www.epa.gov/nps/green-streets-handbook

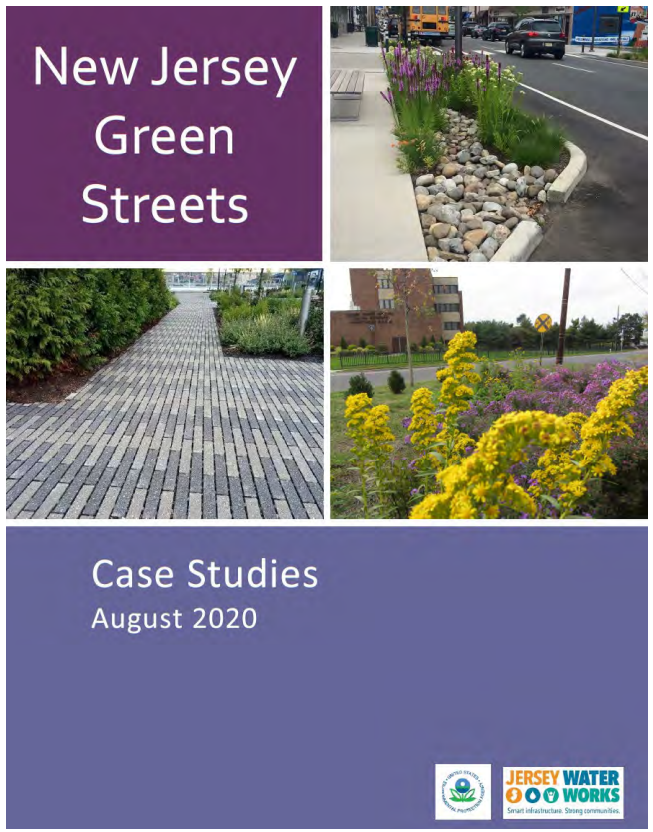
Additional EPA Resources



- 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.

Green and Gray Stormwater Management Practices Included in CLASIC Tool

Rain Garden / Bioretention	Extended Detention Basin	Green Roof
Sand Filter	Wet Pond	Permeable Pavement
Infiltration Trench	Wetland Channels	Vegetated Buffer
Vegetative Swale	Stormwater Harvesting	Grass Strip
	Storage Vault/Tunnel	Rooftop Disconnection

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

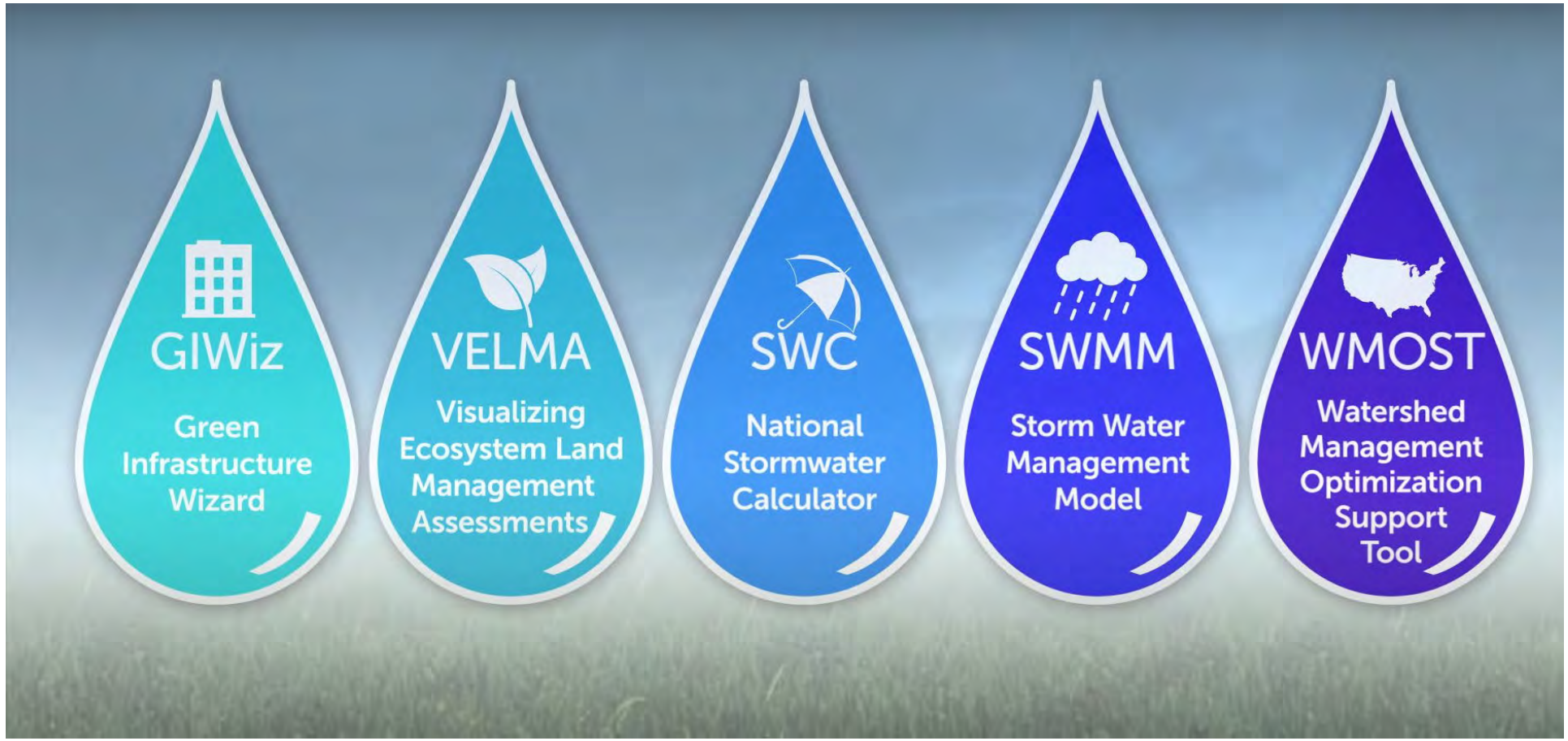
Green Infrastructure Webcast Series

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

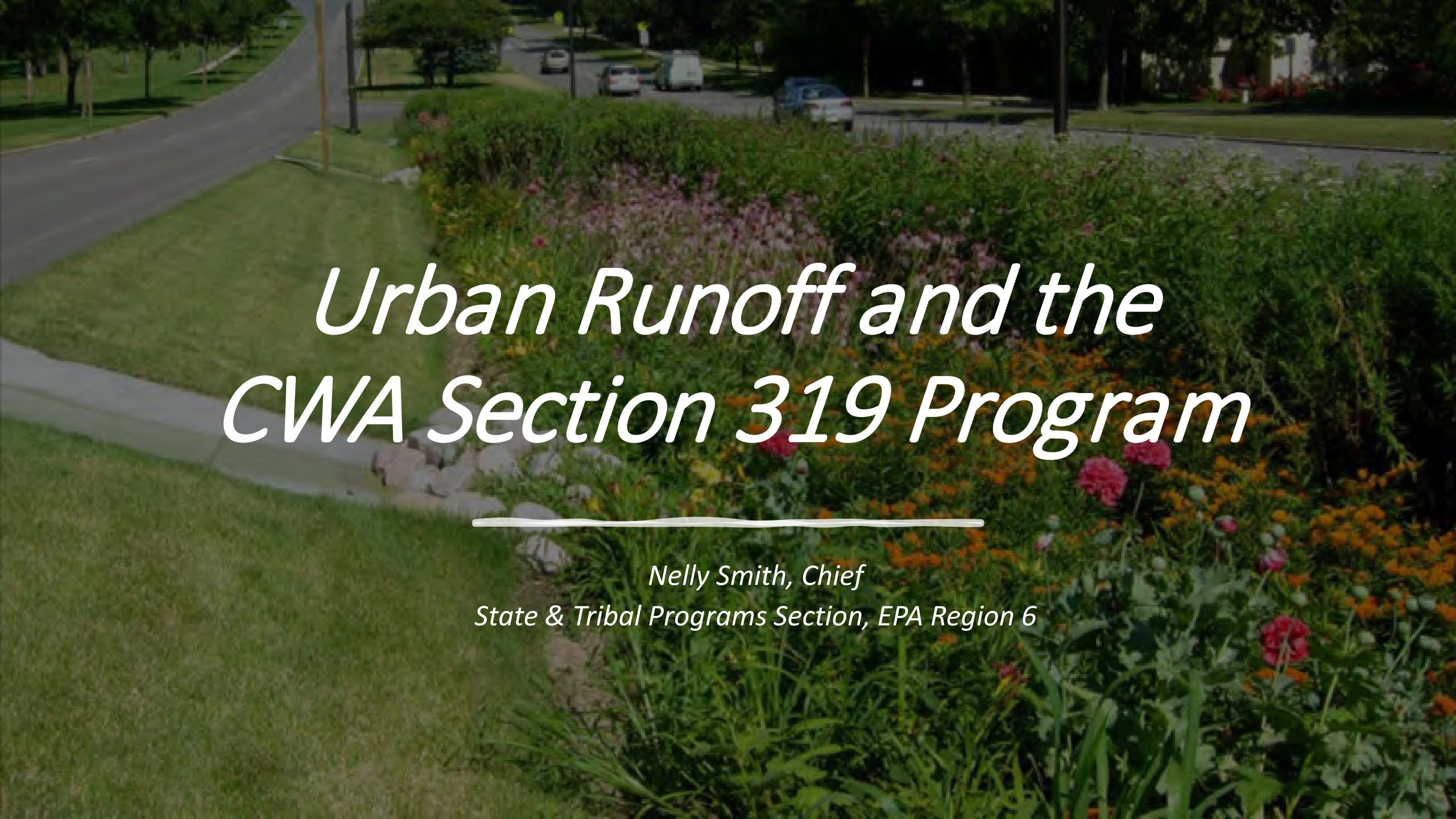
2021 Webcast Schedule

- ❑ *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

https://www.nationalgeographic.org/encyclopedia/point-source-and-nonpoint-sources-pollution/

‘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**

§319 Program Guidelines for Urban Stormwater Runoff

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

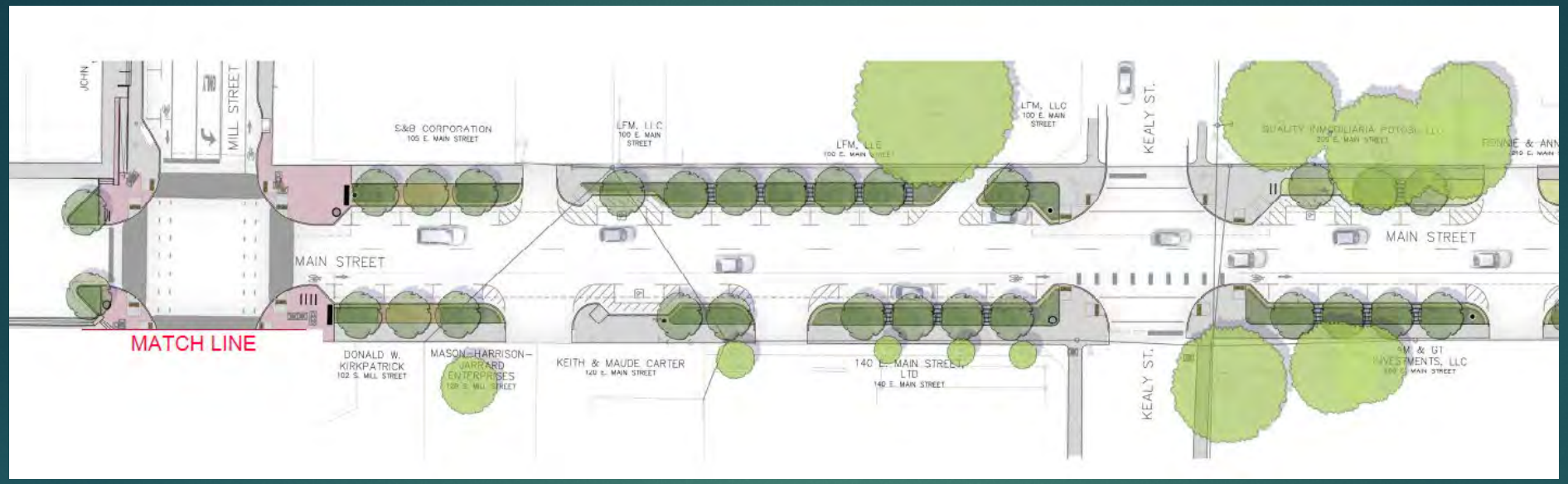
RAIN GARDENS / BIOSWALES

MAIN STREET AND MILL STREET IMPROVEMENTS PROJECT IN OLD TOWN LEWISVILLE

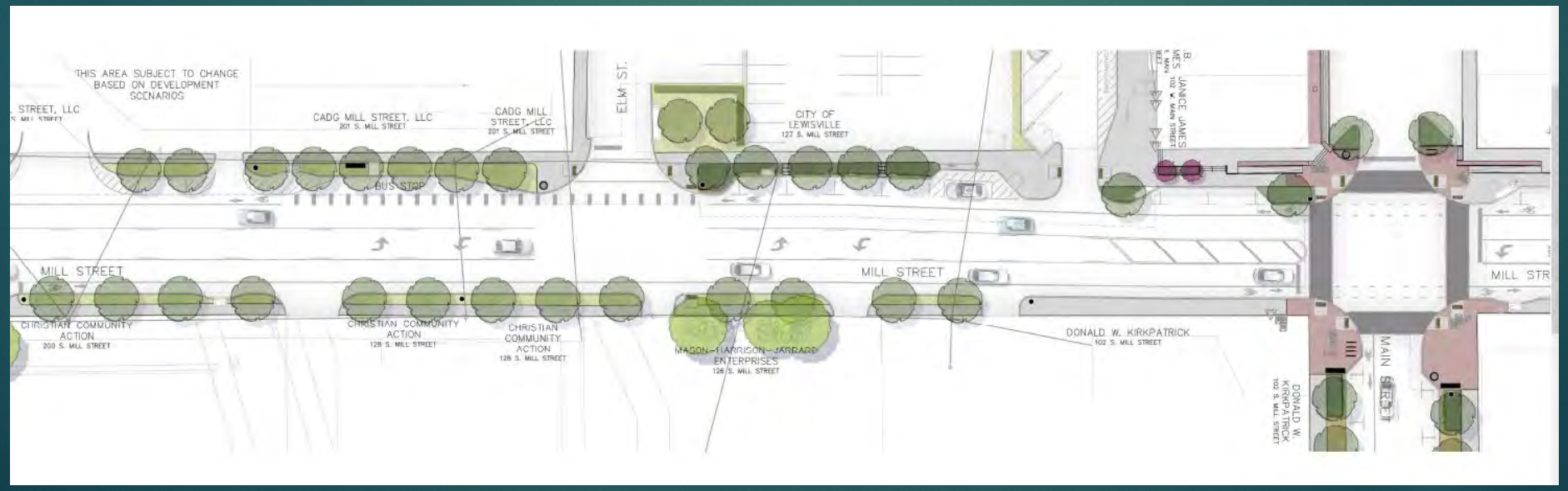
Main St & Mill St Project

- 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 and Mill St Project - Schematics



