

**CITY OF EL PASO, TEXAS  
AGENDA ITEM  
DEPARTMENT HEAD'S SUMMARY FORM**

**DEPARTMENT:** Capital Improvement Department

**AGENDA DATE:** April 2, 2018

**CONTACT PERSON/PHONE:** Lauren Baldwin, Sustainability Coordinator, 212-1835

**DISTRICT(S) AFFECTED:** All Districts

**STRATEGIC GOAL:**  
Goal 1: Cultivate an environment conducive to strong economic development  
Goal 3: Promote the visual image of the city  
Goal 7: Enhance and sustain El Paso's infrastructure network  
Goal 8: Nurture and promote a healthy sustainable community

**SUBJECT:**

Discussion on green infrastructure best practices and how this concept can enhance stormwater management in the region.

**BACKGROUND / DISCUSSION:**

Green infrastructure (GI) uses vegetation, soils, rocks, and mulch, and other elements to manage water and create healthier urban environments. GI is a patchwork of natural areas that enhance resilience by increasing permeable surface area, deliver air and water quality benefits, AND provide habitat for wildlife. While green infrastructure typically refers to *passive* rainwater harvesting methods (raingardens, green parking, green streets, permeable surfaces, green roofs, etc.), it can also include *active* rainwater harvesting (rain barrels and cisterns). Passive rainwater harvesting is essentially shaping the earth to slow the velocity of runoff, infiltrate it into the soil and direct it to where it can be beneficially used by vegetation. Medians, parks, parkways, and residential front and back yards are ideal locations for passive rainwater harvesting. GI offers an opportunity to increase the amount of green space in the community, provide food and habitat for pollinators and other wildlife, improve the amount of water that infiltrates into our groundwater supply, filter and sustainably manage stormwater, and improve parkways.

El Paso has started to incorporate green infrastructure into City projects, including design projects in parkways, medians, and parks. Other leaders in the El Paso community, such as UTEP and a few private sector developers, have also started to include green infrastructure in their designs.

**SELECTION SUMMARY:**

N/A

**PROTEST**

No protest received for this requirement.

Protest received.

**COUNCIL REPRESENTATIVE BRIEFING:**

Was a briefing provided?  Yes or  Not Applicable (Routine)  
If yes, select the applicable districts.

- District 1
- District 2
- District 3
- District 4
- District 5
- District 6
- District 7
- District 8
- All Districts

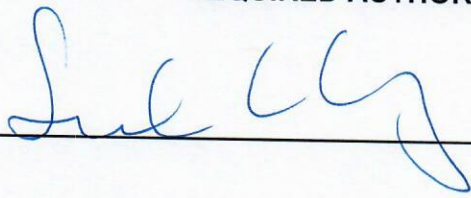
**PRIOR COUNCIL ACTION:**  
N/A

**AMOUNT AND SOURCE OF FUNDING:**  
N/A

**BOARD / COMMISSION ACTION:**  
N/A

\*\*\*\*\*REQUIRED AUTHORIZATION\*\*\*\*\*

**DEPARTMENT HEAD:**



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Lauren Baldwin  
Sustainability Coordinator  
City Of El Paso

# Green Infrastructure



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# Strategic Goals Addressed

- **Goal 1: Cultivate an environment conducive to strong economic development**
  - 1.2: Enhance visitor revenue opportunities
    - Catalyze eco-tourism as an economic development driver focused on El Paso's unique and authentic urban desert identity
- **Goal 3: Promote the visual image of the city**
  - 3.3: Set one standard for infrastructure across the city
- **Goal 7: Enhance and sustain El Paso's infrastructure network**
  - 7.5 Set one standard for infrastructure across the city
    - Institutionalize sustainable building design and development practices for all city-owned and operated property
    - Design and implement infrastructure projects that maximize co-benefits, simultaneously addressing climatic and social stressors such as flooding, heat, and energy and citizen mobility
- **Goal 8: Nurture and promote a healthy sustainable community**
  - 8.5 Improve air quality throughout El Paso

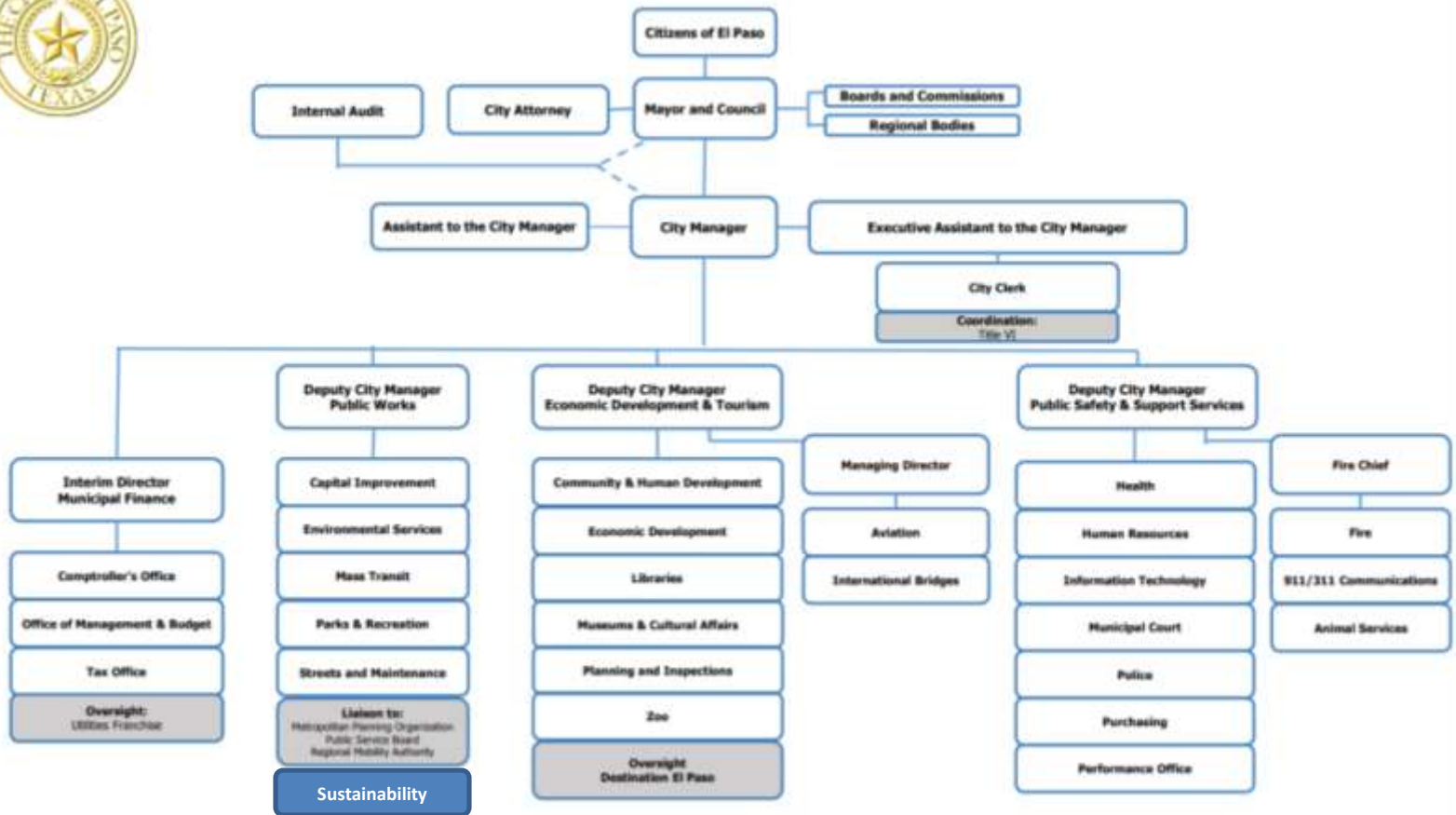


# Where is Sustainability?

- **2008** – Sustainability Office formed (CM, ESD, ED, Gen. Svcs...)
- **2013** – COEP receives 100 Resilient Cities recognition and funding to hire CRO for two years (Dec. 2014- Dec. 2016)
- **2015** – Office of Resilience and Sustainability formed (CRO + Sustainability Coordinator + Resilience AmeriCorps volunteers)
- **2017** – City Council votes to incorporate Resilience Strategy actions into Strategy Plan
  - Summer 2017: CRO serves as Interim Director of Community and Human Development
  - Summer 2017: Sustainability Coordinator embedded in Public Works portfolio directly reporting to DCM to influence sustainability within infrastructure-related departments (CID, Parks, ESD, SaM, Sun Metro)
- **2018** – Resilience Strategy released



# Where is Sustainability?



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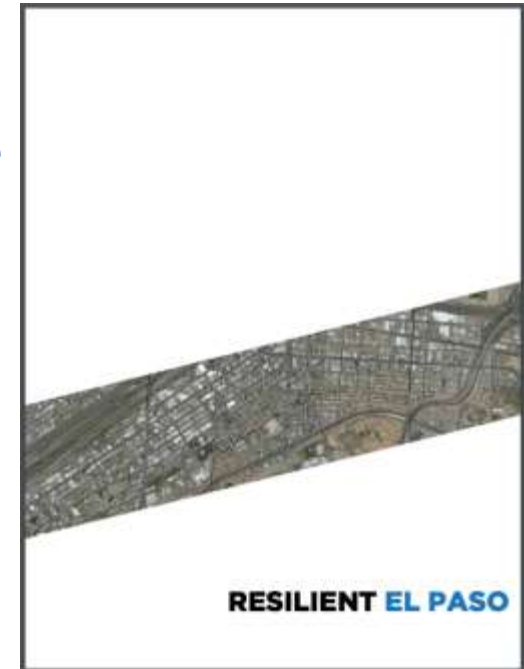
# Background: Green Infrastructure

- **January 2007 - *“Toward a Bright Future – A Green Infrastructure Plan For El Paso Texas”***
  - Halff Associates
  - Very open-space related (need, existing, opportunities, recommendations, implementation)
- **February 2017**
  - Resilience Strategy actions integrated into Strategic Plan
- **August 2017**
  - Green infrastructure workshop and demonstration project
- **December 2017**
  - Presented to OSAB



# Resilience Strategy Integration

- **ACTION 1.4.1 Address identified environmental challenges by deploying best practices and identifying key performance-based metrics to assess infrastructure resilience.**
- Best practices for reducing runoff volume, improving water quality, minimizing heat island effect and maximizing energy efficiency will be prioritized as infrastructure development projects are implemented. **A keen focus will be placed on how to effectively deploy green infrastructure with capacity to address not only water management**, but also improve air quality, enhance walkability, and beautify public spaces.





