United States Environmental Protection Agency

2012 GREEN INFRASTRUCTURE TECHNICAL ASSISTANCE PROGRAM
City of Phoenix
Phoenix, Arizona

Green Infrastructure Barriers and Opportunities in Phoenix, Arizona

An Evaluation of Local Codes and Ordinances

Photo: Plaza with trees in downtown Phoenix

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About the Green Infrastructure Technical Assistance Program

Stormwater runoff is a major cause of water pollution in urban areas. When rain falls in undeveloped areas, the water is absorbed and filtered by soil and plants. When rain falls on our roofs, streets, and parking lots, however, the water cannot soak into the ground. In most urban areas, stormwater is drained through engineered collection systems and discharged into nearby waterbodies. The stormwater carries trash, bacteria, heavy metals, and other pollutants from the urban landscape, polluting the receiving waters. Higher flows also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water. These neighborhood or site-scale green infrastructure approaches are often referred to as *low impact development*.

EPA encourages the use of green infrastructure to help manage stormwater runoff. In April 2011, EPA renewed its commitment to green infrastructure with the release of the *Strategic Agenda to Protect Waters and Build More Livable Communities through Green Infrastructure*. The agenda identifies technical assistance as a key activity that EPA will pursue to accelerate the implementation of green infrastructure.

In February 2012, EPA announced the availability of $950,000 in technical assistance to communities working to overcome common barriers to green infrastructure. EPA received letters of interest from over 150 communities across the country, and selected 17 of these communities to receive technical assistance. Selected communities received assistance with a range of projects aimed at addressing common barriers to green infrastructure, including code review, green infrastructure design, and cost-benefit assessments. The City of Phoenix was selected to receive assistance to evaluate green infrastructure barriers and opportunities.

For more information, visit http://water.epa.gov/infrastructure/greeninfrastructure/gi_support.cfm.

Acknowledgements

Principal EPA Staff

Tamara Mittman, USEPA
Christopher Kloss, USEPA
Laura Bose, USEPA Region IX

Community Team

Phoenix Office of Environmental Programs
Steve Carsberg
Philip McNeely

Phoenix Parks and Recreation
Richard Adkins
Ken Vonderscher
Lysistrata Hall

Phoenix Planning and Development
Jacob Zonn
Carl Edwards

Phoenix Street Transportation
Hasan Mushtaq

Phoenix Water Services
Jamie Massart
Linda Palumbo

Arizona State University Sustainability Cities Network Program
Anne Reichman

Watershed Management Group
Lisa Shipek

Consultant Team

Kimberly Brewer, Tetra Tech
Jason Wright, Tetra Tech
Martina Frey, Tetra Tech

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Contents

1 Introduction

Green infrastructure uses vegetation and soil to manage rainwater where it falls. This broad term can include minimizing impervious area on a development site; preserving a site's natural features, vegetation, and water; planting new trees; or installing "engineered" best management practices (BMPs) that mimic natural functions such as rainwater storage, infiltration, and cleansing. These practices not only treat and retain stormwater on-site, but also provide multiple environmental benefits and support sustainable communities. The City of Phoenix provides a unique opportunity to examine the compatibility of green infrastructure practices with zoning and development codes in an urban, arid environment. Phoenix is the sixth largest city in the United States, encompassing an area of approximately 600 square miles. The City is located in a dry, desert environment, characterized by only 7 inches of rain per year, high evaporation rates, and low soil permeability. These defining characteristics require modified approaches to green infrastructure techniques, as compared to those typically used in a more temperate environment. The City is also characterized by progressive leadership that recognizes the value of green infrastructure in addressing stormwater management as well as other City priorities. These priorities include conserving and protecting the water supply and open space, creating more shade for bikable and walkable streets, improving air quality, and reducing the urban heat index.

As a part of this project, EPA completed a review of the City's plans, policies, and codes to identify current practices that either support or present barriers to green infrastructure. The project team also recommended code changes that can address barriers and strengthen opportunities for green infrastructure implementation and evaluated the applicability of the EPA Water Quality Scorecard in an arid environment.

2 Green Infrastructure Opportunities and Barriers Evaluation

The purpose of this section is to summarize key findings from EPA's review of the City's plans, policies, and codes, with special emphasis on gaps and barriers identified that the City may wish to address.

2.1 Approach

To review relevant sections of the City Codes and Zoning Ordinance, EPA and the Project Team used two existing green infrastructure code and policy evaluation tools: Tetra Tech's Green Infrastructure Opportunity Checklist Tool and the EPA Water Quality Scorecard (hereafter referred to as the "Checklist" and "Scorecard"). The review identified existing City plans and policies that support green infrastructure implementation. The review also identified language and provisions that actively limit or prevent the use of green infrastructure, create ambiguity that could discourage or prevent its use, or have omissions that, if remedied, could better promote the use of green infrastructure. This evaluation included all green infrastructure techniques including downspout disconnection; rainwater harvesting; rain gardens; planter boxes; bioswales; permeable pavements; green alleys and streets; green parking/efficient parking; green roofs; urban tree canopy; and land conservation/preserving open space.

Prior to conducting the code review, EPA and the Project Team identified the following codes, ordinances, standards, guidelines, and plans that could have bearing on green infrastructure implementation and should be subject to review:

- City Code Chapter 23 – Morals and Conduct
- City Code Chapter 24 – Parks and Recreation
- City Code Chapter 27 – Solid Waste
- City Code Chapter 31 – Streets and Sidewalks (including Street Landscape Standards and Street Planning and Design Guidelines)
- City Code Chapter 32 – Subdivisions (Article III)
- City Code Chapter 32A – Grading and Drainage and the referenced Stormwater Policies and Standards Manual
- City Code Chapter 32C – Stormwater Quality
- City Code Chapter 34 – Trees and Vegetation
- City Code Chapter 39 – Neighborhood Preservation Ordinance and Code Enforcement Policy
- City Code Chapter 41 – Zoning Ordinance
- 2006 Phoenix Building Code
- 2006 Uniform Plumbing Code
- 2006 Phoenix Residential Code
- Phoenix General Plan 2002
- Phoenix Tree and Shade Master Plan, and
- 2011 Phoenix Green Construction Code

(Note: Specific chapters and sections reviewed are detailed in Attachment 1.)

Next, EPA and the Project Team modified the Checklist and Scorecard tools, tailoring them for use in the City's arid, urban environment. Based on local hydrologic and climate conditions and the City's sustainability objectives, the project revised the level of importance of various techniques to reflect a higher priority for:

- **Preserving trees** to provide water quality, reduce urban heat island effect, improve walkability, and provide other triple-bottom-line benefits.
- **Reducing the impervious area of streets and parking** to reduce negative impacts on water quality, flooding, and hydromodification.
- **Promoting green infrastructure practices that capture stormwater on site** to reduce water quality, flooding, and hydromodification impacts.
- **Protecting washes** to maintain natural flows, reduce erosion and flooding and enhance habitat.

Specifically the project assigned higher available points or weight to the following tools and policies compared to the original EPA Scorecard:

- Regional approaches to watershed protection and stormwater management.
- Protection and maintenance of trees through a variety of education, policies, designs and other guidance.
- Reducing the impervious area associated with driveways by allowing shared or two-track driveways and minimum percentage of alley-accessible, rear-loading garages.
- Reducing stormwater runoff associated with streets by encouraging or requiring narrower streets, improving crossings, allowing or requiring permeable paving, tree planting, and green

infrastructure, allowing replacement of conventional curb and gutter, and developing retrofit standards and technical specifications.

- Reducing the impervious area associated with parking by allowing flexibility in meeting parking space requirements, reducing parking requirements based on neighborhood character and context, establishing penalties for oversupply, and adjusting the size of parking stalls.
- Encouraging or requiring green infrastructure through education and outreach, code changes, stormwater credits or other monetary incentives, expedited reviews, and requirements to install green infrastructure.

In the City of Phoenix rainwater harvesting was deemed impractical given the local precipitation regime. The Phoenix area has a mean annual precipitation of approximately 7 inches. On average, there are 15 distinct rainfall events annually with a measured rainfall of over 0.10 inches, about four of these which provide rainfall greater than 0.5 inches. The average rain event is approximately 0.2 inches, but nearly half of all measured events range from 0.01–0.09 inches. Historically, the majority of the rainfall has fallen during the winter season, when many plants are dormant or have minimal water needs. May and June are the driest months of the year, with almost no rainfall, but are also among the hottest months. In any given year, certain localized areas in the region may receive only light rain to almost no measurable rain during the entire summer wet season. During the summer wet season (July-October), after the sparse rain events, storing collected rainwater for extended periods for future use can present challenges related to evaporation, as temperatures can easily soar above 110 degrees and air masses may become exceptionally dry. Therefore, the City Team considered several green infrastructure BMPs (green roofs, rain barrels, and cisterns) to be less practical and cost-effective than other BMPs given the region's frequency and amount of rainfall, as well as local building norms (e.g., lack of gutters and downspouts).

There are very few intermittent or perennial streams or rivers in the region; however, there are many dry washes and ephemeral washes. For washes, minimizing erosion and potential for flooding were deemed of more importance than preservation of hydrologic function, so stream buffers were deemphasized in the Scorecard. Table 1 highlights the elements of the Scorecard that the City Team deemed "not applicable" to the City of Phoenix.

EPA conducted a code and ordinance review using the Checklist and Scorecard tools, while the City Team used the Scorecard to review the key City policy documents, including the *Phoenix General Plan 2002*, *Phoenix Tree and Shade Master Plan*, and *2011 Phoenix Green Construction Code*. The City Team sent its evaluation results to EPA to compile the Scorecard values for all categories.

This Draft Memo summarizes the key findings of the Checklist and Scorecard evaluations. The five goals of Checklist tool were used to compile and report findings:

Goal #1	Minimize effective or connected impervious area.
Goal #2	Preserve and enhance the hydrologic function of unpaved areas.
Goal #3	Harvest rainwater to enhance potable and nonpotable water supply.
Goal #4	Allow and encourage the use of multi-use stormwater controls.
Goal #5	Manage stormwater to sustain stream functions.

The detailed findings for the Checklist and Scorecard can be found in Attachments 2 and 3, respectively.

Table 1. Scorecard Elements Not Applicable to the Phoenix Region

Category	Tools/Policies
Protection of Water Bodies Aquifers	Critical water resource areas cannot be counted in calculating allowable density on a site. Performance standards exist and are well-enforced for stormwater discharges to wetlands. Local land use plans identify aquifer recharge source water areas and recommend protection measures. Map and publish wellhead and aquifer recharge areas to alert developers to potential restrictions. Identification of drinking water source protection and aquifer recharge areas with a dedicated funding source in place to purchase and protect such areas. Protection of critical water source areas qualifies for additional credit toward local open space requirements.
Green Roofs	Provide credit against open space impact fees for green roofs. Create development incentives for green roofs. Do not count parking structures with green roofs against allowable floor area ratio of a site.
Miscellaneous	Establish tax increment financing districts to encourage redevelopment. Technical information and analysis on the effectiveness of various treatment systems are readily available to developers. Local government has determined which systems work best for their soil conditions and topography, and have made this information available to the development community. Development code prohibits homeowner covenants forbidding overnight parking in driveways, on-street overnight parking, and shared driveways. Provide accelerated review of projects where developer attended a pre-application meeting.

2.2 Findings

For each of the five green infrastructure goals, EPA has highlighted below the findings of the review of plans and policies (according to the related Scorecard sections on plans, educational programs, and incentives) and code barriers (according to related Checklist findings and related Scorecard sections on barriers and regulations).

2.2.1 Minimize Effective or Connected Impervious Area

Plans and Incentives

The City's strongest efforts to minimize impervious area are found in its community level plans and incentives to promote infill, redevelopment, and mixed use development. The City's General Plan, Revitalization Plan, and district plans all have policies to direct development to previously developed areas, including brownfield sites. The City's Capital Improvement Program (CIP) includes funding specifically for improvements on brownfield redevelopment projects, and expedited permitting is available for brownfield areas. The City's General Plan, core plans, and district plans have identified areas appropriate for infill and mixed use development, and the zoning map has been revised to reflect these policies. The City's CIP targets projects to mixed use and transit-oriented development areas. Parking requirements may be adjusted in these areas, not only acting as incentives for compact, efficient development but also further reducing impervious area. Indeed, the City achieved almost perfect scores in the Scorecard for the sections related to infill and redevelopment and mixed use development.

The City also achieved a high scoring for plans that encourage alternative types of transportation, including walking, biking, and transit. The General Plan endorses context-sensitive design for streets, including those for residential neighborhoods and local streets; however, there were no specific recommendations for narrower streets. As noted in the Code Barrier section below, the existing street classification system requires overly wide pavement widths and travel lanes for local, residential streets. The City is currently developing a Complete Streets Program, and green infrastructure is one of the components being evaluated.

Code Barriers

Mitigating runoff from effective impervious area

Impervious area on a development site can be "disconnected" from a city's storm drain system by routing it to natural areas, landscape areas, or storage areas where it can be reused and infiltrated. Effective impervious area includes rooftops, driveways, compacted lawns, etc. that drain to (and in effect discharge to) a storm sewer collection system. Although the City does not distinguish between impervious area and effective impervious area in its code definitions, its stormwater performance standards do make this distinction through application of its water quality performance standard. Normally, the City's water quality treatment standard (called "First Flush") is met by following the City retention requirements to capture the 100-year, 2-hour storm. However, in the event there is a discharge into a structure owned or operated by the City, the applicant must also comply with the First Flush standard.

Street and right-of-way widths

The current City of Phoenix Street Planning and Design Guidelines do not allow local single-family streets or minor residential collector streets to have narrow street pavement and travel lane widths (e.g., residential street pavement widths between 18 to 22 feet and travel lanes from 10 to 12 feet). In addition to the environmental benefits of narrowing streets, some studies have found that narrow residential streets are safer than wide streets.

In the last decade, a number of techniques have been used to narrow street and right-of-way width. These include but are not limited to curb pullouts, staggered pull-out parking areas (rather than continuous lanes), having a parking lane on one side of the street only, narrowing travel lanes in residential areas, and using permeable pavement for on-street parking. Developments employing these techniques have been still been able to meet the needs of service and emergency vehicles as well as on-street parking. That said, it should be recognized that concerns about narrow streets and right-of-ways often make this component of green infrastructure challenging to implement. In each community, moving forward requires a great deal of discussion and problem solving with staff from the fire department, public works, engineering, and other potentially affected departments in order to address concerns and develop mutually supported ordinance and code revisions.

Flexibility in locating BMP techniques in the street right-of-way

The City of Phoenix Street Landscape Standards allow and provide specifications for drainage swales in the street right-of-way, however the required designs appear to be solely for efficient, safe movement of stormwater (rather than also incorporating retention and water quality objectives). The location of other green infrastructure BMPs in other street areas (e.g., parking medians, the parkway strip between sidewalk and curb) is for the most part not explicitly prohibited or allowed in the ordinance (with the exception of permeable pavement, which appears to be prohibited). The Street Planning and Design Guidelines have specifications for traffic calming devices, including several standard drawings of curb

bumpouts and planters that could accommodate green infrastructure BMPs such as bioretention; however, lack of certainty about approval of these techniques can pose a barrier to implementation. It appears that height and setback limitations for landscaping at intersections and the Street Landscape Standards guidance on the preferred height and density of plants in the median and parkway areas could essentially prohibit the use of green infrastructure techniques. For driveway entrances and intersections, landscaping must not exceed 3 feet tall. The Street Landscape Standards show preferred landscaping designs with very sparse vegetation not conducive to the use of bioretention or bioswales. Communities have been able to design green infrastructure BMPs that have higher density of plants and a mixture of plant heights such that the biological component and treatment/uptake benefits of the green infrastructure BMP are realized and safety/viability issues are addressed.

Sidewalks

The City of Phoenix Street Planning and Design Guidelines require sidewalks to be a minimum of 4 feet wide on local streets and 5 feet wide on arterials, collectors, and local streets with sidewalk setbacks. Sidewalks must meet American Disability Act requirements for safe passing; these requirements could be met through drives, intersections, and other means if a sidewalk is narrow.

Parking

Large office buildings, the Downtown, Infill Development, the Warehouse District, and Transit Oriented Zoning Districts have standards that either require no minimum parking or allow minimum parking requirements to be reduced. Other zoning districts, however, establish a high minimum parking space requirement and require overly large parking stalls and drive aisles for new development. In commercial parking areas, compact spaces are only allowed in excess parking area. Together these minimum parking requirements can unnecessarily increase the overall imperviousness of the development site. Some communities allow a smaller number of parking spaces per square feet of floor area in the development, as well as allow smaller stalls and aisles (e.g., stall width of 9 feet, minimum stall length of 15 feet, and minimum drive aisle width of 22 feet). Some also allow paver stones, porous pavement, or other pervious pavers to be used for on-street parking. These standards minimize paved area, provide adequate parking space, and reduce development costs.

Under certain conditions for large-scale developments, the City Code does allow an applicant to use a shared parking model to predict parking demand. Also the City may require a parking management study and reduce parking requirements if there is a retail center or mixed use project with more than 100,000 square feet of public assembly.

Although the General Plan recommends landscaping in parking lots to reduce stormwater runoff, parking area landscape and screening regulations have no incentives or requirements to use green infrastructure. The codes do not expressly prohibit the use of green infrastructure BMPs in parking areas; however, the planting height, width, and spacing requirements could greatly limit their use. For example, for screening along the parking perimeter, landscaping must be 4 feet tall, and landscape screening generally must provide a continuous evergreen shrub or hedge in a minimum 3 foot wide planting area.

Buildings

The Building Code states that swales may be used to divert water away from the foundation of buildings and may be located within 10 feet of the building. Groundwater must be greater than 5 feet below the bottom of the foundation; the Code does include an exception such that that a subsurface soil investigation is not required if waterproofing is provided. The Code states that the ground must slope

away from the foundation at a slope no less than one unit vertical to 20 units horizontal. This correlates well with recommended side slopes for most Green infrastructure BMPs. The Residential Housing Code allows grey water to be discharged to an approved gray water recycling system. It allows for the use of grey water for toilet flushing with proper disinfection and coloring.

The building codes reviewed appear to allow Green infrastructure techniques. However, the lack of specific standards and guidelines could serve as a barrier to implementation.

Clustering development, redevelopment, and mixed use

The City may waive its retention requirement for infill and redevelopment, proving a strong incentive for these types of development. For a parcel to be considered infill, the lot must be within a developed subdivision, but not developed during the normal build-out of the subdivision. To be considered a redevelopment parcel, the site must have been previously developed. In these cases, the post-development discharges are not to exceed the pre-development discharges, and are not to impact the City's storm sewer system.

Redevelopment is also generally encouraged instead of greenfield development through the City's site performance standards for Infill Development, Planned Residential Development, and High-Rise Development Incentive District. The City has amended its zoning atlas to designate mixed use and transit-oriented development areas and requires a minimum of mixed uses in these areas. The transit-oriented development overlay is an interim district and has some limitations. The Planning Department is currently working on developing a new walkable urbanism code (form based code) that has a strong focus on green infrastructure. The City achieved high ranking for regulations related to infill, redevelopment, and mixed uses—essentially requiring and incentivizing clustered, efficient development in the urbanized or urbanizing areas. Open Space Design and Conservation is encouraged in some of the less intense urban areas of the city, such as in the Desert Character and Maintenance Overlay Districts as guided by the Sonoran Preserve Master Plan. However, there are still City areas amenable to infill, outside of the downtown area, which require zoning variances or rezoning to allow more dense urban development or incorporate other transit-oriented or mixed-use development.

2.2.2 Preserve and Enhance the Hydrologic Function of Unpaved Areas

Plans and Incentives

The City's General Plan, Water Resources Plan, Sonoran Preserve Master Plan, and Tree and Shade Master Plan identify and map critical natural resources and establish goals for their preservation. The Phoenix Parks Preserve Initiative and the 2006 Bonds Funds have provided financial support to collaborate with land trusts in acquiring natural areas.

The City's Open Space Element of the General Plan does not address the role of open space as green infrastructure and sustainable stormwater management. At this time the City does not have a community-wide parks and open space plan that could form the foundation of a coordinated green infrastructure plan.

The City places a high value on tree preservation to provide water quality, heat island reduction, community walkability, and other triple-bottom-line benefits. However, much work remains on implementing these efforts. Currently the City is developing an inventory of existing publicly owned and maintained trees, and it maintains an active maintenance program for public trees. The City has Tree Care Workshops, a Citizen Forester Program, and partnerships with various non-profit tree-related

organizations. Until 2009, the City provided free or reduced-price trees to homeowners to be used as street trees; this program has since been discontinued. As noted below, there are design guidelines for preserving existing trees on a development site and requirements for creation of an urban tree canopy through new development.

Code Barriers

Topsoil, vegetation, and building footprint

The City has provisions to minimize disturbance of vegetated areas, riparian areas and washes in the Hillside Development area and the Estate Development Option 2. In the Guidelines for Design Review, there are guidelines for minimizing the removal of existing, healthy Sonoran vegetation and removal of healthy non-native plants. However, these guidelines appear to be goals, not mandatory standards. The City's code does not require that the disturbance of vegetated area be phased during construction to minimize erosion and loss of topsoil. The code review did not identify regulations that would prohibit or limit removal of specimen trees on existing, private development (i.e., a tree ordinance).

The City actively promotes creation of an urban tree canopy through new development. The standards and guidelines in the Downtown Code have minimum shade requirements: All buildings over 5,000 square feet shall provide a minimum of 50 percent of all accessible public and private open space areas as shaded area of which 50 percent of the shade shall be provided by trees or trellised vines. Landscaping treatment shall be used for the entire site exclusive of buildings with 30 percent tree canopy at maturity. Importantly, the City's Guidelines for Design Review stipulate that development should minimize removal of existing healthy non-native plants (trees 4" in caliper or greater); if removal is necessary, mature trees should be salvaged and utilized on site. Street improvement projects must be made in accordance with adopted streetscape designs. One street tree landscape ordinance had a relatively high pruning height requirement compared to some other municipalities and could negatively impact urban tree canopy aesthetics, shade, and tree health.