MAIN ST



MILL ST

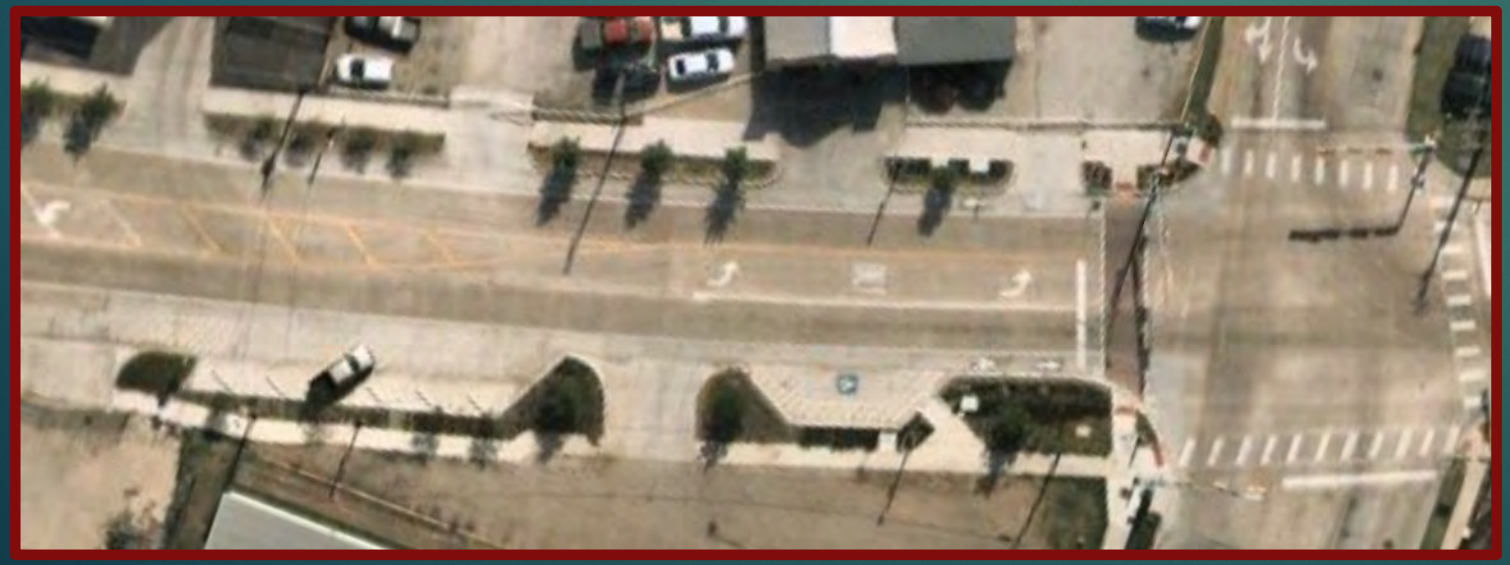
MAIN ST – Before & After Project

BEFORE

AFTER

MILL ST – Before & After Project

BEFORE



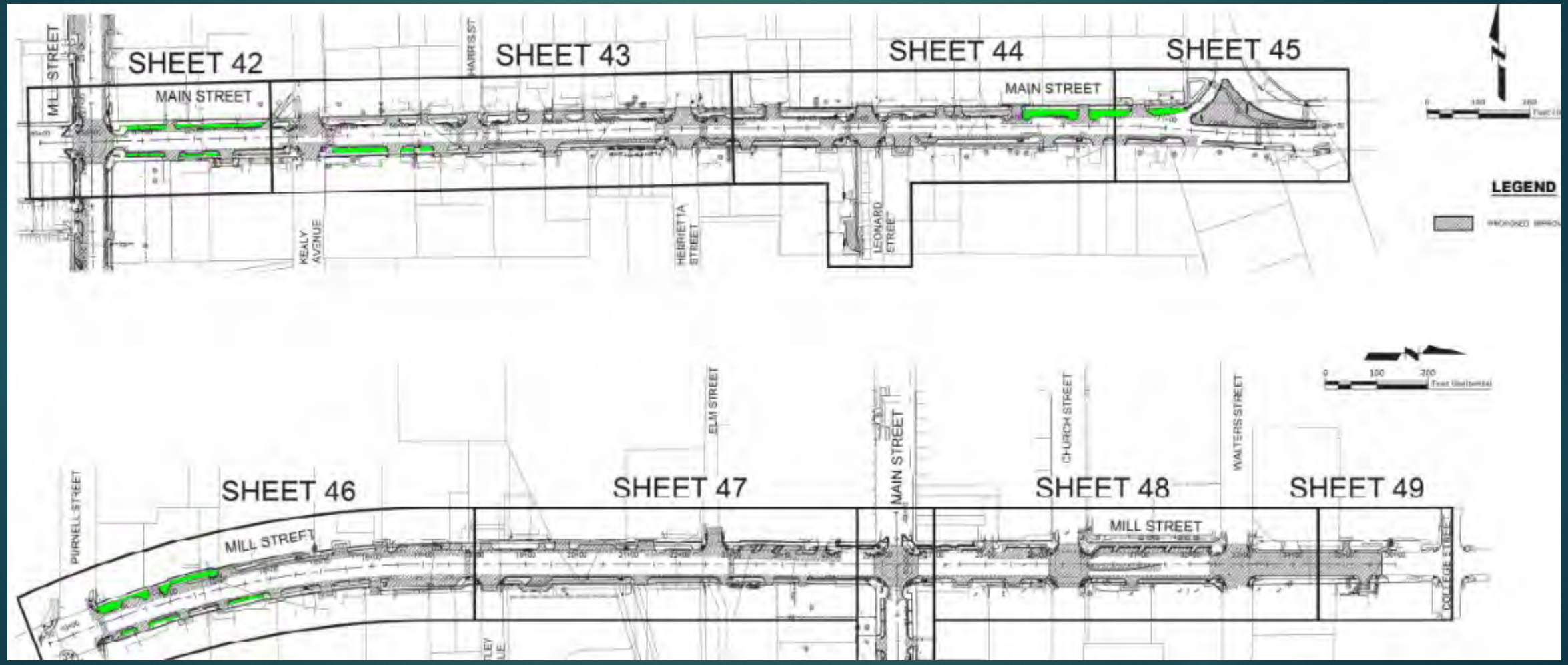
AFTER

RAIN GARDENS – MAIN ST & MILL ST PROJECT

- Decision made by City early on during the planning stages
  - **To add raingardens** 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

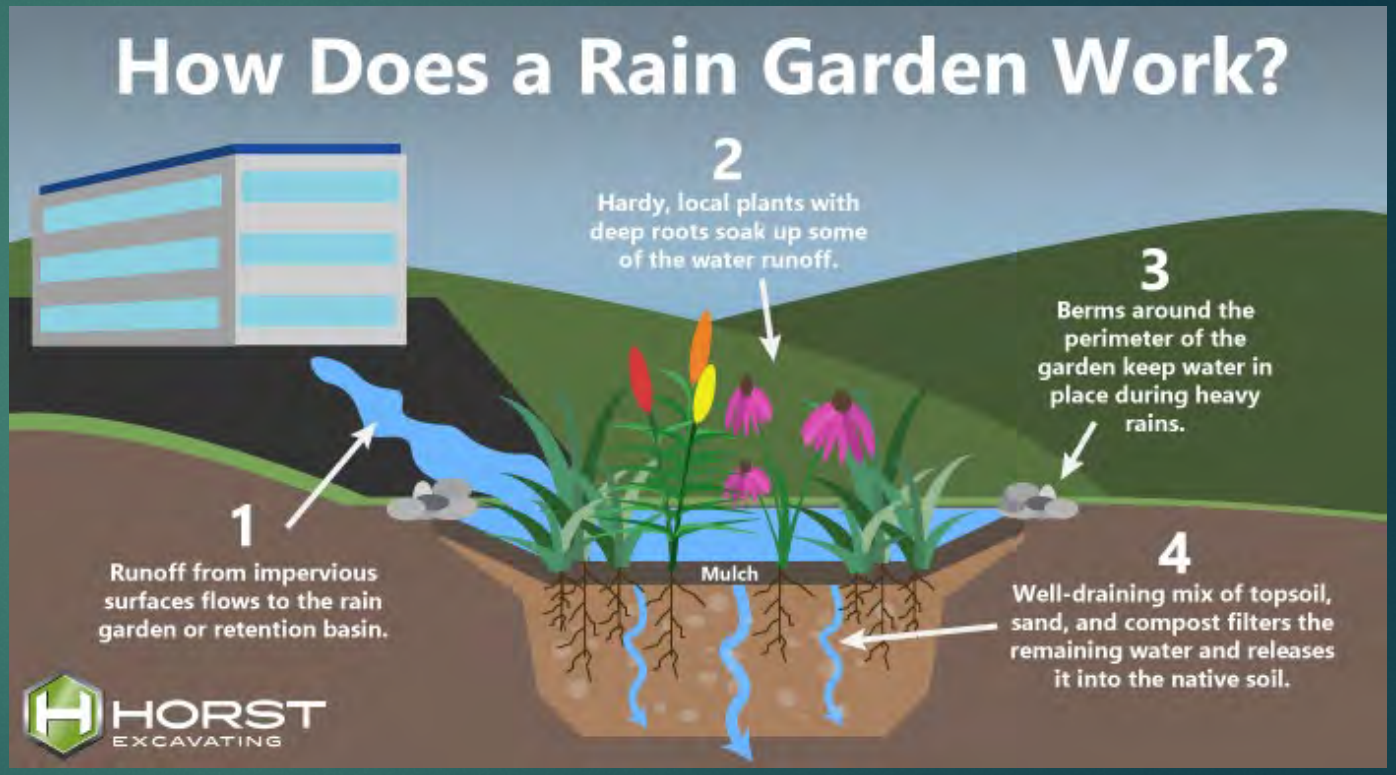
RAIN GARDENS IN MAIN ST & MILL ST PROJECT

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?

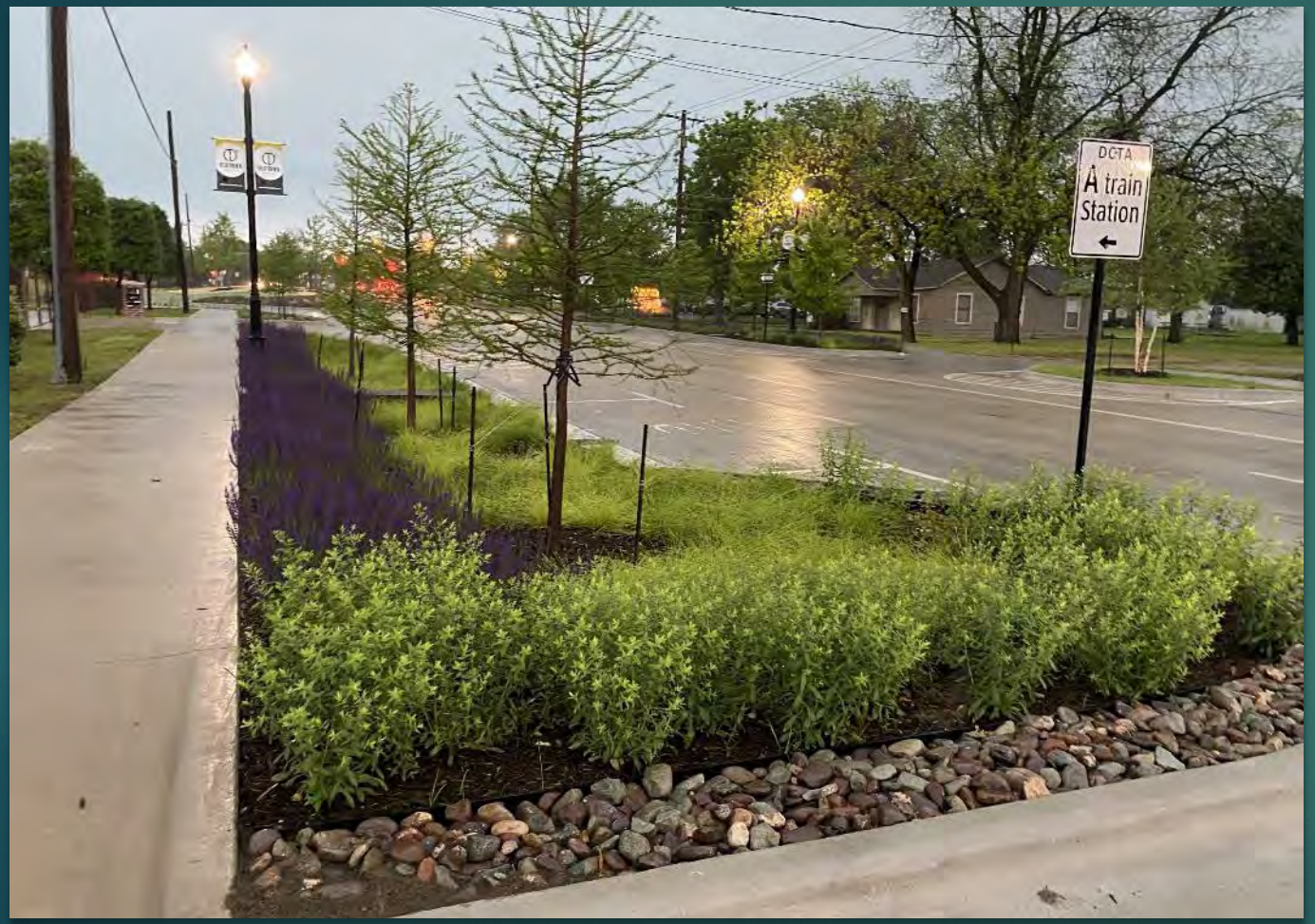
- EPA states, stormwater runoff is the leading source of Water Pollution
- Storm water contains:
  - Pathogens
  - Bacteria
  - Chemicals
  - Heavy Metals
  - Oil
  - Fertilizers
  - Pesticides etc.

Source: www.fairfaxcounty.gov

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

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

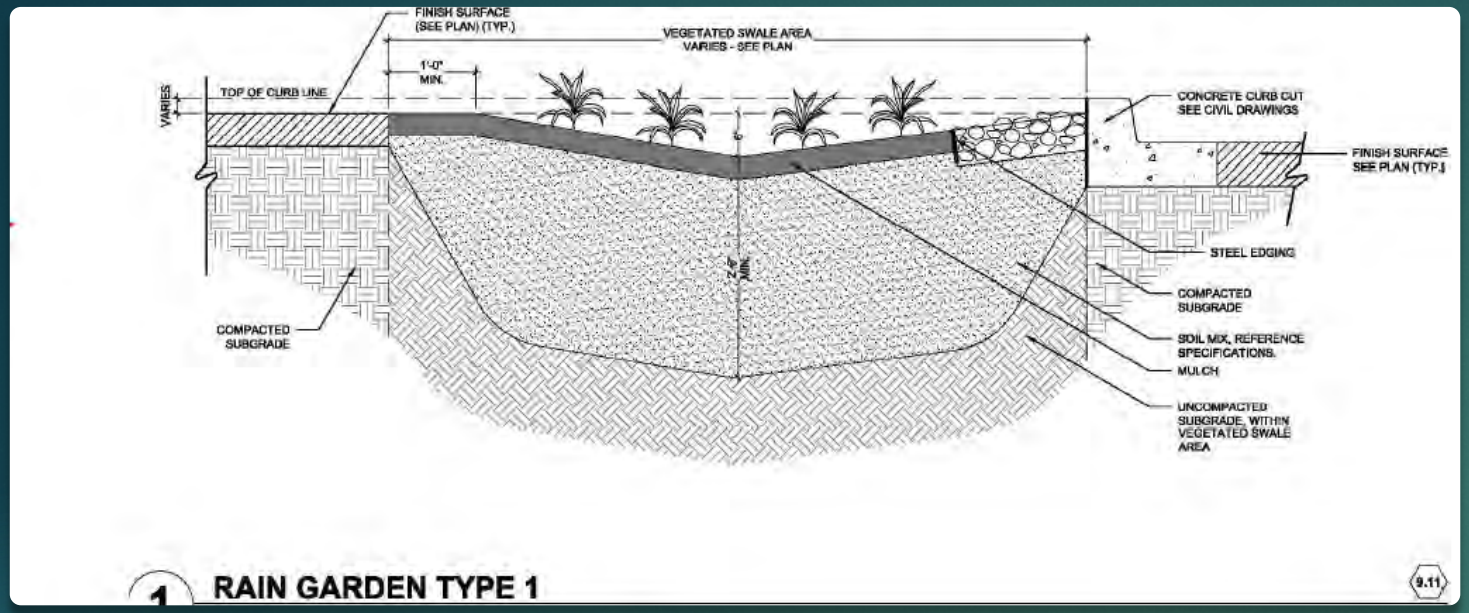


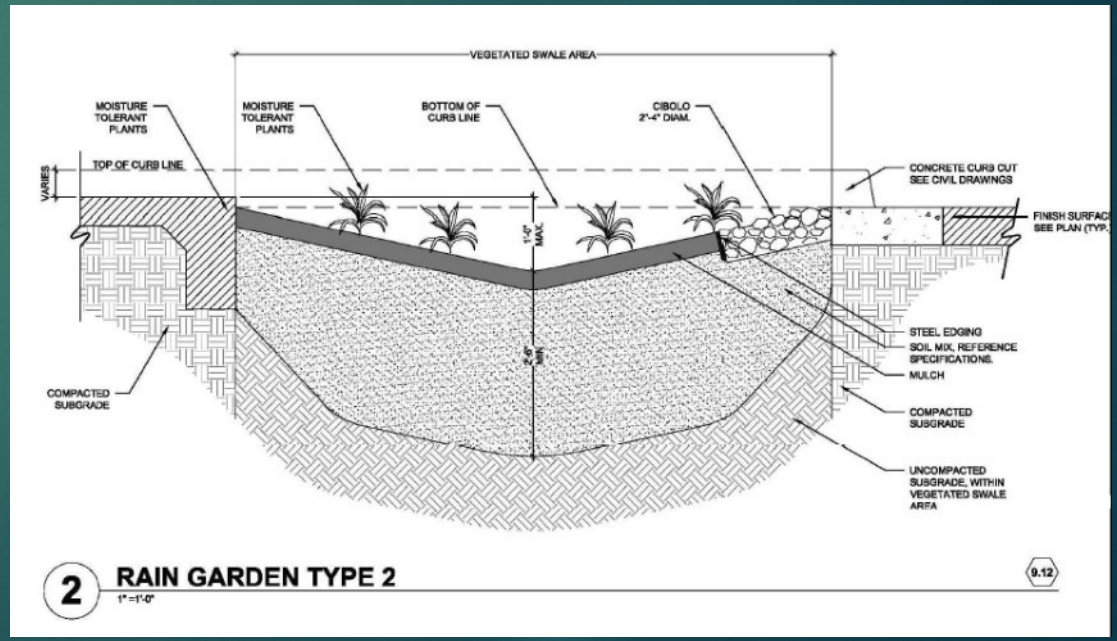
What does a Rain Garden in Old Town Lewisville look like?

