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conserves resources, can save costs, and has been shown to both save water and improve plant growth.

In areas where long-term drip irrigation is deemed necessary, set irrigation timers to mimic natural rainfall patterns by providing deep, infrequent irrigation (this can reduce maintenance needs by controlling plant growth).

Soils

All collection basins should be designed to infiltrate their maximum stormwater capacity within 24 hours to avoid mosquito breeding - conduct a percolation test to determine infiltration rates.

In areas with clay soils, hardpan or caliche (an impenetrable layer of calcium carbonate often found in desert soils), consider removing or boring holes through these layers, and/or improving soil with compost (in some cases, soil may have to be replaced with engineered soil mixes to allow adequate infiltration). Avoid compaction of soils during construction, and/or rip soil surface after construction to reduce compaction.

Soil improvements such as compost, minerals etc. have not been shown to enhance the growth of most drought adapted native plants. However, mixing soil with compost may be a useful tool for improving soil infiltration and soil moisture retention. In areas where the water table is high and/or infiltration is low, underdrains (alternate outlet below grade) may need to be incorporated into bioretention features.

Mulch

Mulch refers to any substance used to cover and protect soil. Organic mulch is made up of dry, shredded plant pieces. Inorganic mulch is made of crushed gravel or stone.

Mulch reduces evaporation of moisture from the soil. This function is crucial in desert regions with high potential evaporation rates. However, keep mulch away from trunks of plants to prevent rot.

Organic Mulch

- Use organic mulch in areas where water pools or eddies, such as in a basin attached to a curb cut.
- A 4" layer of organic mulch is required to effectively reduce weed growth.
- Replenish organic mulch every year to maintain a depth of 3"-4". Plant litter should be used to replenish mulch.

Inorganic Mulch

- Use rock mulch in areas where water is flowing or where flooding is a concern, such as in a swale or in-street practices.
- Do not use decomposed granite or unwashed gravel in or near infiltration areas, as small particles can fill pore space in the soil and prevent infiltration of water.
- Use larger rock (4"-8" or larger) to reduce erosion in sites where high water volume is an issue.
- Clean leaf drop and sediment from the surface of rock mulch as needed.

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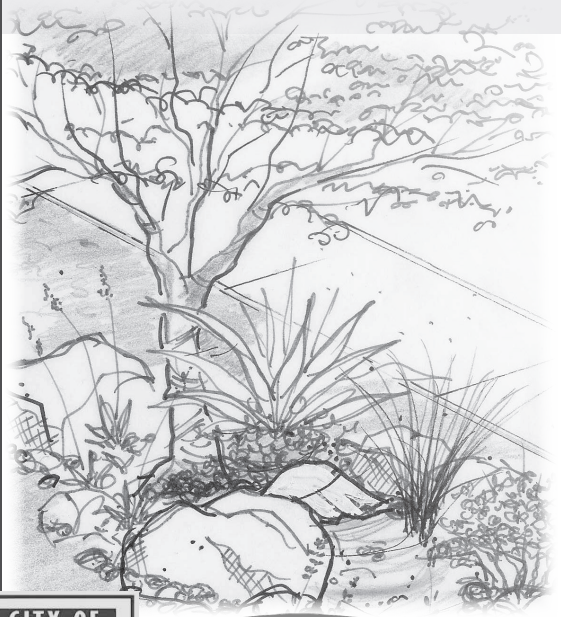
GI-1

Green Infrastructure for Public Right-of-ways

Soil, Plants and Mulch

Soil, plants, and mulch are the critical components among all green infrastructure practices. Soil and plants provide the natural living components to green infrastructure. Mulch reduces moisture loss, controls weeds, and reduces erosion.



Developed by Watershed Management Group in coordination with City of Tucson Department of Transportation.

Vegetation

Native plants are often the best choice for using in green infrastructure (GI) practices, as they: are **uniquely adapted** to grow in local soil and climate conditions; **provide the best habitat** for native wildlife; help create a **unique sense of place** and connection with the surrounding environment; and are **adapted to local rainfall** patterns.

A reference drought tolerant/ low water use plant list is available for Tucson at:

- **www.azwater.gov or**
- **www.ci.tucson.az.us/ dsd/DevStd906.pdf**

Plant Placement

Though each unique GI practice has its own site selection guidelines, the following specifics should be followed for plants in all applications:

Where possible, choose sites where adequate runoff is available to offset or eliminate the need for long-term irrigation of vegetation.