Wetlands and washes

Where a stream or important surface drainage course abuts or crosses the tract, dedication of a minimum 10-foot public drainage easement is required. The City references the Army Corps of Engineers for its wetlands regulations.

Stream buffers

There are very few perennial streams and rivers in the City of Phoenix. The City's hydrology network is dominated by ephemeral sand channels or washes that most often lack water flow and/or well-defined stream banks. Protection of riparian areas in these cases does not provide the bank stabilization and load reduction benefits that are typically seen in other areas. Therefore, the City Team deemphasized the importance of stream buffers as a green infrastructure BMP for the region.

There are several code provisions for buffers and erosion setbacks. A 50-foot buffer is required in the Desert Character Overlay District. City of Phoenix Stormwater Policies and Standards Development requires erosion setbacks in locations where the 100-year discharge in a wash exceeds 500 cubic feet per second, is contained within the existing channel banks, and when water courses are to be left in an undisturbed state. Where a stream or important surface drainage course abuts or crosses the tract, dedication of a minimum 10-foot public drainage easement is required. Finally, the AZPDES General Permit for Stormwater Discharges Associated with Construction Activity (Final Draft) requires a 50-foot

buffer along perennial waters during construction activity. This rule would apply to certain segments of the Salt River.

2.2.3 Harvest Rainwater to Enhance Potable and Nonpotable Water Supply

Plans and Incentives

Information on water harvesting practices is available on the City's Water Conservation website. The Water Conservation program has brochures on rainwater harvesting and distributes them to homeowners at outreach events.

Code Barriers

Plumbing Code

The Residential Housing code allows grey water to be discharged to an approved gray water recycling system. It allows for the use of grey water for toilet flushing with proper disinfection and coloring. There are no codes specifically regulating the use of stormwater for non-potable uses.

Building Code

There are no building code provisions that prohibit rainwater harvest. The City requires that new developments retain on site the runoff from the 100-year, 2-hour duration rain event. In the Guidelines for Design Review, the City has a policy requiring development applicants to integrate site drainage and retention with overall landscape design in a form of "rainwater harvest." Moreover, in its Stormwater Policies and Standards, the City stresses the establishment of natural or semi-natural drainage corridors. Using natural corridors to accommodate stormwater is the City's preferred approach due to its multi-use flood control, trails, recreation, and habitat.

2.2.4 Allow and Encourage Multi-use Stormwater Controls

Plans and Incentives

The City has recently begun to include green infrastructure and Low Impact Development (LID) in outreach efforts. Presentations to future City teachers and mentors include tips on stormwater management through LID, and information is available on the City's stormwater website. In addition, the City is working on an LID workshop scheduled for early 2013. The City also participates in a regional Tree & Shade Summit to educate local municipalities, landscape architects, etc., on green infrastructure practices. The City's Conservation Program distributes information on a website and through outreach events.

Code Barriers

Open space areas

The City's codes have open space preservation requirements and policies, particularly for establishment of linear open space. According to the City's Guidelines for Design Review, green infrastructure structural techniques are allowed to be constructed in a development's designated open space and given credit as required open space. However, the Zoning Ordinance does not include green infrastructure in the elements to be provided in open space areas. Also, the code does not expressly allow or prohibit the use of protected sensitive, natural areas to qualify as credit for open space.

At the community level, the City does not have a community-wide parks and open space plan that could form the foundation of a coordinated green infrastructure plan. Such a plan could be used for off-site stormwater mitigation (see Section 3.5 for more details).

Landscape areas

The City's Guidelines for Design Review stipulate that surface site drainage and retention should be integrated with overall landscape design. Required landscape setbacks adjacent to perimeter streets may use the setbacks for stormwater retention. This does not explicitly allow green infrastructure to be constructed in or given credit for other required landscape areas (e.g., side and back yard screening and parking areas). The Zoning Ordinance has very prescriptive requirements for required landscape areas (one tree, five shrubs, and ground cover of living materials for each 300 feet of required landscape area) which, in addition to the previously described landscape barriers, could limit the practical use of green infrastructure BMPs.

The Guidelines for Design Review also state that applicants should use low water use plants that reflect and enhance the image of the Sonoran Desert. No more than 50 percent of the landscape area at maturity or 10 percent of the net lot area should be planted in turf or high water use plants; in other landscape areas, applicants must use the ADWR Low Water Use Drought Tolerant Plant List.

EPA conducted a round table discussion regarding the current practice of using these drought tolerant plants for green infrastructure BMPs in the Phoenix area. Topics included which types of BMPs work well using these plants; which low water use plants work well in the BMPs; and what factors drive successful implementation. Participating in the discussion were James DeRoussel, RLA, Watershed Management Group; Summer Waters, CFM, University of Arizona Cooperative Extension Maricopa County; Steve Priebe, Horticulturist, City of Phoenix Street Maintenance Division; Kimberly Brewer, AICP and Jason Wright, PE, Tetra Tech. Key points of the discussion include:

- The main "engineered" green infrastructure practices currently being used in Phoenix include bioretention areas and bioswales consisting of depressed landscaped areas, simple surface treatments, mulching, and drought tolerant planting. These bioretention/bioswale areas are not as highly engineered as those in many other communities (e.g., they do not have as large a water storage area, do not have underdrains, etc.).
- These green infrastructure practices are primarily being used to retrofit existing development rather than being used in new development.
- Plants selected from the ADWR Low Water Use Drought Tolerant Plant List work well in the bioretention areas and bioswales.
- Research demonstration plots are showing that the frequency and duration of inundation are not causing plant mortality or damage. The drought tolerant plants are "surprisingly tolerant to inundation." green infrastructure BMP designers in Phoenix try to not exceed 24 hours of inundation. Most often, the basin is drained within 8 hours.
- A key factor to success is even dispersal of rainwater through the development. For example, in retrofit sites, a chain of curb cuts can result in the interception of rain in the upstream facilities with the downstream facilities not getting enough irrigation. This is easier to address in new development.
- Another key factor to success is the "right plant in the right place." Certain plants function best in the bottom of the bioretention basin where inundation is longest; certain do well along the

sides of the basin; others do best at the top and along the rim of the basin. Some cities, such as San Diego, have LID Design Manuals that provide detailed guidance on these issues.

- The bioretention areas and bioswales require a 2- to 3-year establishment period with irrigation. After that, the need for continued irrigation should be based on variations in microclimate, plant type, seasonal evapotranspiration, and the availability of passive water sources like rain and stormwater within the bioretention area.
- In public settings that have bioretention, bioswales, and other landscaping, continued irrigation is typically desired in order to maintain a higher aesthetic value for the public. However, even permanent irrigation should be adjusted in response to rainwater and stormwater availability. Rain gauges, or better still, soil moisture sensors, can provide for automatic and site-specific adjustments, greatly reducing unnecessary irrigation with potable water.
- Swales in the right-of-way are often designed for drainage and must withstand heavy and forceful volumes of rainfall, as well as contaminants such as oil and grease. Plants must be selected carefully for these areas, again following the "right plant/right place" tenet. Organic mulch helps break down the oil, adding to the "biological treatment component" of bioretention and bioswales. These bioswales can be designed to slow the flow and hold the mulch (so the mulch is not floating and flooding away). Although rock is commonly used in these areas, it does not help break down pollutants, it can become unsightly with oil sheen, and it adds to the urban heat island effect. Use of organic mulch should be encouraged rather than hardscape materials. Again these issues could be addressed in an LID Design Manual.
- Lack of design templates or a design manual showing how to incorporate these plantings into stormwater practices in effect limits the use of these green infrastructure practices.

The group said that research is needed in two primary areas. First there is a need to identify which native and non-native drought tolerant species work best in the bottom of the bioretention basins where inundation of the plants is longest. This area of the basin has the fewest known options for the Phoenix area. Second there is a need to better understand how little and how much water the plants can tolerate. Out of this there is a need to develop a list of drought tolerant, non-invasive species that work well in the Phoenix region because not everything on the state's list will work well in the Phoenix region.

2.2.5 Manage Stormwater to Sustain Stream Functions

Plans and Incentives

The City code has very strong stormwater retention polices and standards for new development (as detailed below). At this time, the City lacks a plan for retrofitting existing development with green infrastructure BMPs. Some communities identify high-ranking sites based on multiple criteria such as

- Most cost-effective in reducing important, existing drainage problems.
- Most cost-effective in reducing important, existing water quality problems.
- Most successful at improving natural habitat and green space in the City.
- Most feasible in terms of cost, natural site factors, site access, ownership, and public acceptance.

- Added “multi-benefits” for the citizens (e.g. recreation, shading).
- Most protective of public safety and public property.

Code Barriers

Plan review

Preliminary stormwater plan review occurs with preliminary site plan review and before any development approvals. The development applications must include preliminary/conceptual stormwater management plans that incorporate retention of stormwater on the site and incorporation of stormwater management and drainage into the site landscape plan. However, discussion of green infrastructure practices is voluntary.

Performance standards

The City has strong stormwater management performance standards for new development and received high rankings in this category. The City’s Grading and Drainage code stipulates that on-site stormwater retention areas shall be adequate to contain the volume of water required by the City of Phoenix Stormwater Policies and Standards. All developments shall not increase the 100-year, 2-hour peak runoff, change the time of the peak, nor increase the total runoff from its predevelopment values. The City’s Stormwater Policies and Standards requires that all new development make provisions to retain the stormwater runoff from a 100-year, 2-hour duration storm (translating to a 2.5-inch storm event) falling within its boundaries. The City uses this retention standard for water quality, channel protection and flood control. In the event the retention standard is waived, the developer must meet the “First Flush” standard, which consists of retaining or treating the first 0.5 inch of direct runoff from a storm event. The City’s stormwater performance standards for new development do not account for street right-of-way area.

Inspections and maintenance

Inspections and maintenance of BMPs are required during construction activity. The City code requires that all privately owned drainage facilities and stormwater storage basins be maintained by the owner. Although inspection of these facilities by the owner is not explicitly required, it is implied by the maintenance requirement. The City performs inspections on the basis of complaints received. ADEQ requires that a certified professional perform maintenance of BMPs during construction; however, the City code does not require that post-construction facilities be maintained by a certified professional.

Off-site mitigation

It can be significantly more difficult and costly to retain/treat stormwater for developments with greater than 65 percent impervious area on site. The City code does not require off-site mitigation when on-site management fails to meet the performance standards, or allow off-site mitigation when full on-site retention is very costly to achieve. For example, there are no provisions for land banking or retrofit of existing BMPs off-site, or for payment-in-lieu fees for off-site stormwater management. Rather than simply allowing a variance from the requirement, some communities establish an off-site mitigation requirement such that a portion of the standard is met on-site and the balance of the mitigation (or greater) is met off-site. Such off-site mitigation provisions can provide more flexibility to the development community, help meet the City’s open space and greenway needs, and offer a more cost-effective alternative to meeting the standards (particularly in an ultra-urbanized, downtown environment).

2.3 Conclusions

The City of Phoenix recognizes the importance of green infrastructure in addressing stormwater management as well as other key issues for the City, such as conserving and protecting the water supply and open space, creating more shade for bikable and walkable streets, improving air quality, and reducing the urban heat index.

The review of City plans, policies, and codes found that the City is already implementing a number of strong green infrastructure practices, most notably

- Community level plans, district plans, and incentives to promote infill, redevelopment, and mixed use development and reduce overall imperviousness.
- Regulations for new development that require development of urban tree canopy, preservation of existing, mature vegetation and healthy Sonoran vegetation, as well as strong protections for existing street trees.
- Requirements for using drought tolerant plants.
- Tree Care Workshops, a Citizen Forester Program, and partnerships with various non-profit tree-focused organizations.
- Progressive stormwater management standards for new development, including the requirement to retain the stormwater runoff from a 100-year, 2-hour duration storm (translating to a 2.5-inch storm event) falling within the development's boundaries.
- A stormwater policy that stresses the establishment of natural corridors for multi-use flood control, trails, recreation, and habitat, linking required open space to stormwater management.
- Building code that effectively allows rainwater harvest, and plumbing code that allows greywater use.

The review also identified a number of gaps and barriers that, if remedied, could better promote the use of green infrastructure. Some of the most important of these include:

- Lack of a City-wide parks and open space plan that could serve as a foundation for an overall green infrastructure plan.
- Lack of tree protection regulations for existing, private development. Street tree ordinance that has somewhat high and prescriptive pruning requirements compared to other municipalities, which does not reflect current arboriculture best practices.
- Lack of a strategic green infrastructure BMPs retrofit plan for existing development.
- The need to explicitly allow green infrastructure in the street right-of-way (e.g., parkway areas).
- Requirements for overly wide streets and right-of-ways in residential areas.
- Requirements for overly large parking stalls and aisles.
- Parking area landscape and screening requirements (e.g., plant height and spacing) that limit the use of green infrastructure.
- Lack of weather-based or moisture-based irrigation controls.

- Lack of design templates for green infrastructure in the Street Landscape Standards and Street Planning and Design Guidelines.
- Lack of a green infrastructure Design Manual.
- The need for an on-going inspections program for post-construction stormwater BMPs.
- The need for off-site mitigation provisions.

Section 3 presents possible code revisions to address the key code barriers and opportunities identified.

3 Opportunities for Code Revisions to Encourage Green Infrastructure Implementation

The primary purpose of this section is to provide example code language that the City of Phoenix can consider to address the key barriers and opportunities identified. Different approaches and a number of different wording options are provided for each barrier, so the City can determine which approach or option(s) might be most appropriate. Note that such code revisions are not mandatory. They are offered only as examples of how to incorporate language into the City's codes and ordinances to provide more flexibility and effectiveness in implementing green infrastructure, meeting resource protection regulations, and meeting the City's sustainability goals. This section also highlights additional planning and research needed to enhance the use and function of green infrastructure practices in the region.

3.1 Example Code Language to Address Green Infrastructure Barriers

This section summarizes the significant green infrastructure barriers identified in the code review and recommends the high priority code revisions needed. Table 2 provides specific approaches and example code language to address each barrier identified. The City can use the table to determine which barriers are most important and which code revision options are most suitable. In the future, the City can use the example code language to craft code amendments for City Council consideration.

3.1.1 Minimize Effective or Connected Impervious Area

Effective impervious area typically includes rooftops, driveways, compacted lawns, and other non-absorbing surfaces that drain (and in effect discharge) to a storm drain collection system. Effective impervious area can be minimized by routing runoff from non-absorbing surfaces to natural areas, landscape areas, or storage areas where the runoff can be infiltrated or stored for later use.

In the City of Phoenix, the most significant barriers to minimizing effective impervious area are code provisions that a) limit the use of green infrastructure in street and parking areas, and b) preclude narrower streets and more space-efficient parking. These provisions include:

- Height and setback limitations for landscaping at intersections.
- Street Landscape Standards guidance on the preferred height and density of plants in the median and parkway area.
- Parking area screening and landscape regulations, which include planting height, width, and spacing requirements that could limit green infrastructure practices.
- Street Planning and Design Guidelines for street pavement and travel land widths in residential areas.

- Parking standards that establish high minimum parking requirements and require excessively large parking stalls and drive aisles.

Options for code revisions are provided in Table 2. Among the options provided are revisions that would encourage green infrastructure in street and parking areas by:

- Waiving dimensional requirements for landscaping to allow for the use of green infrastructure practices.
- Expressly encouraging the use of green infrastructure practices in surface parking landscape areas.
- Addressing off-street parking requirements that yield unnecessarily large impervious area (and costs).
- Allowing for the use of dustproof permeable paving material.

Code revisions related to reducing the effective impervious area of streets and parking are a high priority in the City of Phoenix. Implementing revisions to codes and specifications regarding narrower streets can be challenging. In each community, moving forward requires a great deal of discussion and problem solving with staff from the fire department, public works, engineering, and other affected departments to develop mutually supported ordinance and code revisions. As a next step, the City may wish to select one or more districts to test and implement these policies in conjunction with the Reinvent Phoenix project.

3.1.2 Preserve and Enhance the Hydrologic Function of Unpaved Areas

Protecting natural resource areas, creating open space networks, and preserving trees can reduce stormwater runoff, improve water quality, and provide many other community benefits. The City of Phoenix places particular value on tree preservation to maintain water quality, mitigate the urban heat island effect, and provide other triple-bottom-line benefits. In the City of Phoenix, omissions in the provisions related to tree preservation and minimizing disturbance of vegetated areas pose the greatest barrier to enhancing the hydrologic function of unpaved areas. Options for addressing these barriers are provided in Table 2. Barriers include:

- Lack of a requirement that would prohibit or limit removal of specimen trees on existing, private development (i.e., a tree ordinance).
- A relatively high pruning height requirement for vegetation over the public right of way that could negatively impact urban tree canopy aesthetics, shade, and tree health.
- Lack of a requirement for phased disturbance of vegetated area during construction to minimize erosion and loss of topsoil.

Given the value that the City places on tree preservation (to provide water quality, heat island, and other triple-bottom-line benefits), code revisions to limit the removal and pruning of healthy trees on private property is a high priority for the City of Phoenix. Enacting tree protection standards for private property could be challenging. At a minimum, the City may wish to strengthen its existing property owner education programs regarding the benefits of and best practices for tree preservation and planting (e.g. the existing Tree Care Workshops and Citizen Forester Program, and the former program providing free- or reduced-priced trees to homeowners).

3.1.3 Harvest Rainwater to Enhance Potable and Nonpotable Water Supply

In dense, urban areas with limited spaces for vegetated green infrastructure, rainwater harvesting for later use may represent a cost-effective alternative for reducing runoff volumes. In the City of Phoenix, however, rainwater harvesting was deemed impractical given the local precipitation regime. The Phoenix area has a mean annual precipitation of approximately 7 inches. On average, there are 15 distinct rainfall events annually with a measured rainfall of over 0.10 inches, about four of these which provide rainfall greater than 0.5 inches. The average rain event is approximately 0.2 inches, but nearly half of all measured events range from 0.01 – 0.09 inches. Historically, the majority of the rainfall has fallen during the winter season, when many plants are dormant or have minimal water needs. May and June are the driest months of the year, with almost no rainfall, but are also among the hottest months. In any given year, certain localized areas in the region may receive only light rain to almost no measurable rain during the entire summer wet season. During the summer wet season (July-October), after the sparse rain events, storing collected rainwater for extended periods for future use can present challenges related to evaporation, as temperatures can easily soar above 110 degrees and air masses may become exceptionally dry. Therefore, the City Team considered several green infrastructure practices (green roofs, rain barrels, and cisterns) to be less practical and cost-effective than other stormwater controls given the City's frequency and amount of rainfall, as well as local building norms (e.g., lack of gutters and downspouts).

While barriers to rainwater harvesting in the City of Phoenix were not assessed, one barrier to water conservation was identified. Where the City's Guidelines for Design Review and Street Landscape standards require irrigation of landscaping, the standards do not stipulate that weather-based or moisture-based irrigation controls be installed. Such a code requirement would add minimal up-front costs while significantly reducing the need for and cost of irrigation water over the long-term.

3.1.4 Allow and Encourage Multi-use Stormwater Controls

Many green infrastructure practices can be integrated into existing features of the built environment, including rooftops, streets, parking areas, landscaped areas, and open space areas. Integrating green infrastructure into these features allows them to serve many additional functions – including water quality protection, air quality improvement, micro-climate regulation, and habitat provision. Although the Phoenix Guidelines for Design Review stipulate that surface site drainage and retention should be integrated with overall landscape design and the City has an express policy of preferring multi-functional stormwater controls, many of the code barriers identified inhibit the integration of multi-functional green infrastructure practices into the built environment. The most significant barrier to multi-functional stormwater controls is their omission from open space and landscape provisions. Omissions include:

- The Zoning Ordinance does not include green infrastructure in the elements to be provided in open space areas.
- Although stormwater retention BMPs are allowed in required landscape setbacks adjacent to perimeter streets, the code does not explicitly allow green infrastructure to be constructed or receive credit in other required landscape areas (e.g., side and back yard screening and parking areas).
- The Zoning Ordinance has very prescriptive requirements for required landscape areas (one tree, five shrubs, and ground cover of living materials for each 300 feet of required landscape area) which could limit multi-use of green infrastructure BMPs.

- As noted above, parking area landscape and screening regulations have no incentives or requirements to use green infrastructure. The codes do not expressly prohibit the use of green infrastructure BMPs in parking areas; however, the planting height, width, and spacing requirements could greatly limit their use. For example, for screening along the parking perimeter, landscaping must be 4 feet tall, and landscape screening generally must provide a continuous evergreen shrub or hedge in a minimum 3-foot-wide planting area.
- Also noted previously, the code review does not prohibit or limit removal of specimen trees on existing, private development (i.e., a tree ordinance), and requires trimming of vegetation over the public right-of-way that could negatively impact urban tree canopy, aesthetics, and shade (i.e. multi-functional uses), as well as tree health.

Options for code revisions are provided in Table 2. Among the options provided are policies discouraging the use of turfgrass and encouraging the use of multi-functional green infrastructure practices in landscape and open space areas.

The omission of green infrastructure from open space and landscaping provisions poses a significant barrier to green infrastructure in the City of Phoenix.

3.1.5 Manage Stormwater to Sustain Receiving Water Functions

In order to ensure that stormwater discharges are adequately managed throughout an urbanized area, robust stormwater management programs address the long-term performance of stormwater controls and account for the variability in site physical conditions. In the City of Phoenix, the most significant barriers to ensuring that stormwater discharges are adequately managed throughout the urbanized area are omissions in the provisions related to maintenance and performance standards. Omissions are as follows:

- The City's stormwater quality and drainage regulations, policies, and standards do not expressly require owners to inspect post-construction BMP facilities or enter into maintenance agreements. Such provisions are essential to ensure the long-term performance of stormwater BMPs and conveyance facilities.
- The City code does not require off-site mitigation when on-site management fails to meet the performance standards, nor does it allow off-site mitigation when full on-site retention is very costly to achieve. For example, there are no provisions for land banking or retrofit of existing BMPs off-site, or for payment-in-lieu fees for off-site stormwater management. Rather than simply allowing a variance from the requirement, some communities establish an off-site mitigation requirement such that a portion of the standard is met on-site and the balance of the mitigation (or greater) is met off-site. These requirements are intended to maintain water quality while offering a more cost-effective alternative to developers.