# Infrastructure – What is it?

- Infrastructure manages our access to food, water, energy, transportation, communication, waste disposal, and other critical services.
- “Infrastructure” has been synonymous with engineered systems that support basic functions of modern industrialized society.



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# Green Infrastructure (GI) can include:

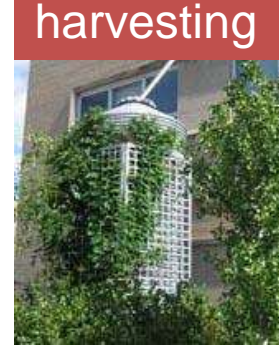
Green streets and alleys



Green parking



Rainwater harvesting



Green roofs



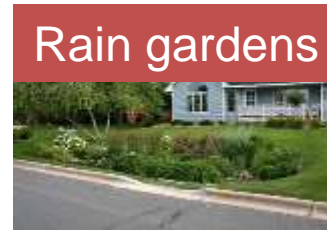
Bioswales



Permeable pavements



Rain gardens



Downspout disconnection



Land conservation



Planter boxes



Urban tree canopy

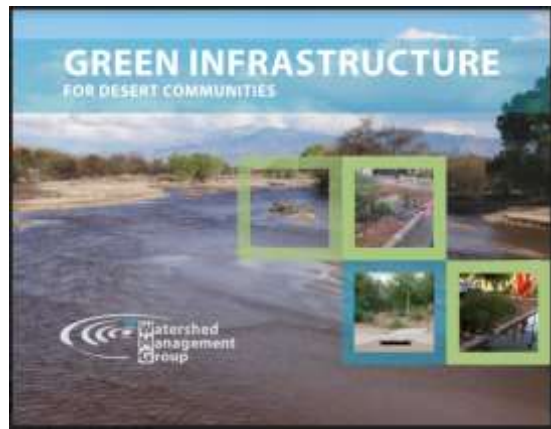
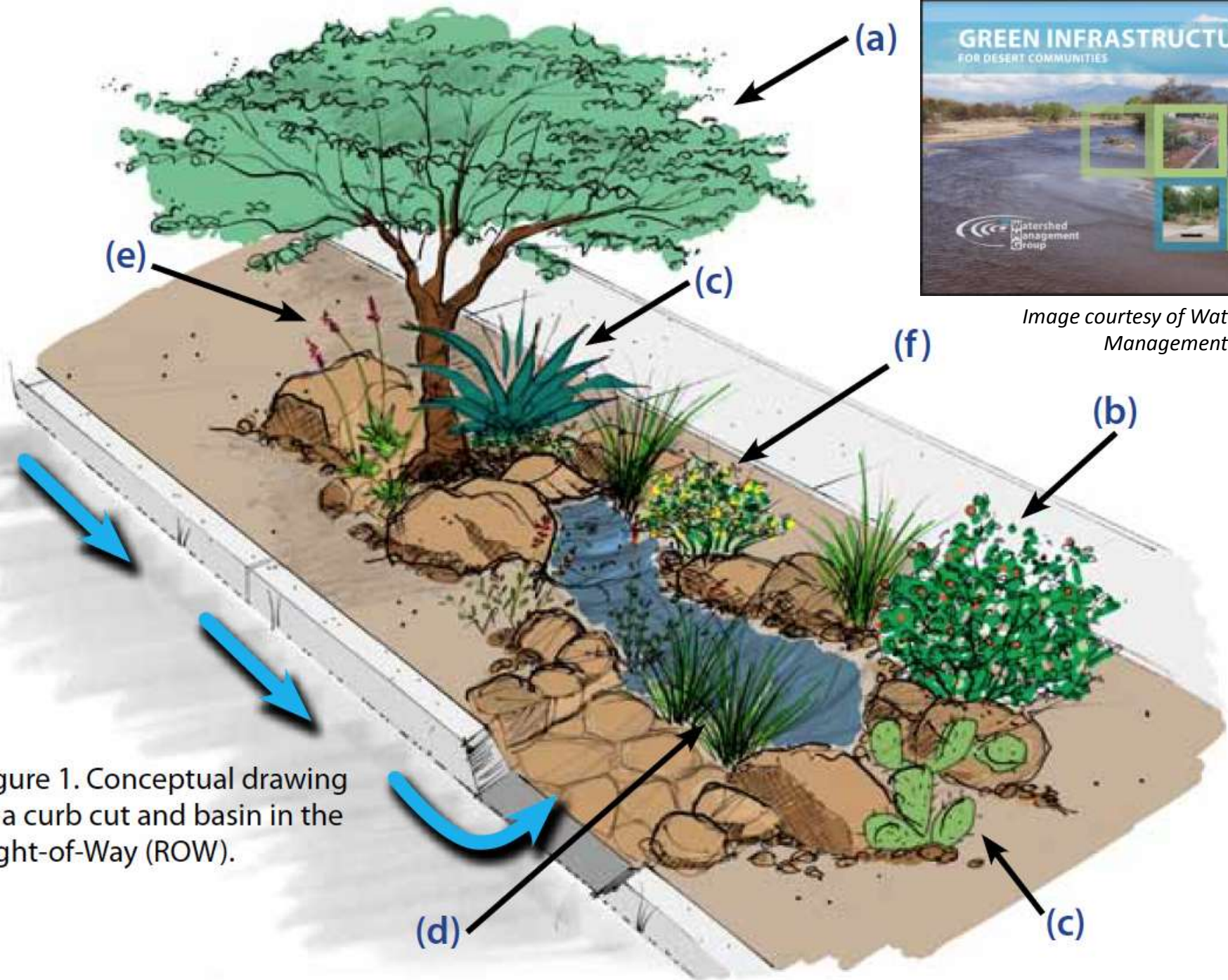


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# Berms, swales, basins





*Image courtesy of Watershed Management Group*

Figure 1. Conceptual drawing of a curb cut and basin in the Right-of-Way (ROW).



# El Paso Examples: Country Club Road



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# El Paso Examples: Country Club Road



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# El Paso Examples: Viscount Hike and Bike



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# El Paso Examples: Knights Blvd



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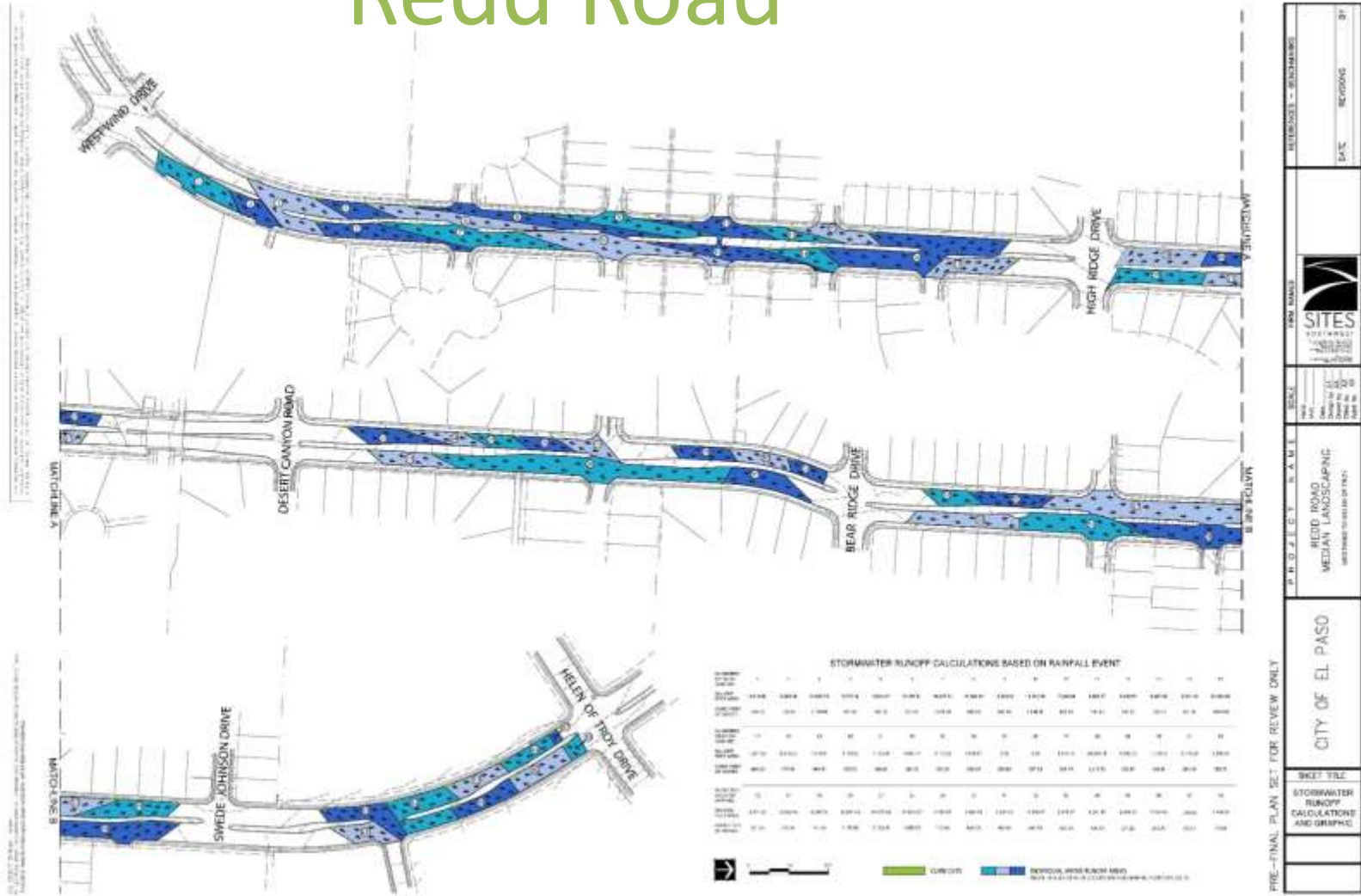
# El Paso Examples: Riverbend