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**

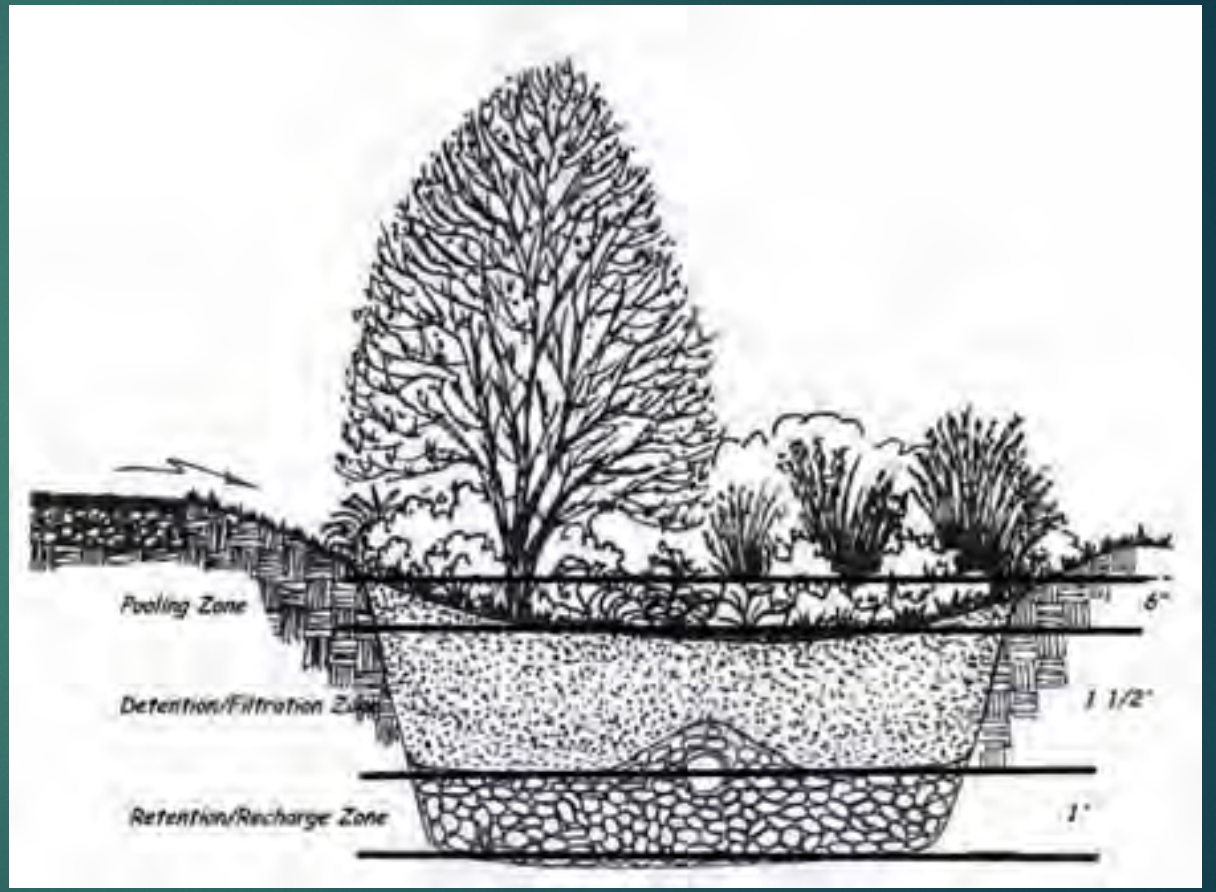


Image Source: www.tamu.edu

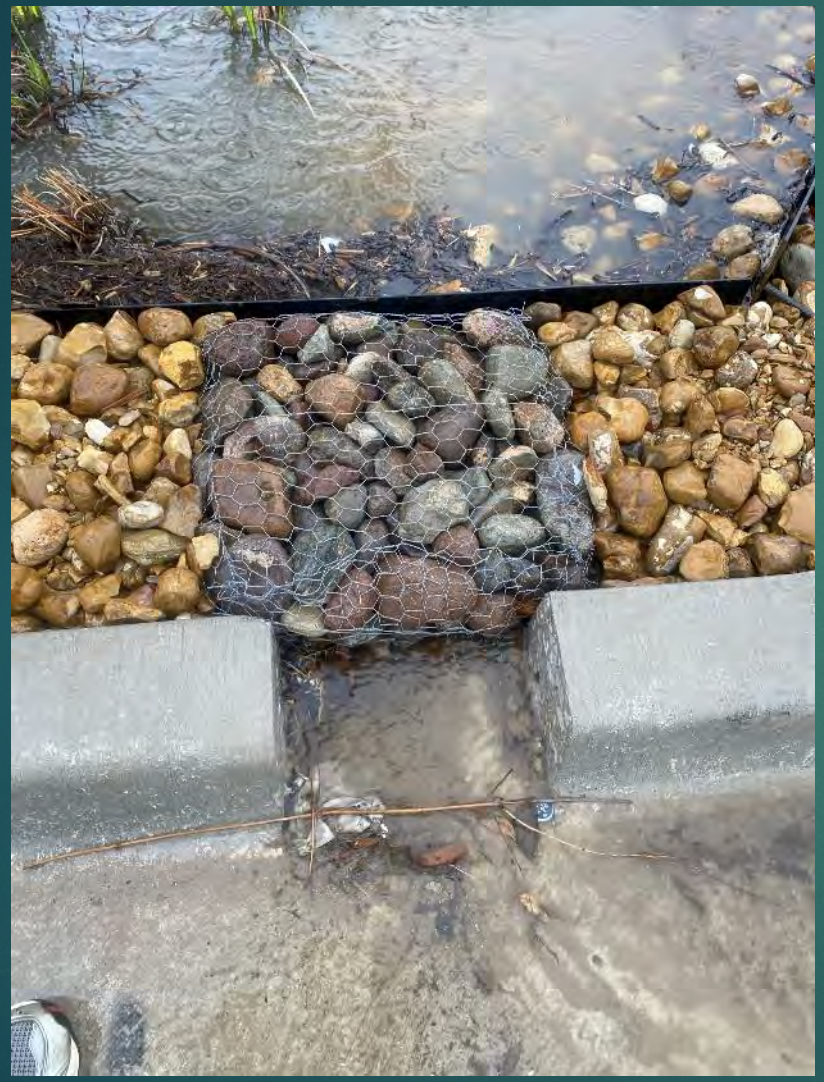
Elements of a Rain Garden (contd)

- **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 – Main St & Mill St

Raingarden Operation (contd)



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

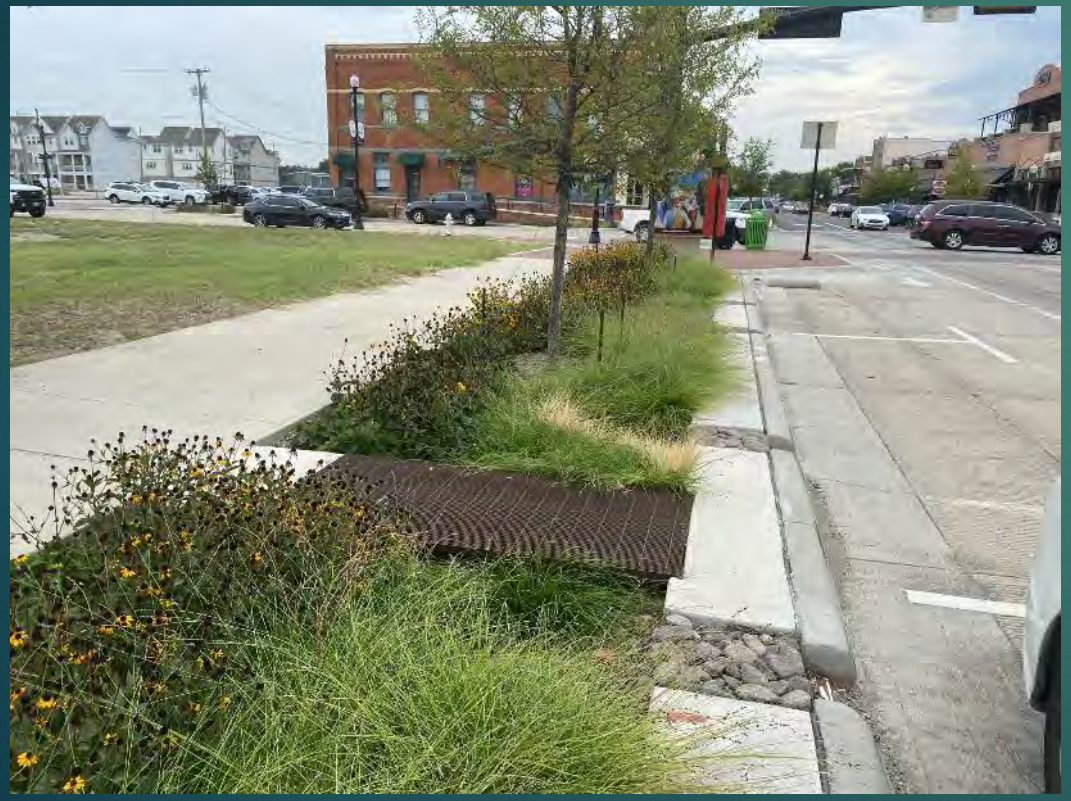
Raingarden Operation (contd)

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

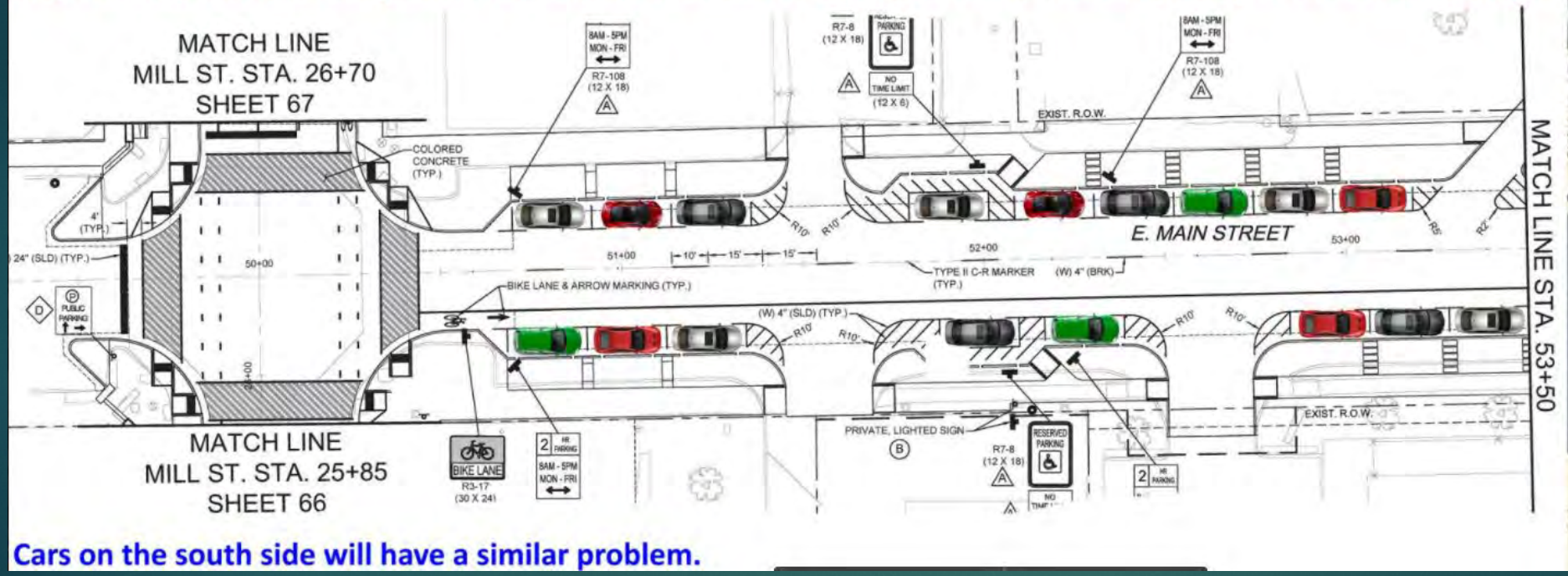
Rain Gardens at Thrive – RG 2

Rain Gardens at Thrive – RG 3

CHALLENGES

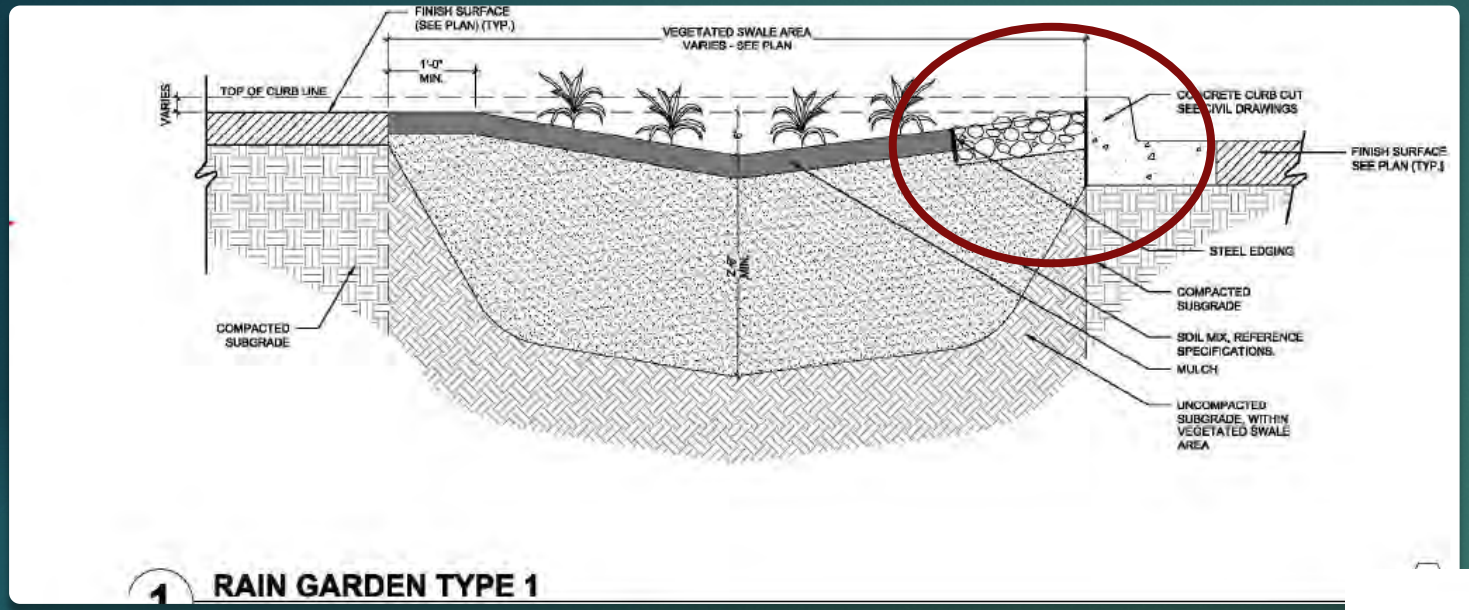
Challenge # 1– No Mow Strip in Design

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.

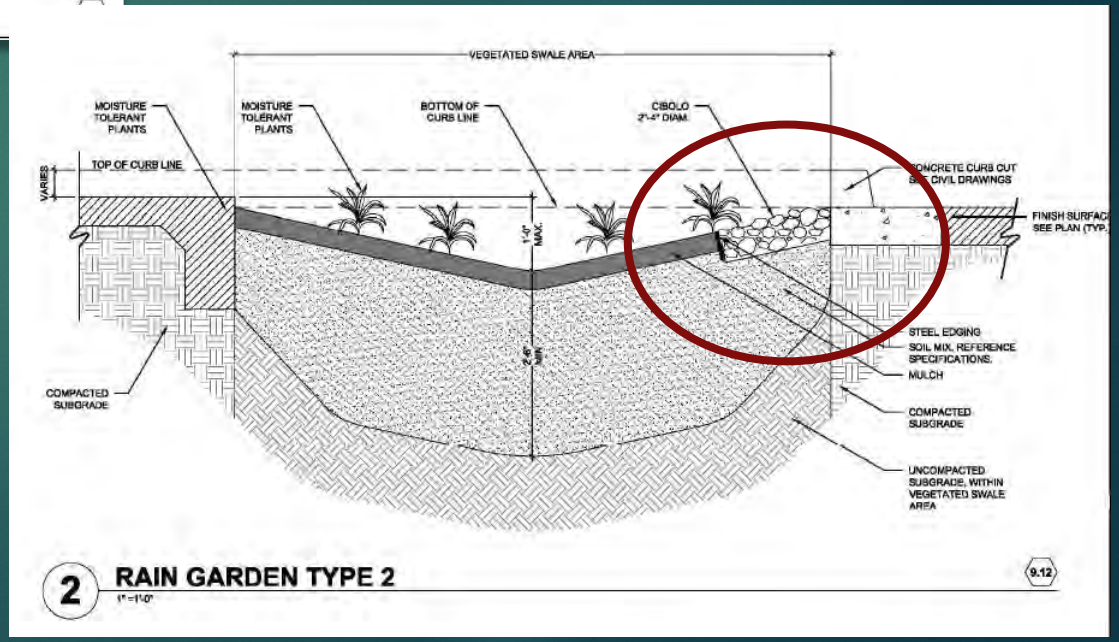


Cars on the south side will have a similar problem.

Challenge # 1 – No Mow Strip in Design



No Mow Strip Behind Curb



Challenge # 1Resolution – 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 – water logging 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?

NCTCOG Green Transportation Infrastructure Workshop

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

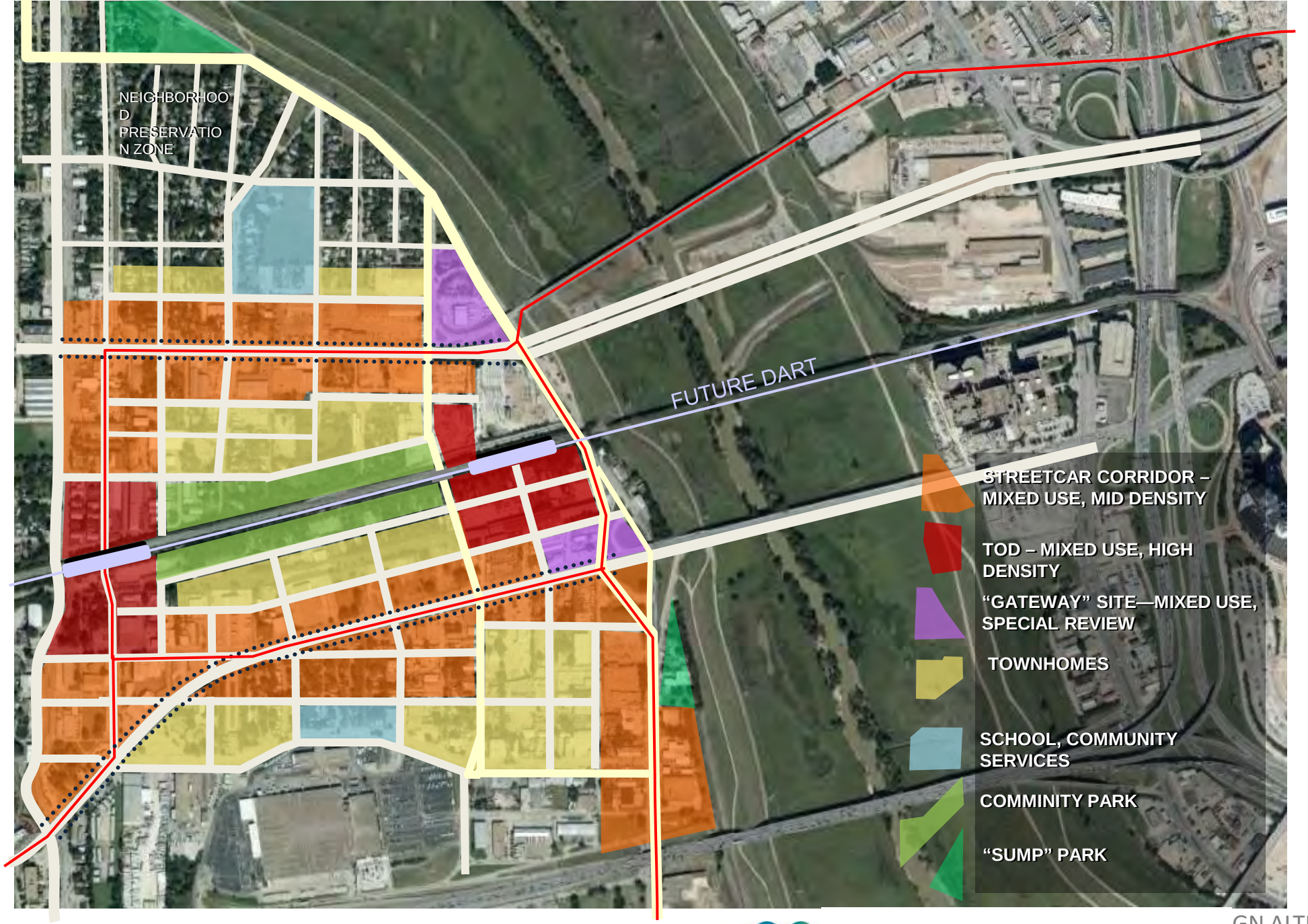
The Beckley / Commerce Corridor Usage Study engaged key stakeholders to understand their vision for transitioning from Commercial / Industrial to more a walkable Mixed Use Land Use pattern.