Table 2 provides example language for the City to consider to establish inspection and maintenance requirements and to provide more flexibility to the development community. The code revisions providing more flexibility to the development community may also help meet the City's open space and greenway needs.

Table 2. Code Revision Approaches and Example Language

GOAL #1: MINIMIZE EFFECTIVE OR CONNECTED IMPERVIOUS AREA

Objective: Minimize impervious area associated with streets.
Objective: Minimize impervious area associated with parking.
Objective: Minimize impervious area associated with driveways and sidewalks.
Objective: Clustering development.
Objective: Incorporate sustainable hydrology practices into urban redevelopment.

Barrier	Optional Approach	Example Language to Address Barriers
Overall Effective Impervious Area		
1. The City of Phoenix Stormwater Policies and Standards make a distinction between effective impervious area (connected to the storm drain system) and disconnected impervious area by requiring treatment of stormwater if the discharge is to the City's storm sewer system. However, the City's Zoning and Subdivision code do not have definitions of impervious area and effective impervious area. Adding such definitions and referencing the stormwater policy could strengthen this city policy.	Define impervious area in codes to be effective impervious area only. Or Provide a definition of both impervious area and effective impervious area.	"Effective Impervious Area: Amount of the development site that is directly connected to the storm drain system."

Barrier	Optional Approach	Example Language to Address Barriers
Streets		
1. City of Phoenix Street Planning and Design Guidelines. The paving width of local single-family residential streets is typically required to be 28 to 32 feet, and 40 feet for minor residential collector streets. Travel lanes for local single-family residential streets are required to be greater than 14 to 16 feet wide.	Amend the Phoenix Street Planning and Design Guidelines (and any related zoning ordinance and/or subdivision ordinance provisions) for right-of-way and paving widths to allow exceptions for narrower streets. Encourage green infrastructure practices such as curb pullouts with bioretention that allow for passing of larger vehicles and enhanced stormwater management. Or Adopt standard green infrastructure standard street drawings as part of the Street Planning and Design Guidelines and Street Landscape Standards.	"An exception to a requirement of a paving width for residential streets may be recommended by the Planning Commission to the Mayor and City Council on the merits of a particular case upon consideration of the following criteria: type of curbing, building heights, building density, use of green infrastructure stormwater management practices, and other applicable factors. In no case shall the paving width be less than 24 feet, provided there will be no less than 16 feet of right-of-way." If the use of "curb" (distance to be measured from face of curb) is perceived as issue for implementation of green infrastructure streets, amend to specify "curb or street edge." "Where a portion of a project or public improvement has been designed specifically as a green infrastructure stormwater management feature, the City Manager or designee shall have the authority to waive the dimensional requirements of this section to enable the installation of green infrastructure stormwater management measures." Or Adoption and use of standard green infrastructure street drawings as part of the Street Planning and Design Guidelines and Street Landscape Standards.
2. City of Phoenix Street Planning and Design Guidelines. Curb bumpouts and curb extensions are allowed as traffic calming devices. However, they do not appear to be used as bioretention stormwater management opportunities. Moreover, the design specifications do not allow flexibility that could better accommodate green infrastructure practices.	Amend the Street Planning and Design Guidelines and related zoning ordinance and/or subdivision ordinance provisions regarding curb and street dimensional and material requirements. Provide waiver for uses of green infrastructure practices. Or Adopt standard green infrastructure street and curb drawings that include curb bump outs and curb extensions with bioretention as part the Street Planning and Design Guidelines and Street Landscape Standards.	If the use of "curb" (distance to be measured from face of curb) is perceived as an issue for implementation of green infrastructure streets, amend to specify "curb or street edge." "Where a portion of a project or public improvement has been designed specifically as a green infrastructure stormwater management feature, the City Manager or designee shall have the authority to waive the dimensional requirements of this section to enable the installation of green infrastructure stormwater management measures." "…or with materials and sizes necessary to support specifically designed green infrastructure drainage functions [consistent with the green infrastructure Manual/specifications]." Or Adoption and use of standard green infrastructure street drawings as part of Street Planning and Design Guidelines and Street Landscape Standards.

Barrier	Optional Approach	Example Language to Address Barriers
3. The Street Landscape Standards have guidelines that could limit the use of bioretention, bioswales and other green infrastructure practices. The pictures show preferred landscaping designs with very sparse vegetation not conducive to bioretention and bioswales.	Amend the Street and Landscape Standards, including pictures of bioretention and bioswales in the median and parkway areas. These pictures should show BMPs that have a higher density of plants and a mixture of plant heights such that the biological component and treatment/uptake benefits of green infrastructure can be achieved and safety/visibility issues are addressed. Amend the Street and Landscape Standards to specifically encourage the use of bioretention and bioswales.	"The City encourages the use of green infrastructure practices in street landscape areas. The dimensional standards for landscaped strips may be varied to accommodate green infrastructure stormwater features." "Where a portion of a project or public improvement has been designed specifically as a green infrastructure stormwater management feature, the City Manager or designee shall have the authority to waive the dimensional and height requirements of this section to enable the installation of green infrastructure stormwater management measures, as long as the sight visibility and public safety are maintained."
4. Code provisions regarding landscaping maintenance, street grass strip planting height, and street screening requirements can prohibit bioretention, swale, and other green infrastructure BMP opportunities. For example: 5. Code 31-13 Obstructing visibility at intersections. No landscaping higher than 3 feet is allowed. 6. Street Planning and Design Guidelines Street Construction Manual 3.1.1.3 Intersection Sight Distance. Vegetation placed in the sight triangle shall be below 24" when mature. 7. Zoning Ordinance 702 B.7.a.3 Screening in residential districts. Along driveway entrances, landscaping shall not exceed 3 feet high and with a triangle measuring 10 feet from the property line tapering to 20 feet on either side of driveway.	Amend code provisions to allow green infrastructure BMPs as a part of an approved stormwater management plan as long as sight visibility and public safety are maintained.	See # 3 above in this section.

Barrier	Optional Approach	Example Language to Address Barriers
8. Zoning Ordinance 703B.4. Landscaping and open space requirements for multi-family development. 9. Code 23-9 Obstructing streets and sidewalks. Has general language that could be interpreted as prohibiting bioretention. 10. Code 31-10 Removal of weeds and overgrown vegetation. Has general language that could be interpreted as prohibiting bioretention. 11. Code 32-35 A, B, and C. Where urban and suburban developments back or side a major or collector street, and for estate developments generally, a minimum 12-foot landscape buffer must be provided between the subdivision wall and back of curb.		
12. Current Street Planning and Design Guidelines require the use of impervious asphalt materials for on-street parking and alleyways. Concerns have been raised about the use of gravel and decomposed granite and their potential to generate dust and large particulate matter.	Amend the Street Planning and Design Guidelines regarding paving material requirements for on-street parking and alleyways, expressly allowing dustproof permeable paving materials. Adopt green infrastructure design manual that provides specifications for the use of permeable pavement.	"The use of dustproof permeable [parking][alley] surfaces including [approved materials] shall be permitted [at the discretion of the official] [upon demonstration that performance standards are met] [in accordance with the standards of the green infrastructure design manual.]" Approved materials exclude gravel, decomposed granite, and other materials generating large particulate matter (PM10).
13. The Street Landscape Standards provide specifications for drainage vegetated swales. While it appears that these practices could be located in the required planting strip or parkway area between the sidewalk and curb, it appears that the BMPs are not designed for retention and water quality. Also, no other green infrastructure techniques are expressly allowed in the parkway area.	Amend the Street and Landscape Standards to specifically encourage the use of bioretention and bioswales in the planting strip/parkway area. Adopt green infrastructure design manual that provides specifications for the use of bioretention and bioswales in the parkway area.	See # 3 above in this section.

Barrier	Optional Approach	Example Language to Address Barriers
Parking		
1. City Code 702 2.b. The City's current commercial, office, and multifamily zoning districts establish a high minimum parking space length requirement (18 ft.). Standard parking stalls for commercial, office, and multifamily developments should be 15 ft deep and 9 ft wide (or less). Compact parking in the City is allowed to be 8 ft wide and 16 ft deep. However, compact parking spaces are only allowed for parking spaces beyond minimum requirements, except multi-family which only allows 10% of required spaces to be compact.	Amend zoning ordinance dimensional requirements regarding parking to establish lower minimum parking requirements. Amend zoning ordinance to allow or require higher percentage of minimum parking spaces to be compact.	"Sites with more than 12 spaces may designate up to 30 percent of the parking for compact vehicles." Revise code to require or allow a parking stall length of 15 feet. (Note: The City's code provisions for parking width are acceptable.)
2. Current commercial and office development zoning establishes high minimum parking and no maximum requirements (except for very large office and commercial developments, Transit Oriented Zoning District, Downtown, and Village Cores).	Amend zoning ordinance to include minimum and maximum parking requirements for commercial, office, and mixed use developments.	See example language City of Portland, OR Code 33.266.115 Minimum and Maximum Parking Requirements. See example language Town of Chapel Hill, NC Unified Development Ordinance § 5.9.1 Minimum and Maximum Off-Street Parking Requirements for Town Center and Non Town Center Zoning Districts. Note: The maximum and minimum limits in the above ordinance could be lowered somewhat to further reduce effective impervious area.
3. City Code 702 2.b. Current zoning requires overly large parking stalls and drive aisles.	Amend zoning ordinance requirements regarding parking stall and drive aisle dimensions.	Revise table with dimensional parking requirements to require a minimum stall width of 9 feet, a minimum stall length of 15 feet, and a minimum drive aisle of 22 feet.

Barrier	Optional Approach	Example Language to Address Barriers
4. The Street Planning and Design Guidelines specify paving materials that in effect prohibit the use of pervious paving in on-street parking areas. The city codes do not expressly allow pervious paving materials in off-street parking areas.	Amend Street Planning and Design Guidelines and zoning ordinance provisions regarding parking material requirements.	"Permeable paving may be used in [twenty percent][x percent] of the off-street parking area, or in the low-traffic portion of the parking area, whichever is greatest. This shall be approved on a case by case basis based on review by the Street Transportation Department." "The use of permeable parking surfaces including [approved materials] shall be permitted case by case basis based on review by the Street Transportation Department [upon demonstration that performance standards are met] [in accordance with the standards of the green infrastructure design manual.]" "Permeable surfaces such as [list approved] are encouraged in low traffic areas and in required parking areas for open space uses [parks, recreation areas]." This shall be approved on a case by case basis based on review by the Street Transportation Department.
5. City Code 702 B.4.b &c. Bioretention areas are not allowed in parking medians. 6. Guidelines for Design Review 6.1.1. Five percent of the surface parking lot, exclusive of perimeter landscaping and all setbacks, must be landscaped. Landscaping shall be dispersed throughout the parking area. Note that there is no express allowance or incentive for green infrastructure (e.g., bioretention or preserved trees) to be part of the landscape area.	Amend code to expressly allow or encourage the use of bioretention areas in parking medians and other surface parking landscape areas. Amend code to increase the percent of parking area that must be landscaped with functional infiltration and retention practices.	"Landscape green infrastructure practices, such as bioretention, are encouraged for use in the surface parking lot landscape areas as part of an approved stormwater management plan." "Minimum parking may be reduced by one parking space for each tree 12" in diameter and larger that is preserved. A maximum of 2 parking spaces or 10 percent of the total required may be reduced, whichever is greater." "[X] percent of surface parking lot, exclusive of perimeter landscaping, must be landscaped using functional stormwater infiltration and retention practices."

Barrier	Optional Approach	Example Language to Address Barriers
Driveways/Sidewalks		
1. Driveway width was not addressed in the codes reviewed. 2. There is no allowance in the code for driveways to be 9 feet or less in width.	Amend the zoning and subdivision code to provide maximum driveway dimensions, including a 9 ft. maximum width.	Note: Amend dimensional tables in zoning and subdivision code as well as street specification drawings to provide maximum driveway dimensions.
3. City Code 32-33 E.3. All sidewalks are required to be surfaced with Portland Cement material.	Amend Subdivision Ordinance to allow use of permeable pavement for sidewalks.	"Variations from standard sidewalk materials and patterns may be allowed pursuant to approval by [officer/board] where permeable materials are used in conjunction with or a part of a green infrastructure stormwater management feature." "The use of permeable surfaces including [approved materials] shall be permitted [at the discretion of the official] [upon demonstration that performance standards are met] [in accordance with the standards of the green infrastructure design manual.]"
Clustering Development		
No significant barriers identified.		

GOAL #2: PRESERVE AND ENHANCE THE HYDROLOGIC FUNCTION OF UNPAVED AREAS

Objective: Minimize building footprint/envelope area.
Objective: Preserve topsoil structure.
Objective: Preserve sensitive wetlands.
Objective: Preserve sensitive soils.
Objective: Preserve sensitive stream buffers.

Barrier	Optional Approach	Example Language to Address Barriers
Topsoil Structure & Building Footprint		
1. Neither the City of Phoenix Stormwater Policies and Standards Section 3.10.2 Erosion Control nor the referenced Erosion Control Manual of the Flood Control District of Maricopa County require disturbance of vegetated areas to be phased during construction. 2. City code does not limit or prohibit removal of specimen trees in existing development. 3. City code provisions regarding tree trimming over right-of-way areas could negatively impact tree health.	Amend the Stormwater Policies and Standards to require or encourage phased disturbance of land during construction. Or Work with the Flood Control District of Maricopa County to amend the Erosion Control Manual.	Example Language City of Durham, NC Unified Development Code "Ongoing Activity. Land left exposed shall be planted or otherwise provided with temporary ground cover, devices, or structures sufficient to restrain erosion within the applicable time period after completion of any phase grading or period of inactivity as follows: seven days for a steep slope; ten days for a moderate slope; and 14 days for land with no slope or inclination. Completed Activity. For any area where grading activities have been completed, temporary or permanent ground cover sufficient to restrain erosion shall be provided as soon as practicable, but in no case later than seven days after completion of grading." Or Principle: Limit Exposed Area and Time of Exposure All land-disturbance activities are to be planned and conducted to minimize the size of area to be exposed at any one time, and limit the exposure to the shortest feasible time."
Wetlands		
No significant barriers identified.		
Stream Buffers		
No significant barriers identified.		

GOAL #3: HARVEST RAINWATER

Objective: Through plumbing code provisions, enhance rainwater harvesting and water conservation.
Objective: Through the building code and zoning code, allow the use of rooftop runoff disconnection and rainwater harvesting by routing rainwater to natural and landscape areas throughout the site.

Barrier	Optional Approach	Example Language to Address Barriers
1. Code 507 Tab A Guidelines for Design Review and Street Landscape Standards do not have requirements for weather-based or moisture-based irrigation controls.	Where irrigation is required for landscaping in the Guidelines for Design Review and Street Landscape Standards, specify that these must be either weather-based or moisture-based irrigation controls.	

GOAL #4: ALLOW AND ENCOURAGE MULTI-USE STORMWATER CONTROLS

Objective: Allow and encourage stormwater controls as multiple use in open space areas.
Objective: Allow and encourage stormwater controls as multiple use in landscaped areas.

Barrier	Optional Approach	Example Language to Address Barriers
Landscaped Areas		
1. The Code does not include regulations that would limit removal of specimen trees on existing, private development (i.e., tree ordinance).	Adopt a tree ordinance that requires a permit for the removal or cutting of specimen trees.	See City of Austin, TX Tree Ordinance and Tree Removal Permit See Guidelines for Developing and Evaluating Tree Ordinances (http://www.isa-arbor.com/education/resources/educ_TreeOrdinanceGuidelines.pdf)
2. Required landscape setbacks adjacent to perimeter streets may use the setback for stormwater retention. However, the Zoning 507 Tab A , Guidelines for Design Review, does not explicitly allow green infrastructure to be constructed or receive credit in other required landscape, setback, or screening areas. This is a structural disincentive to green infrastructure.		"The following are illustrative of the types of required [landscape] [screening] areas that may be deemed to count toward satisfaction of the [landscaping] [screening] of this section: Add: - Stormwater retention basins or storage areas when suitably designed to emulate natural features - Bioretention areas, bioswales, other landscape green infrastructure features "Required Plant Reduction and Substitution. In order to accommodate green infrastructure BMPs the number of planted trees may be reduced in buffer yards by 10 percent, 50 percent of the required trees may be 1.5 inches in caliper, and all shrubs may be 24 inches in height." "Encroachments. Stormwater retention and water quality BMPs may encroach into required buffer yard as long as the encroachment does not disturb existing vegetation. Minor understory may be disturbed in order to accommodate water quality structures. Trees and shrubs shall be placed to maximize screening where the encroachment takes place. If encroachment runs parallel to the buffer, the width of the buffer shall be increased by the amount of the encroachment." "In order to accommodate green infrastructure BMPs, required setbacks, side yards, and rear yards may be reduced by up to 25 percent. The reductions may not compromise public safety such as the site distance triangles as defined by this Zoning Ordinance."

Barrier	Optional Approach	Example Language to Address Barriers
3. Guidelines for Design Review. required the use of edge areas that are suited to stormwater management are not compatible with green infrastructure.	Develop provisions for landscaped strips to (1) be allowed to vary in width where necessary to act as green infrastructure stormwater management features, (2) incorporate multi-function landscape and green infrastructure principles, and (3) discourage the use of turfgrass. Or Explicitly allow green infrastructure as a landscaping feature in required strips and refer to this in green infrastructure design manual.	"Planting plans for required landscaped strips shall minimize the use of turfgrass and hardscape except in areas of high foot traffic." "The dimensional standards for landscaped strips and walls may be varied to accommodate green infrastructure stormwater features designed in conjunction with an overall landscaping and stormwater management plan for the site." "The ground plane shall be vegetated with potted plants, vines, shrubs, green infrastructure stormwater management features such as planter boxes or green walls, or groundcover. The use of turfgrass is discouraged except where an area is specifically designed for regular pedestrian use and foot traffic." "The use of turfgrass is discouraged except in areas specifically designed for regular use for active or passive recreation activities that require a flat, maintained, vegetated surface, such as but not limited to playing fields, picnic areas, gathering spaces, and active parks." "To encourage multi-function landscaping and discourage monoculture, areas…shall be suitably landscaped with a mixture of shrubs, trees and ground cover, which are encouraged to incorporate xeriscaping and low water use plants, and to function as green infrastructure stormwater management areas." "Planter boxes, green infrastructure planters, rainwater harvesting systems, or a green wall treatment may be substituted for the required landscaping. Such substitute landscaping shall be subject to the approval of the City Manager [and may be drawn from the green infrastructure Design Manual]."
4. Zoning 702 B.7. Screening for Off-Street Parking. Standard dimensional requirements for screening along the parking perimeter are incompatible with green infrastructure BMPs. For example, the screening requirements include landscaping to be 4 feet tall and a continuous evergreen shrub or hedge in a minimum 3-foot-wide planting area.	See #3 above in this section.	See # 3 above in this section.

Barrier	Optional Approach	Example Language to Address Barriers
5. Standard dimensional requirements for landscaping width, depth, and density prohibit changes necessary to bring in or infiltrate water or size plants correctly. For example, the zoning ordinance 703.B.3. has very prescriptive requirements for required landscape areas (one tree, five shrubs, and ground cover of living material for each 300 feet of required landscape area).	See #3 above in this section.	"The use of turfgrass is discouraged except in areas specifically designed for regular use for active or passive recreation activities that require a flat, maintained, vegetated surface, such as but not limited to playing fields, picnic areas, gathering spaces, and active parks." "The dimensional standards for landscape areas, landscaped strips and walls may be varied to accommodate green infrastructure stormwater features designed in conjunction with an overall landscaping and stormwater management plan for the site." "To encourage multi-function landscaping and discourage monoculture, areas …shall be suitably landscaped with a mixture of shrubs, trees and ground cover, which are encouraged to incorporate xeriscaping and low water use plants, and to function as green infrastructure stormwater management areas." "In order to accommodate green infrastructure BMPs, required setbacks, sideyards, and rear yards may be reduced by up to 25 percent. The reductions may not compromise public safety such as the site distance triangles as defined by this Zoning Ordinance."
6. Code 27-13. For street landscape trees, the code has a relatively high pruning height requirement compared to some other municipalities and could negatively impact the urban tree canopy aesthetics, shade, and tree health.	Revise code to decrease the required pruning height. Revise the code to require pruning of street trees only when the tree becomes a nuisance to vehicles and pedestrians (i.e., do not provide a specified height.)	It shall be a violation for any person to permit trees, shrubs, or brush growing upon their property to encroach on or over any public right-of-way so as to interfere with the movement of persons, bicycles, or vehicles. It is the responsibility of the responsible party to trim trees or shrubbery on their property and in the adjacent right-of-way back to their property line in such a manner as to allow reasonable use of the right-of-way and allow a [10] [14] foot clearance. Or It shall be a violation for any person to permit trees, shrubs, or brush growing upon their property to encroach on or over any public right-of-way so as to interfere with the movement of persons, bicycles, or vehicles. It is the responsibility of the responsible party to trim trees or shrubbery on their property and in the adjacent right-of-way back to their property line in such a manner as to allow reasonable use of the right-of-way.