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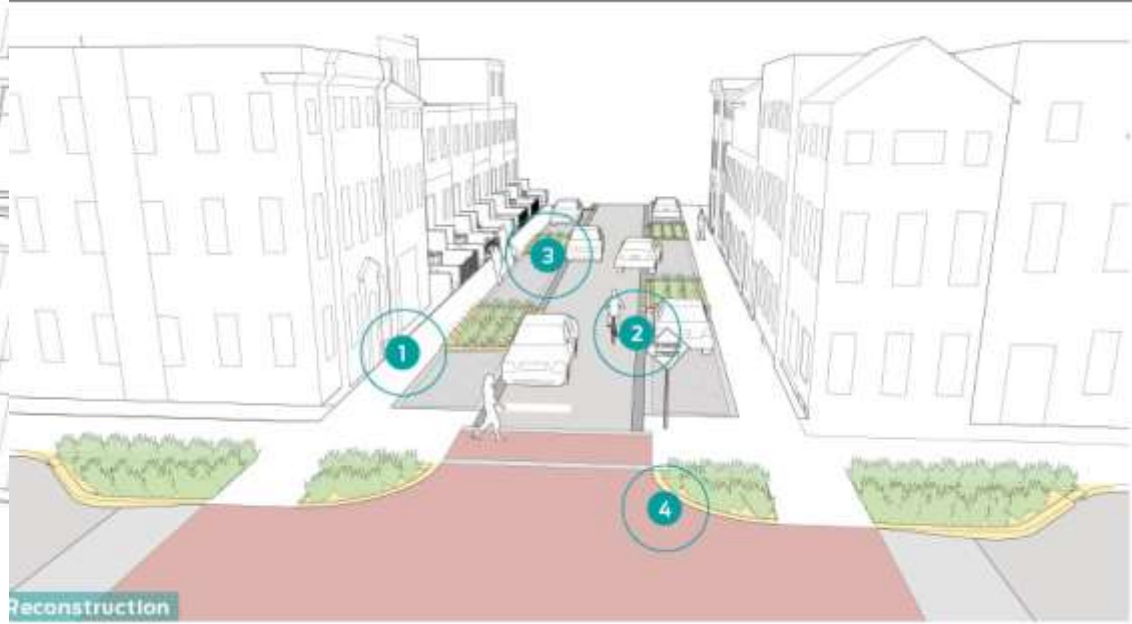


# El Paso Examples: Redd Road

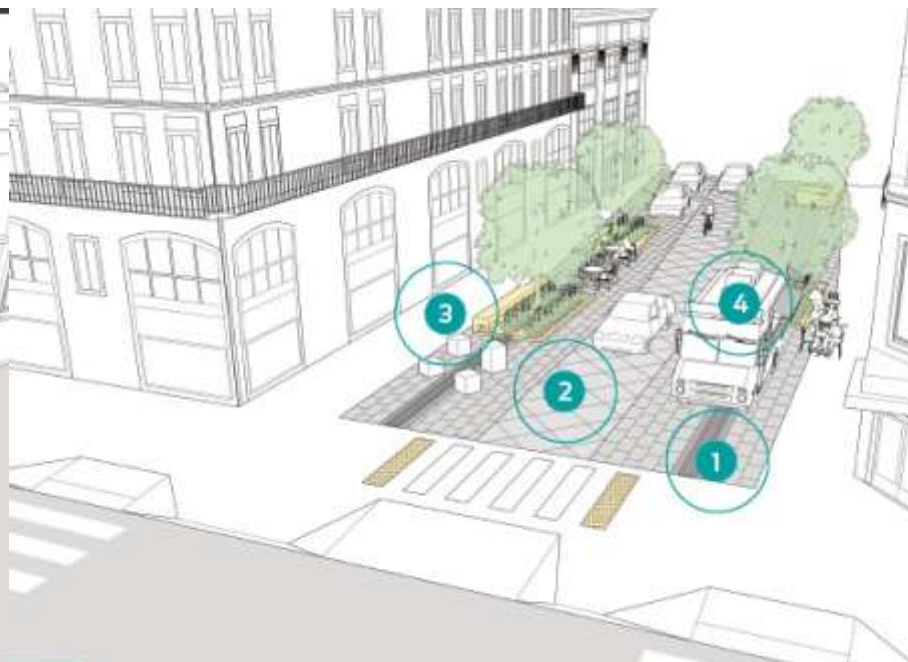


PRE-FINAL PLAN SET FOR REVIEW ONLY  
 CITY OF EL PASO  
 MEDIAN LANDSCAPING  
 REDD ROAD  
 PROJECT NO. 10-10-10-10  
 SCALE: AS SHOWN  
 DATE: 10/10/10  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]  
 APPROVED BY: [Name]  
 SITES  
 ELEVATIONS - REVISIONS  
 DATE: 10/10/10  
 BY: [Name]

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## Examples from NACTO's new Urban Street Stormwater Guide





## Examples from NACTO's new Urban Street Stormwater Guide





# El Paso Examples: Sun Metro's New TOC



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# El Paso Examples: San Jacinto Plaza



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# El Paso Examples: San Jacinto Plaza



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# El Paso Examples: UTEP



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# El Paso Examples: UTEP



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# El Paso Examples: Esmeralda Park



**BEFORE**



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# El Paso Examples: Esmeralda Park



## DESIGN AND CONSTRUCTION



### GREEN INFRASTRUCTURE IN ESMERALDA PARK

**Benefits of Green Infrastructure**

- Native plants provide wildlife habitats for pollinators like birds and insects while absorbing and filtering rain water.
- Most land surfaces in urban areas are impervious, which means that water cannot infiltrate into the ground. Green infrastructure allows stormwater infiltration (seepage) which naturally filters out the oils, greases and heavy metals.

**Plant Control:** Bees and other insects collect nectar from flowers to help prevent flooding.

**Roofs:** Rainwater from street angles, rocks, and vegetation which slow down the water and facilitate pollution removal.

**Soil Absorption:** Pollution-eating bacteria are hard at work as water seeps down into the soil. This's a good job since bacteria can break down nitrogen and phosphorus.

**Water Filtration:** Rocks, layers of soil, and plant roots help trap decomposing material and debris that is backing up, which helps clean water as it slowly absorbs into the ground.

**Happy Hummingbirds:** The rocks in tubular flowers attract hummingbirds and other pollinators that hover when pollinating. They are adapted to pollinate plants that do not have branches.

**Esmeralda Park**

**Esmeralda Park**

- Impervious surfaces prevent water infiltration into soil, thus stormwater overflows must be drained into underground pipes. Green infrastructure can reduce costs associated with diverting stormwater into pipes. Green stormwater management techniques are being used all around the United States. For example, in San Francisco, green stormwater management techniques manage 90% of stormwater runoff from streets in certain areas.
- Green infrastructure (GI) can also aid in vector control by reducing standing water, ultimately discouraging mosquitoes and other insects to linger.

This project was made possible by funding from Texas Parks and Wildlife Department's Conservation License Plate program: [www.conservativelicense.org](http://www.conservativelicense.org)



# El Paso Examples: Esmeralda Park



**EDUCATION +  
IMPACT VOLUNTEERING**

**GREEN INFRASTRUCTURE WORKSHOP**  
**PUTTING IT TO WORK**

**AUGUST 24 & 25**  
Thursday, August 24 | 8 am - 3 pm  
Friday, August 25 | 8 am - 12 pm  
EPCC Library - 6701 S. Desert Blvd., El Paso, TX 79932

Green infrastructure (GI) uses vegetation, soils, and other elements to restore some of the natural processes required to manage water.

Green infrastructure creates healthier urban environments & provides several cost-saving benefits as well.

RSVP to [Hernandezja0@elpasotexas.gov](mailto:Hernandezja0@elpasotexas.gov)

This workshop will provide an overview of green infrastructure & its implementation. It will also include a hands-on portion at Esmeralda Park to show how green infrastructure can be easily incorporated into landscape design.

Funding for this workshop & project is made possible by the Conservation License Plates Program: [www.conservationplate.org](http://www.conservationplate.org)



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# El Paso Examples: Esmeralda Park

**BEFORE**



**AFTER**



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# El Paso Examples: Esmeralda Park

**AFTER**



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# El Paso Examples: Esmeralda Park

**AFTER**



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# El Paso Examples: Esmeralda Park

**AFTER**



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# El Paso Examples: Esmeralda Park

Rainwater Capture Estimates:

**13,529 gallons of water**, which is the equivalent of 21.21% of the potential runoff in a 0.43 inch storm

**AFTER A RAIN STORM**



# El Paso Examples: Rim Road





ts



# El Paso Examples: Kennedy Law



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# El Paso Examples: 7400 Via Canutillo Dr.



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# El Paso Examples: 7400 Via Canutillo Dr.