.

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.



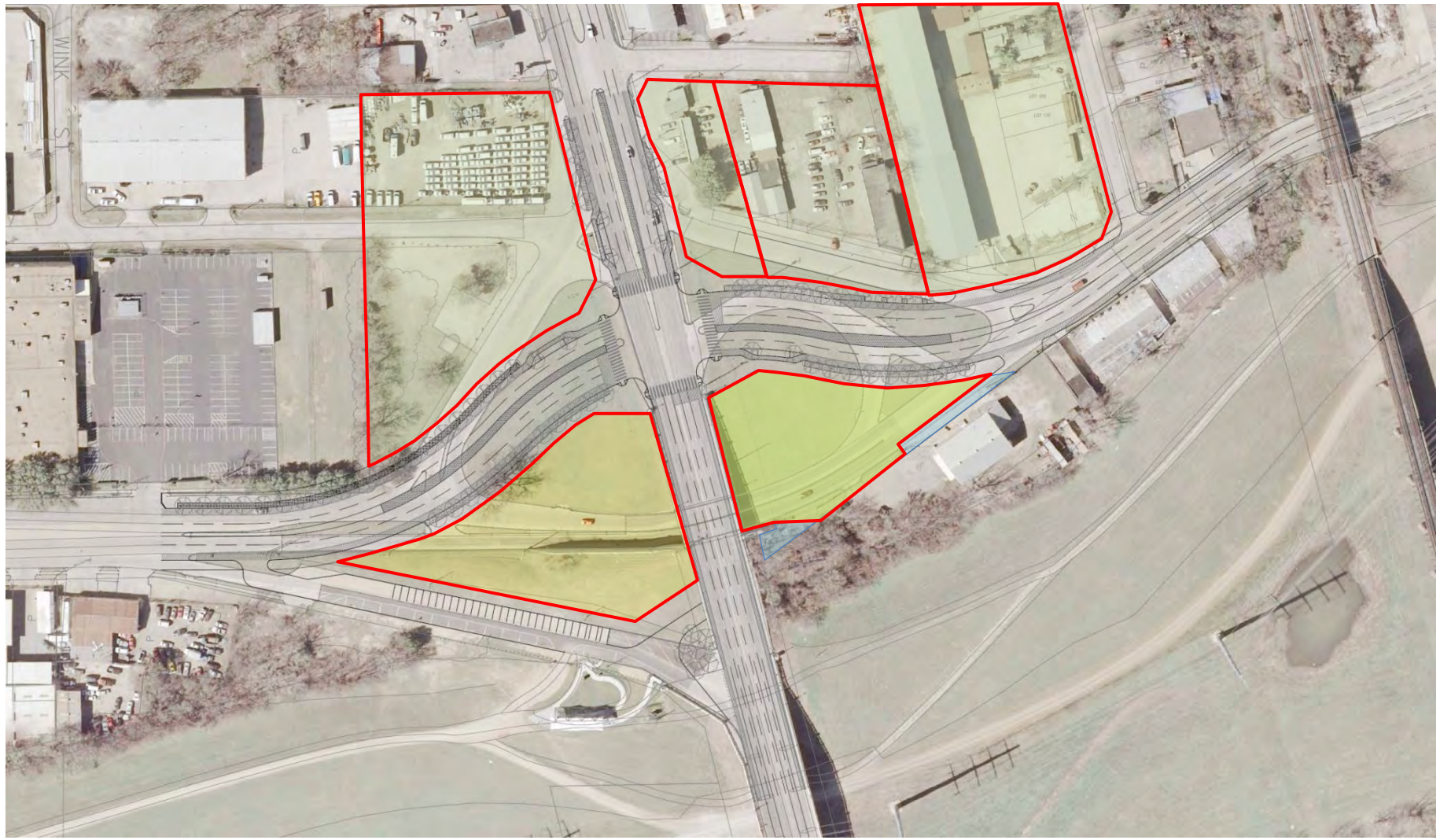
West Dallas Transit/Land Use Concept

Site Context

Beckley / Commerce – Existing Conditions 2009

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.**

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

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

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.**

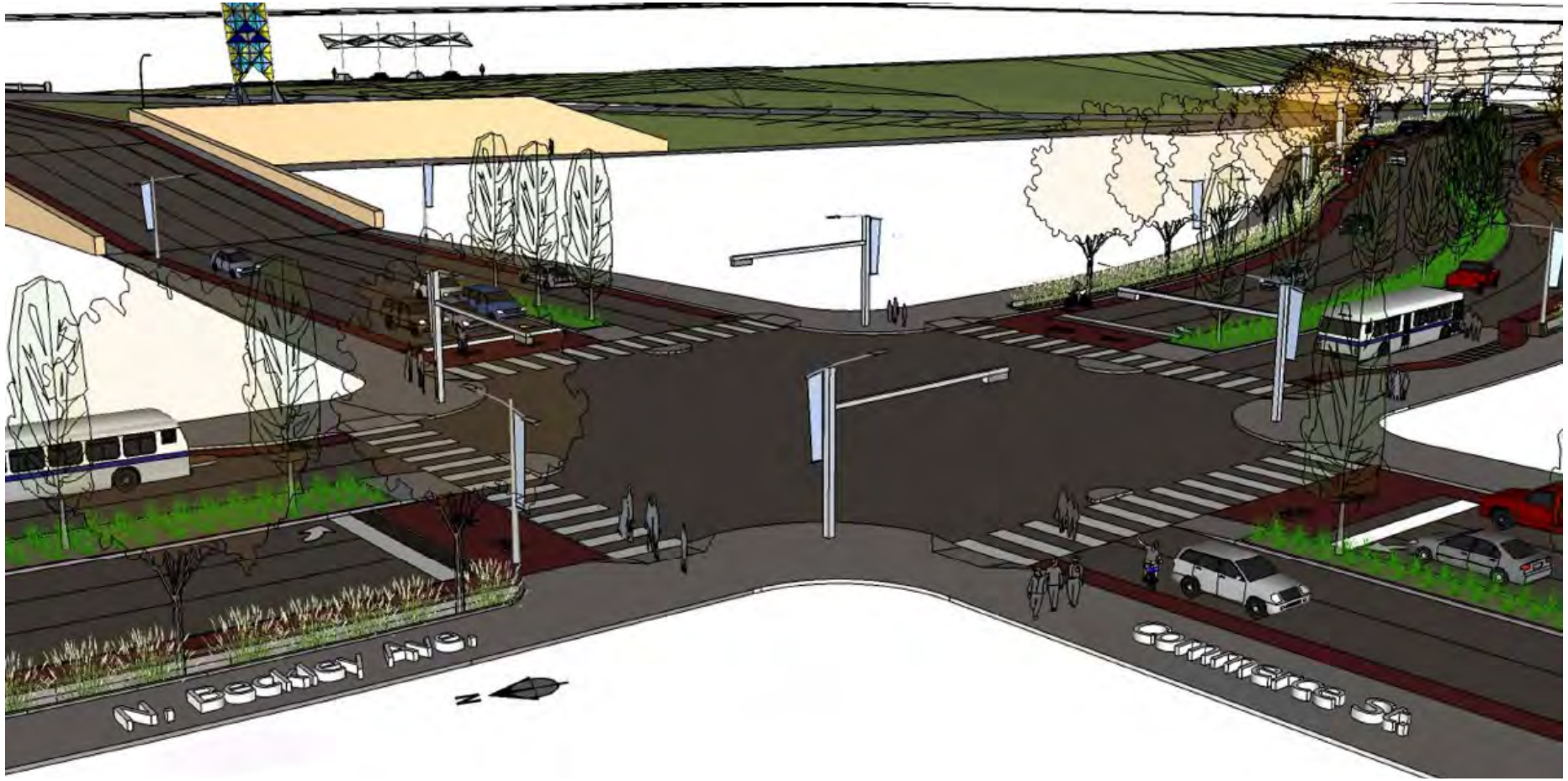
Pedestrian oriented design features:
Pedestrian Refuge at median
Timed Pedestrian crosswalk signalization
11-6” wide shaded sidewalks

Complete & Green Street
Castro Valley CA – WRT Design

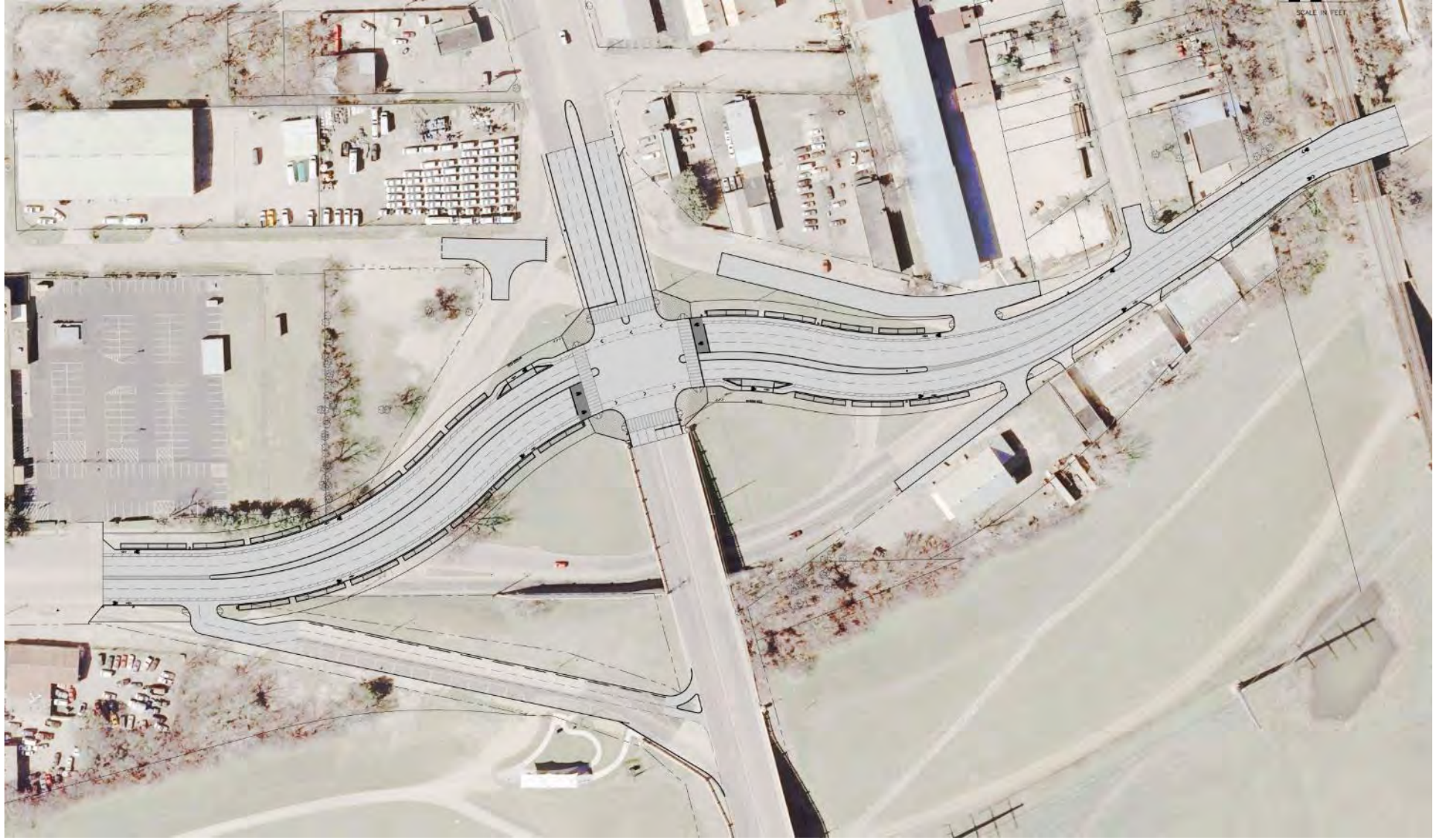
Green Streets

- **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.**

Rain Garden – Portland OR

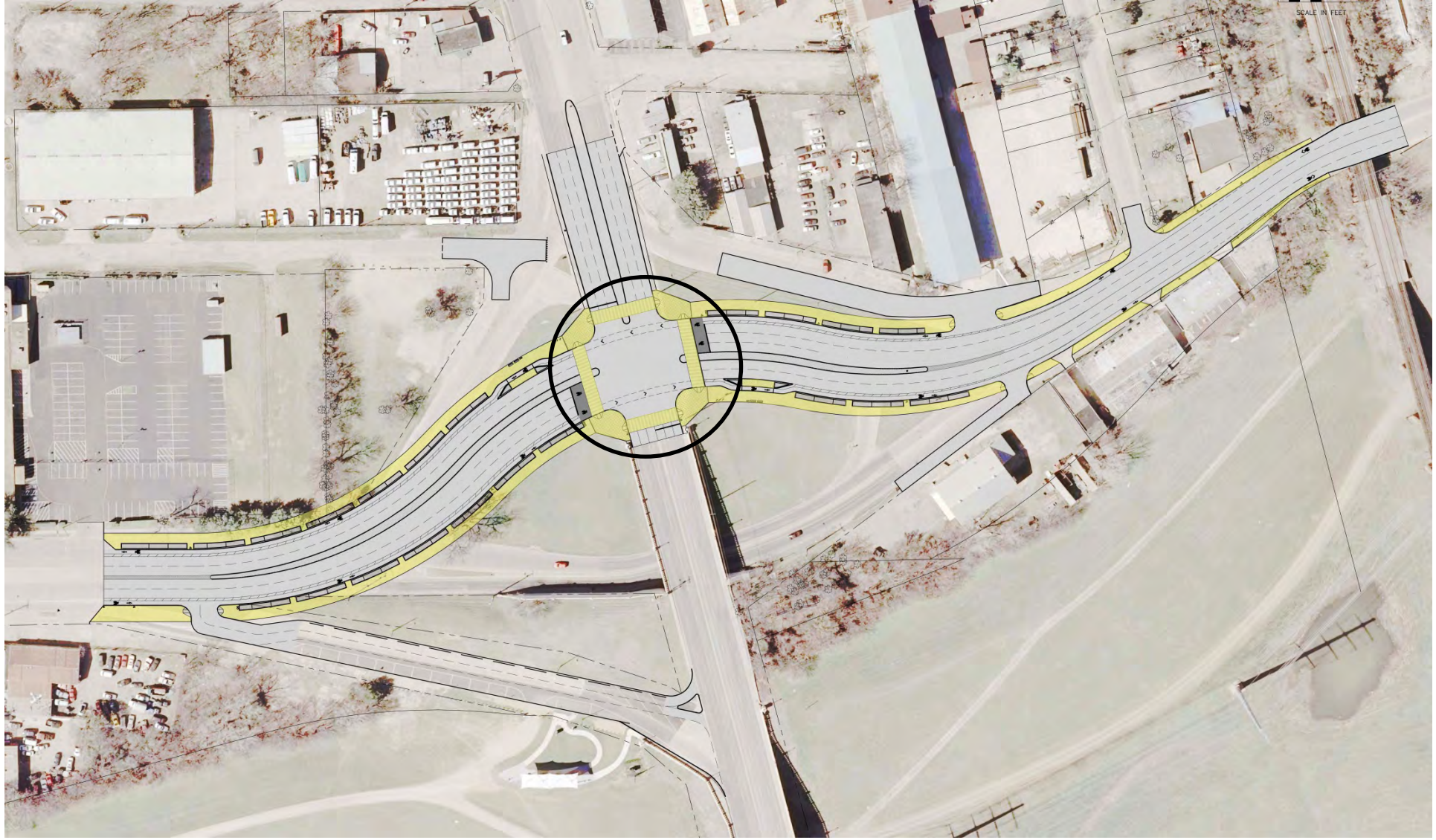


Beckley Commerce Intersection – Complete and Green Street Concept



Proposed Street Design Plan

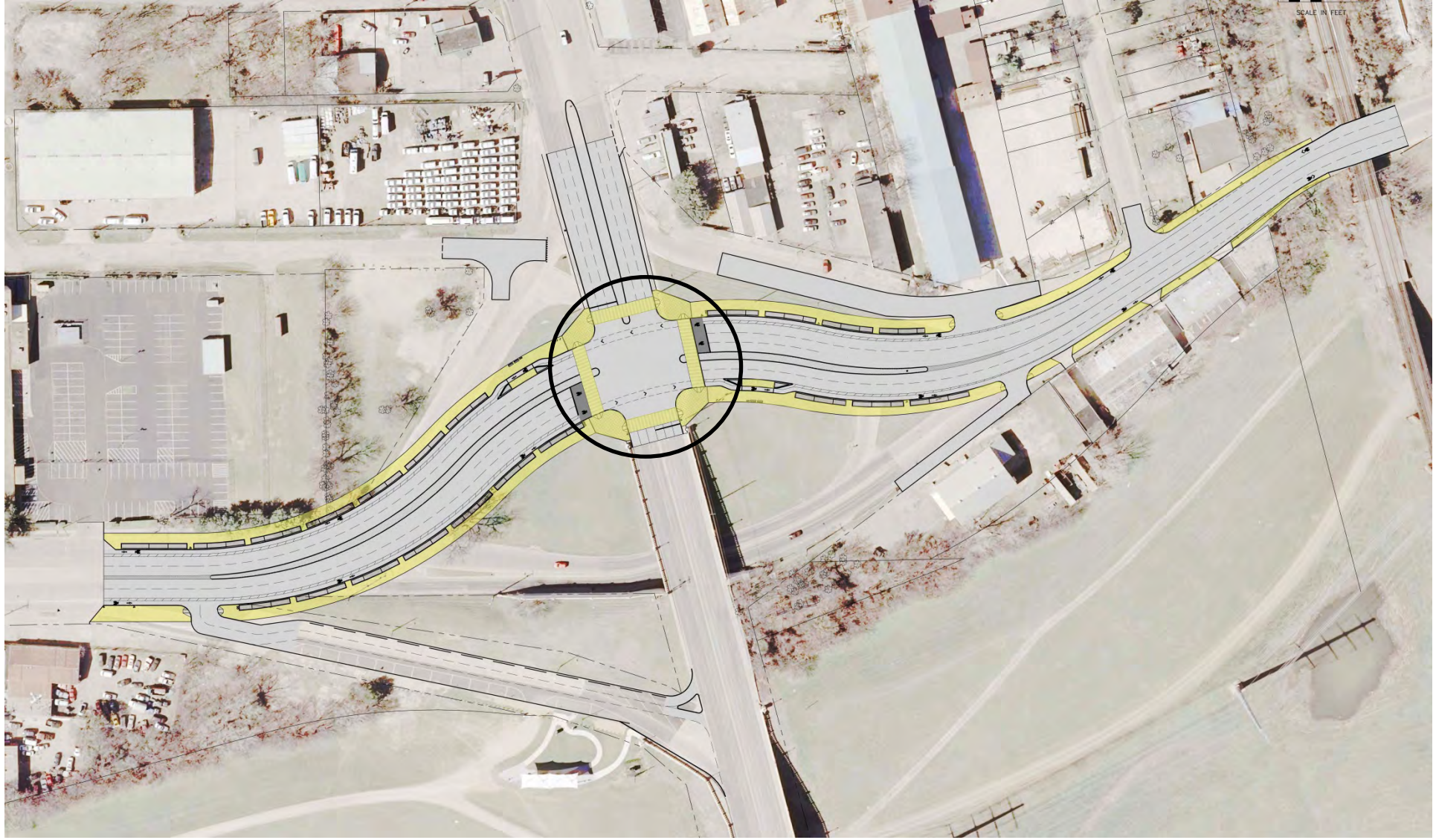
Complete Street - Diagrams



Complete Street - Diagrams

Pedestrian amenities:

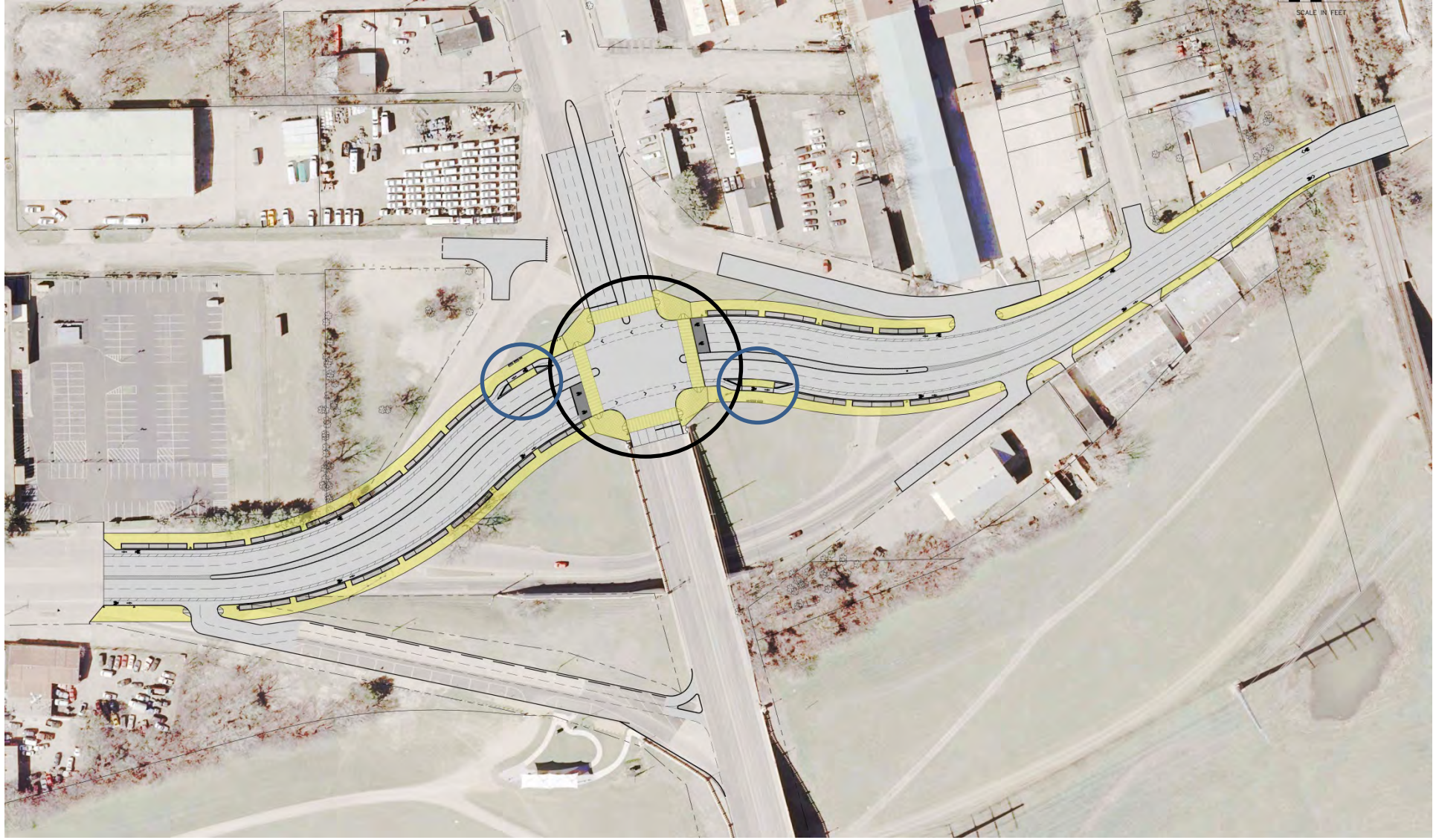
- 11’- 6” wide shaded sidewalks
- 15’- 0” crosswalks with 8’-0” pedestrian refuge at the median



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

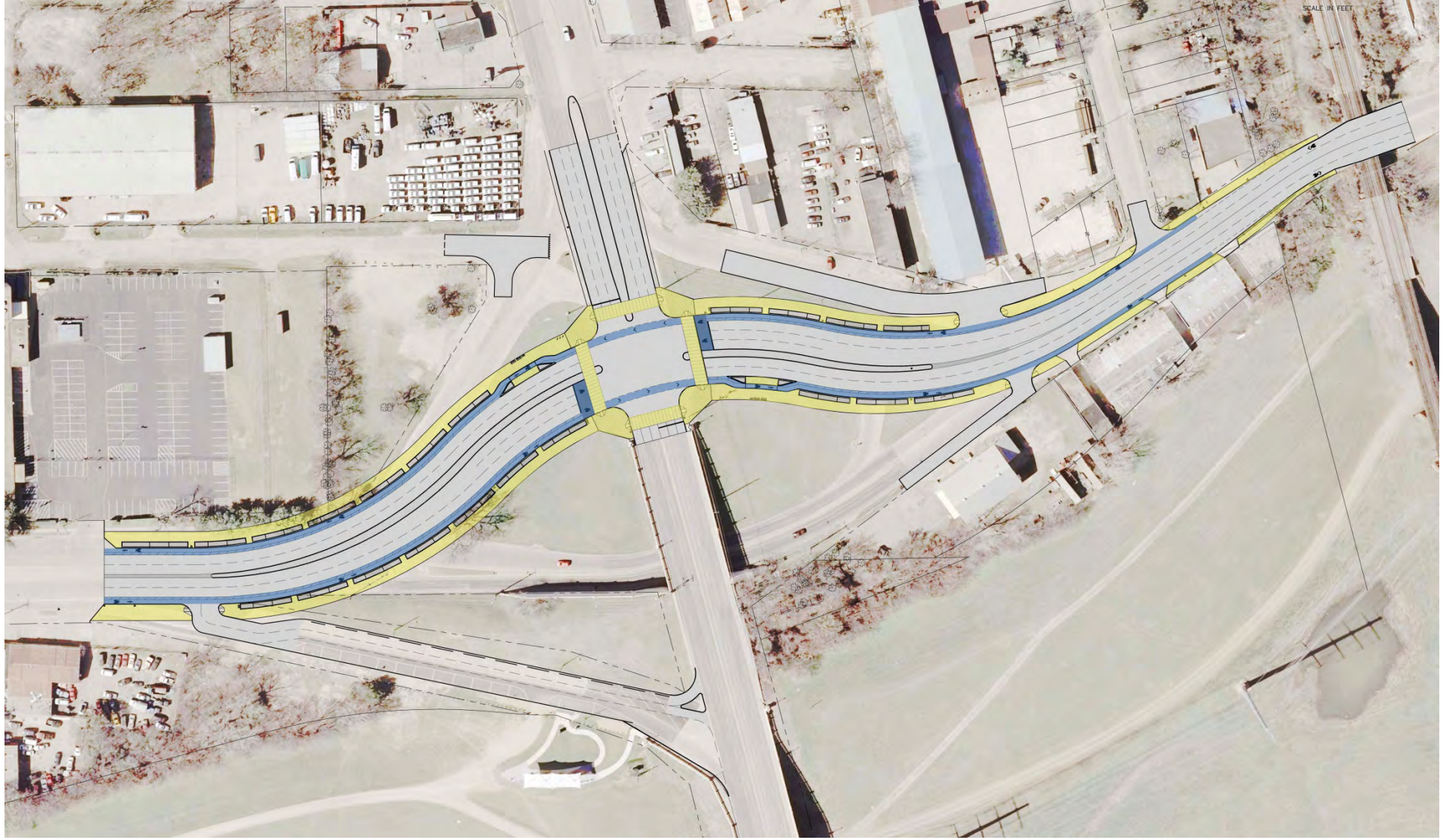
Complete Street - Diagrams



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

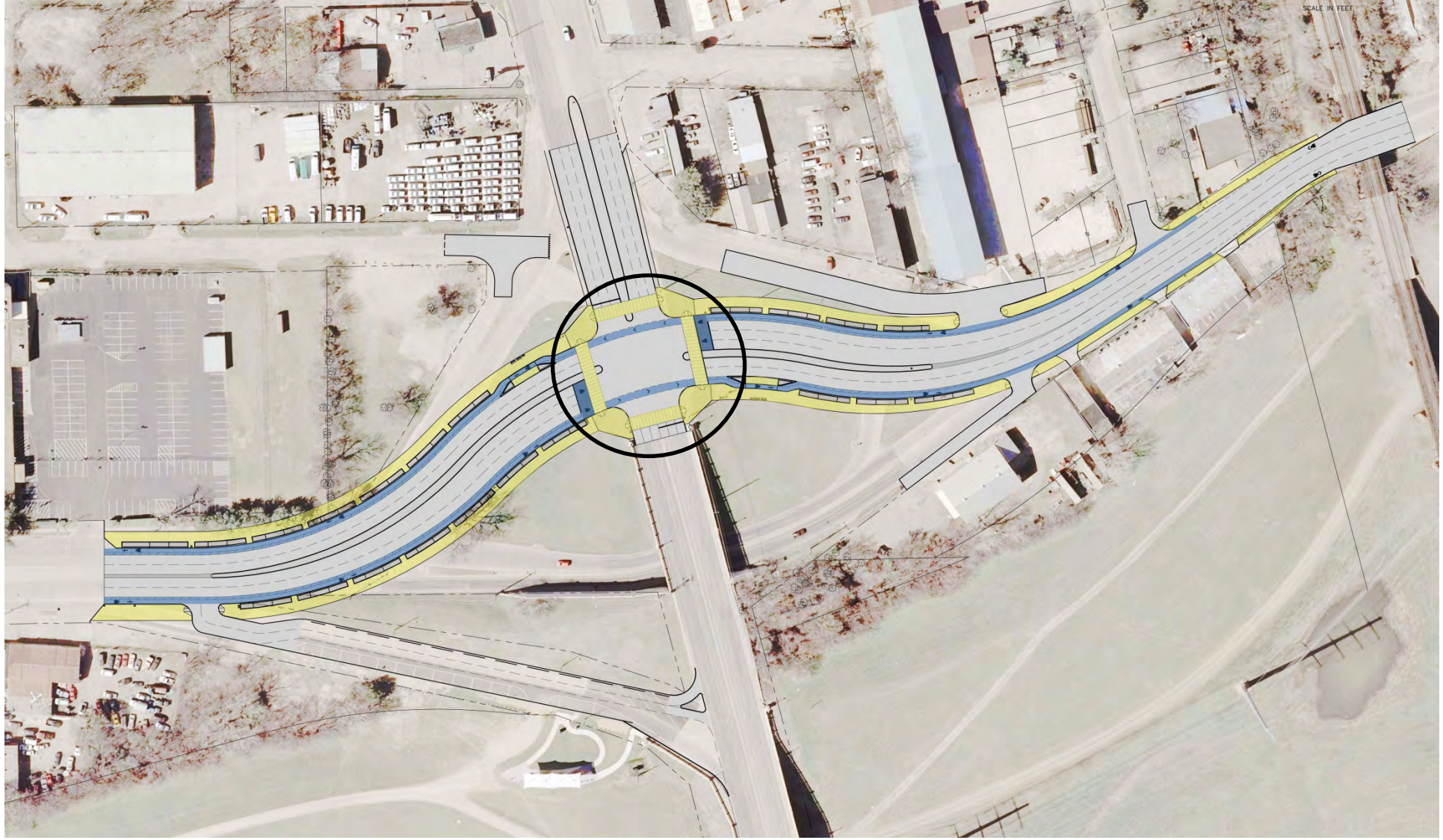
Complete Street - Diagrams



Cyclist amenities:

- **Bike lanes (5’-0” width with 3’ buffer)**

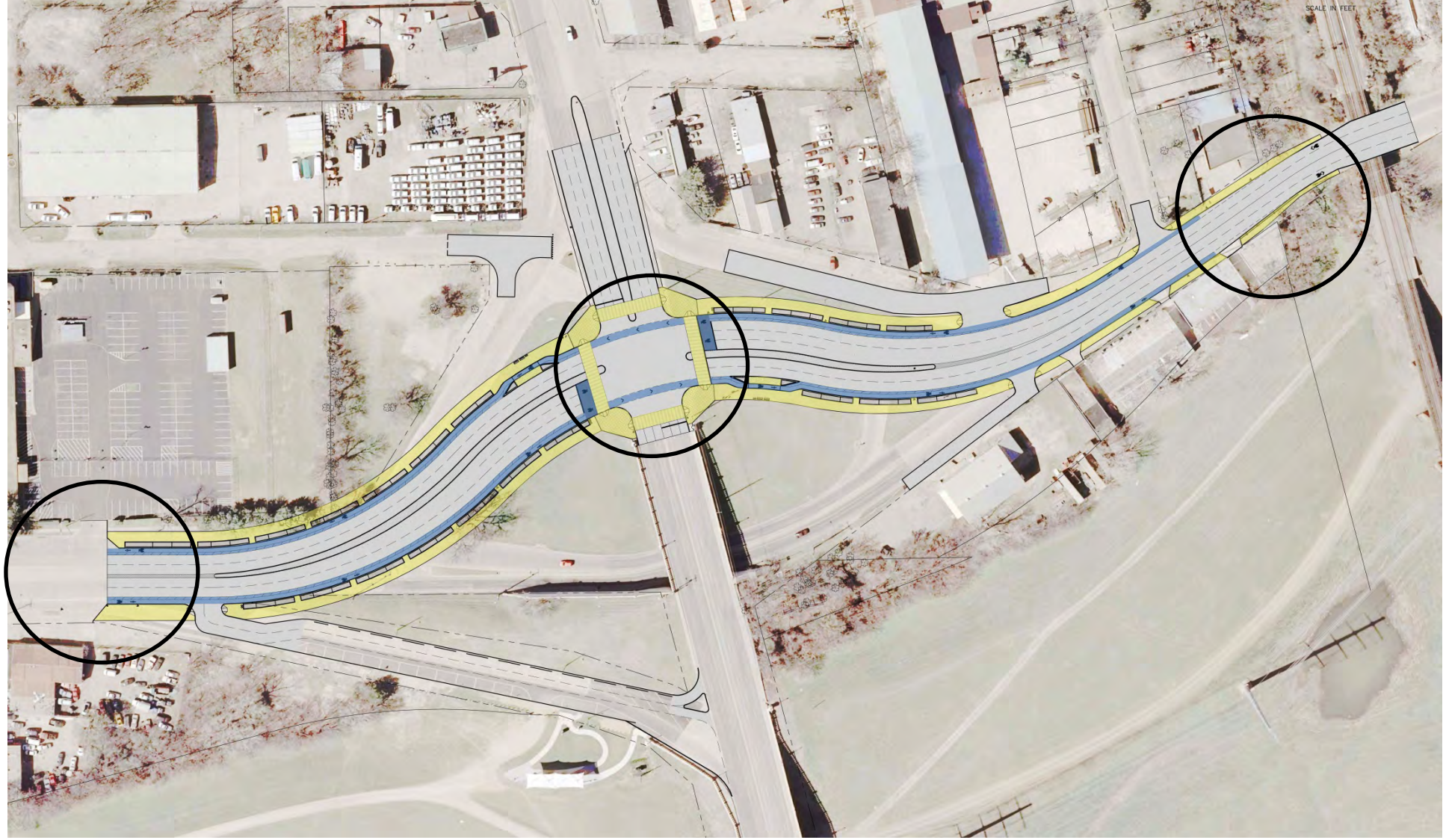
Complete Street - Diagrams



Cyclist amenities:

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

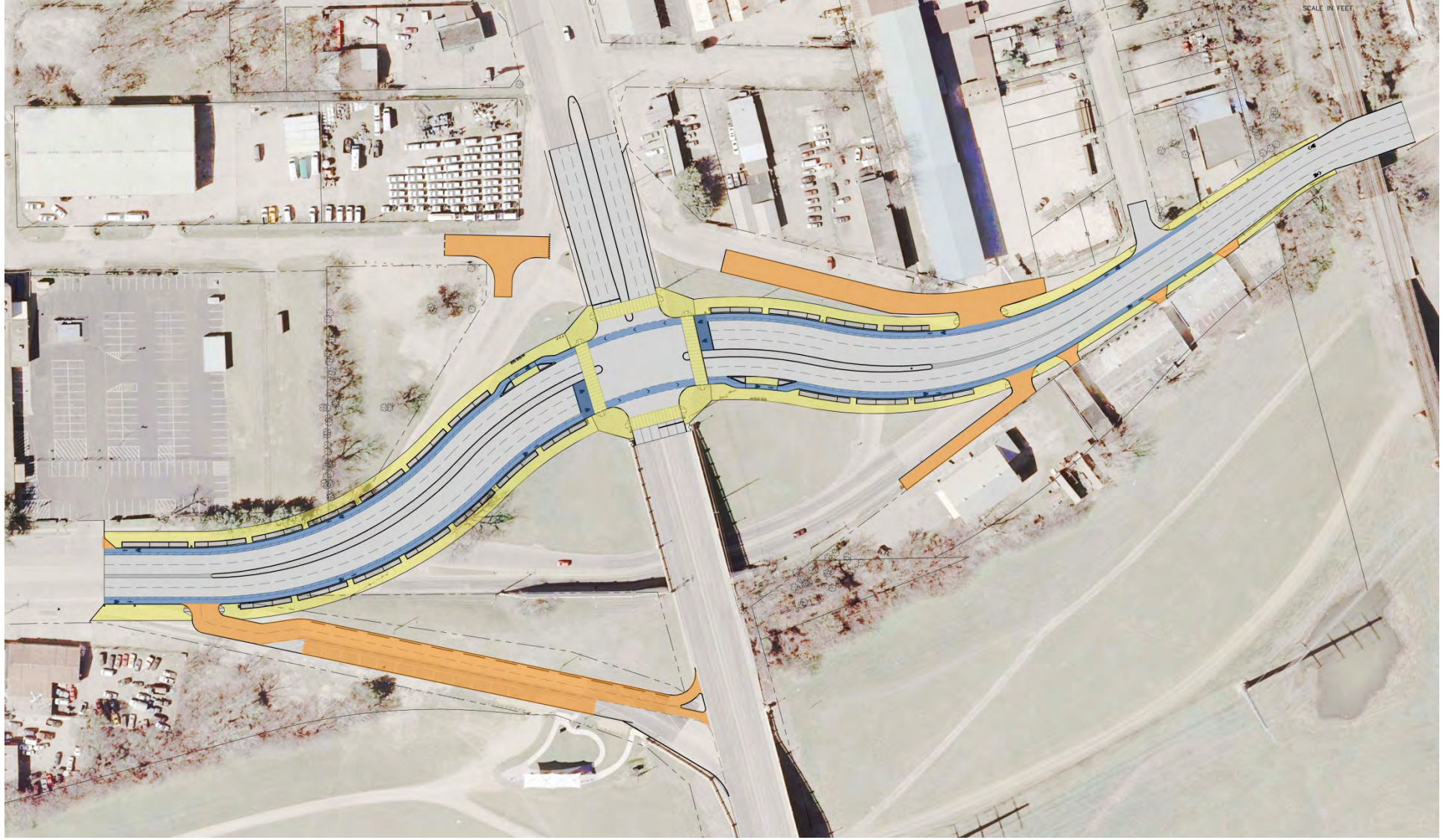
Complete Street - Diagrams



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)

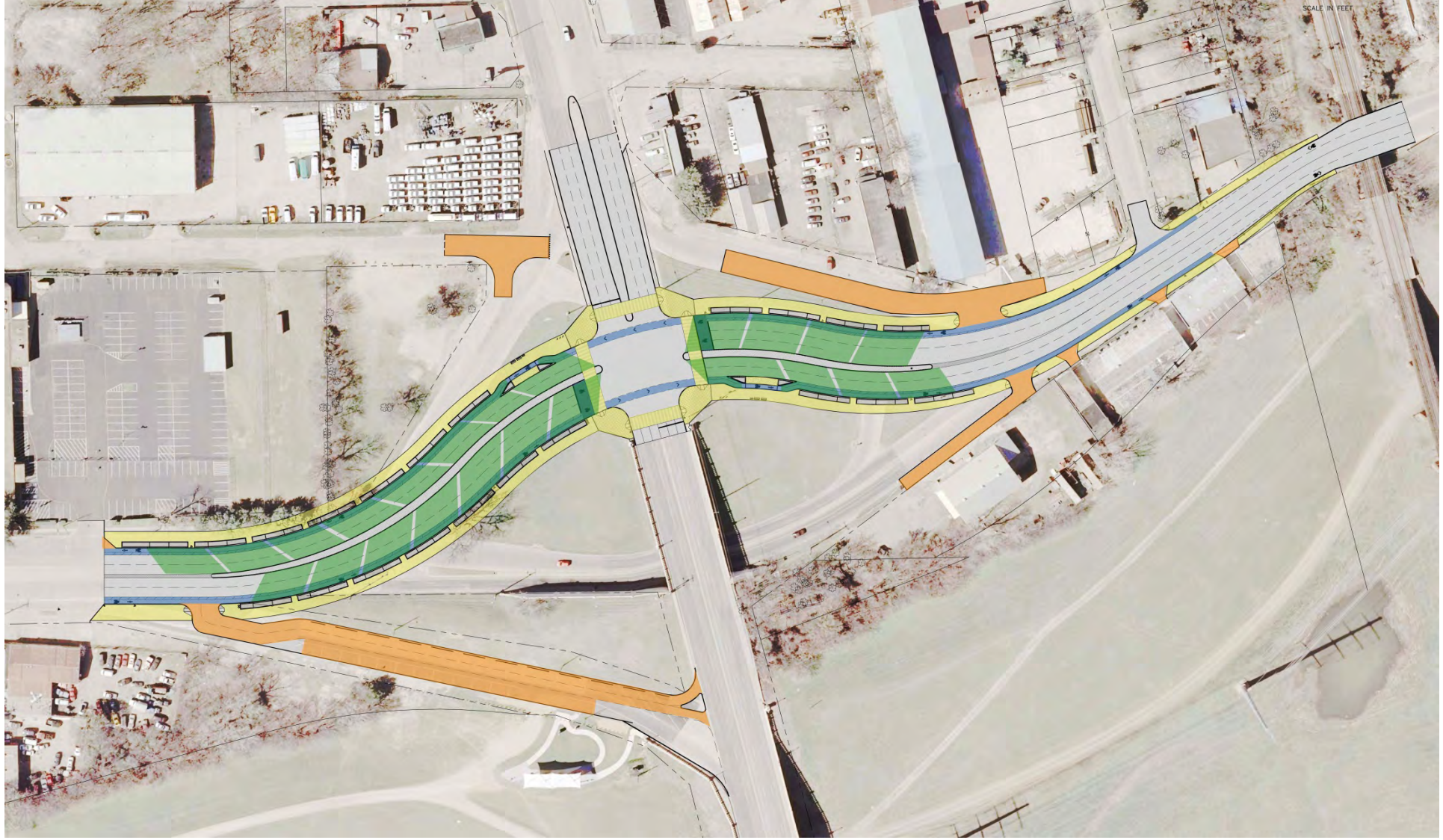
Complete Street - Diagrams



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.

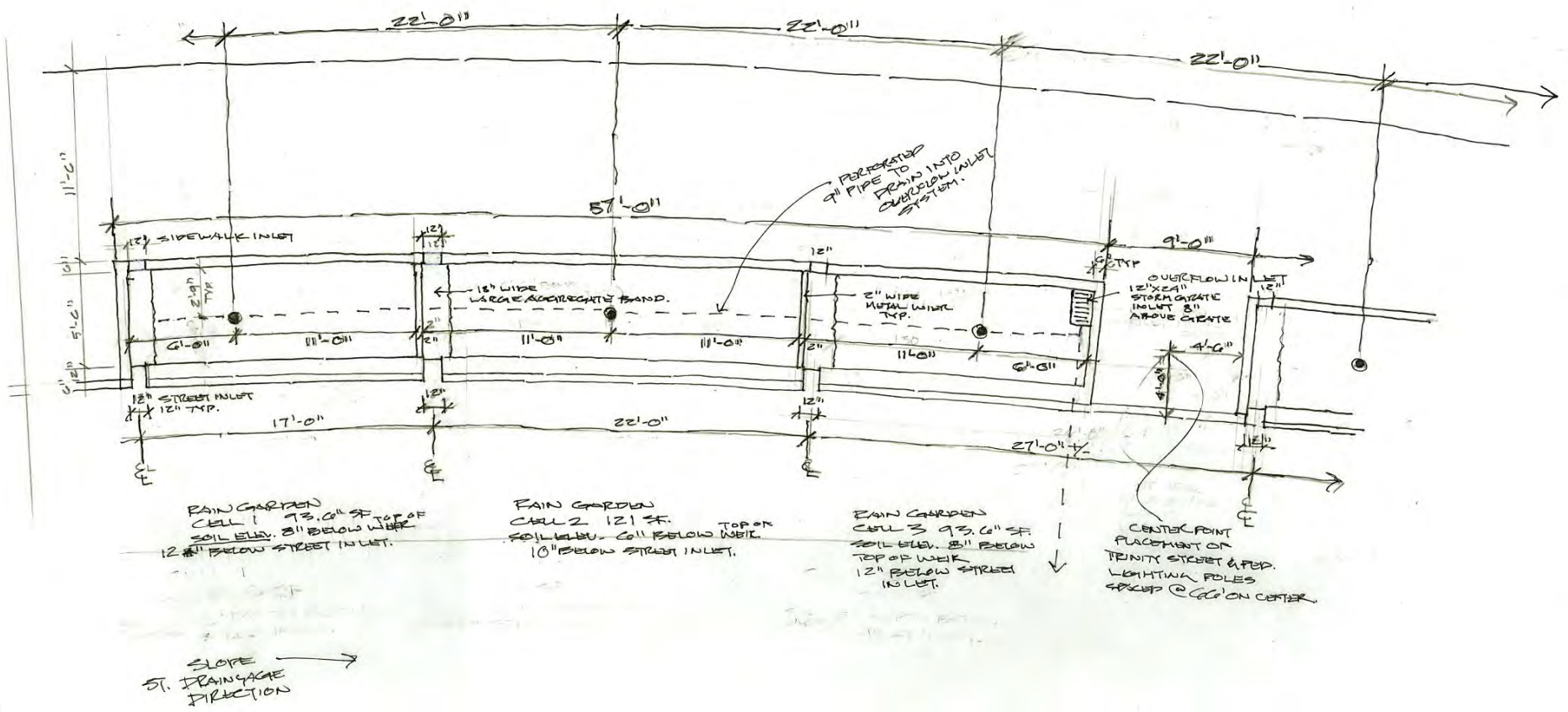
Complete Street - Diagrams



Green Street - Diagram

Rain Harvesting:

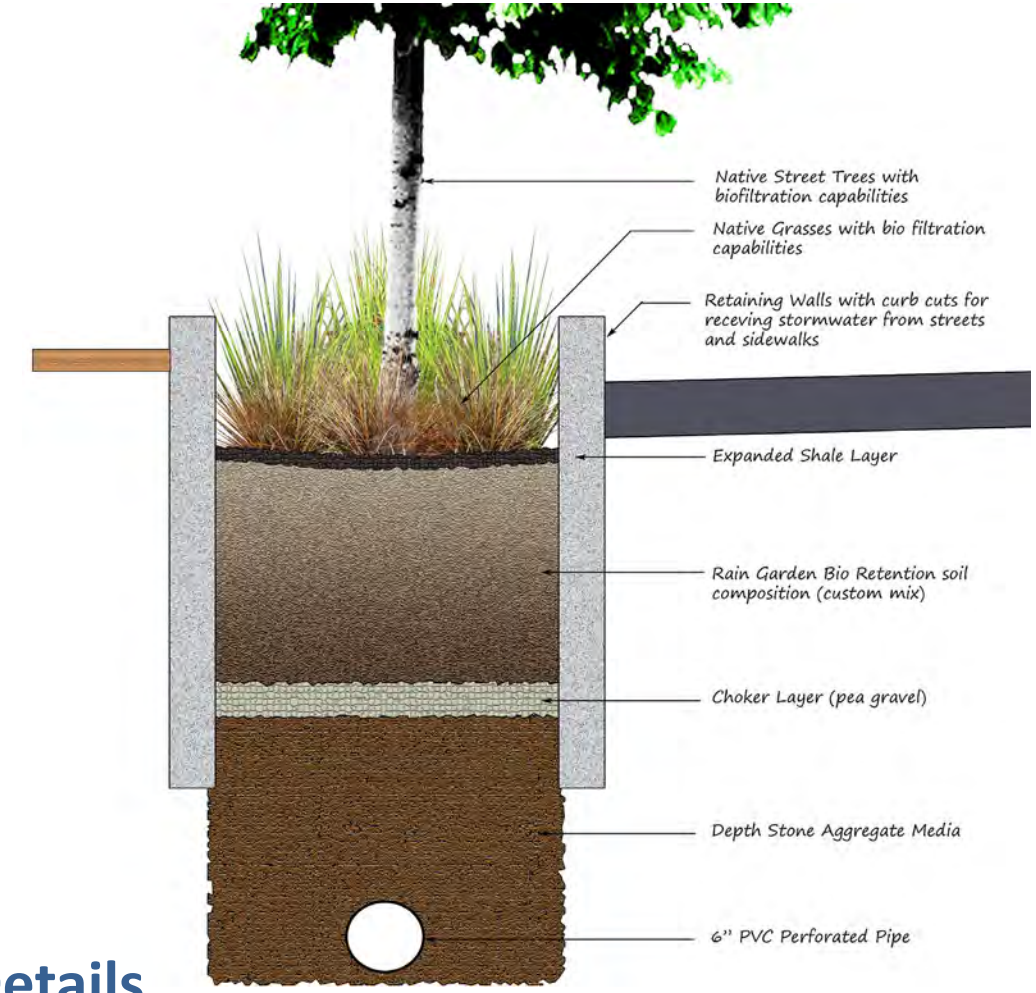
- Storm water runoff mapping and calculations
- Rain Garden dimensions, anticipated storm water runoff, soil composition and plant selections were factored into the landscape design



Rain Harvesting & Landscape Details

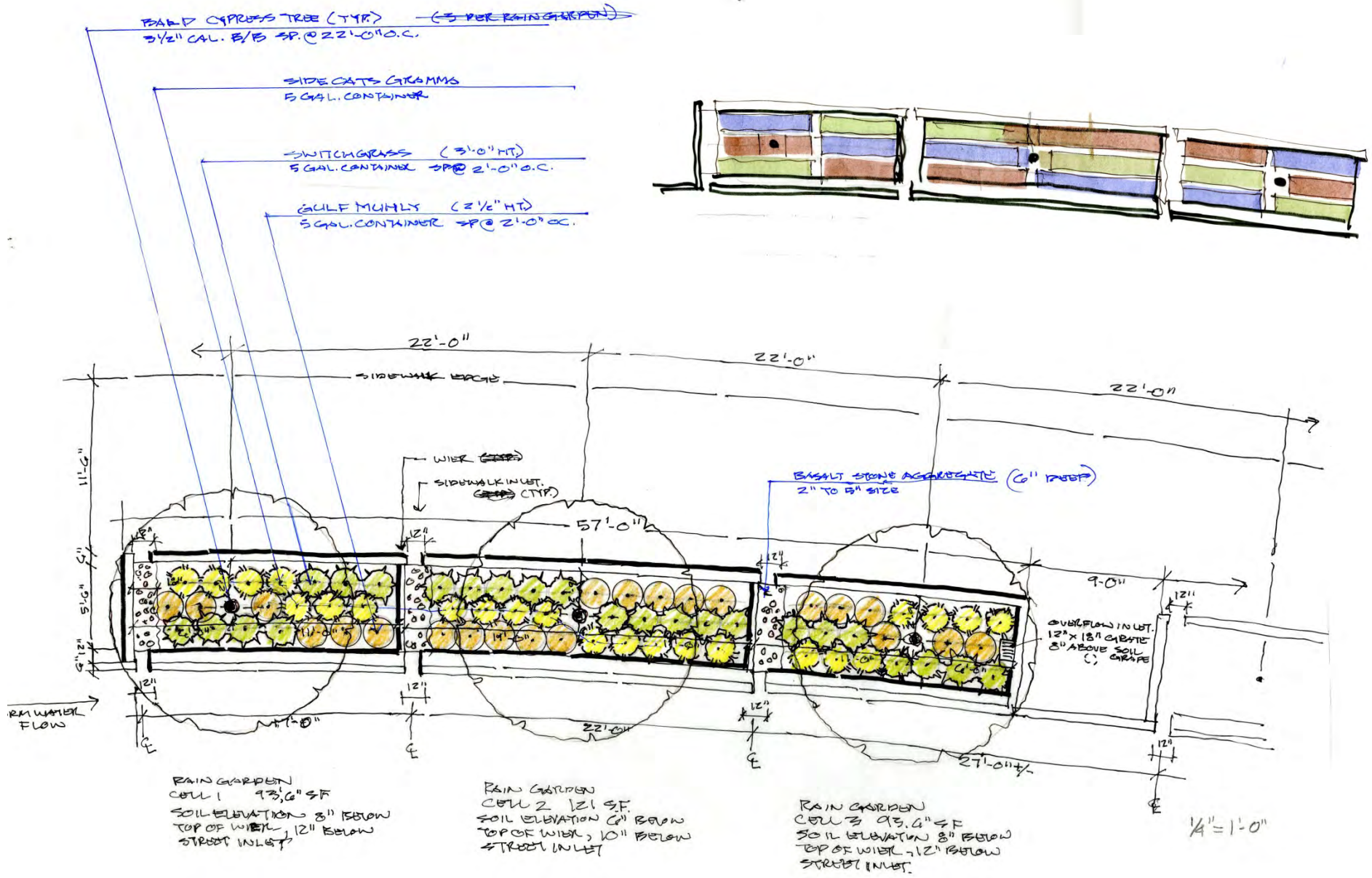
- Rain Garden with curb and sidewalk inlets per each 'cell'
- Soil depth and composition allow for balance for retention and percolation rate
- Designed to hold storm water for up to a 1 ½" rain event, the Internal weir system directs flow, disperses and maintains water levels.
- An overflow inlet is provided at the lower cell, designed to receive storm water above

Rain Garden – Lexington KY



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

Bald Cypress

Side oats Gramma

Gulf Muhly

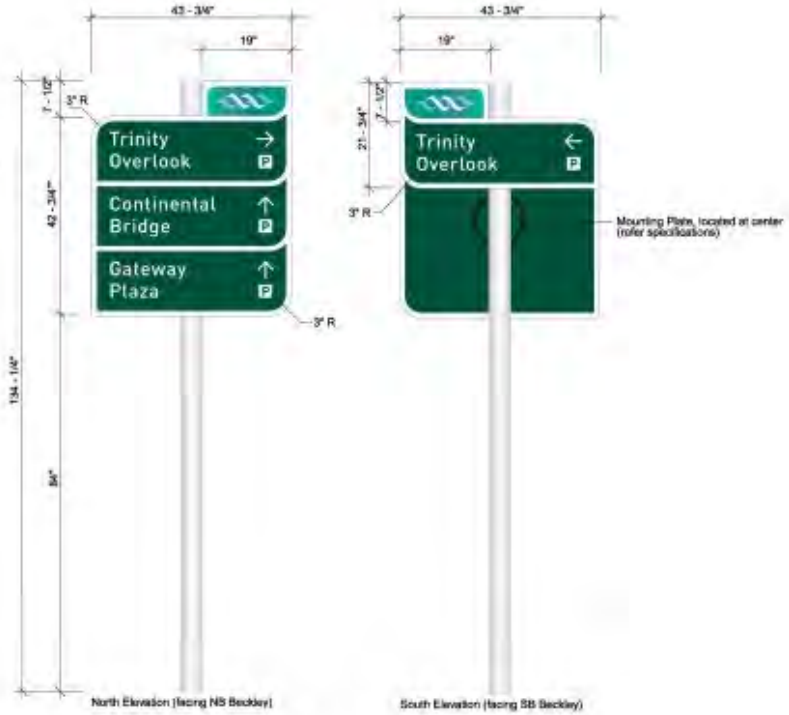
Switch grass

Little Bluestem (Median)