Barrier	Optional Approach	Example Language to Address Barriers
7. The Street Landscape Standards required landscape and screening standards lack active incentives or requirements for green infrastructure BMPs.	Green Infrastructure could be incentivized through amendments that create additional points/incentives for incorporation of green infrastructure features and native, low-water use plants, xeriscaping or multi-function landscaping. Revise points or other landscape requirement system and calculations to allow or incentivize the use of green infrastructure landscape features as part of overall landscaping plans and requirements. In cases where a certain size tree is required per square foot of area, a waiver provision can be introduced; however, the waiver most likely will need to be designed in such a way that a tree requirement cannot be avoided entirely.	"Each one square foot of vegetated parkway area with street trees provided shall satisfy 1.5 square feet of the front and street side yard vegetated area requirements, or [2.0 or more] square feet for vegetated parkway areas designed and planted as green infrastructure stormwater management features." "Required Plant Reduction and Substitution. In order to accommodate green infrastructure BMPs the number of planted trees may be reduced in buffer yards by 10 percent, 50 percent of the required trees may be 1.5 inches in caliper, and all shrubs may be 24 inches in height." "Encroachments. Stormwater retention and water quality BMPs may encroach into required buffer yard as long as the encroachment does not disturb existing vegetation. Minor understory may be disturbed in order to accommodate water quality structures. Trees and shrubs shall be placed to maximize screening where the encroachment takes place. If encroachment runs parallel to the buffer, the width of the buffer shall be increased by the amount of the encroachment."
8. The Street Landscape Standards have guidelines that appear to encourage the use of white stone in landscape areas. Although rock is commonly used in these areas, it does not help break down pollutants, it can become unsightly with oil sheen, and, according to the University of Arizona, it also can add to the urban heat island effect. Use of organic mulch should be encouraged rather than hardscape materials.	Amend Street Landscape Standards to discourage use of white stone and encourage the use of organic mulch. Develop and adopt green infrastructure Design Manual with specifications for appropriate design to slow water flow such that organic mulch is retained within feature during storm events.	

Barrier	Optional Approach	Example Language to Address Barriers
Open Space Areas		
1. Although the zoning ordinance does allow bioretention and green infrastructure to receive credit as part of the required open space on a development site, the code does not specifically require that green infrastructure be considered as part of open space elements. For example, Code 703 B.4. does not include green infrastructure in the elements to be provided in Open Space areas.	Add green infrastructure to the list of elements to be provided in open space areas to provide extra incentive for its use.	Open Space Requirements for Multi-Family Development Two or more of the following elements are to be provided in these open space areas (1) Swimming pool. (2) Tot lot. (3) Barbecue and picnic areas. (4) Game courts. (5) Jogging and/or parscours. (6) <u>Green infrastructure stormwater management practices as part of an approved stormwater management plan. (Added).</u> (7) Lawn or turf.

GOAL #5: MANAGE STORMWATER TO SUSTAIN STREAM FUNCTIONS

Objective: Replicate the predevelopment hydrology of the site, to the extent practicable.
Objective: Maintain water quality functions of the watershed.
Objective: Minimize channel erosion impacts.
Objective: Minimize flooding impacts.
Objective: Inspect BMPs to ensure proper construction and design.
Objective: Long-term maintenance.

Barrier	Optional Approach	Example language to Address Barriers
Performance Standards		
No significant barriers identified.		
Inspections		
1. Code 32 A, Code 32C and Storm Water Policies and Standards. There is no express requirement for owners to inspect post-construction BMP facilities on a regular basis, and the City conducts inspections based on complaints.	Revise Code 32 A, Code 32C and Storm Water Policies and Standards to expressly require inspections and maintenance of private BMPs. Implementing an inspections program could require significant additional resources.	"(1) Private maintenance responsibility The inspection, maintenance, repair and reconstruction of stormwater control measures and stormwater conveyances not located in the city right-of-way shall be the responsibility of a) the owner of the property on which such BMPs and conveyances are located; and b) any person or entity that has legally agreed to be responsible for the BMPs; and c) the non-city properties served by the BMPs or conveyances, as determined by reference to site plans, plats, and construction drawings for the BMPs or conveyances. (2) Level of maintenance. Every BMP and stormwater conveyance shall be maintained, repaired, and reconstructed so as to continue its functionality to the level for which it was designed for the control and/or conveyance of stormwater and for the treatment of stormwater. Maintenance, repair, and reconstruction shall be performed in compliance with city stormwater standards. Standards for maintenance include but are not limited to the specific operation and maintenance agreement that may exist for particular facilities on file with the city and the most recent version of the city's *Owner's Maintenance Guide.* (3) Annual private inspection. An annual inspection report that meets the city's stormwater standards shall be provided for each BMP by the persons or entities responsible for such facility, identified above. The report shall be submitted on such schedule as approved by the department. In addition, such persons or entities shall maintain inspection and repair reports regarding the BMPs as required by city stormwater standards. (4) City right to inspect. The city may inspect BMPs and stormwater conveyances located on private property. Inspection may include but not be limited to testing of structures, water, or vegetation as the city determines may be useful to determine the history or performance of the BMP or conveyance."

Barrier	Optional Approach	Example language to Address Barriers
Maintenance		
1. Maintenance agreements are not required and there are no requirements for a certified professional to maintain BMP facilities.	Revise Code 32 A, Code 32C and Storm Water Policies and Standards to require a maintenance agreement. Specify in the maintenance agreement that maintenance be performed by certified professionals.	See #1 above in this section.
Off-site Mitigation		
1. The City of Phoenix does not have off-site mitigation requirements. At times it is difficult to meet full stormwater criteria requirements on-site, particularly in urban areas where proposed developments have high impervious area. Cost-effective and equitable alternatives can be provided through partial off-site mitigation and payment-in-lieu.	The City may wish to consider providing additional off-site options for building BMPs off-site, buy downs, and banking/trading of credits.	"Mitigation Purpose. The purpose of this mitigation is to reduce the cost of complying with the stormwater retention criteria for development and redevelopment with greater than [X] percent built-upon area while ensuring the overall retention and achievement of the ordinance objectives. Payment in Lieu. For development and redevelopment with greater than [X] percent impervious area, the owner or designee of the proposed development site shall have the option of paying an in-lieu fee to the City which will be used by the City to construct stormwater BMPs or acquire open space off site. The fee required will be based on the stormwater in-lieu fee published in the city's annual fee schedule. In addition to the payment-in-lieu mitigation option, there are two mitigation options available to development and redevelopment greater than [X] percent built upon area, including off-site mitigation and a buy down option. Both off-site and buy-down mitigation will result in the construction of retrofit BMPs in the same named watershed Criteria for Off-Site Mitigation. The owner or designee of a proposed development site that will include greater than or equal to [X] percent built upon area shall construct a BMP retrofit project designed to achieve an equivalent or greater stormwater retention as would be achieve by meeting the stormwater retention criteria from the proposed site. Off-site mitigation is allowed only for stormwater retention above [X] percent. On-site BMPs shall be constructed to achieve [X] percent of stormwater retention from the project site. The criteria for approval of off-site stormwater retention are: a. BMPs must be constructed in accordance with [reference design standards and/or manual]; b. BMPs must be inspected and found to be in compliance; c. Following inspections, BMPs may be installed and credits obtained for stormwater retention that can be applied to future projects. These credits may be accumulated or "banked." All off-site mitigation BMPs shall be subject to the maintenance requirements herein.

Barrier	Optional Approach	Example language to Address Barriers
		Criteria for Stormwater Retention Buy Down. The owner or designee of a proposed development site that will include greater than or equal to [x] percent built upon area may buy down the stormwater retention requirement on site to no less than [X] percent. On-site BMPs must be installed to retain the remaining stormwater runoff. The money shall be used by the City to construct BMP retrofit projects designed to achieve equivalent or net stormwater retention as would be achieved if the total stormwater retention requirement was met on the proposed site. The criteria for the buy down option are [add]. All BMPs constructed by the City as part of this mitigation option shall be maintained by the jurisdiction into perpetuity.

3.2 Other Planning and Research Needs

The review of City plans and policies also identified a number of gaps that, if remedied, could better promote the use of green infrastructure. The most important planning and research recommendations include:

- Develop a City-wide parks and open space plan that could serve as a foundation for an overall green infrastructure plan.
- Develop a strategic green infrastructure retrofit plan for existing development.
- Develop green infrastructure design templates for the Street Landscape Standards and Street Planning and Design Guidelines.
- Develop a green infrastructure Design Manual inclusive of private/commercial projects.
- Conduct additional research to
    - Identify which native and non-native drought tolerant species work best in the bottom of the bioretention basins where inundation of the plants is longest. This area of the basin has the fewest known options for the Phoenix area.
    - Conduct additional research regarding how little and how much water the plants can tolerate.
    - Develop a list of drought tolerant, non-invasive species that specifically work well in the Phoenix region.

The recommended research would provide more specific and tailored guidance on plants that can thrive in the City's arid environment. Attachment 4 provides an example of such a plant list used by the City of San Diego in its Low Impact Design Manual. The plant list table includes information on native species; plants that work best in the top, mid, and bottom areas of the green infrastructure practices; maturity size; irrigation demands; light requirements; and seasonal deciduous/evergreen features. It is recommended that a similar table be developed for the Phoenix region based on local research.

3.3 Next Steps

EPA developed a case study highlighting the project's findings and use of the EPA Water Quality Scorecard in an urban, arid environment. The case study and project findings were shared with other communities in the region at a Sustainability Cities Network workshop on February 5, 2013.

In the coming year as the City works on other planning initiatives such as Reinvent Phoenix and the Complete Streets program, it could use the example code language and other memo recommendations to craft code text amendments, draft design templates, and a draft design manual for City Council consideration.

Attachment 1 Specific City of Phoenix Plans, Policies, Standards, and Codes Reviewed

- City Code Chapter 23 – Morals and Conduct (23-32 Encroachment of trees, shrubs or bushes prohibited)
- City Code Chapter 24 – Parks and Recreation (24-37 Vandalism in a City Park)
- City Code Chapter 27 – Solid Waste (27-13 Unobstructed Passage in Streets and Alleys)
- City Code Chapter 31 – Streets and Sidewalks (including Street Landscape Standards and Street Planning and Design Guidelines)
- City Code Chapter 31 – Streets and Sidewalks (31-10 Removal of debris, rubbish, weeds, overgrown or dead vegetation; Sec. 31-13 Obstructing visibility at intersection; Sec. 31-53 Tree Line)
- City Code Chapter 32 – Subdivisions (Article III)
- City Code Chapter 32A – Grading and Drainage and the referenced Stormwater Policies and Standards Manual
- City Code Chapter 32C – Stormwater Quality
- City Code Chapter 34 – Trees and Vegetation (34.6 Diagrams to be prepared by Street Transportation Director; 34.14 Determination of kind and variety to be planted; 34.15 Cutting, trimming, or removal of trees and vegetation)
- City Code Chapter 39 – Neighborhood Preservation Ordinance and Code Enforcement Policy (Sec. 39-7 Exterior Premises and Vacant Land and Sec. 39.9 Airborne pollens)
- City Code Chapter 41 Zoning Ordinance
    - Chapter 1 (103 Applicability)
    - Chapter 2, Rules of Construction and Definitions
    - Chapter 5, Development Review Procedures (502 Procedures of general applicability; 505.1 Special Permits; 507 Tab A. Guidelines for Design Review
    - Chapter 6, Zoning Districts (601 to 649, 662, 663, 671). This includes most City zoning districts, but excludes area specific design overlays and overlay districts. The City may wish to select one overlay district as an example for code review.
    - Chapter 7, Development Standards of General Applicability (702 Off-Street Parking and Loading; 703 Landscaping, Fences, and Walls; 704 Environmental Performance
    - Zoning Ordinance: Chapter 7 Section 705 – Signs (as pertains to Urban Tree Canopy)
    - Standards; 710 Hillside Development; 714 Future Width Lines; 716 Sustainability)
    - Chapter 8, Historic Development (City to select most relevant sections)
    - Chapter 12, Downtown Code (1206 Parking and Loading Standards; 1223 Sustainability Bonus)
- 2006 Phoenix Building Code (Chapter 15 Roof Assemblies and Rooftop Structures; Chapter 18 Soils and Foundation; and Chapter 32 Encroachment into the Public Right-of-Way)

- 2006 Uniform Plumbing Code (Chapters 11 Storm Drainage, Chapter 14 Gray Water Systems, Table 11.1 Roof drains, gutters, and scupper size requirements)
- 2006 Phoenix Residential Code (as narrowed to following sections: Chapter 3 Building Planning Section R328 Location on Property; Chapter 8 Roof-Ceiling Construction; Chapter 9 Roof Assemblies; Chapter 26 General Plumbing Requirements; Appendix O Gray Water Recycling Systems)
- Phoenix General Plan 2002
- Phoenix Tree and Shade Master Plan
- 2011 Phoenix Green Construction Code

Attachment 2 Completed City of Phoenix Green Infrastructure Opportunities Checklist Tool

City of Phoenix
Green Infrastructure Opportunities Checklist Tool
Worksheet #1
Identification of Barriers and Opportunities
FINAL 10/31/2012

Degree of Importance Key to Symbols:

- ● Essential
- ◑ Very important
- ○ Important
- NI Not important to the City of Phoenix

GOAL #1: MINIMIZE EFFECTIVE OR CONNECTED IMPERVIOUS AREA

Objective: Minimize impervious area associated with streets.
Objective: Minimize impervious area associated with parking.
Objective: Minimize impervious area associated with driveways and sidewalks.
Objective: Clustering development.
Objective: Incorporate sustainable hydrology practices into urban redevelopment.

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Effective Impervious Area		
1. Does the code distinguish between pervious paved areas and impervious paved areas in the determination of onsite stormwater requirements?	◑	Code Findings: No
2. Does the code definition of impervious area distinguish between impervious area connected to the storm drain system (effective impervious area) and disconnected impervious area?	◑	Code Findings: Yes City of Phoenix Stormwater Policies and Standards. 6.8.3. First Flush. Normally, the City's water quality treatment standard (first flush) minimum is met by following the City retention requirements to capture the 100-year, 2-hour storm. In the event there is a discharge into a structure owned or operated by the City, the applicant must also comply with the First Flush policy.

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Streets		
1. For residential development, are the street pavement widths allowed to be between 18 to 22 feet, with curb pullouts for passing of large vehicles?	●	Code Findings: No City of Phoenix Street Planning and Design Guidelines. Local Single Family Residential Streets- 28 to 32 feet of pavement width is required; minor residential collector streets- 40 feet are required.
2. Are travel lanes allowed to be from 12 to 10 feet (or less), with curb pullouts for passing of large vehicles?	●	Code Findings: No City of Phoenix Street Planning and Design Guidelines. Local Single Family Residential Streets 14 to 16 feet are required.
3. Are curb bumpouts/extensions allowed near intersections and mid-block for traffic-calming and bioretention opportunities?	◑	Code Findings: Yes City of Phoenix Street Planning and Design Guidelines. Traffic calming devices include several standard drawings of curb bumpout and planters that could accommodate bioretention.
4. Is pervious paving allowed for on-street parking and alleyways?	○	Code Findings: No City of Phoenix Street Planning and Design Guidelines. Alleys, on-street parking lanes and on-street bike lanes require asphalt.
5. Are grass swales or bioretention swales allowed instead of curb and gutter or with curb cuts (where slopes allow)?	◑	Code Findings: Not expressly allowed or prohibited, but appears to be limited City Code 32-289A. Urban density of 3 or more lots per gross area must have paved and curb streets. Note: There is no express allowance for bioretention or swales in those cases where curb is not required. City Code Zoning 702 B.4.b. &c. Indicates that if drainage is required, only curbs can be used, otherwise could be bound by landscape plot. This implies that bioretention would not be allowed or would be greatly limited.
6. Are bioretention areas, swales, and other green infrastructure techniques allowed to replace the required "planting strip" or "parkway area" between the sidewalk and curb?	●	Code Findings: Partially City of Phoenix Street Landscape Standards provide specifications for vegetated swales for drainage. No other Green Infrastructure techniques are expressly allowed or prohibited

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
7. If there are cul-de-sacs, is the radius required to be 35 feet or less?	○	Code Findings: No City Code Subdivision 32-27(3)(a) A 50 foot radius is required.
8. If there are cul-de-sacs or roundabouts, are landscaped islands or bioretention islands allowed or encouraged?	○	Code Findings: Not expressly allowed or prohibited
9. Are site designs required to promote the most efficient street layout to reduce overall street length?	○	Code Findings: No
Parking		
1. Is the minimum stall width for a standard parking space 9 ft. or less?	●	Code Findings: Yes (substantially) City Code Zoning 702 2.b. Commercial stall widths are required to be 9.5 feet in width; office and multifamily stalls are required to be 8.5 feet. Compact spaces are allowed to be 8 feet, however these are only allowed in excess parking area.
2. Are parking stall lengths allowed to be 15 ft.?	●	Code Findings: No. Zoning City Code 702 2.b. Commercial, office and multifamily stalls are required to be 18 feet long.
3. Are parking lot drive aisles allowed to be 22 ft.?	◑	Code Findings: No City Code Zoning 702 2.b. A single-load aisle must be 43 feet, including depth of parking area (i.e. 25 feet). A double-loaded aisle must be 62 feet.
4. Are bioretention cells allowed in parking medians?	●	Code Findings: No City Code Zoning 702 B.4.b. &c. Indicates that if drainage is required, only curbs can be used, otherwise could be bound by landscape plot. This implies that bioretention would not be allowed for drainage and water quality.
5. Are consolidated travel lanes and on-street parking allowed to create space for bioretention?	○	Code Findings: No

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
6. Are pervious surfaces such as paver stones, porous pavement, or other pervious pavers allowed for on-street parking?	◑	Code Findings: No City of Phoenix Street Planning and Design Guidelines. On-street parking lanes require asphalt.
7. For office buildings, is the required parking ratio 3.0 spaces per 1,000 sq.ft. of gross floor area or less?	◑	Code Findings: Partial City Code Zoning 702 C. Only for office buildings with leasable area over 600,000 sq.ft. City Code Zoning 643 F.1. Downtown has no minimum parking requirements. City Code Zoning 645 Warehouse District has no minimum parking requirements. City Code Zoning 662 Zoning Interim Transit Oriented Zoning District One (reduction in parking requirements within certain distance of rail stop; maximum parking limit). City Code Zoning 663 Interim Transit Oriented Zoning District Two City Code Zoning 702 E.5 Village Cores (allows reduction in parking based on multi-modal transportation study). City Code Zoning 702 E.9. Infill Development (allows on-street parking to be counted toward reducing parking requirements.

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
8. For commercial centers, is the required parking ratio 2 to 4.5 spaces per 1,000 sq.ft. of gross floor area or less?	◑	Code Findings: Partial City Code Zoning 702 C. Only for retail establishments with leasable area over 50,000 sq.ft. City Code Zoning 702 D. Large scale commercial developments require a minimum of 4 spaces per 1,000 sq.ft. of tenant leasable area and a maximum of 5 spaces per 1,000 sq.ft. of tenant leasable area. However, additional parking spaces may be allowed as incentives for providing public amenities such as clocks, landscaping, art, etc. City Code Zoning 662 Zoning Interim Transit Oriented Zoning District One (reduction in parking requirements within certain distance of rail stop; maximum parking limit) City Code Zoning 663 Interim Transit Oriented Zoning District Two City Code Zoning 702 E.5 Village Cores (allows reduction in parking based on multi-modal transportation study)

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
9. Are proposed developments allowed to take advantage of opportunities for shared parking?	◑	Code Findings: Yes City Code Zoning 702 E 1. A parking management study for shared parking may be required for retail and mixed use development project with large public assembly spaces. City Code Zoning 702 E 2. Allows the applicant to use a shared parking model to predict parking demand. The shared parking model considers different peak uses. Share parking agreements may be developed under these options. City Code Zoning 702 A.4. Non-residential development may have parking on another lot, but it must be used exclusively for the subject's use (off-site parking provision).
10. Are proposed developments allowed to have parking stalls under the second floor podium?	○	Code Findings: Not addressed
Buildings		
1. Do requirements for rooftop structures and materials allow or encourage cisterns?	NI	

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
2. Are buildings allowed to have bioretention areas, swales, and other Green Infrastructure practices near the foundation if properly designed?	◑	Code Finding: Not expressly allowed or prohibited Section 1802.2.3 of the Building Code states that the groundwater must be greater than 5 feet below the bottom of the foundation and provides an exception that a subsurface soil investigation is not required if waterproofing is provided in accordance with section 1807. Section 1803.1 states that the ground must slope away from the foundation at a slope no less than one unit vertical to 20 units horizontal. This is conducive with recommended side slopes for most BMPs. Note: This indicates that infiltration would be allowed if proper waterproofing is used. There is no indication that green infrastructure practices promoting infiltration would be prohibited.
Driveways/Sidewalks		
1. Are driveway standards 9 feet or less in width?	◑	Code Findings: Not addressed in the codes reviewed
2. Are shared driveways allowed?	○	Code Findings: Yes City Code Zoning 507 Tab A Design Review Guidelines. One option for varying driveway orientation is providing shared driveways for 25% of the block.
3. If sidewalks are required, are they required to be designed to the narrowest allowable width (e.g., 4 ft.)?	○	Code Findings: Yes City of Phoenix Street Planning and Design Guidelines. Sidewalks shall be a minimum of 4 feet on local streets and 5 feet on arterials; collectors, and local streets with sidewalk setbacks. Must ADA requirements for passing (this can be met through drives, intersections, and other means if sidewalk is narrow).

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
4. Are sidewalks allowed to be on one side of the street only?	○	Code Findings: Yes (if meeting ADA and other requirements City Code Subdivision 32-33 E. (3) Where density of development is light or where for other reasons installation of sidewalks is not necessary, the Department may waive requirements on one or both sides. Note the city interprets ADA to require sidewalks on both sides of the street if there is development on both sides.
Clustering Development		
1. Is redevelopment encouraged in lieu of greenfield development through site performance standards?	●	Code Findings: Yes City of Phoenix Retention Policy Infill and Redevelopment Parcels Interpretation (07-09-2012) The City may waive its retention requirement for infill and redevelopment. For a parcel to be considered infill, the lot must be within a developed subdivision, but not developed during the normal build-out of the subdivision. To be considered a redevelopment parcel, the site must have been previously developed. In these cases, the City's retention requirement is waived. However, the post-development discharges are not to exceed the pre-development discharges, and are not to impact the City's storm sewer system. City Code Zoning 630 Residential Infill R1 Multifamily District City Code Zoning 633 High Rise Incentive District – High Rise and Mixed Use
2. Is Conservation or Open Space Design an option?	●	Code Findings: Yes

GOAL #1 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
3. To encourage clustering and open space design, are setbacks minimized (e.g., for residential lots that are ½-acre or less in size, is the front set back 20 feet or less, the rear setback 25 feet or less, and the side setback 8 feet or less?)	●	Code Findings: Yes City Code Zoning 611 Planned Residential Development R1 through R16; Planned Residential Development Multifamily R2 through R5 City Code Zoning 630 Residential Infill R1 Multifamily District City Code Zoning 633 High Rise Incentive District – High Rise and Mixed Use
4. Are site designs required to have development focused on areas of lesser slopes and farther from watercourses?	◑	Code Findings: Partial City Code Subdivision 32-329c) Hillside development areas
5. Are policies effective in encouraging higher density development to be centered around transportation corridors?	○	Code Findings: Yes City Code Zoning 662 & 663 Transit Oriented Zoning Overlay Districts One and Two

GOAL #2: PRESERVE AND ENHANCE THE HYDROLOGIC FUNCTION OF UNPAVED AREAS

Objective: Minimize building footprint/envelope area.
Objective: Preserve topsoil structure.
Objective: Preserve sensitive wetlands and washes.
Objective: Preserve sensitive soils.
Objective: Preserve sensitive stream buffers.