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**THIS GARDEN IS A COLLABORATION**  
between the students of Coronado High School,  
the Texas A&M AgriLife Extension Service and  
Master Gardeners, the City of El Paso Office of  
Resilience & Sustainability, and Sunset Gardens.





# Examples from other cities:









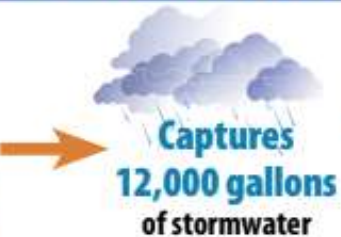
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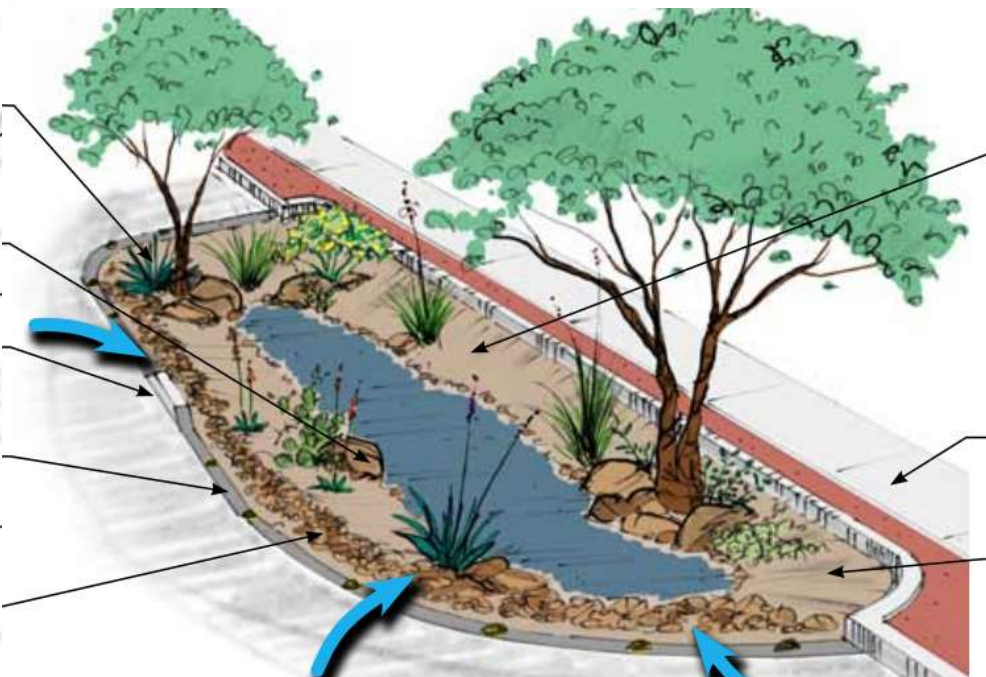
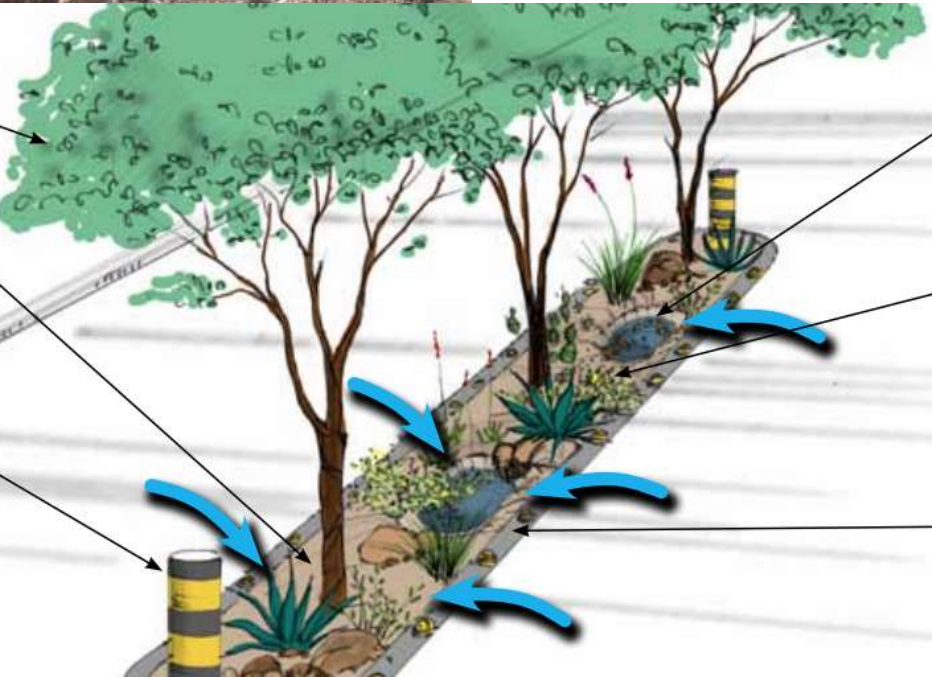


# TUCSON'S ANNUAL RAIN GARDEN BENEFITS:

**1**  
Streetside  
Rain Garden  
Costs \$500



**500**  
Streetside  
Rain Gardens  
Cost \$250,000







# Rain Gardens

*Making a Beautiful Difference!*

This practical garden of native plants grows lakes and streams while adding beauty to the yard.

Water from the roof soaks into the ground, instead of running off.

**Why Build a Rain Garden?**

- Water that soaks into a rain garden recharges groundwater and helps prevent flooding.
- A rain garden prevents water quality by trapping soil, pesticides and other pollutants.
- Some rain gardens, in fact, garden can be additional fertilizer and help cleaning.
- Native plants in rain gardens provide food and shelter for butterflies, song birds and other animals.

**A Typical Rain Garden...**

- In a suburban garden 4 - 8 inches deep.
- Has a 3% to 5% slope.
- Is on the side of the area draining to it - usually 10 - 200 square feet in size.
- Can be formed in between 2 drains.
- Drains within 48 hours.

**Did you know...**

Approximately 80% of our rain gardens are built with concrete blocks. They are easy to build and can be built in a variety of shapes and sizes.

Approximate guidelines for building a rain garden are: 1. The rain garden should be built on the side of the area draining to it. 2. The rain garden should be 4-8 inches deep. 3. The rain garden should be 10-200 square feet in size. 4. The rain garden should be built in between 2 drains.

**Why use native plants?**

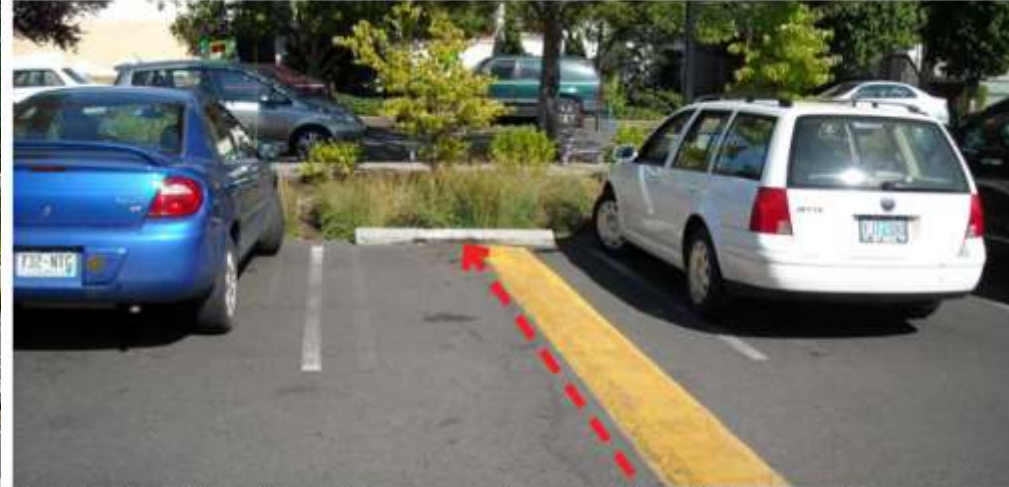
Native plants are better suited to the local climate and soil. They are more drought-tolerant and require less water. They also provide food and shelter for local wildlife.

They will grow naturally in the area, providing their beauty for years to come.









**Figure 1-3:** This asphalt speed bump redirects stormwater into a vegetated swale. Without the speed bump, stormwater runoff would enter the vegetated swale much lower in the system, bypassing some of the area available for treatment.