Rain Harvesting & Landscape Details

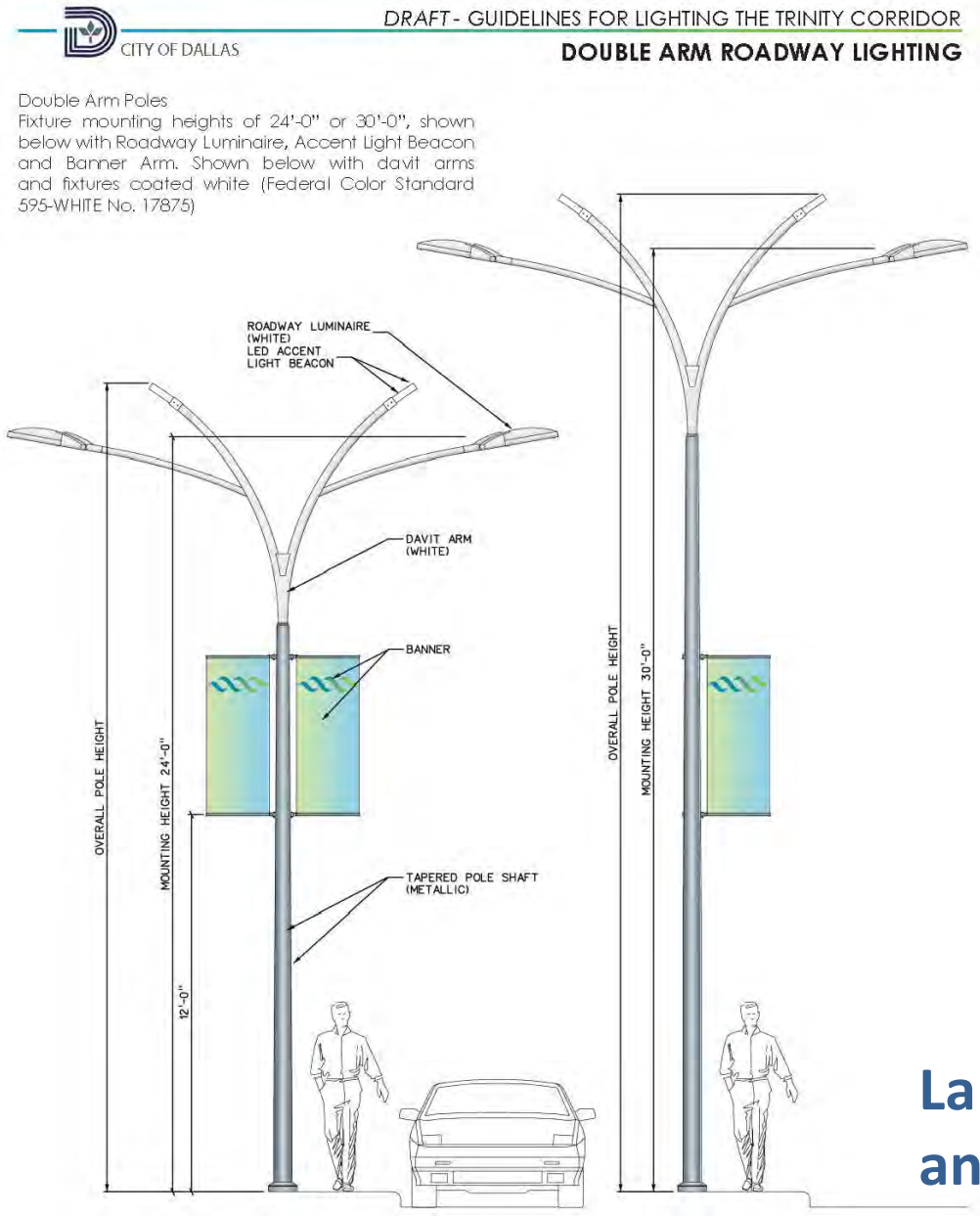
- **Native Plants chosen for their endurance and mitigation qualities more floodplain than drought tolerant due to inundation abilities and low oxygen levels.**
- **Rain Garden soil composition will provide substantial organic nutrition and optimal conditions for storm water percolation.**
- **While 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.**

1 Sign 1: (Ramp entrance at Beckley Ave.) Destination Signage for Commerce West



2 Sign 2: (Beckley Ave. Median)Directional Signage

Landscape Details – Dallas Bike and Trinity Wayfinding Signage



Landscape Details – Trinity Street and Pedestrian Lighting

Before

Beckley / Commerce – Existing Conditions 2009

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

Implementation

Trinity Wayfinding Signage and New Mixed-Use Dev. - 2021

NCTCOG Green Transportation Infrastructure Workshop

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

Elm Street, Good Latimer Expressway to Exposition Avenue

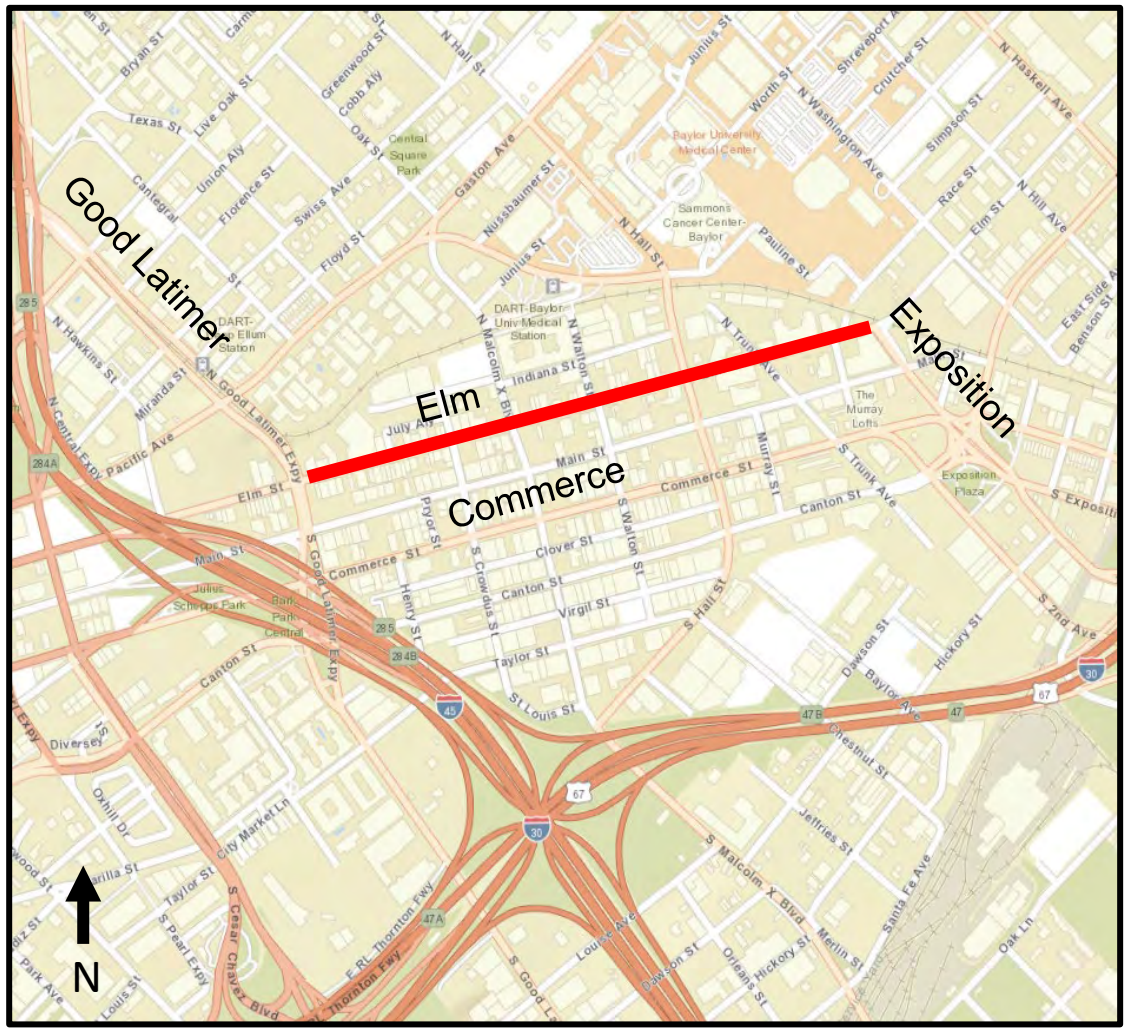
Green Transportation Infrastructure Workshop
August 24, 2021

Chris Turner-Noteware, P.E.
City Engineer
Department of Public Works
City of Dallas

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

Project Location

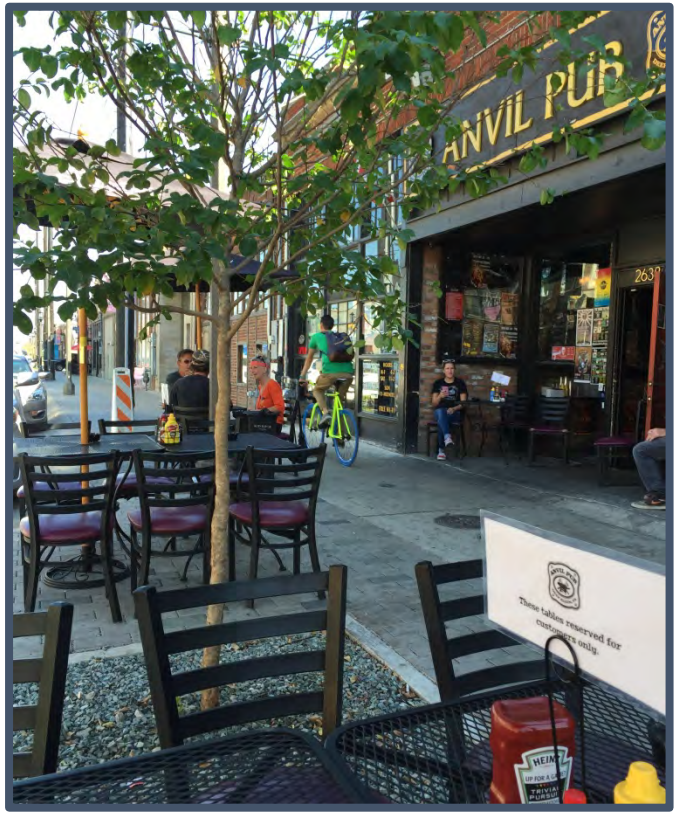


Background

- 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

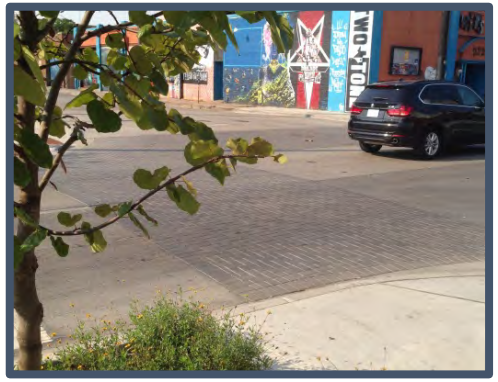
Reconstruction Concept

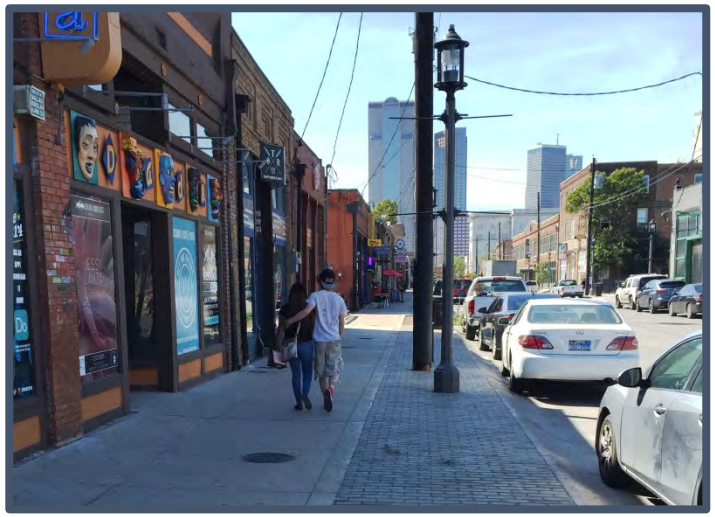
- Change from one-way to two-way street
- Increase sidewalk areas in front of businesses
- Parallel parking areas
- Enhanced crosswalks at intersections
- Stormwater conservation through pervious pavement, amended planters and rain gardens
- Increase landscaping
- Enhance pedestrian accommodations
 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



Sidewalk Paving

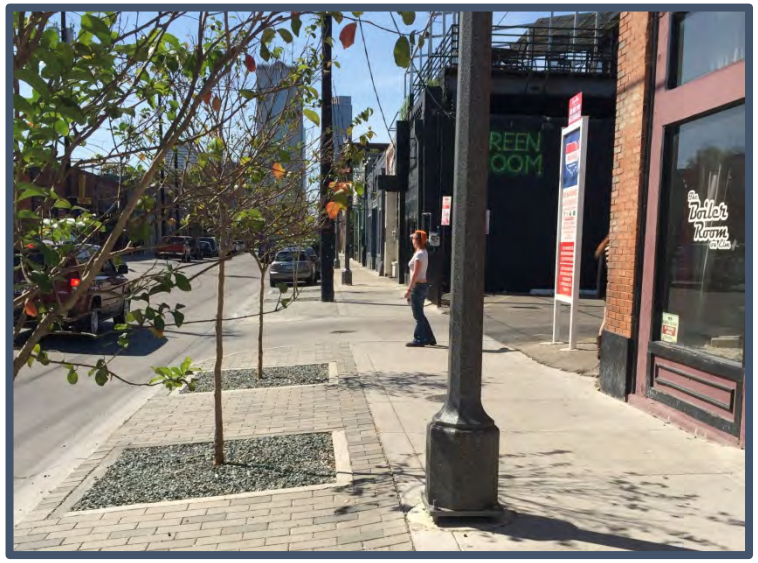
- Utilized Broom finished concrete band and walk section next to buildings
  - Allows for expansion/remodel of shop fronts
  - Diffused runoff
- Pavers used for accent bands along parallel parking, at intersection bulb-outs and main intersections
  - Accent colors and patterning
  - Transition slope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

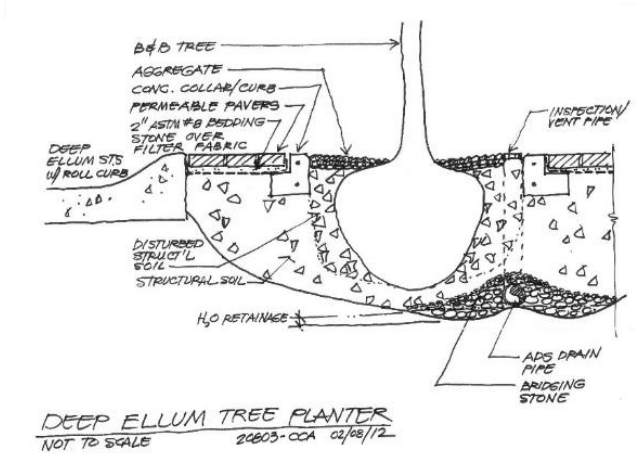


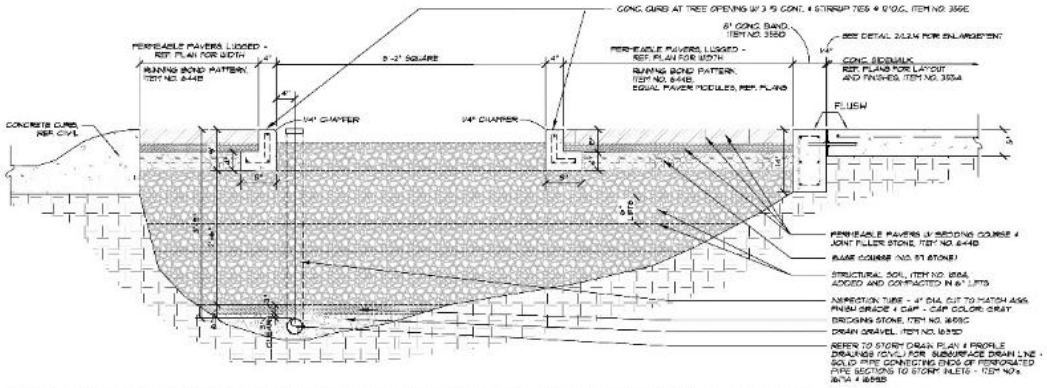


Sidewalk Paving

- 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



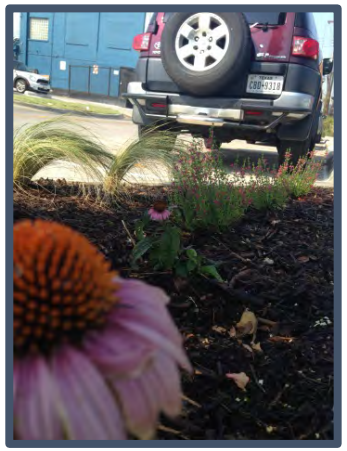


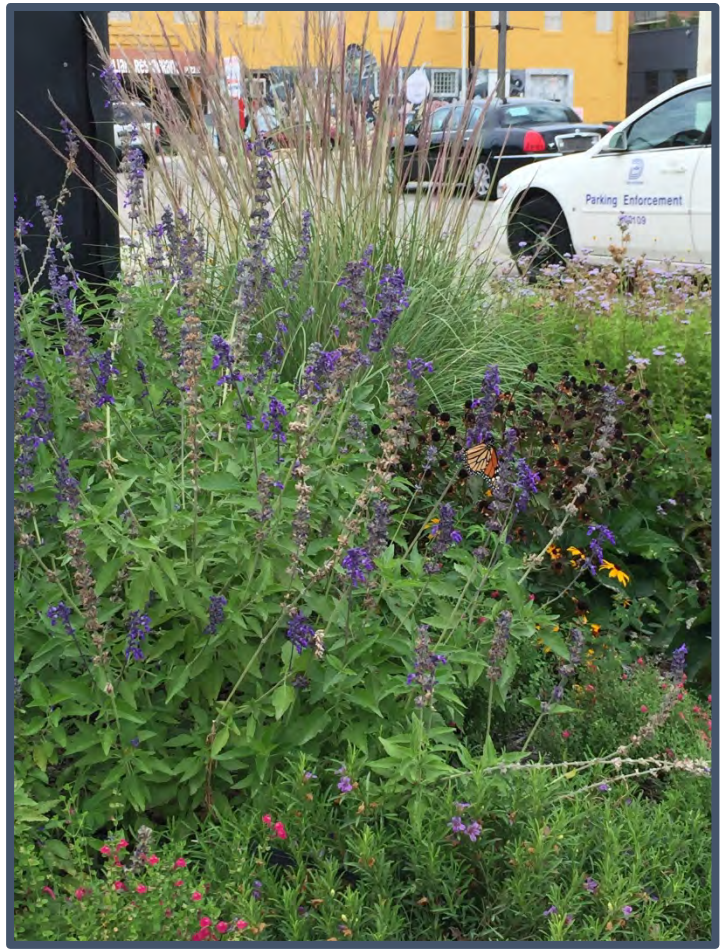


2 TREE IN STRUCTURAL SOIL @ PERMEABLE PAVERS WITH TREE OPENINGS - SECTION
NTS

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”