GOAL #2 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Topsoil Structure & Building Footprint		
1. Is disturbance of vegetated areas required to be phased?	●	Code Findings: No

GOAL #2 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
2. Is disturbance of vegetated areas, riparian areas, and washes required to be minimized?	◑	Code Findings: Partially City Code Subdivision 32-32C(5) Hillside development areas – total grading area shall not exceed 35% of the hillside lot area. City Code Subdivision 32-35 C.(1) Estate development option 2 requires that building envelopes be located on high points and such that development does not disturb major vegetation stands. City Code Subdivision 32-30 C. Where a stream or important surface drainage course abuts or crosses the tract, dedication of a minimum 10 foot public drainage easement is required. City Code Zoning 507 Tab A Guidelines for Design Review Desert Preservation. Development should minimize the removal of existing healthy Sonoran vegetation. Natural washes and vegetation should be maintained in a natural state to avoid impeding drainage flows, for public safety and natural ecology; landscape plans should reflect the establishment of an on-site wash system for surface drainage. Significant vegetation or riparian habitats associated with significant natural washes should be preserved. (Design goals not requirements)
3. Are building envelopes required/encouraged to avoid sensitive environmental areas such as riparian areas, washes, wetlands, high infiltration soils, and steep slopes?	◑	Code Findings: Partially City Code Subdivision 32-32C(5) Hillside development areas – total grading area shall not exceed 35% of the hillside lot area. City Code Subdivision 32-35 C.(1) Estate development option 2 requires that building envelopes be located on high points and such that development does not disturb major vegetation stands.

GOAL #2 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Wetlands and Washes		
1. Are site designs required to minimize hydrologic alteration to existing wetlands or washes?	○	Code Findings: Partially City Code 32-30 C. Where a stream or important surface drainage course abuts or crosses the tract, dedication of a minimum 10 foot public drainage easement is required.
Sensitive Soils		
1. Are building footprints required/encouraged to avoid highly erodible soils?	◑	Code Findings: Partially City Code Subdivision 32-32C(5) Hillside development areas – total grading area shall not exceed 35% of the hillside lot area.
2. Are building footprints required/encouraged to avoid soils with high permeability (e.g., Hydrologic Soil Group A and B)?	◑	Code Findings: No

GOAL #2 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Stream Buffers		
3. Is a 50- to 75-foot stream buffer required/encouraged for new development (adjacent to streams and washes)?	○	Code Findings: Partial City Code Zoning 507 Tab A. A 50 foot buffer is required in the Desert Character Overlay District. APDES General Permit for Stormwater Discharges Associated with Construction Activity (Final Draft) requires a 50 foot buffer along perennial waters during construction activity. This rule would primarily apply to the Salt River. City of Phoenix Stormwater Policies and Standards Development in City Code Floodway 3.5.2.1. Erosion Setbacks. In locations where the 100-year discharge in a wash exceeds 500 cfs and is contained within the existing channel banks, erosion setbacks consistent with the ADWR standard is required when water courses are to be left in an undisturbed state. Note: the ADWR erosion setback requirement varies by the straightness/curvature of the stream or alternative methods used to calculate setback needs. City Code 32-30 C. Where a stream or important surface drainage course abuts or crosses the tract, dedication of a minimum 10 foot public drainage easement is required.
4. Are stream buffers for new development required to remain in a natural state?	○	Code Findings: No (except in the Desert Character Overlay District) See notes above.
5. Are site designs required to preserve existing runoff pathways to provide maximum drainage and flood control using natural drainage patterns, including washes?	◑	Code Findings: Yes City Code Subdivision 32-34 requires that drainageways be mapped and a drainage plan be developed. City Code 32-30 C. Where a stream or important surface drainage course abuts or crosses the tract, dedication of a minimum 10 foot public drainage easement is required.
6. Is a 50-foot wetland buffer required/encouraged?	NI	

GOAL #3: HAVEST RAINWATER TO ENHANCE POTABLE & NONPOTABLE WATER SUPPLY

Objective: Through plumbing code provisions, enhance rainwater harvesting and water conservation
Objective: Through the building and zoning code, allow the use of rooftop runoff disconnection and rainwater harvesting by routing rainwater to natural and landscape areas throughout the site

GOAL #3 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Plumbing Code		
1. Are interior or exterior cisterns allowed?	NI	
2. Is a BMP maintenance plan required?	○	Code Finding: No There is no requirement expressly stated in the plumbing code.
3. Is harvested rainwater allowed to be used for nonpotable interior uses such as toilet flushing?	○	Code Finding: Not expressly allowed or prohibited Section P2601.2 of the Residential Housing code allows grey water to be discharged to an approved gray water recycling system. Section AO102 allows for the use of gray water for toilet flushing with proper disinfection and coloring.
4. Are personal treatment systems allowed to be used for potable water supply?	NI	

GOAL #3 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Building and Zoning Code		
1. Can rooftop runoff be disconnected and distributed throughout the site via contours and drainageways to discharge into natural areas or landscape areas?	●	Code Findings: Yes City Code Zoning 507 Tab A Guidelines for Design Review. Surface site drainage and retention should be integrated with overall landscape design. Section 1803.3 of the Building Code states that swales may be used to divert water away from the foundation of buildings and may be located within 10 feet of the building. City of Phoenix Stormwater Policies and Standards. 2.6.4. Linear Open Space. The City stresses the establishment of natural or semi-natural drainage corridors. Using natural corridors to accommodate stormwater is the City's preferred approach due to its multi-use flood control, trails, recreation, and habitat. The City considers use of natural corridors for stormwater management a cost effective designation of required open space due to the increased risk of flooding in these corridors.
2. Are interior or exterior cisterns allowed?	NI	
3. Can rain barrels be placed within standard zoning setback areas?	NI	
4. Do zoning and building provisions allow cisterns to be placed on rooftops to harvest rainwater?	NI	
5. Is a BMP maintenance plan required?	NI	

GOAL #4: ALLOW AND ENCOURAGE MULTI-USE STORMWATER CONTROLS

Objective: Allow and encourage stormwater controls as multiple use in open space areas.
Objective: Allow and encourage stormwater controls as multiple use in landscaped areas.

GOAL #4 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Landscaped Areas		
1. Does the code and zoning ordinance allow or promote development of an urban tree canopy?	●	Code Findings: Yes City Code 1207 General Standards and Guidelines. D.1 & 2. Shade Standards. All buildings over 5,000 square feet shall provide a minimum of 50% of all accessible public and private open space areas as shaded area of which 50% of the shade shall be provided by trees or trellised vines. Landscaping treatment shall be used for the entire site exclusive of buildings with 30% tree canopy at maturity. City Code Zoning 507 Tab A Guidelines for Design Review. Development should minimize removal of existing healthy non-native plants (trees 4" in caliper or greater); if removal is necessary, mature trees should be salvaged and utilized on site. The location of curb cuts for parking lots or driveways shall not cause the removal of mature canopy. Street improvement projects shall be made in accordance with adopted streetscape designs.
2. Are bioretention areas allowed to be constructed in the development's designated landscape areas, if properly designed?	●	Code Findings: Partially City Code Zoning 507 Tab A Guidelines for Design Review. Surface site drainage and retention should be integrated with overall landscape design. Required landscape setbacks adjacent to perimeter streets may use the setbacks for stormwater retention. This does not explicitly allow green infrastructure to be constructed in other required landscape areas (e.g. side and back yard screening and parking areas).

GOAL #4 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
3. Are bioretention areas given "credit" as landscape area to count as a percent of the required landscaping?	●	Code Findings: Partially City Code Zoning 507 Tab A Guidelines for Design Review. Required landscape setbacks adjacent to perimeter streets may use the setbacks for stormwater retention. This does not explicitly allow green infrastructure to given credit in other required landscape areas (e.g. side and back yard screening and parking areas).
4. Are landscaping plans required to consider less water-intensive, native vegetation?	●	Code Findings: Yes City Code Zoning 507 Tab A Guidelines for Design Review. Low water use plants that reflect and enhance the image of the Sonoran Desert should be used. No more than 50% of the landscape area at maturity or 10% of the net lot area should be planted in turf or high water use plants.
5. Do landscaping requirements allow plantings conducive to bioretention, bioswales, raingardens , and other Green Infrastructure BMPs?	●	Code Findings: Yes City Code Zoning 507 Tab A Guidelines for Design Review. Surface site drainage and retention should be integrated with overall landscape design. Applicants must consider alternative paving materials that are permeable for hardscape landscaping. General Note: The requirements for use of ADWR Low Water Use Drought Tolerant Plant List does not pose barriers to the use of bioretention, bioswales, and raingardens. However, lack of design templates or a design manual showing how to incorporate these plantings into stormwater practices in effect limits the use of these Green Infrastructure practices. Encouragement of the use of hardscape such as rock not only discourages the expanded use of bioretention and bioswsales, it also adds to the City's heat island effect.

GOAL #4 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
6. Do tree planting requirements allow use of raingardens, tree boxes, and other Green Infrastructure BMPs?	●	Code Findings: Not expressly allowed or prohibited
7. If irrigation is required, are weather-based irrigation controls required?	●	Code Findings: No City Code Zoning 507 Tab A Guidelines for Design Review. Irrigation systems should be permanent and automatic. Does not require systems to be weather based.
Open Space Areas		
1. Are there open space preservation requirements or incentives?	◑	Code Findings: Yes City of Phoenix Stormwater Policies and Standards. 2.6.4. Linear Open Space. The City stresses the establishment of natural or semi-natural drainage corridors. Using natural corridors to accommodate stormwater is the City's preferred approach due to its multi-use flood control, trails, recreation, and habitat. The City considers use of natural corridors for stormwater management a cost effective designation of required open space due to the increased risk of flooding in these corridors. City of Phoenix Stormwater Policies and Standards. 2.6.5. Storm Water Storage. Drainage corridors and storm water storage basins should be combined with open space, parks, and trails to create focal points for the community. These combined uses should be planned and designed to augment City of Phoenix parkland and increase open space with landscape amenities.

GOAL #4 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
2. Is preserved open space required to be managed in a natural condition?	◑	Code Findings: Yes City Code Zoning 507 Tab A Guidelines for Design Review. Within areas identified as permanent undisturbed open spaces, no grading or other disturbance shall occur except grading for trails, utility easements, and fire protection.
3. Are Green Infrastructure structural techniques such as constructed wetlands, swales, and bioretention areas allowed to be constructed in a development's designated open space, if properly designed?	●	Code Findings: Yes City Code Zoning 507 Tab A Guidelines for Design Review. Retention areas should be integrated into usable open space areas. City Code Zoning 507 Tab A. Open Space/Amenities. 4.2. Common retention may quality for required common open space if it has a minimum area of 1,000 square feet of level bottom with maximum side slopes of 4:1, and is properly landscaped as usable open space (minimum 50% vegetation). Note: City Code 703 4. Open Space Area does not include Green Infrastructure in the elements required to be provided in open space areas.
4. Are Green Infrastructure structural techniques such as constructed wetlands, swales, and bioretention areas given "credit" as open space to count as a percent of the required open space area, if properly designed?	●	Code Findings: Yes City Code Zoning 507 Tab A Guidelines for Design Review. Common retention may qualify for required common open space if it has a minimum area of 1,000 sq.ft. of level bottom with maximum side slope of 4:1, and is properly landscaped as a usable open space (minimum 50% vegetation). Note: the stipulations above are overly restrictive and could limit the use of green infrastructure practices in open space areas.

GOAL #4 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
5. Does protection of sensitive, natural areas and habitat qualify as credit for local open space dedication?	●	Code Findings: Not expressly allowed or prohibited City Code 703 4. Open Space Area does not include Green Infrastructure in the elements to be provided in open space areas.

GOAL #5: MANAGE STORMWATER TO SUSTAIN STREAM FUNCTIONS

Objective: Replicate the predevelopment hydrology of the site, to the extent practicable.
Objective: Maintain water quality functions of the watershed.
Objective: Minimize channel erosion impacts.
Objective: Minimize flooding impacts.
Objective: Inspect BMPs to ensure proper construction and design.
Objective: Long-term maintenance.

GOAL #5 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
Performance Standards		
1. Is stormwater required to be retained/infiltrated onsite (through bioretention, natural areas, and swale infiltration) where possible (e.g., Hydrologic Soil Group A and B)?	●	Code Findings: Yes City Code 32A-24 Grading and Drainage. On-site stormwater retention areas shall be adequate to contain the volume of water required by the City of Phoenix Stormwater Policies and Standards. All developments shall not increase the 100 year, two-hour peak runoff, change the time of the peak, nor increase the total runoff from its predevelopment values. City of Phoenix Stormwater Policies and Standards. 6.8.1 Stormwater Storage. All new development shall make provisions to retain the stormwater runoff from a 100-year, 2-hour duration storm falling within its boundaries. Note: This is equal to a 2.5 inch stormevent.
2. Do stormwater management practice standards and sizing provide sufficient storage volume?	●	Code Findings: Yes According to the Maricopa County Drainage Design Manual the 100-year 2 hour duration storm is equivalent to 2.1 to 2.7 inches of rainfall (or average 2.5 inch stormevent). This is sufficient storage.

GOAL #5 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
3. Are water quality treatment performance standards adequate?	●	Code Findings: Yes City of Phoenix Stormwater Policies and Standards. 6.8.3. First Flush. The City has established a minimum level of control for new development at which stormwater pollution practices must be put in place. The minimum standard is the "First Flush", and consists of retaining or treating the first 0.5 inch of direct runoff from a storm event. Normally, this minimum level is met by following the City retention requirements to capture the 100-year, 2-hour storm. In the event the normal retention standards are waived, or a surface based bleed off for the retention basin is proposed, the First Flush provision shall apply. Discharges into a structure owned or operated by the City must comply with the First Flush policy. The policy can be met by retaining the First Flush volume, treating the First Flush discharge, or a combination of approaches. Where detention is allowed, the post-construction peak discharge shall not exceed the post-development peak discharge for the 2-, 10-, and 100- year storm events.
4. Are channel protection performance standards adequate?	●	Code Findings: Yes See retention policies and standards in #1 above. There are no additional channel protection performance standards.
5. Are flood control performance standards adequate?	●	Code Findings: Yes See retention policies and standards in #1 above. There are no additional flood control protection performance standards.
6. Are thresholds of applicability adequate (e.g. land disturbance greater than 5,000 sq.ft.)?	●	Code Findings: Yes City Code 32A- Grading and Drainage. On-site retention of stormwater shall be required for all developments. This requirement may be waived for isolated developments under ½ acre where there will be no critical drainage problems creating runoff. The NPDES program may require on-site retention for parcels less than ½ acre.

GOAL #5 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
7. Are outfalls required to be stabilized to reduce erosion?	●	Code Findings: Yes
Inspections		
1. Are inspections required during construction and routinely after construction (i.e. for post construction BMPs)?	●	Code Findings: Partially During Construction. ADEQ Stormwater Construction Permit requirements Post Construction. City Code 32C 104 F. The stormwater management plans shall include best management practices for…maintenance of retention basins and other stormwater management devices and facilities. Stormwater Policies and Standards 3.9.5 Drainage Policies – Private Maintenance. All drainage facilities owned or operated by private entities shall be properly maintained to promote performance of the drainage facilities consistent with the original design intent. Stormwater Policies and Standards 6.8.19. Maintenance. Stormwater storage basins are to be privately maintained and be located within a designated drainage tract unless sited in conjunction with a City owned and operated facility. General Note: Post construction facilities are required to be maintained which implies some level of inspection. However, there is no express requirement for routine inspections.
2. Are inspectors required to be trained and certified?	●	Code Findings: Yes for construction activity (per ADEQ requirements) Code Findings: No for post-construction
Maintenance		
1. Are maintenance agreements required?	●	Code Findings: No

GOAL #5 KEY QUESTIONS	DEGREE OF IMPORTANCE	COMMENTS (INDICATE ORDINANCE FINDINGS "YES" OR "NO". WHEN "NO", NOTE SPECIFIC LOCATION OF BARRIER IN CODE)
2. Is maintenance required to be performed by a certified professional?	●	Code Findings: Yes for construction activity (per ADEQ requirements) Code Findings: No for post-construction
Off-Site Mitigation		
3. Is offsite mitigation required when on-site management does not meet the performance criteria (unless there is proof of no adverse impact)?	●	Code Findings: No
4. Is offsite mitigation for forested area conservation allowed in the same named watershed? Is the replacement ratio at least 1:1?	◑	Code Findings: No
5. Is offsite mitigation for riparian area conservation allowed in the same named watershed? Is the replacement ratio at least 1:1?	◑	Code Findings: No
6. Is offsite mitigation for BMP retrofit allowed in the same named watershed?	◑	Code Findings: No
7. Is nutrient banking or the equivalent land banking allowed in the same named watershed? Is redevelopment encouraged in lieu of greenfield development?	○	Code Findings: No

Attachment 3 Completed City of Phoenix Modified Water Quality Scorecard

EPA
United States
Environmental Protection
Agency

WATER QUALITY SCORECARD

MODIFIED FOR PHOENIX, ARIZONA

Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scales

1. PROTECT NATURAL RESOURCES (INCLUDING TREES) AND OPEN SPACE

1.A NATURAL RESOURCE PROTECTION

1.A.1 Sensitive Natural Lands/Critical Area Protection

QUESTION: Are development policies, regulations, and incentives in place to protect natural resource areas and critical habitat?

GOAL: Protect natural resource areas (e.g., forests, prairies) and critical habitat (e.g., conservation corridors, buffer zones, wildlife preserves) from future development.

WHY: Protection of significant tracts of critical lands and wildlife habitat will aid in protecting and improving water quality by increasing infiltration and groundwater recharge, preventing erosion and contamination of ground water and surface water resources, and protecting sources of drinking water.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Identify and map critical natural resource areas (e.g., steep slopes, wildlife habitat, forests, drinking water source areas).	1	1	Open Space Element General Plan 2002 Figure 1 and Goal 1. Natural Resources Conservation & Energy Element Goal 3 Vegetation Protection Policy#3. Phoenix 2011 Water Resource Plan 1.1-1.4 and Chapter 2 maps city water resources. Arizona Department of Water Resources (ADWR) maps wells and groundwater Active Management Areas. Rio Salado Habitat Restoration Project and Recreation Area. Burrowing Owl protection program (Rio Salado)
The local comprehensive plan contains a natural resource protection element with goals calling for preservation of identified critical natural resource areas.	1	0.5	Natural Resources Conservation & Energy Element General Plan 2002: Goal 3 Vegetation Protection; Goal 4 Wildlife Protection; Goal 2 Erosion Protection. This is somewhat general in nature and focuses mostly on native vegetation preservation. No specific identified critical resource locations are identified except for the Rio Salado.
Identify key natural resource areas for protection in jurisdiction's parks and open space plan.	1	0.5	Open Space Element General Plan 2002 Goal 1: Sonoran Preserve Master Plan; Goal 3: Preservation of Desert Preserve Trails; . Tree and Shade Master Plan 2010: Goal 2 Protect, Preserve and Increase. General note: much of this is outdated and does not include the area west of I-17 & north of Carefree Highway. In addition, the Parks and Recreation Department does not have a standalone parks and open space plan.
Assist landowners in identifying sensitive natural areas and laying out developments to avoid such areas.	1	0.5	Zoning Ordinance 507 Tab A. Guidelines for Design Review: II. City-wide Design Review Guidelines A. 1-5 & 9, E. Specialized Areas, 3. Sonoran Preserve Edge Treatment Guidelines. General note: Sonoran Preserve Edge Treatment Guidelines only apply to areas adjacent to the Sonoran Preserve. There is limited enforcement /oversight for 507 Tab A and there is some discussion about deletion.

