Overview of Green Stormwater Infrastructure

Detention / Retention Basins

Basins that capture stormwater runoff and release it at a controlled rate to prevent downstream flooding. Retention basins maintain a permanent pool of water.

They work best as community amenities with trails or fishing which can increase nearby property values; regular maintenance is critical.

Bioretention / Rain Gardens

Vegetated depressions that collect and filter runoff from impervious surfaces using soil and plants, highly adaptable to various urban settings.

They can be found in parking lots, rights-of-way, and yards. While local native soils drain slowly, equipping them with underdrains can help discharge filtered water into the storm system.

Green Roofs

Rooftops covered with vegetation that absorb rainwater, reduce runoff, and provide insulation for buildings, effectively doubling roof life.

They are best suited for large commercial, institutional, or multi-family residential buildings. They are most cost-effective for flat roofs on new construction where the structural load can be planned from the start.

Constructed Wetlands

Man-made wetlands designed to treat wastewater or stormwater through natural filtration and biological processes, providing high habitat value.

Because they typically need a large drainage area to maintain water levels, they are most practical in less dense or peri-urban areas. They are ideal for parks where land costs are moderate and ecological benefits are a priority.

Urban Trees

Trees in urban areas that reduce stormwater runoff by intercepting rainfall and increasing soil infiltration, while also mitigating heat island effects.

Trees fit well in streetscapes, parks, and retail districts. Planners must site them carefully to avoid conflicts with power lines and sidewalks, and select diverse species to ensure resilience.

Permeable Pavements

Porous surfaces that allow water to pass through into the ground, reducing runoff and filtering pollutants.

They are ideal for high-density areas where land is too expensive for other stormwater control methods. It fits well in parking stalls, alleys, and driveways, though it may require underdrains when used on North Central Texas clay.

Green Stormwater Infrastructure

Green stormwater infrastructure can help reduce flooding at **similar or reduced costs** compared with conventional stormwater infrastructure, while simultaneously providing **co-benefits**, such as aesthetic improvements, recreational opportunities, improved air quality, and improved safety.

Benefit Type	Detention /Retention	Constructed Wetlands	Bioretention / Rain Gardens	Urban Trees	Green Roofs	Permeable Pavement
						
Flood Mitigation	3	3	3	2	2	3
Public Health	2	2	2	3	2	3
Recreation / Aesthetics /Greenspace	2	2	3	3	2	1
Property Values	2	2	2	2	2	1
Water Quality	2	3	3	2	2	3
Habitat	2	3	2	2	2	NA
Air Quality / Climate	2	2	2	3	3	NA
Groundwater Recharge Note: groundwater recharge is limited in the North Central Texas region due to clayey soils.	1	1	1	1	NA	1

North Central Texas Council of Governments

integrating Transportation & Stormwater Infrastructure

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Funding Partners: Texas General Land Office, U.S. Department of Housing and Urban Development; Texas Water Development Board; Texas Department of Transportation, Federal Highway Administration; Federal Emergency Management Agency

Types of Green Stormwater Infrastructure

BMP	Detention / Retention Basins	Constructed Wetlands	Bioretention / Rain Gardens	Urban Trees	Green Roofs	Permeable Pavement
Key Advantages	Cost-effective for flood control; potential recreational amenity.	High pollutant removal; high habitat value.	High flexibility for siting (yards, parking lots); large volume reduction.	Heat island mitigation; aesthetic/retail enhancement; energy savings.	Doubles roof life; building energy savings; requires no additional land.	Minimal space required; safety benefits.
Site Suitability	Requires large land area (2-3% of drainage); good for clay soils (Group C/D).	Requires large area.	Highly adaptable: parking lots, ROWs, yards. Works in clay with underdrains.	Streets right-of-ways (ROW)s, parks, retail districts.	Commercial/Institutional flat roofs; best for new construction.	Low-traffic areas (parking, alleys, driveways); high-density areas.
ROI / Cost Savings	**Moderate.** Cost-effective for flood control, less so for water quality compared with other practices.	**High.** High benefit-cost (BC) ratios (up to 45.3) due to low maintenance and high ecosystem value.	**High.** Can save up to 80% vs. gray infrastructure; BC ratios ~2.0 to 12.7.	**High.** Review of studies of urban trees, mostly in North America, shows avg BC ratio of 5.4.	**Moderate.** BC ratio between 1.1 and 2.2, primary benefit is avoided roof replacement.	**Moderate.** Cost-competitive when planned in place of storm drains; lower lifecycle costs than asphalt.
Cost	**Capital:** $201k–$864k/acre. **Maint:** 3% of capital cost/year ($22k–$166k/acre).	**Capital:** <$1–$55/sq ft (approx 25% more than ponds). **Maint:** <$1–$5/sq ft/year.	**Capital:** $2–$80/sq ft. **Maint:** <$1–$10/sq ft (lower than wet ponds).	**Capital:** $100–$1,000/tree. **Maint:** $8–$62/tree/year.	**Capital:** $12–$84/sq ft (High). **Maint:** $0.11–$2/sq ft/year.	**Capital:** $3.52–$491/sq ft (20-50% higher than traditional). **Maint:** Lower lifecycle O&M.
Drawbacks	Good design and maintenance necessary to ensure beneficial aesthetics; mosquitoes in retention basins; requires larger land area.	Requires larger land area; sensitive to human disturbance.	Requires maintenance (weeding/mulch) to function.	Conflicts with infrastructure (sidewalks/power lines); pruning costs.	High upfront cost; irrigation or drought-tolerant native species needed in hot climates.	Ongoing maintenance (risk of clogging, esp. in high-traffic areas; requires vacuum sweeping); high initial installation cost.