**Before**



**After**





er



Variations of sidewalk curbs allowing stormwater to flow under sidewalk.





liv

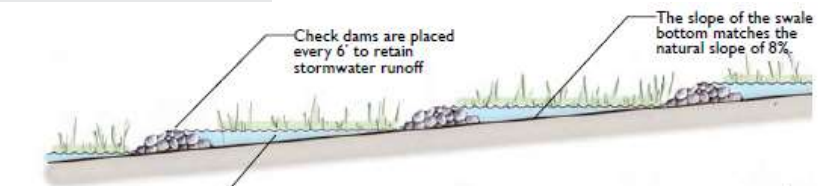


Figure E-6: Vegetated Swale Example

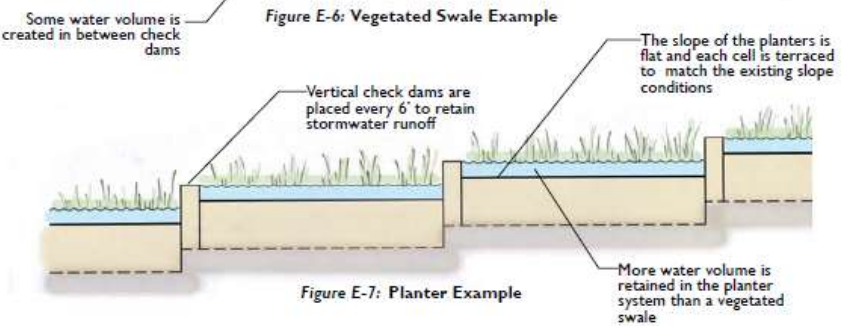


Figure E-7: Planter Example





# Cooling Corridors – Las Cruces, NM



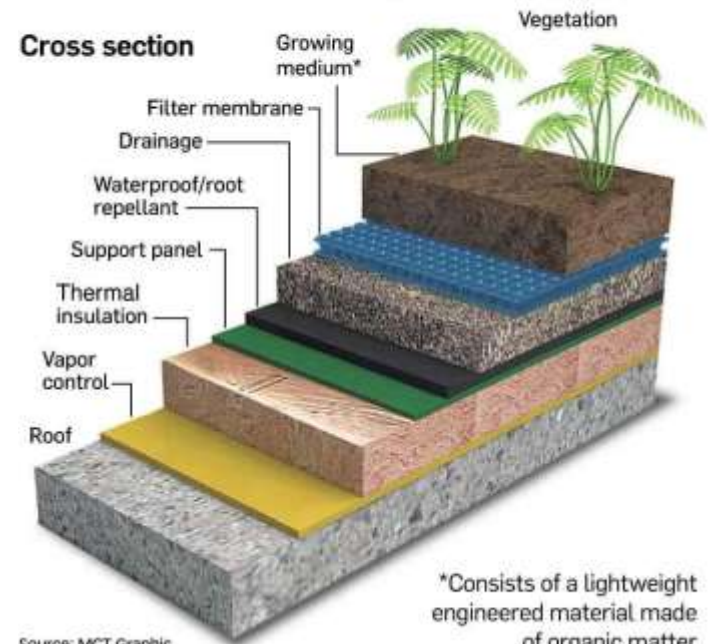


“We successfully designed and fabricated accurately scaled prototypes of a green roof and a conventional white roof and began testing in simulated conditions of 115-70°F with relative humidity of 13%... Our green roof model resulted in a 14°C (**25.45°F**) difference in temperature for the air below the green roof compared to the air below the white roof.”

Source: Jenkins, Bryan M. , Bhat, Ashwini , Botros, Christopher , Fong, Karen , Patel, Vishal, Valladares, Carmen , Watts, Andre. *Implementation of Green Roof Sustainability in Arid Conditions*. UC Davis. 2009.

## Roofs that really hold water

Green roofs vary in plant types used, size and shape, but may consist of some or all of the following:



Source: MCT Graphic

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"In Philadelphia, developers became leaders in advocating for the market value that green infrastructure could provide to projects. We saw progressive developers able to educate other developers, their financial backers, and the market.

Their work showed that green infrastructure could provide for both the bottom line and for their sense of corporate identity and placemaking." | MAMI HARA, GENERAL MANAGER/CEO,

SEATTLE PUBLIC UTILITIES; FORMER DEPUTY COMMISSIONER, PHILADELPHIA

WATER DEPARTMENT

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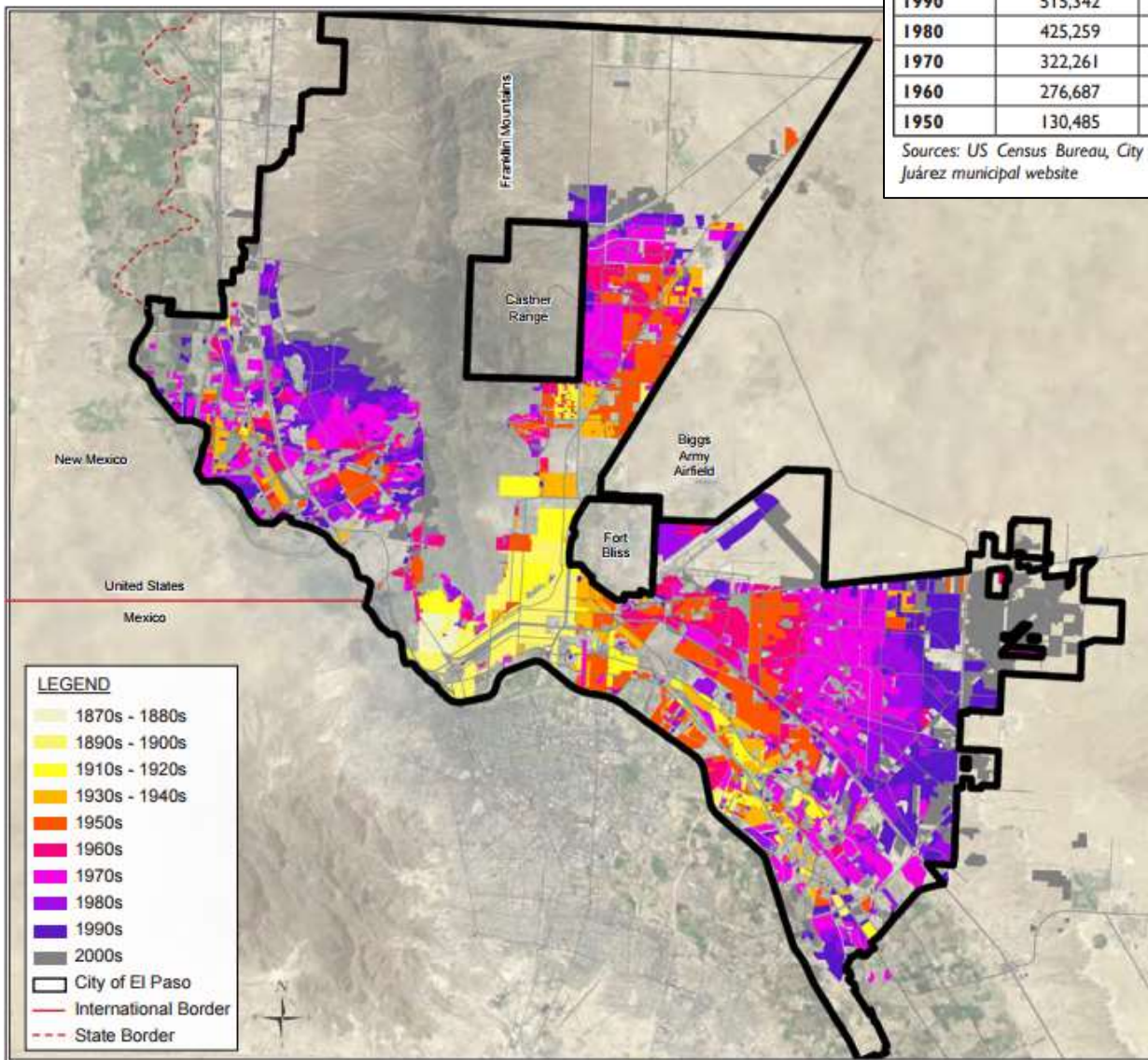


# Trends: Population Growth

## POPULATION TRENDS

	City of El Paso	El Paso County	Ciudad Juárez
2010	649,121	800,647	1,313,338
2000	563,662	679,622	1,218,817
1990	515,342	591,610	798,499
1980	425,259	479,899	649,275
1970	322,261	359,291	407,370
1960	276,687	314,070	262,119
1950	130,485	194,968	122,566

Sources: US Census Bureau, City of El Paso Planning Division, Ciudad Juárez municipal website





# Impact of Development – Los Angeles example

- “In the 1920s, approximately 5% of precipitation in the Los Angeles region flowed to the sea.
- Today, extensive impervious cover and massive stormwater conveyance systems deliver 50% of the rain falling in the region to the sea, even as more than 80% of the city’s water demand is met by costly imports from distant locations”
- More impervious cover means less absorption which means more water that needs to be managed.





# Trends: More extreme weather events



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# Trends: “Nuisance flooding”



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# Opportunity for Increased Permeability



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# Opportunity for Creative Development



“We could have put a six- to seven-acre detention pond on the far side of the development and gone off without thinking about using the drainage system as an amenity. But the idea was to be different. We chose to use the facility as landscaping and give it a look that’s not an ugly ditch.” | RANDY JONES, PRINCIPAL, TERRA VISIONS LLC

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# Opportunity for Creative Development



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# Opportunity to Complement Grey Infrastructure with GI



who we are public information customer service purchasing conservation water reclaimed wastewater

Stormwater:  
▶ About  
▶ Rates  
▶ FAQs  
▶ Environmental

## Stormwater Master Plan: Improving the System

### El Paso County Stormwater Master Plan

[County Stormwater Master Plan](#)

### City of El Paso Master Plan: Improving the System

[Stormwater Master Plan](#)

[Master Plan Community Advisory Committee Report](#)

The El Paso Stormwater Master Plan, approved by the Public Service Board and City Council in 2009, lays out the capital improvement projects that prepare the city for major rain events. The projects are financed through cash funding and bonds.

In the first three years, these master plan projects improved flood control in watersheds throughout the city. More than 50 percent of the flood risk was addressed or reduced. Typical improvements include the following:

- Additional ponds
- Expanded street inlets
- Enlarged culverts
- Expanded reservoirs
- Additional storm drains
- Enlarged culvert crossings and road underpasses
- Lining earthen channels

The master plan study evaluated all areas of the city, but focuses on areas where flood risk is particularly high. This focus on major threats produces a more cost-effective and useful plan. Ultimately, about 100 projects were recommended. EPWU staff recommended an additional \$80 million in projects that address localized flooding issues.

The master plan uses standards consistent with those used by other Texas and Southwest communities. As a result, it has been well received by regulators, insurers, infrastructure financiers and other parties. The master plan forms the basis of significant reductions to flood risk, economic, transportation and health and safety issues in the El Paso communities.