Local plans establish and enforce areas which are available for development and which lands are a priority for preservation.	1	0.5	General Plan 2002 Open Space Element & Natural Resources Conservation Element. General note: For driveway entrances and intersections, landscaping must not exceed 3 feet tall: Plans establish this, but variances for development are frequently granted. For example middle mountain was designated to be included as part of the Sonoran preserve. In 2005 it was approved to be rezoned from S-1 to R-18 (residential). In 2007 it was given several variances to allow the development to not preserve the ridgeline views and visible significant natural features.
REMOVE BARRIERS:			
Protection of sensitive natural areas and wildlife habitat qualifies for credit towards local open space dedication and set-aside requirements.	1	0	
ADOPT INCENTIVES:			
Provide financial support to or collaborate with land trusts to acquire critical natural areas.	1	1	Phoenix Parks Preserve Initiative (3PI), 2006 Bond Funds and Impact Fees (this can no longer be used to acquire natural open space)
Establish a dedicated source of funding for open space acquisition and management (e.g., bond proceeds, sales tax).	2	2	Open Space Element General Plan 2002; $127.5M bond proceeds for land acquisition for Phx Sonoran Preserve, Phoenix Mtn Preserves, and South Mtn Park, per Phoenix Parks Preserves and Initiative (3PI); Sonoran Preserve MasterPlan General note: 3PI has 10% cap on funding operations.
Adopt a transferable developments rights program to provide an incentive for landowners to preserve sensitive natural lands and wildlife habitat.	1	0	The City of Phoenix does not have a process for transferring development rights.
Land use regulations provide for the creation of cluster and conservation subdivision on the periphery of urban growth areas to encourage preservation of intact blocks of sensitive natural areas.	1	0	
ENACT REGULATIONS:			
Adopt regulations to protect steep slope, hillsides, and other sensitive natural lands (e.g., by limiting development on slopes > 30% or requiring larger lot sizes in sensitive areas).	2	2	City Code Subdivision 32-32C(5) – Hillside development areas – total grading area shall not exceed 35% of the hillside lot area.
Adopt wildlife habitat protection regulations aimed at preserving large contiguous blocks of habitat areas.	2	1	Though the City does not have regulations to preserve large contiguous blocks of habitat for wildlife or agriculture, the City does have an aggressive program to preserve natural areas. For example, the 16,000 acre South Mountain Park is the largest municipal park in the country. And the Sonoran Preserve, which includes thousands of acres of native desert land in north Phoenix, is still growing (through purchase of land with voter approved funds and state grants)
Create agriculture/natural resource zoning districts (e.g., minimum lot size of 80 acres and larger) to preserve agricultural areas and forests.	2	0	
		9	Out of 17 possible points

1.A.2a	**Protection Of Water Bodies/Aquifers**
	QUESTION: Are no-development buffer zones and other protective tools in place around wetlands, riparian areas, and floodplains that improve/protect water quality?
	GOAL: Protect critical areas such as wetlands, floodplains, lakes, rivers, and estuaries with a mandatory no-development buffer.
	WHY: The use of these practices will reduce pollutant loads and hydrologic alterations to water bodies.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Identify and map critical water resource areas.	1	1	The city of Phoenix has a comprehensive Water Resource Plan. Arizona Department of Water Resources maintains a Groundwater Site Inventory database (GWSI) and Wells Registry database and USGeological Survey (USGS) interactive map , which, can be used to identify and locate registered wellheads throughout the state. Arizona Department of Water Resources has mapped and manages 5 active management areas as required by the 1980 Arizona Groundwater Code, and manages an artificial aquifer recharge program ADEQ has mapped impaired and unique waters. Also see Water Resources Element of the General Plan
The local comprehensive plan contains a water quality protection element with goals calling for protection of identified water bodies and other water resource areas such as wetlands.	1	1	Water Resources element General Plan 2002 and 2011 Water Resource Plan; also Phx City Code 32A-17, 32B, 507 Tab A of COP Storm Water Policies and Standards Manual (April, 2011), as well as the State GW Management Act – Phx AMA, ADEQ Aquifer Protection Program, CWA 401, 402, 404. Wetlands exist but are negligible.
Identify key critical water resource areas for protection in jurisdiction's parks and open space plan.	1	0.5	Washes are currently protected in parks and preserves. Rio Salado Habitat Restoration Project's (City Park project) primary purpose is to restore and preserve this riparian area and restore critical habitat. This is addressed in current General Plan Parks and Open Space element. General note: most of this is outdated and does not include the area west of I-17 & north of Carefree Highway. This area is a critical drinking water source area because it is adjacent to Lake Pleasant. In addition, the Parks and Recreation Department does not have a standalone Parks and Open Space plan.
Cooperate in developing regional approaches to watershed protection and stormwater management.	2	2	Phoenix works with SRP on watershed protection and FCDMC on stormwater/floodplain coordination. Phoenix works with other municipalities on stormwater management issues. Phoenix participates in Stormwater Outreach for Regional Municipalities (STORM) and the Sustainable Cities Network (SCN). Both STORM and SCN focus education and outreach on a regional level.
REMOVE BARRIERS:			
Wetlands, washes, and other water bodies and buffer areas qualify for credit against local open space dedication/set-aside regulations.	1	1	Although buffer areas are not currently provided for, the water bodies themselves would qualify for this credit, according to Planning and Development policy/practice.
ADOPT INCENTIVES:			
Protected water bodies, washes, and buffer areas qualify for twice the credit (or more) against open space requirements set by the municipality.	1	0	
Restoration of degraded riparian/wetland areas and washes qualifies for additional open space credit within the local municipal system.	1	0.5	Yes, Zoning Chapter 6 provides for this, in some instances, but not consistently.

Transfer of density from protected riparian areas/buffers and washes to upland portions of development sites.	1	0.5	The protected riparian area or buffer portion of a site would be included as part of the site's overall allowable density, effectively allowing greater density in upland developed part of site.
ENACT REGULATIONS:			
Riparian and wash buffer areas required by local land use regulations • Limited basis/certain riparian areas only = 1 point • Buffer areas required for all riparian and wash areas = 2 points	1 to 2	1	Restrictions on development types exist within 100 feet of the Salt River.
Critical water resource areas cannot be counted in calculating allowable density on a site (e.g., on a 200-acre site with 50 acres of wetlands, only 150 acres can be used to calculate density under zone district regulations, and only those 150 acres may be developed).	N/A	N/A	Note: 404 permit governs development of stream channel and high water mark that essentially prohibits development in floodplains, washes, and channels. There are no "critical water resource areas" in Phoenix otherwise. There are some critical habitat areas (migratory birds and endangered species) directly between banks of the Rio Salado, which is not developable and is protected as a Water of the U.S.
Development in floodplains is prohibited or must demonstrate no adverse impacts upstream and downstream (See resources below for details on "no adverse impact" approach to floodplain management).	2	2	City Code Chapter 32B
Stormwater quality and quantity performance standards exist for development sites (e.g., restrictions on sedimentation levels, pre/post development flows).	1	1	City Code 32A-24 Grading and Drainage. On-site stormwater retention areas shall be adequate to contain the volume of water required by the City of Phoenix Stormwater Policies and Standards. All developments shall not increase the 100 year, two-hour peak runoff, change the time of the peak, nor increase the total runoff from its predevelopment values. City of Phoenix Stormwater Policies and Standards. 6.8.1 Stormwater Storage. All new development shall make provisions to retain the stormwater runoff from a 100-year, 2-hour duration storm falling within its boundaries. Note: This is equal to a 2.5 inch stormevent. City of Phoenix Stormwater Policies and Standards. 6.8.3. First Flush. The City has established a minimum level of control for new development at which stormwater pollution practices must be put in place. The minimum standard is the "First Flush", and consists of retaining or treating the first 0.5 inch of direct runoff from a storm event. Normally, this minimum level is met by following the City retention requirements to capture the 100-year, 2-hour storm. In the event the normal retention standards are waived, or a surface based bleed off for the retention basin is proposed, the First Flush provision shall apply.
Local regulations require restoration of degraded riparian areas and washes on a development site.	1	0	Not required
Compensation for damage to riparian areas and washes must be on a minimum 2:1 basis on- or off-site.	1	0	
Performance standards exist and are well enforced for stormwater discharges to wetlands that protect the hydrologic regimes and limit pollutant loads.	1	N.A.	Wetlands exist but are minimal in size and significance as a water resource. Many are simply result of flows at MS4 outfalls.
		10.5	Out of 17 possible points

1.A.2b

Protection of Water Bodies/Aquifers

QUESTION: Does the community have protection measures for source water protection areas through land use controls and stewardship activities?

GOAL: Protect source water areas from current or potential sources of contamination.

WHY: These practices will help safeguard community health, reduce the risk of water supply contamination, and potentially reduce water treatment costs.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Local land use plans identify aquifer recharge/source water areas and recommend protective measures.	N/A	N/A	
Require that all stormwater inlets carry a notice regarding discharge to receiving waters.	1	0.5	Pollution Awareness Markers are installed as standard practice for city-owned storm drain inlets, and are and an integral part of the Phoenix stormwater program This year, more than 1,500 PAMs were added to existing catch basins using a two part epoxy, and more than 14,000 PAMs have been installed since the program started. However this is not something that is required of others (e.g., private developers in new subdevelopments)
Map and publish wellhead and aquifer recharge areas to alert developers to potential restrictions.	N/A	NA	
ADOPT INCENTIVES:			
Identification of drinking water source protection and aquifer recharge areas with a dedicated funding source in place to purchase and protect such areas.	N/A	N/A	
Protection of critical water source areas qualifies for additional credit towards local open space requirements.	N/A	N/A	
ENACT REGULATIONS:			
Adopt well-head protection regulations/zones to prevent incompatible development and uses.	1	0	Note: development regulations/zones for well-head protection probably are not a significant driver in protection of the area's water quality.
Adopt aquifer protection regulations/zones to prevent incompatible development and uses.	1	1	This already exists at the state level through a rigorous state Aquifer Protection Permit program (including regulating drywells) which requires permits for activities with a potential to pollute. Additional development restrictions would provide little additional value.
		1.5	Out of 3 possible points

1.B OPEN SPACE PROTECTION

1.B.1 Open Space Protection

QUESTION: Does the jurisdiction have adequate open space in both developed and greenfield areas of the community?

GOAL: Create open space networks throughout a community that serve a dual function of providing recreational areas and assisting in the management of stormwater runoff.

WHY: In addition to providing open space throughout a community as an amenity, such a network can provide large areas that contribute little to stormwater loads and can provide large areas for the infiltration and purification of stormwater.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Adopt a community-wide open space and parks plan.	1	0	The Parks and Recreation Department does not have a community-wide parks and open space plan.
The local comprehensive plan contains an open space/parks element that recognizes the role of open space in sustainable stormwater management.	1	0	There is an Open Space Element in the General Plan but it does not address the role of open space in sustainable stormwater management.
REMOVE BARRIERS:			
Green infrastructure practices count towards local open space set aside requirements up to 50% of total.	1	1	City Code 32A-24 Grading and Drainage. On-site stormwater retention areas shall be adequate to contain the volume of water required by the City of Phoenix Stormwater Policies and Standards. All developments shall not increase the 100 year, two-hour peak runoff, change the time of the peak, nor increase the total runoff from its predevelopment values. City of Phoenix Stormwater Policies and Standards. 6.8.1 Stormwater Storage. All new development shall make provisions to retain the stormwater runoff from a 100-year, 2-hour duration storm falling within its boundaries. Note: This is equal to a 2.5 inch stormevent. City of Phoenix Stormwater Policies and Standards. 6.8.3. First Flush. The City has established a minimum level of control for new development at which stormwater pollution practices must be put in place. The minimum standard is the "First Flush", and consists of retaining or treating the first 0.5 inch of direct runoff from a storm event. Normally, this minimum level is met by following the City retention requirements to capture the 100-year, 2-hour storm. In the event the normal retention standards are waived, or a surface based bleed off for the retention basin is proposed, the First Flush provision shall apply.

Allow and encourage retrofits of abandoned or underutilized public lands to serve as permanent or temporary open space and green infrastructure sites.	1	1	City of Phoenix Stormwater Policies and Standards. 2.6.4. Linear Open Space. The City stresses the establishment of natural or semi-natural drainage corridors. Using natural corridors to accommodate stormwater is the City's preferred approach due to its multi-use flood control, trails, recreation, habitat. The City considers use of natural corridors for stormwater management a cost effective designation of required open space due to the increased risk of flooding in these corridors. City of Phoenix Stormwater Policies and Standards. 2.6.5. Storm Water Storage. Drainage corridors and storm water storage basins should be combined with open space, parks, and trails to create focal points for the community. These combined uses should be planned and designed to augment City of Phoenix parkland and increase open space with landscape amenities.
ADOPT INCENTIVES:			
Additional open space credits are eligible for green stormwater management facilities improved/designed for public recreational purposes.	1	0	Retention basins which contain recreational improvements in subdivisions would count towards the site's open space credit -- This would be true for onsite stormwater retention basins whether or not they contain recreational improvements within them. However, these facilities do not receive bonus or incentive open space credit.
Provide credit against open space impact fees for green roofs.	N/A	N/A	Note: the feasibility of green roofs in the desert southwest is questionable; they are uncommon and do not have a proven track record of successful implementation.
ENACT REGULATIONS:			
Adopt neighborhood policies and ordinances that work to create neighborhood—not development site—open space amenities that are within 1/4 to 1/2 mile walking distance from every residence.	1	0	
Adopt an open space impact fee to purchase passive open space that can assist in stormwater management.	1	0	
Adopt open space dedication and/or set aside requirements based on the demand generated by the development. As a baseline, use the average open space requirements adopted by the National Recreation and Park Assn. (e.g., 10 acres of community and neighborhood parks for every 1,000 persons in a development or fraction thereof).	1	0	
		2	Out of 8 possible points

1.C TREE PRESERVATION

1.C.1

QUESTION: Does the local government have a comprehensive public urban forestry program?

GOAL: Protect and maintain trees on public property and rights-of-way and plant additional trees to enhance the urban tree canopy.

WHY: Mature trees provide multiple community benefits, reduce overall stormwater runoff, and improve stormwater quality.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Survey and inventory existing trees on public lands and street rights-of-way. Document the characteristics and location of street trees and urban tree canopy to inform public tree planting, adoption, and maintenance programs.	1	1	Parks and Recreation Department is currently developing an inventory of existing publicly owned and maintained trees. It will be complete by summer of 2013.
Select tree species based on known performance for managing stormwater runoff. Publish list and make widely available for homeowners/others that plant street trees.	1	0	Trees are generally not selected for storm water runoff purposes, but for soil and water conservation qualities. Water Conservation office provides lists of drought tolerant trees to homeowners at outreach events, but they are not made "widely available"
Conduct education and outreach about tree protection, proper maintenance, and replanting opportunities through printed materials, workshops, events, and signage.	2	2	Tree Care Workshop, Citizen Forester Program and Partnerships with various non-profit organizations.
Adopt a policy to protect existing trees on local government development sites (e.g., municipal parking lots, municipal buildings).	2	0.25	There is no city-wide policy for protecting trees on local government development sites, it depends on the department and project manager. The closest thing in place is in the zoning ordinance: 507 Tab A, city-wide design standards, 3. Landscape Architecture, 3.1 Plant Materials.
Maintain an active tree maintenance program for public trees, including pest control, pruning, watering, and similar measures.	1	1	
REMOVE BARRIERS:			
Acknowledge trees as part of community infrastructure and develop a coordinated design for locating public utilities to provide enough space for mature tree canopy and root development.	2	1	Tree and Shade Master Plan 2010; guiding principle. However, there is limited coordination done with public utilities to allow enough space for mature tree canopy and root development.
ADOPT INCENTIVES:			
Provide free or reduced-price trees to homeowners to be used as street trees.	1	0	Program was cut in 2009.
ENACT REGULATIONS:			
Require any public trees removed or damaged during construction associated with private development to be replaced on- or off-site with an equivalent amount of tree caliper (e.g., remove a 24-inch diameter tree/replace with 6 four-inch diameter trees).	2	0.5	Policy based on language in the zoning ordinance: 507 Tab A, city-wide design standards, 3. Landscape Architecture, 3.1 Plant Materials. General note: this is categorized as a "presumption" in the Guidelines, not a Requirement. Does not provide for equivalent caliper replacement or offsite replacement option.
Adopt construction protection rules for all public trees (e.g., fencing, no storage of hazardous materials, avoid cutting into root zones).	1	0.25	Policy based on language in the zoning ordinance: 507 Tab A, city-wide design standards, 3. Landscape Architecture, 3.1 Plant Materials. General note: Presumption, not Requirement, and there is very little oversight for this.
		6	Out of 13 possible points

1.C.2	QUESTION:	Has the community taken steps to protect trees on private property?
	GOAL:	Preserve trees on private property and require replacement when trees are removed or damaged during development.
	WHY:	Mature trees provide multiple environmental, economic, and community benefits, including improved water and air quality, reduced heat island effects, lowered energy costs, and improved community aesthetics.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Community plans specifically include tree preservation and replacement as community goals.	1	0.5	Tree and Shade Master Plan 2010: goal 2 preserve, protect and increase. Zoning ordinance: 507 Tab A, city-wide design standards, 3. Landscape Architecture, 3.1 Plant Materials. General note: this is not a policy that is consistently or firmly *enforced.*
Conduct educational sessions for builders and developers regarding appropriate tree protection techniques and/or publish a technical tree protection manual.	1	0	
Follow maintenance and inspection timelines and meet canopy goals and milestones by ensuring old trees survive, replacing dead or diseased trees, and planting new trees.	2	0.5	Tree and Shade Master Plan 2010 General Note: due to budget cuts we are not replacing trees at a consistent rate. Currently we are removing more trees than we are planting.
REMOVE BARRIERS:			
Set up maintenance and inspection agreements for private properties meeting stormwater requirements or receiving stormwater fee credit for trees.	1	0	
Set up long-term maintenance and inspection schedules for trees on public lands.	1	.5	City of Phoenix Street Landscape Standards Parks and Recreation standard operating procedures for trees in city parks and some other non-street landscape public lands owned by the City.
ADOPT INCENTIVES:			
Support local non-profits that plant trees and provide educational services.	1	0.5	The Parks and Recreation Department partners with a variety of nonprofit organizations but we don't provide direct resources to non-profits
Provide financial incentives for tree purchases and planting.	1	0	Program cut in 2009
A tree fund has been established to receive in-lieu payments when trees must be removed from a development site to accommodate permitted projects.	2	0	There is a Tree Bank with Arizona Public Service; although somewhat related, this program does not meet the intent of this incentive.
Trees of a specified minimum size count towards a percentage of stormwater management requirements (e.g., partial credit given for each mature tree exceeding a specified height or canopy size).	1	0	
Trees over a specified minimum size (e.g., 3-inch caliper) protected during development are credited towards landscaping requirements. • meeting the established landscape requirement = 1 point • exceeding the established landscape requirement = 2 points	1 to 2	2	Zoning ordinance: 507 Tab A, city-wide design standards, 3. Landscape Architecture, 3.1 Plant Materials. General note: developers that do inventory salvage generally exceed their landscape requirements.

ENACT REGULATIONS:			
Require permits before removing trees on proposed development or redevelopment sites. Provide fines and/or stop-work authority for permit violations.	1	.5	City Code 507 I.2.d.(1) Landscape conservation plan. Prior to clearing or grubbing a site or obtaining a grading permit, an applicant must submit a landscape conservation plan indicating existing vegetation and salvage items.
Set minimum tree preservation standards for new development sites.	1	1	City Code Zoning 507 Tab A Guidelines for Design Review. Development should minimize removal of existing healthy non-native plants (trees 4" in caliper or greater); if removal is necessary, mature trees should be salvaged and utilized on site. The location of curb cuts for parking lots or driveways shall not cause the removal of mature canopy. City Code Zoning 507 Tab A Guidelines for Design Review Desert Preservation. Development should minimize the removal of existing healthy Sonoran vegetation. Natural washes and vegetation should be maintained in a natural state to avoid impeding drainage flows, for public safety and natural ecology; landscape plans should reflect the establishment of an on-site wash system for surface drainage. Significant vegetation or riparian habitats associated with significant natural washes should be preserved.
Require site plans or stormwater plans to include tree preservation.	1	1	See notes above
Require/allow tree replacement off-site for infill sites.	1	0	
		6.5	Out of 17 possible points

1.C.3	QUESTION:	Are street trees encouraged or required as part of road and public right-of-way capital improvement projects?
	GOAL:	Leverage existing capital funds to plant more street trees and add multiple benefits to the public right-of-way.
	WHY:	Street trees can help manage and reduce stormwater runoff while providing multiple public and environmental benefits.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Local comprehensive and transportation plans support the planting of street trees by all private and public development projects.	2	0	There are currently no plans to address this.
Capital improvement plans include tree planning as part of project budgets.	2	1	To a certain extent, depends on project and project manager.
ADOPT INCENTIVES:			
Offer incentives, such as reduced setbacks or increased building densities, in exchange for additional tree preservation beyond ordinance requirements.	1	1	Does not apply to *preservation* of existing trees, but Zoning Ordinance Chapter 6 (Section 608 I. Development Regulations. 2a Dwelling unit density. STREETSCAPE ENHANCEMENT CATEGORY 2 and 2.a) allows for additional density in R1-10 through R-5 districts for tree planting beyond ordinance. "Receive 10 bonus points for providing landscaping and irrigation for all front yards within development which include a minimum 1 24" box tree and 5 5-gal shrubs. 5 bonus points for each additional tree (minimum 15-gallon)"
ENACT REGULATIONS:			
All private and public developments are required to plant street trees in accordance with size, spacing, and other local government requirements.	1	1	City Code Zoning Ordinance 1207 General Standards and Guidelines. D.1 & 2. Shade Standards. All buildings over 5,000 square feet shall provide a minimum of 50% of all accessible public and private open space areas as shaded area of which 50% of the shade shall be provided by trees or trellised vines. E. Landscaping treatment shall be used for the entire site exclusive of buildings 30% tree canopy at maturity. City Code Zoning 507 Tab A Guidelines for Design Review. Development should minimize removal of existing healthy non-native plants (trees 4" in caliper or greater); if removal is necessary, mature trees should be salvaged and utilized on site. The location of curb cuts for parking lots or driveways shall not cause the removal of mature canopy. Street improvement projects shall be made in accordance with adopted streetscape designs.
New street designs and redesigns of existing streets take into account space for tree development and require necessary surface area and volume of soil dependent on type of tree species selected (this includes lateral root growth as well as direct downward growth to accommodate mature tree canopy and roots without adversely affecting other utilities).	2	1	City of Phoenix Street Landscape Standards General Note: Not expressly addressed in the City of Phoenix Street Planning and Design Guidelines.
Street specifications require permeable paving for sidewalks and other surfaces to reduce stormwater runoff and allow street trees to benefit from the available water.	2	0	
		4	Out of 10 possible points

Total score for SECTION 1: PROTECT NATURAL RESOURCES (INCLUDING TREES) AND OPEN SPACE

= _____39.5_____ (TOTAL POINTS AVAILABLE: 85)

2. PROMOTE EFFICIENT, COMPACT DEVELOPMENT PATTERNS AND INFILL

2.A INFILL AND REDEVELOPMENT

2.A.1

QUESTION: Are policy incentives in place to direct development to previously developed areas?