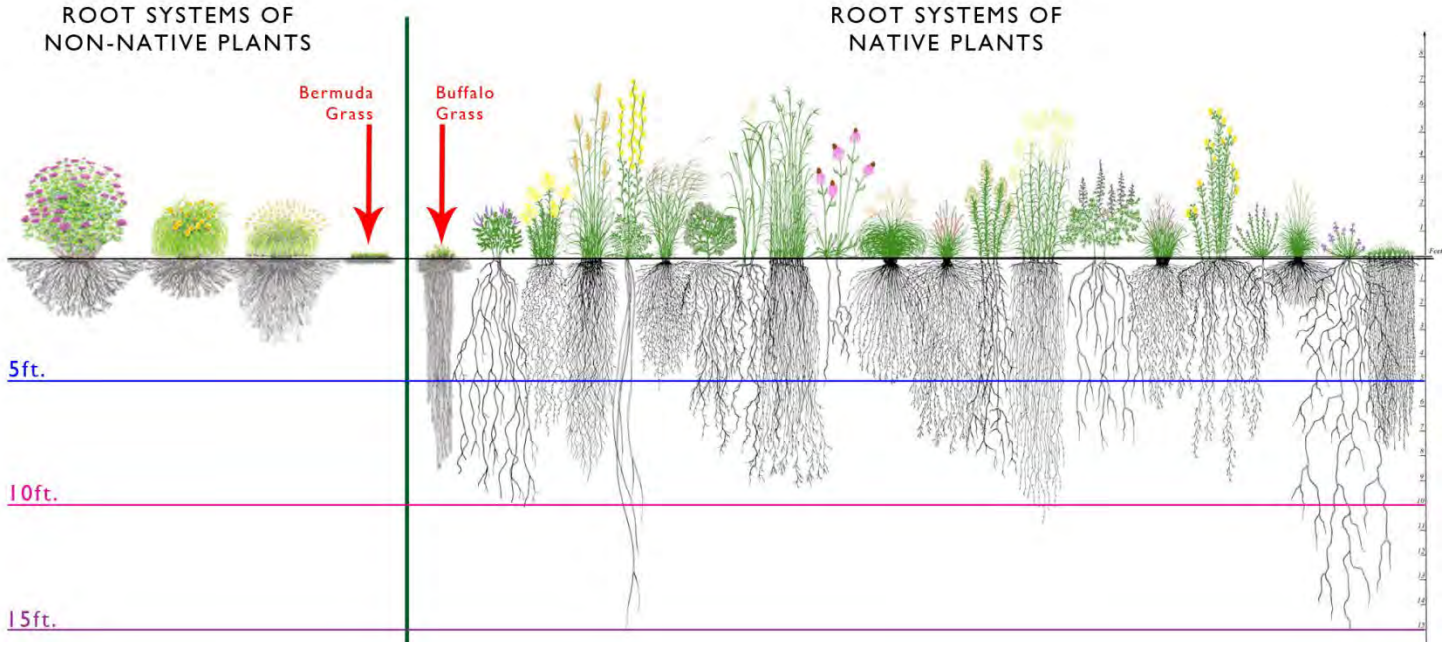


Planting Beds

- 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

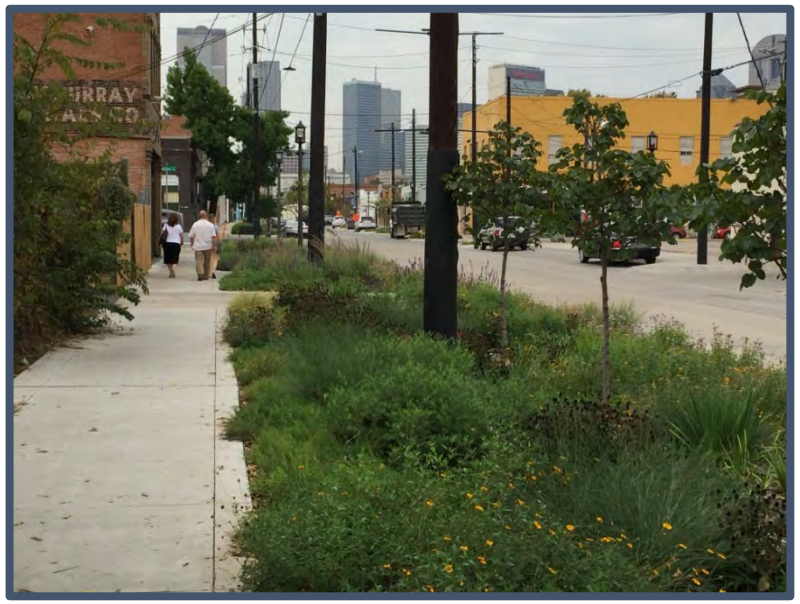
Plant Material

- 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



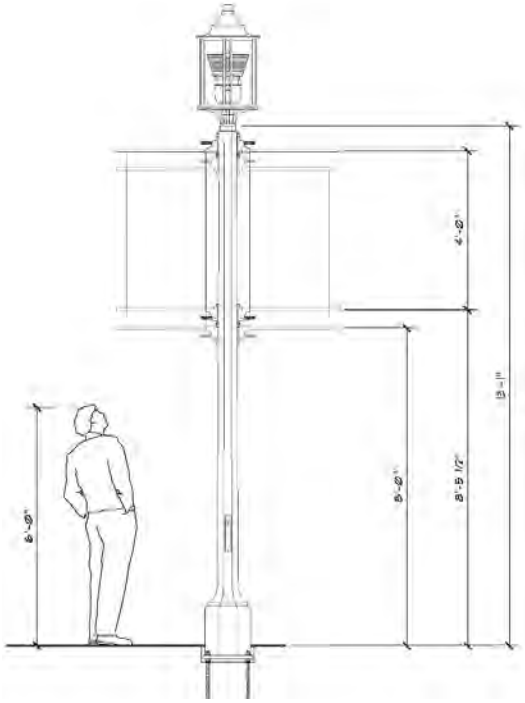
Rain Gardens

- 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

Existing fixture with 16’ metal pole and no reflector

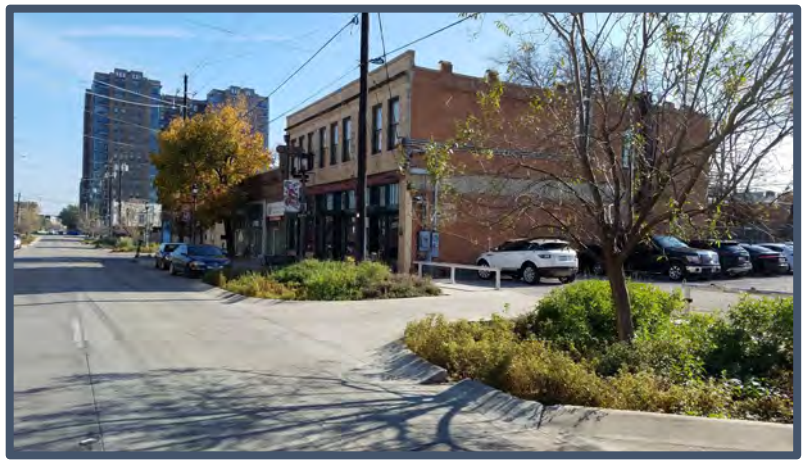


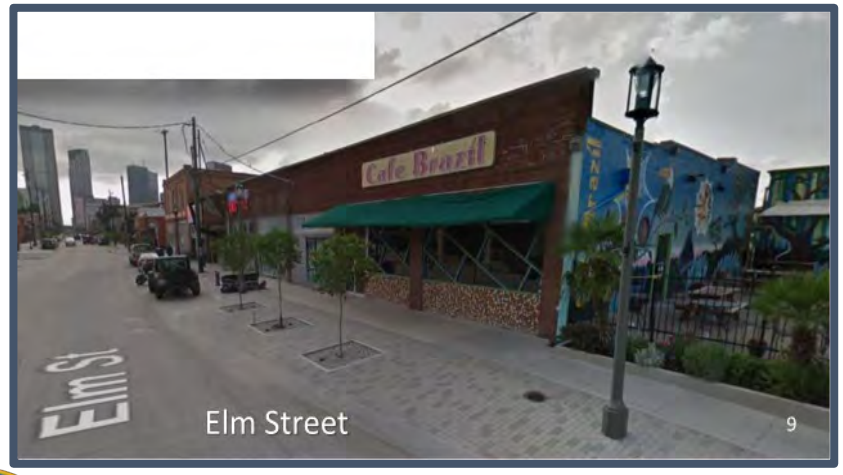
New fixture with 13’ spun concrete pole, reflector, and banner arms

- 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

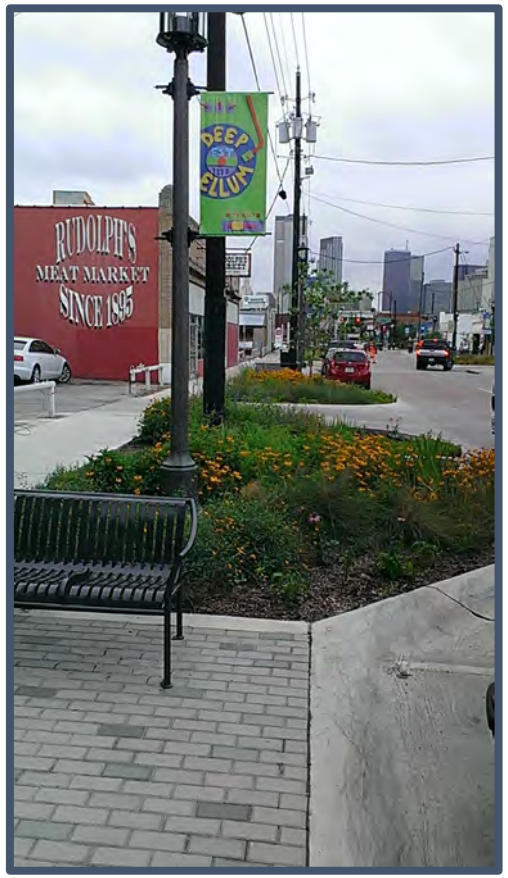
Maintenance

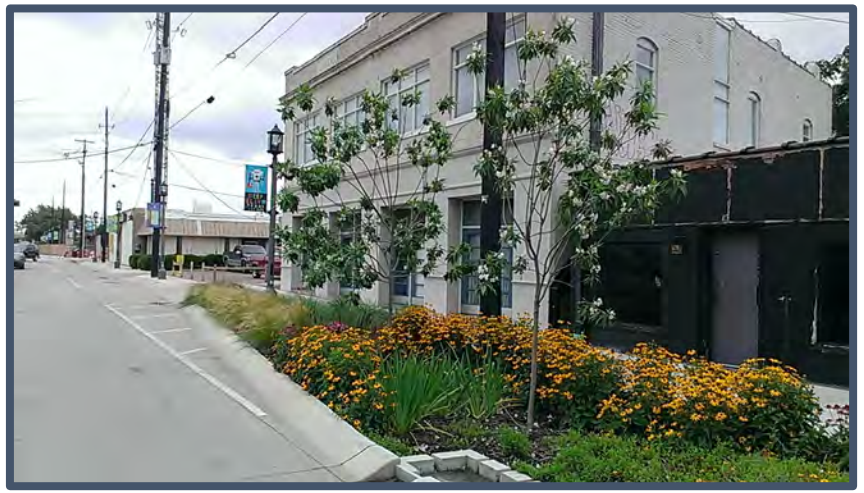
- Maintaining landscaping after construction is complete and allow for establishment
  - Provided two year maintenance contract (held plant replacement warranty)
  - Deep Ellum Foundation took maintenance responsibility after the two year maintenance contract
  - Use of deeply amended soils, rain gardens and permeable pavers for potable water reduction for irrigation

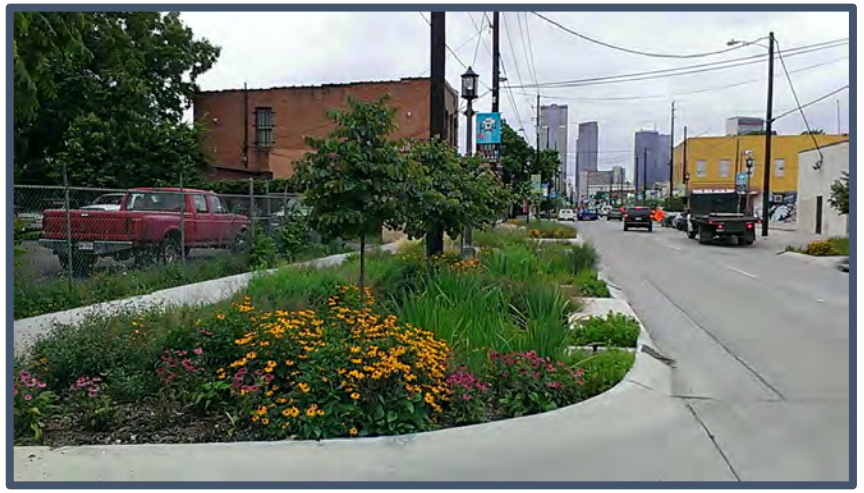




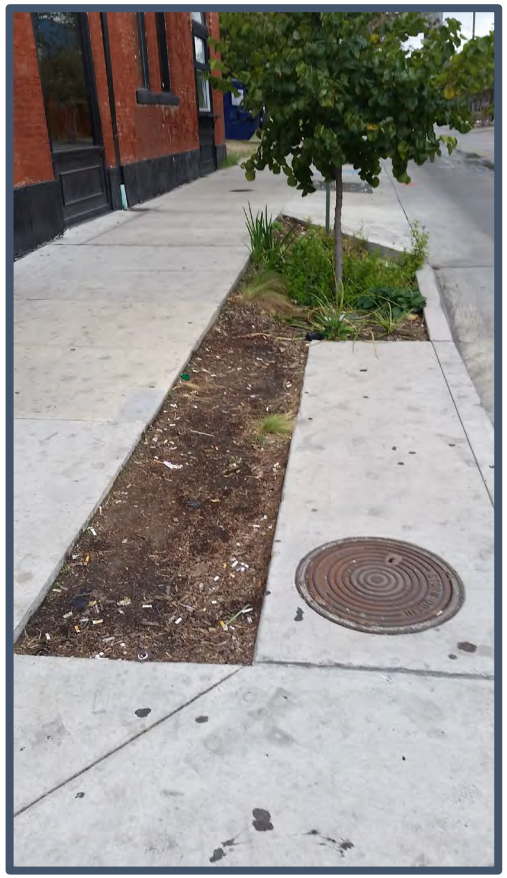
Post-Construction Photos – Shortly After Construction

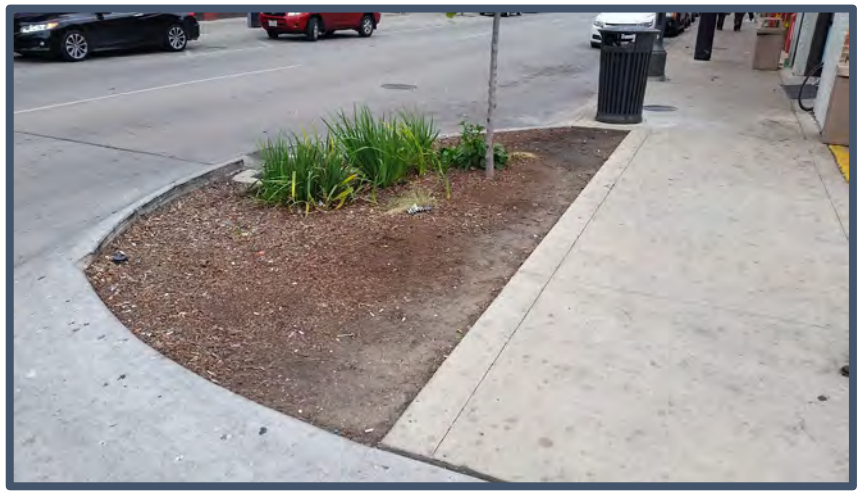






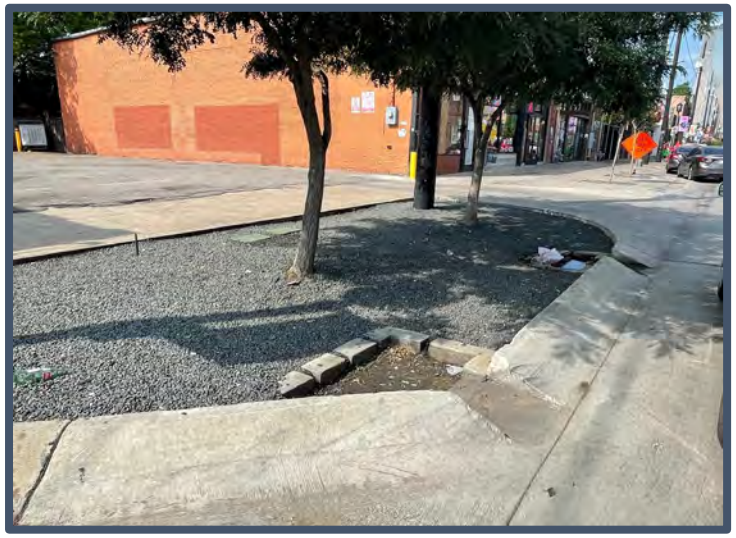
Post-Construction Photos – Several Years after Construction





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