Future Projects		
Watershed	System	Scope
Central	Caballo	New pump station in Gateway West Pond
	Caballo	Caballo Pump Station wet well improvements
	Hagnulla	Increase crest or improve spillway on Dam No. 7
	Dallas	Replace principal spillway on Dam No. 9
East	Dallas	Dallas Pump Station Improvements Phase 2
		Add capacity to Dallas system
		Dam 8 Upgrade - outlet tower improvements
	Eastwood Dam	Under review
Jesuit Basin	Rio Norte	Improve storm drain system to Rio Norte Drain
	Jesuit Basin	Add pipes to capture flow
	Jesuit Basin	Add new detention pond
American	American	Add detention sediment basin - Socoma Athletic Complex No. 1
	American	Add detention sediment basin - Socoma Athletic Complex No. 2
Mission Valley	Mesa Drain Upstream	Thomas Manor Pond and Pump Station Improvements
	Playa Drain	Remove Structures - Yarbrough and Playa Drain
Northeast		Install new pump station and culverts - Vocational/Riverside
		Install new pump station - Basin C/Shawover Park
	Northeast Sump	Northeast Sump Excavation
		Expand facility - Alpe to Hards Pass
		Substation for flows in Threadell/Tobin Drain
		Install pipes to flow to Northgate Dam



[http://www.epwu.org/stormwater/master\\_plan.html](http://www.epwu.org/stormwater/master_plan.html)



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# Thank You

**Lauren Baldwin**

Sustainability Coordinator

City of El Paso

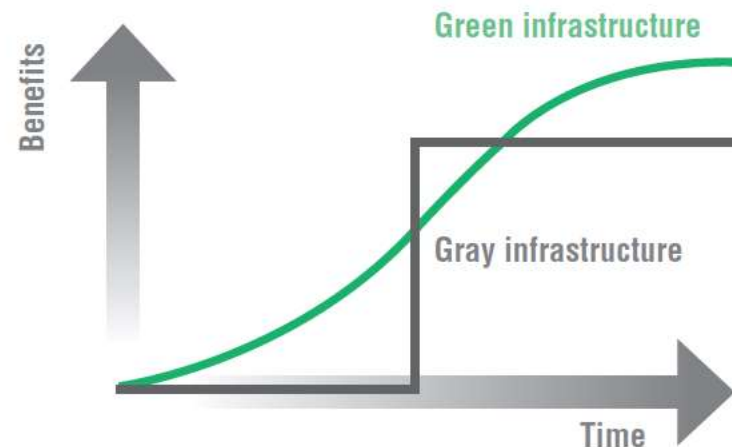
[BaldwinLD@elpasotexas.gov](mailto:BaldwinLD@elpasotexas.gov)

915-208-9693



# Benefits of GI

- GI uses vegetation, soil and rocks to manage rainwater **where it falls.**
- **Added benefits include:**
  - Wildlife habitat
  - Healthier watershed
  - Slow down runoff velocities and reduce potential for flooding
  - Reduce erosion
  - Increase infiltration and reduced ponding
  - Reduce pollutants (water and air)
  - Recharge local groundwater
  - Community beautification
  - Reduce urban heat island effect
  - Sequester carbon
  - Increased land value
  - Improved human health



Over time, green infrastructure provides increasing benefits, in contrast with gray infrastructure. (NYC Green Infrastructure Plan, Executive Summary)





# Benefits span across different departments

- **EPWU** – GI can reduce “nuisance flooding” or “localized flooding”
- **Economic Development** – GI can create more attractive spaces, which means more visitors (and increased property value), which means increased tax revenue
- **Office of Emergency Management** – GI can help slow water velocities and capture rain across the city, meaning reduced risks associated with extreme flooding. Plus, the increased green space means reduced risks associated with extreme heat
- **Public Health** – GI can reduce standing water which means reduced breeding areas for mosquitos which reduces risk of disease outbreaks
- **Environmental Services** – GI can reduce standing water, which means reduced costs associated with vector control
- **Streets and Maintenance** – GI channels the water off the roads meaning less water ponding on streets, leading to fewer potholes



# RESEARCH AND CASE STUDIES



# Case Study – Lancaster, Pennsylvania

- For the 25- year green infrastructure scenario, the **avoided capital costs** associated with implementing green infrastructure instead of all gray infrastructure is **\$120 million** and the avoided operational cost is **\$661,000** per year.
- The total cost to implement GI is \$141 million over 25 years OR \$77 million IF incorporated into planned projects.

## TOTAL CALCULATED BENEFITS OF CASE STUDY

The sum total of the benefits calculated for Lancaster's Plan in this case study came to an **estimated value of more than \$120 million in avoided gray infrastructure capital costs and nearly \$5 million in annual benefits** beginning after the 25-year implementation period. The value of the benefits provided by green infrastructure can be compared to the estimated cost. The Plan estimates a total capital cost of \$141 million for the long-term implementation scenario, and a total marginal cost of \$77 million if green infrastructure is incorporated into planned projects.

Total Calculated Benefits (at Long-Term 25-Year Implementation)		
Estimated Value from Water Benefits		
Reduced CSS Gray Infrastructure Capital Costs (one-time)	\$120,000,000	
Reduced Pumping and Treatment Costs (per year)	\$661,000	
Estimated Value from Energy Benefits (per year)		\$2,368,000
Estimated Value from Air Quality Benefits (per year)		\$1,023,000
Estimated Value from Climate Change Benefits (per year)		\$786,000
Estimated Value from other Qualitative Benefits		Not calculated
<b>TOTAL</b>		
Avoided Capital Costs	\$120,000,000	
Annual Benefits	\$4,838,000	

Source: EPA [https://www.epa.gov/sites/production/files/2015-10/documents/cnt-lancaster-report-508\\_1.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/cnt-lancaster-report-508_1.pdf)



# Case Study – NYC

- In the 1990s, NYC avoided spending **\$6-\$8 billion** on new grey infrastructure water filtration and treatment plants by instead purchasing and protecting watershed land in the Catskill Mountains for about \$1.5 billion



Source: Environmental Finance Center, Syracuse University - [http://www.esf.edu/outreach/gi/documents/Environmental\\_Finance\\_Center\\_Brochure.pdf](http://www.esf.edu/outreach/gi/documents/Environmental_Finance_Center_Brochure.pdf)

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# Case Study – Kansas City, MO

- *10,000 Rain Gardens* is a public initiative in Kansas City, Missouri, to support the improvement of water quality with rain gardens and other green solutions.
- In 2005, Kansas City began the initiative to address its stormwater and overflow control issues. The goal of the program was to install 10,000 rain gardens, vegetated swales, and rain barrels in the greater metropolitan area.





# Case Study – Charlotte, NC

- Landsat images for the Charlotte, NC, area covering a time span from 1984 to 2003 revealed a **20% loss in tree cover and open space**, while urban surfaces increased by 127%.
- The loss of green infrastructure, valued at **\$5.3 billion**, dramatically increased the volume of stormwater that the county manages.



Source: Environmental Finance Center, Syracuse University

<http://www.esf.edu/outreach/gi/documents/Environment>

*"Delivering Outstanding Financial Centers"* Brochure.pdf



# Case Study – Philadelphia, PA

## Philadelphia offers:

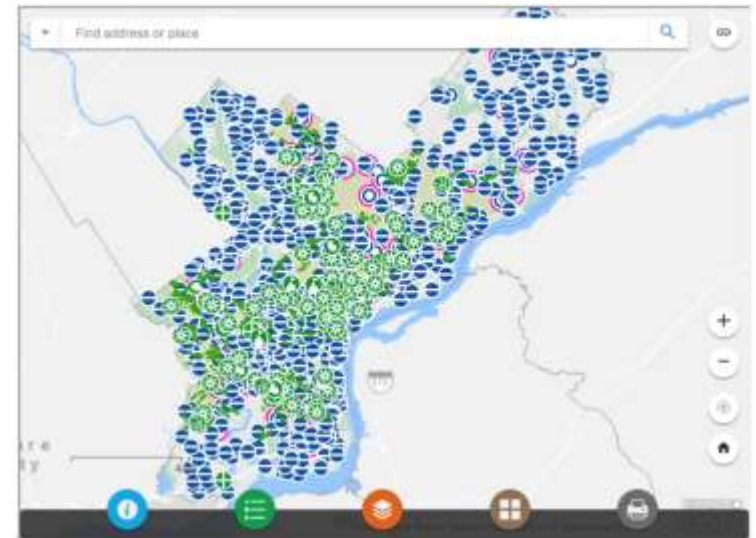
- **Rain barrel workshops**
- **Reduced stormwater fees** for GI implementation
- Stormwater **grants up to \$100,000** per acre to manage the first one inch of rainwater
- **Interactive tool** that allows commercial property owners to calculate how much they would save by implementing GI



## Green Stormwater Infrastructure Project Map

The Philadelphia Water Department has completed or is in the process of designing:

- 742 Stormwater Tree Trenches
- 195 Stormwater Planters
- 49 Stormwater Bumpouts
- 179 Rain Gardens
- 6 Stormwater Basins
- 268 Infiltration/Storage Trenches
- 63 Porous Paving Projects
- 48 Swales
- 2 Stormwater Wellands
- 33 Downspout Planters (not shown in map)
- 25 Other Projects