GOAL: Municipalities implement a range of policies and tools to direct development to specific areas.

WHY: Municipalities can realize a significant reduction in regional runoff if they take advantage of underused properties, such as infill, brownfield, or greyfield sites. Redeveloping already degraded sites such as abandoned shopping centers or underutilized parking lots rather than paving greenfield sites for new development can dramatically reduce total impervious area while allowing communities to experience the benefits and opportunities associated with growth.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Local plans identify potential brownfield and greyfield sites, and support their redevelopment.	1	1	The General Plan, Rio Salado Beyond the Banks Plan, West Phoenix Revitalization Plan, and Del Rio Area Brownfields Plan identifies potential brownfield sites and/or areas and supports their redevelopment.
Capital improvement plans include infrastructure improvements (water, sewer, road, sidewalk, etc. upgrades) for identified brownfield and greyfield sites.	1	1	Capital improvement program includes funding specifically for infrastructure improvements on public and private brownfields redevelopment projects.
Educate lending and financial institutions about benefits and local priorities of directing development to existing areas.	1	1	The city's Brownfields Land Recycling Program has and continues to educate lending/financial institutions on brownfields redevelopment.
Conduct outreach to the community to ensure support for local forms and patterns of development.	1	1	Outreach to the community is an inherent component in the city's Brownfields Land Recycling Program and is conducted city-wide and for specific brownfields redevelopment projects.
REMOVE BARRIERS:			
Establish a brownfields program to remove uncertainty regarding cleanup and liability issues.	1	1	The city formally established the Brownfields Land Recycling Program in 2000, which included a budget for staff and program expenses, and municipal grants. The program also received funding from the city's capital improvement bond program. These funds are provided as grants to the private sector and to city departments for brownfields redevelopment.
ADOPT INCENTIVES:			
Provide incentives such as density bonuses and accelerated permitting for brownfield and greyfield sites.	1	0.5	Expedited permitting is available for brownfield sites. Density bonuses would be reviewed on a case-by-case basis.
Adopt funding mechanisms for remediating/redeveloping brownfield and greyfield sites.	1	1	Capital Improvement Program bond funds are available for brownfield sites. Funds are provided to the private sector for public infrastructure improvements, development fees, and remediation. Funds are also provided to city departments for acquisition, investigation, and remediation of brownfield sites for public use.
Streamline permitting procedures to facilitate infill and brownfield redevelopment plan review.	1	1	Projects entered into the city's brownfields program are provided streamlined permitting and plan review processes.
Establish tax increment financing (TIF) districts to encourage redevelopment.	N/A	N/A	Note: TIFs are prohibited in Arizona.

ENACT REGULATIONS:			
In local codes, ordinances, and policies, the municipality differentiates between greenfield and infill development.	1	1	City of Phoenix Retention Policy Infill and Redevelopment Parcels Interpretation (07-09-2012) The City may waive its retention requirement for infill and redevelopment. For a parcel to be considered infill, the lot must be within a developed subdivision, but not developed during the normal build-out of the subdivision. To be considered a redevelopment parcel, the site must have been previously developed. In these cases, the City's retention requirement is waived. However, the post-development discharges are not to exceed the pre-development discharges, and are not to impact the City's storm sewer system. City Code Zoning 630 Residential Infill R-1 Multifamily Residential City Code Zoning 633 High Rise Incentive District – High Rise and Mixed Use City Code Zoning 703 G.9. Parking reductions for infill development
		8.5	Out of 9 possible points

2.B DEVELOPMENT IN AREAS WITH EXISTING INFRASTRUCTURE

2.B.1

QUESTION: Does the municipality direct growth to areas with existing infrastructure, such as sewer, water, and roads?

GOAL: Adopt policies, incentives, and regulations to direct new development to areas that have infrastructure, such as water and sewer. However, in situations where development is in areas with no sewer infrastructure, permitting alternative treatment options that can allow for higher density development or clustering of houses will reduce the overall water quality impact.

WHY: Sewer and water authorities can play a major role in directing a region's growth by determining when and where new infrastructure investment will occur. Well-drafted facility planning areas can direct growth by providing sewer service in areas least likely to impact water resources.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Local plans recommend/establish urban growth areas and urban growth boundaries. Development is encouraged within urban growth boundaries and discouraged outside of them.	1	0.5	City uses an infrastructure limit line along the North Black Canyon Corridor Plan. No infrastructure funding is provided outside the infrastructure limit line. The General Plan also provides Targeted Growth Areas (Growth Element).
Analyze which areas within the jurisdiction are appropriate for higher density development based on existing infrastructure capacity, cost of providing new services, and access.	2	2	Higher density development is focused toward the Village Cores and Infill Incentive Areas.
Capital improvement plans for public infrastructure (roads, water, sewer, etc.) target funding inside urban growth boundary.	2	0.5	City has not established an urban growth boundary separate from the infrastructure limit line noted above, but infrastructure projects target areas of active growth or where gaps in infrastructure exist between already developed areas, rather than in peripheral areas.
Local sewer/water authority capital improvement plans follow development policies established in local comprehensive plans and target areas with existing development/infrastructure.	1	1	CIP funding plans target (prioritize) areas with existing infrastructure and follow policies of General Plan (Growth element)
REMOVE BARRIERS:			
Development standards addressing landscaping, buffering, parking, and open space are tailored for infill areas to avoid creating unnecessary hurdles to development (e.g., imposing suburban parking requirements in high-density infill areas).	2	2	City Code Zoning 630 Residential Infill R1 Multifamily City Code Zoning 633 High Rise Incentive District – High Rise and Mixed Use
Remove prohibitions on accessory dwelling units in infill areas to increase density of development.	2	0	
Off-site, regional water retention/detention encouraged/allowed to avoid costly on-site retention in densely developed infill areas and to provide benefit to priority retrofit sites, such as schools.	2	0	
Package plants and other wastewater treatment trains are encouraged for development in limited circumstance areas where growth is appropriate but sewers/treatment capacity does not exist.	1	0	
Technical information and analysis on the effectiveness of various treatment systems are readily available to developers. Local governments have determined which systems work best for their soil conditions and topography and have made this information available to the development community.	1	N.A.	This is overseen by Maricopa County, not the City.
Allow a wide variety of housing types and sizes within infill areas and reduced minimum lot sizes.	1	1	City Code Zoning 630 Residential Infill R1 Multifamily City Code Zoning 633 High Rise Incentive District – High Rise and Mixed Use

ADOPT INCENTIVES:			
Increase development densities and allowable height in infill areas.	1	1	High Rise and Urban Residential zoning designations are only allowed in certain areas of the city that include Village Cores and infill areas. The Land Use Element, Goal 3, of the General Plan also discusses infill and allowable height and densities.
Reduce impact fees for infill development based on less demand for new infrastructure.	1	1	Impact Fee areas are only on the outlying portions of the city (Development Impact Fee Areas).
Create development incentives for green roofs (e.g., increased floor area ratio [FAR] bonus, additional building height).	N/A	N/A	Note: the feasibility of green roofs in the desert southwest is questionable; they are uncommon and do not have a proven track record of successful implementation.
Include provision in stormwater management requirement that reduces on-site management requirements for projects that decrease total imperviousness on previously developed sites.	1	0.75	Designers may utilize weighted runoff coefficients which results in lower retention volumes if more pervious areas are utilized. (e.g. pervious concrete runoff coefficient is reduced 10% versus impervious concrete, which may be somewhat conservative)
ENACT REGULATIONS:			
Zoning and land development regulations implement urban service areas/ urban growth boundary policies by restricting development in outlying areas.	1	0	
Adopt adequate public facility and concurrency ordinances that require adequate public infrastructure to be available when development comes on line (e.g., water, sewer, roads).	1	.5	City Code Chapter 32-33, 32-35 and 32-37. Planning and Development inspects and enforces construction of both city and private utility/infrastructure in subdivisions before any Certificates of Occupancy would be issued. Also see Chapter 28 Sewers Section 28-29 and Chapter 37-45 (Water). A public facilities ordinance or concurrency ordinance would require confirmation of adequate facilities much earlier in the development review process (e.g. prior to issuance of a building permit).
Adopt large-lot/agricultural zoning (e.g., 1 unit/160 acres) on fringe of city to restrict inappropriate greenfield development.	1	0	
Enact transitional compatibility standards to ensure that new denser infill development is compatible with existing neighborhoods/adjacent development.	1	.5	City Code Zoning 507 D.3. During pre-application meeting, a context plan is required that shows the relationship of the project's site to its adjacent setting (within 300 feet). Impact on adjacent property is to be discussed during the pre-application meeting, however, there are no compatibility requirements or standards. City Code Zoning Section 507A 1 F. Guidelines for Design Review – Character/Distinctiveness –Every project should strive to enhance the unique character of its neighborhood. (Goal not requirement)
		10.75	Out of 22 possible points

2.C MIXED-USE DEVELOPMENT

2.C.1

QUESTION: Are mixed-use and transit-oriented developments allowed or encouraged?

GOAL: Revise codes and ordinances to allow for the "by right" building of mixed-use and transit-oriented developments.

WHY: Mixed-use developments allow for the co-locating of land uses, which decreases impervious surfaces associated with parking and decreases vehicle miles traveled—resulting in a reduction of hydrocarbons left on roadways and reduced air deposition.

Transit-oriented development (TOD) produces water quality benefits by reducing: (1) land consumption due to smaller site footprints; (2) parking spaces and the impervious cover associated with them; and (3) average vehicle miles traveled, which, in turn, reduces deposition of air pollution into water bodies.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Comprehensive plans identify appropriate areas for higher-density mixed-use developments (e.g., at transit stops) and recommend policies to encourage their development.	1	1	The city of Phoenix General Plan and associated core plans identify the appropriate areas. The Reinvent PHX project is currently identifying areas surrounding light rail stations.
Local capital improvement plans and funding are targeted to areas appropriate for mixed-use development.	2	2	City encourages local capital improvement plans and makes effort to target city projects towards mixed-use development and encourages transit-oriented development . For example, along Metro Light Rail, CityScape retail downtown, Centennial Way improvements downtown.
REMOVE BARRIERS:			
Zoning ordinances can create by-right mixed-use and transit-oriented development districts or overlays through amendments.	1	1	City Code Zoning 633 High Rise Incentive District – High Rise and Mixed Use allows greater building height and density within the central corridor of the infill area. City Code Zoning 662 &663 Transit Oriented Zoning Overlay Districts One and Two
Initiate map amendments to designate mixed-use and transit-oriented development areas, eliminating the need for developers to secure zoning amendments.	1	1	
ADOPT INCENTIVES:			
Parking requirements are reduced to reflect decreased automobile use.	1	1	In the Adaptive Reuse Program and TOD Overlay (Section 702 and 662, 663 of the Zoning Ordinance. Downtown Code does not require parking standards.
Credit given for adjacent on-street parking, which can count for local parking requirements.	1	1	In the TOD Overlay (Section 662 and 663 of the Zoning Ordinance.
Shared parking and alternative parking arrangements encouraged.	1	1	In the Adaptive Reuse Program and TOD Overlay (Section 702 and 662, 663 of the Zoning Ordinance.
Mixed-use districts/areas feature increased densities and height.	1	1	Mixed use development is focused toward the Village Cores and Infill Incentive Areas
Accessory parking structures are not counted against maximum floor area ratio (FAR) on a site.	1	0	Accessory parking structures are counted against FAR.

ENACT REGULATIONS:			
Zoning code requires a minimum mix of uses and minimum density in designated mixed-use and transit-oriented development areas.	1	1	City Code Zoning 630 Residential Infill R1 Multifamily. Requires a minimum of 50% of the total gross area to be residential when combined with commercial office uses. City Code Zoning 633 High Rise Incentive District – High Rise and Mixed Use. With certain exceptions, any development in this district shall have at least 50% of the total gross floor area devoted to residential use, excluding parking. For mixed commercial/residential development, the commercial may be increased to 75% with certain requirements. City Code Zoning 662 &663 Transit Oriented Zoning Overlay Districts One and Two do not require a mix of uses.
Auto-oriented uses and drive-throughs are restricted or prohibited in mixed-use and transit-oriented development areas.	1	.5	City Code Zoning 662 &663 Transit Oriented Zoning Overlay Districts One and Two prohibit drive through business. City Code Zoning 633 High Rise Incentive District does not prohibit or restrict such uses.
		10.5	Out of 12 possible points

Total score for SECTION 2: PROMOTE EFFICIENT, COMPACT DEVELOPMENT PATTERNS AND INFILL

= _____29.75_____ (TOTAL POINTS AVAILABLE: 43)

3. DESIGN COMPLETE, SMART STREETS THAT REDUCE OVERALL IMPERVIOUSNESS

3.A STREET DESIGN

3.A.1

QUESTION: Do local street design standards and engineering practices encourage streets to be no wider than necessary to move traffic effectively?

Do street designs vary according to:

- street type (arterial streets, collector streets, neighborhood streets) and
- urban context (urban core, transit station area, suburban center, general suburban, rural)?

Do policies allow narrow neighborhood streets designed to slow traffic and create safer conditions for pedestrians and bicyclists?

GOAL: Appropriate street widths allow narrower lanes for certain street types, thereby reducing overall imperviousness.

WHY: The width of travel lanes, parking lanes and sidewalks should be tailored to the urban setting. Where appropriate, narrowing travel lane width to 10-11 feet, rather than the standard 12-13 feet, can significantly reduce the total amount of impervious surfaces. Such streets can also substantially improve conditions for walking, biking, and using transit, which reduces automobile use and overall demand for parking spaces.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Comprehensive plan/transportation plan emphasizes alternative modes of transportation (walking, biking, and transit) to reduce vehicle miles traveled and width and prominence of roads/streets.	1	1	Multiple elements of the General Plan emphasize alternative modes of transportation. Bicycling and Circulation.
Comprehensive/transportation plan calls for distributing traffic across several parallel streets, reducing the need for high capacity streets with wide rights-of-way.	1	1	Phoenix has Street Class Map and Traffic Volume Maps to layout grid system to assign vehicular trips to appropriate roadways.
Comprehensive/transportation planning process brings emergency response and other local government departments (e.g., public works, utilities) to the table early in the process to discuss street design.	1	1	Phoenix has standard utility location policy followed for Street Designs.
Adopt formal bicycle/pedestrian master plan.	1	1	Bicycle element General Plan 2002; Phoenix has formal Bikeway Administrator and Program, bike path network, and bicycle will be integral part of Green Streets Policy
Create “safe routes to school” programs or other pedestrian/bike safety initiatives.	1	1	Program created and average of 5 grants per year.
Make consistent improvements to walking/biking conditions or develop a formal bicycle/pedestrian master plan.	1	1	City continues to make consistent efforts to improve walking/biking conditions and has developed a formal bicyle/pedestrian masterplan. Inclusion of multi-modal transit now included in review process for all overlays.
REMOVE BARRIERS:			
Comprehensive plan endorses context-sensitive street design with narrower streets in appropriate locations.	3	1	The Comprehensive Plan Circulation Section endorses context sensitive street design, including for residential neighborhoods and local streets. However, there were no specific recommendations for narrower streets. Note from City: C.Kowalsky Notes: Phoenix Street Classification exists to address context-sensitive street designs. General Note: Tt found the street classification system to require overly wide pavement widths and travel lanes for local, residential streets.
Improve pedestrian crossing at intersections to encourage walking.	2	1	Formal ADA Program to remove barriers

Consolidate utilities in street right-of-way to improve sidewalk design and function.	1	1	City Code Chapter 32-33 D(3)
Negotiate with state department of transportation or county transportation department to allow different design standards for regional roads passing through downtowns or other key areas.	3	0	
Promote street standards for fire safety that include attributes of narrow streets (20 feet widths) while identifying factors relevant to local government departments involved with streets such as public works, engineering, and utilities.	2 to 3	0	General Note: In City of Phoenix Street Planning and Design Guidelines, local single family residential streets require 28 to 32 feet of pavement width; minor residential collector streets require 40 feet. Other street classifications also require more pavement width and travel lane area than recommended in green infrastructure/low impact development guidelines.
Take formal control of state or county roads within city boundaries to ensure power over design and operations.	2	0	
ADOPT INCENTIVES:			
Developments that provide comprehensive pedestrian/bicycle circulation systems allowed reducing number of vehicle parking spaces. (See parking section below for greater detail.)	1	1	Accepted T.O.D. standards that allow for reduction in parking/allowance within ordinance for shared use parking.
Developments with approved comprehensive mobility/transportation plans allowed building narrower, less costly streets and alleys.	1	0	No current plans exist but the City has developed and implemented a couple of transportation corridors to a narrower width. Examples include 2nd Avenue from Madison Street to Fillmore Taylor Mall from 1st Street to 3rd Street, and 1st Street from Polk St to McKinley St. In addition we have under development Roosevelt St from Central Avenue to 7th Street. Most of the corridors for consideration have been in the downtown area but we are actively investigating other potential re-purposing transportation corridors that have change in character.
ENACT REGULATIONS:			
Revamp local government technical street specifications to allow context- sensitive, innovative street design with narrower travel lanes, without curb and gutter, etc., in appropriate circumstances (See Institute of Transportation Engineers Recommended Practice document below).	3	0	
Emergency response professionals and other local government departments involved with streets (e.g. public works, engineering, utilities) have endorsed or adopted design standards for narrower neighborhood streets.	1	1	Yes, private access way standards for residential and commercial uses allowed.
Development review process involves emergency response early on to reach consensus on appropriate project street design and access.	1	0	
Development review process requires submittal of project pedestrian/bicycle circulation plans with safe street routes and other pedestrian/bicycle-friendly features in addition to traffic circulation plans for larger developments.	1	0	
Apply formal connectivity index[1] or other measures to ensure adequate internal street and pedestrian/bicycle connections.	2	0	
Zoning/subdivision regulations require minimum number of connections between new project and surrounding developments and neighborhoods.	2	0	
		11	Out of 32 possible points

[1] Connectivity index refers to the directness of links and the density of connections in path or road network. A well-connected road or path network has many short links, numerous intersections, and minimal dead-ends (cul-de-sacs). As connectivity increases, travel distances decrease and route options increase, allowing more direct travel between destinations, and creating a more Accessible and Resilient system. Source: Online Travel Demand Management Encyclopedia, http://www.vtpi.org/tdm/tdm116.htm.

3.A.2	QUESTION:	Are shared driveways, reduced driveway widths, two-track driveways, and rear garages and alleys encouraged for all single-family developments?
	GOAL:	Encourage alternative forms and decreased dimensions of residential driveways and parking areas.
	WHY:	Off-street parking and driveways contribute significantly to the impervious areas on a residential lot. Reducing such dimensions can minimize the amount of stormwater runoff from a site.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
REMOVE BARRIERS:			
Allow developments that utilize shared driveways and rear-loaded garages to permit overnight parking in driveways and on-street.	1	1	Not prohibited.
Development code prohibits homeowner covenants forbidding overnight parking in driveways, on-street overnight parking, and shared driveways.	N/A	N/A	
ADOPT INCENTIVES:			
Allow developments with narrow driveways and rear-loaded garages to reduce number of parking spaces for guests.	1	0	No
Zoning/subdivision regulations require minimum number of connections between new project and surrounding developments and neighborhoods.	1	1	Chapter 32 - Subdivisions / Zoning Ordinance 507 Requires minimum connections for arterial and collector roads.
ENACT REGULATIONS:			
Shared driveways are permitted or required for single-family residential developments.	2	1	Encouraged not required.
Minimum widths for single-family driveways reduced to 9 feet.	2	0	
Two-track driveways are allowed by technical street/subdivision specifications.	2	0	
Single-family residential developments encouraged/required to be designed with minimum percentage of alley-accessible, rear-loading garages.	2	.5	General Note: This applies in the downtown area.
		3.5	Out of 11 possible points

3.B GREEN INFRASTRUCTURE ELEMENTS AND STREET DESIGN

3.B.1

QUESTION: Are major street projects required to integrate green infrastructure practices as a standard part of construction, maintenance, and improvement plans?

GOAL: Formally integrate green infrastructure into standard roadway construction and retrofit practice.