Maximize desired benefit from plants, such as shading hardscape or pathways and calming traffic.

Plan for the mature size of plants. Planting too densely based on the small stature of young plants can create overgrown landscapes, result in stunted plants that compete for resources, and cause plants to encroach on adjacent areas (e.g. streets, sidewalks, utilities) requiring frequent pruning.

Plants improve our local environment by:

- **cleaning air and stormwater of pollutants**
- **reducing local temperatures by shading hardscape and cooling through evapotranspiration**
- **providing habitat for wildlife**
- **building organic matter in soil**
- **increasing permeability of soil through penetration of roots**
- **taking up atmospheric carbon dioxide**
- **beautifying neighborhoods**
- **adding value to homes**
- **slowing traffic along neighborhood streets**

During storms, water will pool in basins (bioretention areas) for periods of up to several hours. The trunks of many species will rot when standing in water or where wet mulch lays against their trunks/ stems for extended periods.

Vegetation Setbacks - Follow appropriate setbacks from underground and above-ground utilities.

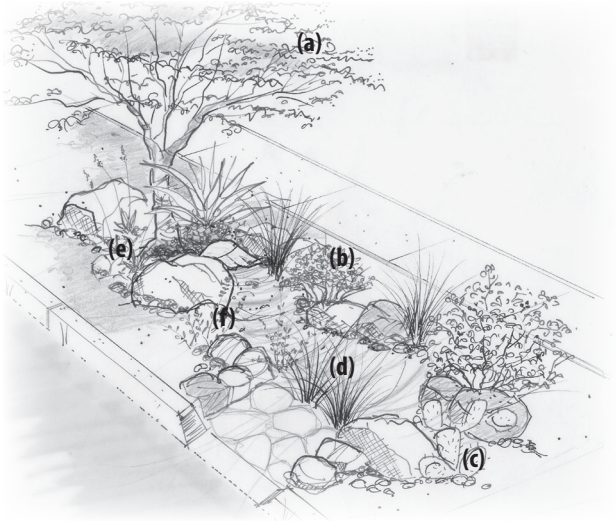
- **In areas where transportation visibility is required (usually within any in-street practices and in the ROW at intersections), plant only shrubs lower than 30" and canopy trees that are clear of leaves and branches up to 6'.**
- **Trees should generally be located 3' back from sidewalks and the street.**
- **Trees whose canopies extend over sidewalks must be pruned to 8' high.**
- **Trees canopies extending into traffic lanes must be pruned to 14' high.**

Trees (a). Trees should be planted on raised surfaces adjacent to bioretention areas, or on raised terraces within them. Extensive root systems allow trees to reach water supplies well beyond the spread of their canopy. Trees demand more water than other plants, and may require irrigation in areas without significant run-on from hardscape.

Shrubs (b). Shrubs are best planted on the slope of a basin/swale or on a raised platform just above the level of extended inundation. This allows plant roots to easily reach moisture in the soil but not to be inundated for extended periods.

Cacti, agaves, yuccas (c). Very low water use plants should be planted above the level of inundation in bioretention basins. They can be used in areas that do not receive extra runoff from hardscape.

Grasses (d). Native bunch grasses provide dense networks of stems and roots that effectively filter stormwater pollutants, reduce erosion and increase infiltration of stormwater into the soil. Bunch grasses can survive both inundation and extended drought quite well, and provide the best benefits in cleaning stormwater at the bottom of the basin.



Wildflowers (e). Perennial wildflowers are the first plants to reach maturity in new GI sites, and can provide much needed color to sites during the first couple years when trees and shrubs are still young. Seeded annuals can create a rush of seasonal color in the first rainy season after planting, but will quickly turn to messy, dry stalks when hot/dry conditions return. Plan to provide seasonal maintenance. Wildflowers are variously tolerant of inundation.

Groundcovers (f). Some perennial wildflowers and shrubs can be used as groundcovers to help protect soil and hold down organic mulch. Groundcovers are variously tolerant of inundation.

Plant Establishment

Irrigate plants for a 2-3 year establishment period after planting; reduce irrigation as much as possible thereafter. After the establishment period, consider occasional irrigation during periods of extended drought. Arrange for deep monthly irrigation in the hottest and driest months of April, May, June and September for 2-3 years beyond the establishment period.

Provide hand-watering vs. irrigation systems where possible. This method

Continued on back

Green infrastructure is a constructed feature that uses natural processes to provide environmental services.