Source: Phillywatersheds.org

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**\$633**

Approximate Monthly Bill

**\$251**

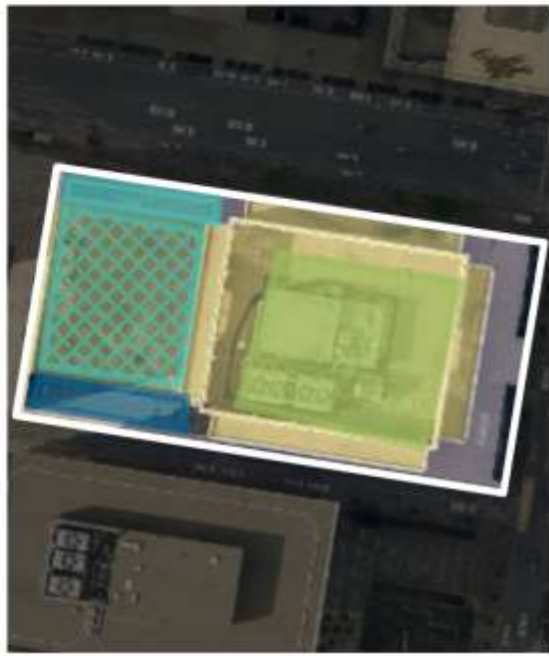
Monthly Bill Reduction

**45%**

Impervious reduction

ADJUSTMENTS

Type	Managed Area (sq. ft.)	Monthly Reduction	One Year Reduction	Five Year Reduction	Ten Year Reduction
Green Roof	14,686	\$142	\$1,704	\$8,520	\$17,040
Permeable Pavement	2,145	\$20	\$240	\$1,200	\$2,400
Rain Garden	10,508	\$89	\$1,068	\$5,340	\$10,680
Totals	27,339	\$251	\$3,012	\$15,060	\$30,120



The credits values provided in the Stormwater Credits Explorer are for estimation purposes only. Actual credit values may be different when projects are actually

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# Case Study – Tucson, AZ

- **Grant program**
  - To help provide homeowners with the opportunity for rainwater harvesting
  - Grants of up to **\$400 are available** to families who have a household income less than or equal to 50% of the area median income.
  - Loans of up to **\$2,000** are available to families who have a household income less than or equal to 80% of the area median income.
- **Rebate program**
  - Must attend Rainwater Harvesting Incentives Program Workshop
  - Tucson Water will provide rebates for qualifying rainwater harvesting system costs of up to **\$2,000 per property.**

Source: <https://www.tucsonaz.gov/water/rainwater-harvesting-rebate>





# Case Study – Phoenix, AZ

- **Adopted a GI goal:**
  - “Reducing urban heat-island through **green-infrastructure** (such as "cool roofs", permeable pavement, and stormwater capture) as well as **doubling the current tree and shade canopy to 25% by 2030...**
  - ...Structured shade and trees facilitate increased walking and biking, increase property values, and, most importantly, can be used to create great public gathering spaces in communities.”

- Source: Phoenix.gov (<https://www.phoenix.gov/sustainability/land>)
- Images: Watershed Management Group





# Case Study – Houston, TX

Source: <http://www.greenhoustontx.gov/compostbinsale.html>

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GREEN PROJECTS

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GREEN HOUSTON

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## GREEN CITY PROJECTS LINKS

[Green Houston Home Page](#)

[Green City Projects Home Page](#)

[Bikeways Program](#)

[Brownfields](#)

[Compost Bin / Rain Barrel Sale](#)

[Electric Vehicles](#)

[Environmental Coordinating Council](#)

[Farmers Market](#)

[Green Building Resource Center](#)

[Green Power Program](#)

[Houston City Energy Proect](#)

## COMPOST BIN / RAIN BARREL SALE

Rain Barrels and Compost Bins at Truckload Prices

**Order online by Sunday, October 8, 2017** at [www.rainbarrelprogram.org/Houston](http://www.rainbarrelprogram.org/Houston). The 50-gallon rain barrels, which typically retail at \$129 and provide homeowners with an affordable alternative to watering from the tap, will be available for \$69. Additionally, 65-gallon compost bins, which reduce the volume of garbage needlessly sent to landfills, will be offered for \$65. Both come with instructions for easy set-up and use.

**Purchases can be picked up Saturday, Oct. 14** from 10 am to 12 pm at the Houston Permitting Center (West) Parking Lot 2, 1002 Washington Ave. GBRC Program Director Steve Stelzer will be available to answer questions and assist all who take part in this offer.

Top Five Reasons to Harvest Rainwater

- Protect our rivers, streams, and ponds from runoff pollution
- Divert water from the municipal storm drain system
- Conserve this vital natural resource and reduce your water bills
- Use rainwater to grow healthy and lush plants
- Control moisture levels around the foundation of your home



Contact:  
832.394.9050



# Research - American Society of Civil Engineers (ASCE)

- “As cities’ stormwater regulations change... green infrastructure (GI) such as green roofs are going to become an **integral part of mitigating stormwater at the source.**”

Source: Gerald J. Zaremba, A.M.ASCE<sup>1</sup>; Robert G. Traver, F.ASCE<sup>2</sup>; and Bridget M. Wadzuk, A.M.ASCE<sup>3</sup>. *Impact of Drainage on Green Roof Evapotranspiration*. July 2016.





# Research - Environmental Protection Agency (EPA)

“Though many green infrastructure practices were first developed and applied in temperate regions, **green infrastructure is perhaps even more relevant in arid and semi-arid climates...**

Communities, researchers, and design professionals in these water-limited regions are increasingly recognizing green infrastructure as a **cost-effective approach** not only to stormwater management, but to water conservation as well.”

The EPA logo is at the top left. To its right, the text reads: "The first in a series of factbooks on LEED, Green High Performance Buildings, and other green building practices in the building industry." Below this is a green banner with the text "GREEN DELIVERY".

## Green Infrastructure in Arid and Semi-Arid Climates

Adapting innovative stormwater management techniques to the water-limited West.

Forward-thinking communities in water-limited regions are increasingly recognizing green infrastructure as a cost-effective approach to stormwater management that conserves water.

When rain falls in natural landscapes, much of it either soaks into the ground or is retained by the atmosphere by plants or evaporation. Rain that is not absorbed into the soil flows into nearby washes, arroyos, creeks, or streams. By paving landscapes with parking lots, roads, and rooftops, we dramatically change this water balance. Much less precipitation is absorbed into the soil, and much more flows across the land, gathering dirt, pesticides, animal waste, and trash along the way. Gray stormwater infrastructure takes on stormwaters to drain the water and its pollutants to the nearest body of water—increasing flooding, pollution loads, and erosion, and degrading water quality and habitat.

Green infrastructure refers to a set of practices that mimic natural processes to retain and use stormwater by promoting infiltration, evapotranspiration, and harvesting the runoff in the landscape. Green infrastructure prevents and restores the natural water balance. Though many green infrastructure practices were first developed and applied in temperate regions, green infrastructure is perhaps

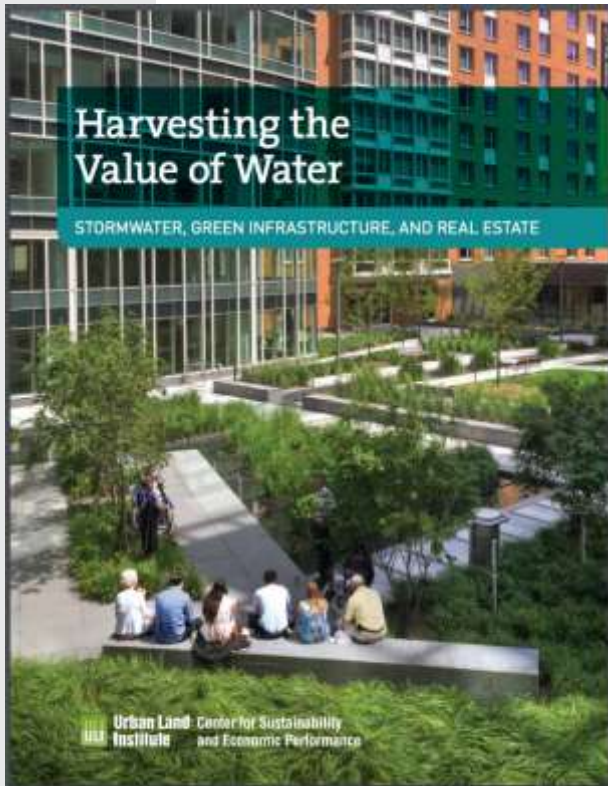
**Mustn't we be doing more green infrastructure for the green stuff?**

Source: EPA, *Green Infrastructure in Arid and Semi-Arid Climate*

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# Research - Urban Land Institute (ULI)



**“...market-rate residents want to live in sustainable communities.”**

**-- Leroy Moore, Senior VP and COO, Tampa Housing Authority**



**Green infrastructure can save space and free up developable land, particularly in comparison to a retention pond alternative.** Green infrastructure made retail development feasible on this 6.25-acre site, which could not have accommodated a traditional wet detention pond, the retail facilities, and parking.

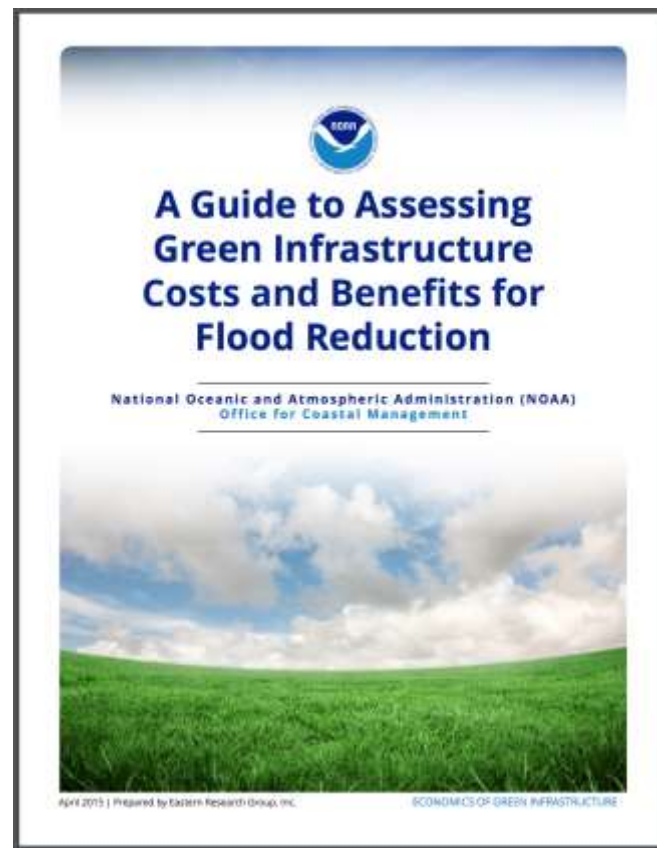
- District-scale sustainable utilities were a part of the marketing draw for the site.** The market-rate units at Encore! were leased up before the affordable units, which the development team attributes to the location, competitive pricing, and branding. **“All of our indications show that market-rate residents want to live in sustainable communities,”** explains Moore.



# Research – National Oceanic and Atmospheric Administration (NOAA)

## Duluth Case Study:

“Based on H&H modeling, the peak discharge for the 100-year, 24-hour storm under current conditions if the 76 acre-feet flood reduction target was met was 1,224 cubic feet per second (**20% decrease**) and the peak velocity was 9.53 ft/s (**1% decrease**).”



Source: A Guide to Assessing Green Infrastructure Costs and Benefits for Flood Reduction. NOAA. April 2015. <https://coast.noaa.gov/data/docs/digitalcoast/gi-cost-benefit.pdf>

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# Research – National Oceanic and Atmospheric Administration (NOAA)

STRUCTURAL DAMAGE ASSESSMENT FOR THE TOLEDO CASE STUDY			
Silver Creek Scenario (all 100-year storm event data)	Number of Buildings Damaged	Maximum Single Building Damage (\$)	Total Damage for all Buildings (\$)
Current flooding without a green infrastructure strategy	253	\$52,000	\$738,300
Current flooding with a green infrastructure strategy	159	\$53,200	\$453,700

## Toledo Case Study:

Reduced costs (**\$284,600**) associated with damage for all buildings AND reduced # of buildings damaged with a green infrastructure strategy (**94 fewer buildings damaged**)

Source: A Guide to Assessing Green Infrastructure Costs and Benefits for Flood Reduction. NOAA. April 2015. <https://coast.noaa.gov/data/docs/digitalcoast/gi-cost-benefit.pdf>

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# Curb Cut Application Process

www.cityofelpaso.gov/planning-and-inspections/applications

GOVERNMENT - RESIDENTS BUSINESS VISITORS DEPARTMENTS - MEETINGS CONTACT | WHAT IS -

**PLANNING AND INSPECTIONS** 915-212-0064

HOME AFFILIATIONS BUSINESS COUNCIL WHICH ACCESS PORTAL INTERACTIVE MAPS ONE STOP SHOP PLANNING DIVISIONS

UTILITY TELECOMMUNICATION FACILITIES SPECIAL EVENTS FLOOD ZONES PLAN EL PASO CONTACT US

**APPLICATIONS**

**SUBDIVISION APPLICATIONS**

- Application Fees FY2015
- Amending Subdivision Application
- Application for Arrears/Amendment
- Dedication of Public Easement
- Development Plat Application
- Land Study Application
- Major Combination Application
- Major Final Application
- Major Preliminary Application
- Minor Subdivision Application
- Office Parkland Dedication
- Platting Determination Application
- Resubdivision Combination Application
- Resubdivision Final Application
- Resubdivision Preliminary Application
- Street Name Change Application
- Subdivision Improvement/Extension Application
- Vacation of Public Easement/MOW
- Vacation of Recorded Subdivision

**ZONING APPLICATIONS**

- Application Fees FY2015
- Application for Mixed-Use Development Plan
- Application for Outdoor Flea Market Operator
- Detailed Site Development Plan Application
- Legal Non-Conforming Application
- NCO Application
- Personal Wireless Service Facility Application
- Personal Wireless Service Facility Checklist
- Re-zoning Application
- Shared Parking Application
- Special Permit Application
- SRM Checklist
- SRM Policy Guide
- Transitional Housing Ordinance
- Zoning Board of Adjustment Application
- Zoning Condition Amendment or Release Application
- Zoning Verification App Form

**LICENSE APPLICATIONS**

- Inspection Rules for Fall

## BUILDING PERMIT APPLICATIONS

- FY18 Schedule of Fees
- Plan, Permit
- Building Permit Application**
- CDM Notification Form
- Declaración de el propietario
- Homeowner Affidavit for Building Permits
- Homeowner Affidavit for Building Permits (Spanish)
- Homeowner Permit for Authorization Affidavit
- Homeowner Permit for Authorization Affidavit (Spanish)
- Mobile Home Placement
- Residential Fence
- Residential Swimming Pool
- TABC Inspection- Alcohol License
- Pre Submittal Meeting Application Form



## Building Permit Application

**CASE NUMBER (Not to be filled out by Applicant):** \_\_\_\_\_

**PROPERTY INFORMATION:**

FID Number \_\_\_\_\_  
 Property Address \_\_\_\_\_ Unit/Space \_\_\_\_\_  
 Legal Description \_\_\_\_\_  
 Subdivision/Survey \_\_\_\_\_  
 Lot \_\_\_\_\_ Block \_\_\_\_\_

**APPLICANT (CONTACT INFORMATION):**

Name \_\_\_\_\_ Phone no. \_\_\_\_\_  
 Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Email address \_\_\_\_\_

Applicant is:  Owner\*  Authorized Agent\*  Contractor  Architect/Engineer  Designer

\* The Homeowner's Affidavit application must be completed if applicant is the authorized agent and/or the homeowner is acting as their own contractor. An owner wishing to act as their own general contractor to construct a new single family home must complete the Homeowner's New Construction Permit Form. (Separate document - needs to be notarized)

**OWNER:**

Name \_\_\_\_\_ Phone no. \_\_\_\_\_  
 Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Email address \_\_\_\_\_

**CONTRACTOR:**

Business Name \_\_\_\_\_ Phone no. \_\_\_\_\_  
 Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Email address \_\_\_\_\_

**SCOPE OF WORK: Check as applicable**

<b>RESIDENTIAL</b>	<b>EXPRESS</b>
<input type="checkbox"/> New Single Family Dwelling _____ sq. ft.	<input type="checkbox"/> Accessory Building _____ sq. ft.
<input type="checkbox"/> New Duplex _____ sq. ft.	<input type="checkbox"/> Commercial Demolition
<input type="checkbox"/> New Townhouse _____ sq. ft.	<input type="checkbox"/> Residential Demolition
<input type="checkbox"/> Addition _____ sq. ft.	<input type="checkbox"/> Fence (Rock, Block, Wood, Chainlink)
<input type="checkbox"/> Alteration _____ sq. ft.	<input type="checkbox"/> Retaining Wall
<input type="checkbox"/> New Triplex _____ sq. ft.	<input type="checkbox"/> Residential Swimming Pool
<input type="checkbox"/> New Quadraplex _____ sq. ft.	<input type="checkbox"/> Patio/Porch/Balcony/Carport _____ sq. ft.
<input type="checkbox"/> Accessory Dwelling Unit _____ sq. ft.	<input type="checkbox"/> Window Replacement
	<input type="checkbox"/> Mobile Home Placement
<b>COMMERCIAL/INDUSTRIAL</b>	<input type="checkbox"/> Temporary Placement
<input type="checkbox"/> New Apartment Complex _____ bldgs. _____ units	<input type="checkbox"/> Dates of operation: _____
<input type="checkbox"/> New Shell Building _____ sq. ft.	<input type="checkbox"/> Completion Permit
<input type="checkbox"/> New Building _____ sq. ft.	<input type="checkbox"/> _____
<input type="checkbox"/> Addition _____ sq. ft.	<input type="checkbox"/> <b>Curb Cut (Driveway)/Sidewalk</b>
<input type="checkbox"/> Tenant Improvement _____ sq. ft.	<input type="checkbox"/> Street Rental _____ sq. ft.



# Recent rains



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# Recent rains





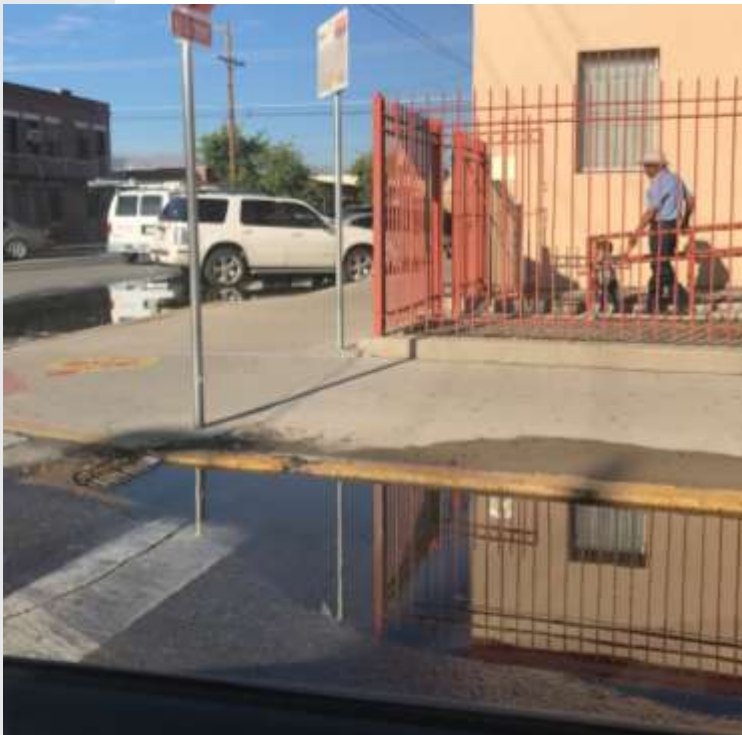
# Recent rains



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# Recent rains



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