WHY: Consistent projects to improve or repair streets provide opportunities to include green infrastructure retrofits as part of larger project budget, design, and construction.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Comprehensive/transportation plans promote green infrastructure practices in street design.	1	0.5	The City is currently developing a Complete Streets Program and Green Infrastructure is one of the components being evaluated. We have done some bio-retention or "water-harvesting" measures in the downtown area but it is on a case by case or pilot basis.
Street project cost estimates include green infrastructure designs and assess cost savings from reduced hard infrastructure.	1	0.25	The transportation projects that the City supports both with internal funding and developer driven projects have several requirements for landscaping along the public right-of-way. There are some limitations due to the Arizona Department of Water Resources that does not allow landscape "turf" in the public right-of-way. City projects do have some elements of cost estimates for green infrastructure based on traditional landscaping techniques. Cost savings from reduced hard infrastructure is not assessed.
REMOVE BARRIERS:			
Technical street specifications allow/require integration of green infrastructure elements into street project construction.	2 to 3	1	City of Phoenix Street Planning and Design Guidelines. Traffic calming devices include several standard drawings of curb bumpout and planters that could accommodate bioretention. City of Phoenix Street Landscape Standards allow and provide specifications for drainage swales. Street trees are encouraged and existing street trees are protected for shading a streetscape. General Note: Green Infrastructure practices are not discussed, encouraged, or required in the Street Planning and Design Guidelines and Street Landscape Standards. No specifications are provided for Green Infrastructure BMPs other than drainage swales, (which appear to solely have a drainage function).
Allow street-side swales to replace conventional curb and gutter for managing stormwater and for separating sidewalks from street traffic in appropriate circumstances.	2 to 3	0	City Code 32-289A. Urban density of 3 or more lots per gross area must have paved and curb streets. General Note: There is no express allowance for bioretention or swales in those cases where curb is not required. City Code Zoning 702 B.4.b. &c. Indicates that if drainage is required, only curbs can be used, otherwise could be bound by landscape plot. General Note: This implies that bioretention would not be allowed or would be greatly limited.
ADOPT INCENTIVES:			
Undertake consistent effort to secure state and federal funds (e.g., transportation enhancements) to pay for green infrastructure elements.	2 to 3	2	City projects that have narrowed existing roads (examples provided previously) have predominately used federal funding. We have been fortunate to use Transportation Enhancements (TE) and Congestion Mitigation & Air Quality (CMAQ) funds. The city is actively pursuing federal and state funding opportunities, but they do not always specifically target G.I.
Streets with green infrastructure count towards stormwater requirements.	2 to 3	0	No

ENACT REGULATIONS:			
Adopt green infrastructure retrofit standards for major street projects.	3 to 4	0	
Adopt technical specifications and design templates for green infrastructure in private and public rights-of-way.	3 to 4	2	City of Phoenix Street Planning and Design Guidelines. Traffic calming devices include several standard drawings of curb bumpout and planters that could accommodate bioretention. City of Phoenix Street Landscape Standards. Provide diagrams/specifications for vegetated swales designed for drainage in median and right-of-way. General Note: No technical specifications or design templates are provided.
All local road projects required to allocate a minimum amount of the total project cost to green infrastructure elements.	1	0	
		5.75	Out of 23 possible points

3.B.2		
	QUESTION:	Do regulations and policies promote use of pervious materials for all paving areas, including alleys, streets, sidewalks, crosswalks, driveways, and parking lots?
	GOAL:	Build and retrofit these surfaces with pervious materials to reduce stormwater runoff and its negative impacts. NOTE: While eliminating sidewalks or placing sidewalks on only one side of the road can reduce impervious cover, this strategy is typically most appropriate for rural areas. However, other effective strategies can achieve the same runoff reductions that will not limit residents' options for recreation and transportation.
	WHY:	Streets, sidewalks, and other hard surfaces contribute a large portion to a municipality's total imperviousness. Making these impervious surfaces more permeable protects water quality, reduces flooding, and can recharge groundwater.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Sponsor/approve pilot programs to determine appropriate pervious materials for different paving areas (e.g., permeable concrete for sidewalks, permeable pavers for driveways), as well as process for installation and maintenance.	1	1	Taylor Mall, Helen Drake Senior Center, Manzanita Park, for example. City does approve and sponsor such pilot programs on a case-by-case basis.
Pilot project results incorporated into standard practice for all new paved areas and retrofits of existing paved surfaces.	1	0	City has not incorporated into standard practice for all new paved areas and retrofits of existing paved surfaces but is currently evaluating the implementation of the City's Complete Streets Program that will include some of the techniques of GI.
Adopt policy to replace impervious materials with pervious materials where practical.	1	0	City has not yet adopted a policy to replace impervious materials with pervious materials. There are operations and maintenance aspects that still needs to be evaluated
REMOVE BARRIERS:			
Technical street specifications allow pervious paving materials in appropriate circumstances (e.g., not allowed over aquifer recharge areas).	1	0	City of Phoenix Street Planning and Design Guidelines do not allow pervious paving materials.
ADOPT INCENTIVES:			
Create formal program offering incentives (e.g., cost sharing, reduction in street widths/parking requirements, assistance with maintenance) to property owners who utilize pervious pavement elements.	1	0	Currently, the City doesn't have any such formal program that offers any incentives.
ENACT REGULATIONS:			
Adopt requirement that some percentage of parking lots, alleys, or roads in a development utilize pervious materials.	1	0	City of Phoenix Street Planning and Design Guidelines do not allow pervious paving materials.
Development approvals that allow/require use of pervious materials include requirements for continuing maintenance/cleaning of pervious surfaces.	1	0	City of Phoenix Street Planning and Design Guidelines do not allow pervious paving materials.
		1	Out of 7 possible points

Total score for SECTION 3: DESIGN COMPLETE, SMART STREETS THAT REDUCE OVERALL IMPERVIOUSNESS

= _____21.25_____ (TOTAL POINTS AVAILABLE: 73)

4. ENCOURAGE EFFICIENT PARKING

4.A REDUCED PARKING REQUIREMENTS

4.A.1

QUESTION: Does your local government provide flexibility regarding alternative parking requirements (e.g., shared parking, off-site parking) and discourage over-parking of developments? Do parking requirements vary by zone to reflect places where more trips are on foot or by transit?

GOAL: Match parking requirements to the level of demand and allow flexible arrangements to meet parking standards.

WHY: Inflexible parking requirements that do not allow for alternative approaches, as well as standards that require too much parking for specific uses increase the amount of impervious surface in a development. Over-parking a development also encourages greater vehicle use and detracts from the overall pedestrian environment.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
The comprehensive plan recognizes the advantages to reduced parking requirements generally and specifically for mixed-use and transit-oriented developments.	1	1	The Circulation Element, Goal 2F of the General Plan recognizes the listed advantages.
The comprehensive plan recommends alternative, flexible approaches to meeting parking demands (e.g., shared parking, counting on-street spaces towards site parking requirements).	1	1	The Circulation Element, Goal 2F, of the General Plan recognizes the listed advantages
Comprehensive/bicycle plans recommend provision of bicycle parking spaces/storage lockers and concomitant reduction in vehicle parking space requirements.	1	1	The Bicycle Element, Goal 2, of the General Plan recommends such provisions.
REMOVE BARRIERS:			
Allow flexibility in meeting parking space requirements through shared parking, off-site parking, and similar approaches.	2	2	City Code Zoning 702.E. 2. Allows the applicant to use a shared parking model to predict parking demand. City Code Zoning 702 A.4. Nonresidential uses can have parking on another lot, but it must be used exclusively for the subject's use (not shared).
Permit businesses with different peak demand periods to share their required parking spaces.	2	2	City Code Zoning 702.E. 1. The City may require a parking management study and reduce parking requirements if there is a retail center or mixed use project with more than 100,000 sq.ft. of public assembly use (e.g. move theater). City Code Zoning 702.E. 2. Allows the applicant to use a shared parking model to predict parking demand. The shared parking model considers different peak uses.
ADOPT INCENTIVES:			
Permit reduction in vehicle parking spaces through the provision of a minimum number of bicycle parking spaces.	1	0	
Allow by-right reduction in required parking spaces (e.g., 25%) in mixed-use and transit-oriented developments and districts.	1	1	In the TOD Overlay (Section 662 and 663 of the Zoning Ordinance
Permit developers to undertake parking studies to establish that specific developments (e.g., senior housing, affordable housing) require fewer parking spaces than typical projects.	1	1	Use Permit process allows reduction in parking for senior housing.

Create parking districts to finance/construct centralized parking lots/ structures as shared parking facilities to reduce on-site parking.	1	0	Currently, the City doesn't have such practices/ policies in-place.
ENACT REGULATIONS:			
Revise parking regulations to reduce minimums below standard ITE (Institute of Transportation Engineers) requirements based on analysis of local developments and actual parking demand/experience.	2	2	City Code Zoning 702 C Office buildings with leasable areas greater than 600,000 sq.ft.,, retail establishments with greater than 50,000 sq.ft. of leasable area. City Code Zoning 702 D Large scale commercial retail developments See also parking reductions associated with certain districts below.
Charge developers for every space beyond parking minimums to offset environmental impacts.	2	0	
Enact parking standards that allow credit for adjacent on-street parking.	2	1	City Code Zoning 702.G.9 Reductions in parking for infill development include on-street parking adjacent to or alongside the project. Code does not address on-street parking associated with new development.
Create zones with reduced parking requirements (e.g., transit overlay districts, mixed-use activity centers, multi-modal districts).	2	2	City Code Zoning 643 F.1. Downtown had no minimum parking requirements. City Code Zoning 645 Warehouse District has no minimum parking requirements. City Code Zoning 662 Zoning Interim Transit Oriented Zoning District One allows reduction in parking requirements within certain distance of rail stop; maximum parking limit. City Code Zoning 663 Interim Transit Oriented Zoning District Two City Code Zoning 702 E.5 Village Cores allows reduction in parking based on multi-modal transportation study. City Code Zoning 702 E.9. Infill Development allows on-street parking to be counted toward reducing parking requirements.
Waive all parking minimums in downtown and other locations that are pedestrian-oriented and/or have good transit access.	2	1	City Code Zoning 643 F.1. Downtown had no minimum parking requirements. City Code Zoning 645 Warehouse District has no minimum parking requirements. City Code Zoning 662 & 663 Transit oriented development may reduce minimum parking requirements by 10 to 25% for residential and multifamily developments and by 5 to 15% for commercial development, and maximum parking limit (125% of the minimum requirement) is established. However, a minimum requirement parking still exists in these transit districts.
Adopt parking standards that reduce requirements based on sliding scale tied to degree of walkability/transit access locations (20% reduction in areas well served by bus, 30% reduction in areas served by rail stations).	2	2	City Code Zoning 662 & 663 Transit oriented development may reduce minimum parking requirements by 10 to 25% for residential and multifamily developments and by 5 to 15% for commercial development, and maximum parking limit (125% of the minimum requirement) is established. However, a minimum requirement parking still exists in these transit districts.
Require shared parking agreements where appropriate complementary uses exist.	2	1	City Code Zoning 702 E 1. A parking management study for shared parking may be required for retail and mixed use development project with large public assembly spaces. City Code Zoning 702 E 2. Allows the applicant to use a shared parking model to predict parking demand. The shared parking model considers different peak uses. Share parking agreements may be developed under these options.

Adopt maximum parking caps (e.g., 125% above minimum) for multi-family and commercial developments.	2	1	City Code Zoning 702 D Large scale commercial retail developments requires a minimum of 4 spaces per 1,000 sq.ft. and a maximum of 5 spaces per1,000 sq.ft. City Code Zoning 662 & 663 Transit oriented development establishes a maximum parking limit of 125% of the minimum requirement.
Reduce minimum parking space size based on analysis of average vehicle size in jurisdiction.	2	0	
		19	Out of 29 possible points

4.B TRANSPORTATION DEMAND MANAGEMENT ALTERNATIVES

4.B.1

QUESTION: Can developers use alternative measures such as transportation demand management or in-lieu payments to reduce required parking?

GOAL: Provide flexibility to reduce parking in exchange for specific actions that reduce parking demands on site.

WHY: Incentives such as transit passes, vanpool arrangements, flexible work schedules, market-priced facilities, and separate leasing for spaces in apartments and condominiums have quantifiable impacts on parking demand. Incorporating them into parking requirements creates the opportunity to meet demand with less impervious cover.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Comprehensive/transportation plans recognize transportation demand management as an approach to reducing vehicle miles traveled and parking requirements.	1	1	The Circulation Element, Goal 2G, of the General Plan.
REMOVE BARRIERS:			
Rather than include parking spaces with an apartment lease, allow tenants to opt-out by treating parking as a separate optional lease agreement.	1	0	
ADOPT INCENTIVES:			
Allow businesses that offer employee transit passes, provide vans for employee commuting, allow flexible working arrangements, or charge market rates for parking to 1) provide fewer parking spaces or 2) pay less into a parking district fund for required parking spaces.	2	0	
Allow developers to make in-lieu fee payments for parking. Fees utilized by local government/parking authority to provide off-site parking lots/structures.	1	0	
Provide mechanisms for car sharing in transit-oriented development. Where done, area parking requirements are reduced.	1	0	
ENACT REGULATIONS:			
Create a parking district and allow/require businesses to support public garages rather than provide their own on-site parking.	1	0	
Require large developments to adopt transportation demand management techniques to lower vehicle use and parking demand.	1	0	
		1	Out of 8 possible points

4.C MINIMIZING STORMWATER FROM PARKING LOTS

4.C.1

QUESTION: Are there requirements for landscaping designed to minimize stormwater in parking lots?

GOAL: Require substantial landscaping to help reduce runoff.

WHY: Parking lots generate a large amount of impervious cover. Requiring landscaping reduces the environmental impact of parking and can provide additional community benefits by providing shade and, if appropriately placed, creating natural barriers between pedestrians and cars.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Comprehensive plan calls for landscaping in parking lots to help reduce stormwater runoff.	1	1	The Natural Resources Conservation and Energy, Goal 1, of the General Plan.
REMOVE BARRIERS:			
Allow alternative or innovative landscaping solutions that provide stormwater management functions to count towards perimeter or other landscaping requirements.	1	.5	City Code Zoning 507 Tab A Guidelines for Design Review. Surface site drainage and retention should be integrated with overall landscape design. Required landscape setbacks adjacent to perimeter streets may use the setbacks for stormwater retention.
ADOPT INCENTIVES:			
Parking lot landscaping on parking structures credited towards meeting local stormwater management requirements.	1	0	
Give additional landscaping credit for preservation of large, mature trees within parking lots.	1	0	
Do not count parking structures with green roofs against the allowable floor area ratio of a site.	N/A	N/A	
ENACT REGULATIONS:			
Adopt parking lot landscape regulations that require provision of trees, minimum percent of parking lot interior area to be landscaped (e.g., 10%), and minimum sized landscaping areas (e.g., minimum of 25 square feet for island planting areas).	1	.5	City Code 507 Tab A Guidelines for Design Review. 5% of the parking lot is required to be landscaped.
In parking lot landscaping regulations, specify the types and sizes of shrubs and trees most appropriate for controlling/reducing stormwater runoff.	1	0	
Adopt standards requiring a minimum area of the parking lot to drain into landscaped areas.	1	0	
Require the management of runoff from parking lots through green infrastructure practices, including trees, vegetated islands, swales, rain gardens, or other approaches.	1	0	
Enact specific alternative landscaping and parking regulations to support infill development (parking requirements, parking lot landscaping options that focus on perimeter landscaping to encourage smaller lots, etc.).	2	0	
Require parking structures to incorporate green roofs to reduce stormwater runoff.	1	0	

Reduce drive aisle widths in parking lots to decrease the amount of pervious surface. For multi-family developments, drive aisles can be shared. In commercial developments, typical drive aisles can be reduced 5–10%.	1	0	
		2	Out of 12 possible points

Total score for SECTION 4: ENCOURAGE EFFICIENT PARKING

= _____22_____ (TOTAL POINTS AVAILABLE: 49)

5. ADOPT GREEN INFRASTRUCTURE STORMWATER MANAGEMENT PROVISIONS

5.A	GREEN INFRASTRUCTURE PRACTICES	
5.A.1	QUESTION:	Are green infrastructure practices encouraged as legal and preferred for managing stormwater runoff?
	GOAL:	Make all types of green infrastructure allowed and legal and remove all impediments to using green infrastructure (including for stormwater requirements), such as limits on infiltration in rights-of-way, permit challenges for green roofs, safety issues with permeable pavements, restrictions on the use of cisterns and rain barrels, and other such unnecessary barriers.
	WHY:	Green infrastructure approaches are more effective and cost efficient than conventional stormwater management practices in many instances, and provide other substantial community benefits.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Inform the public, through education and outreach programs, that green infrastructure practices can manage stormwater runoff on their property.	2	2	The City has recently begun to include GI and LID in outreach efforts. Presentations to Future City teachers and mentors included tips on stormwater management through LID, and information is available on the stormwater website. In addition, we are working with SCN and STORM on an LID workshop scheduled for early 2013. The City also participates in a regional Tree & Shade Summit to educate local municipalities, landscape architects, etc., on green infrastructure practices.
Create a green infrastructure workshop or training program for internal and external reviewers to ensure that the stakeholders who use this tool will have the ability to understand and use it effectively.	1	1	In addition to the Tree and Shade Summit discussed above, the City is working with STORM and SCN on an LID workshop scheduled for early 2013.
REMOVE BARRIERS:			
Development and other codes encourage and allow property owners to adopt home-based green infrastructure practices, such as rain gardens and rain barrels.	2	1	General Note: Codes appear to allow property owners to adopt home-based Green Infrastructure practices; however such practices are not actively encouraged in the codes.
Review and change, where necessary, building codes or other local regulations to ensure that all local government departments/agencies have coordinated with one another to ensure that green infrastructure implementation is legal, e.g. remove restrictions on downspout disconnection.	2	2	Section 1803.3 of the Building Code states that swales may be used to divert water away from the foundation of buildings and may be located within 10 feet of the building. Section 1802.2.3 of the Building Code states that the groundwater must be greater than 5 feet below the bottom of the foundation and provides an exception that a subsurface soil investigation is not required if waterproofing is provided in accordance with section 1807. Section 1803.1 states that the ground must slope away from the foundation at a slope no less than one unit vertical to 20 units horizontal. This is conducive with recommended side slopes for most BMPs. Section P2601.2 of the Residential Housing code allows grey water to be discharged to an approved gray water recycling system. Section AO102 allows for the use of gray water for toilet flushing with proper disinfection and coloring. 2006 Phoenix Building Code section 1509.3 provides guidelines for tanks on rooftops. General Note: None of the codes prohibit green infrastructure but there are no standards for implementation either. The only barrier is on page 30 of the Street Landscape Standards where street median islands 4 feet or less are required to be pavers or hardscape.

ADOPT INCENTIVES:			
Credit green infrastructure practices towards required controls for stormwater runoff.	2	2	General Note: 100-year 2-hour storm event retention is required of development sites, regardless of techniques employed. If onsite retention is considered GI practice, then the City accomplishes this. Per the MS4 Fact Sheet, it seems EPA does consider onsite retention as a form of LID. However, the City generally does not provide additional credit for other forms of LID/Green Infrastructure, except that weighted runoff coefficients may be used for areas that reduce imperviousness in calculation of the required stormwater retention capacity, and other onsite rainwater harvesting vessel capacities would count as part of the site's overall retention volume.
Establish a "Green Tape" expedited review program for applications that include green infrastructure practices.	2	0	
Reduce stormwater utility rates based on the use of green infrastructure practices.	2	0	Rates are based on water connection only. The amount of impervious surface is not included in the calculation.
ENACT REGULATIONS:			
Zoning and subdivision regulations specifically permit green infrastructure facilities, including but not limited to: (1 point for each technique to a maximum of 3 points) • Infiltration approaches, such as rain gardens, curb extensions, planter gardens, permeable and porous pavements, and other designs where the intent is to capture and manage stormwater using soils and plants; • Water harvesting devices, such as rain barrels and cisterns; and • Downspout disconnection.	1 to 3	2	City of Phoenix Stormwater Policies and Standards. Developments must retain the 100-year, 2-hour duration storm on-site through varying drainage and water storage techniques. However, engineered Green Infrastructure practices listed are not specifically permitted.
Developers are required to meet stormwater requirements using green infrastructure practices where site conditions allow. Developers must provide documentation for sites that do not allow on-site infiltration, reuse, or evapotranspiration to meet locally determined performance stormwater management standards.	3 to 4	2	City of Phoenix Stormwater Policies and Standards. Developments must retain the 100-year, 2-hour duration storm on-site through varying drainage and water storage techniques. City Code Zoning 507 Tab A Guidelines for Design Review. Surface site drainage and retention should be integrated with overall landscape design. However, Green Infrastructure practices are not specifically required to meet these standards.
		12	Out of 20 possible points

5.A.2		
	QUESTION:	Do stormwater management plan reviews take place early in the development review process?
	GOAL:	Incorporate stormwater plan comments and review into the early stages of development review/site plan review and approval, preferably at pre-application meetings with developers.
	WHY:	Pre-site plan review is an effective tool for discussing with developers alternative approaches for meeting stormwater requirements. This will incorporate green infrastructure techniques into new projects at early design stages, well before construction begins.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Encourage/require a pre-site plan meeting with developers to discuss stormwater management and green infrastructure approaches. • Voluntary = 1 point • Mandatory = 2 points	1 to 2	1	Pre-Application meetings are mandatory for developers of large projects to discuss *zoning, civil, and traffic requirements*. The civil review aspect includes stormwater management requirements, but Green Infrastructure discussion is optional. Smaller projects still have open discussion with the site plan reviewers which include these topics.
Include landscape architects in design and review of stormwater management plans.	1	0	Our Stormwater plans are for construction only. Including Architects in the Grading design would have to be approved by the various associations that represent the development community.
ADOPT INCENTIVES:			
Provide accelerated review of projects where developer attended a pre- application meeting.	N.A.	N.A.	Pre-apps are standard, so additional criteria would be needed to trigger accelerated reviews.
ENACT REGULATIONS:			
Preliminary stormwater plan review occurs contemporaneously with preliminary site plan review and before any development approvals.	1	1	City Code Zoning Chapter 5 Development Review Procedures
Development applications must include preliminary/conceptual stormwater management plans that incorporate green infrastructure elements and describe how stormwater management standards will be met.	1	1	City of Phoenix Stormwater Policies and Standards. Developments must retain the 100-year, 2-hour duration storm on-site through varying drainage and water storage techniques. City Code Zoning 507 Tab A Guidelines for Design Review. Surface site drainage and retention should be integrated with overall landscape design. City Code Zoning 507 Tab A Guidelines for Design Review Desert Preservation. Development should minimize the removal of existing healthy Sonoran vegetation. Natural washes and vegetation should be maintained in a natural state to avoid impeding drainage flows, for public safety and natural ecology; landscape plans should reflect the establishment of an on-site wash system for surface drainage. Significant vegetation or riparian habitats associated with significant natural washes should be preserved. (Design goals not requirements) City Code Zoning 507 Tab A Guidelines for Design Review. Development should minimize removal of existing healthy non-native plants (trees 4" in caliper or greater); if removal is necessary, mature trees should be salvaged and utilized on site. The location of curb cuts for parking lots or driveways shall not cause the removal of mature canopy. Street improvement projects shall be made in accordance with adopted streetscape designs.
		3	Out of 5 possible points

5.A.3	QUESTION:	Do local building and plumbing codes allow harvested rainwater for exterior uses, such as irrigation, and non-potable interior uses, such as toilet flushing?
	GOAL:	Ensure that the municipality allows and encourages stormwater reuse for non-potable uses.
	WHY:	Stormwater reuse is important for dense, urban areas with limited spaces for vegetated green infrastructure practices.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Local government provides information brochures/manual for homeowners describing acceptable rainwater harvesting techniques.	1	1	Information is available on the Water Conservation website. Water Conservation has brochures on rainwater harvesting and hands them out at outreach events to homeowners
REMOVE BARRIERS:			
Local development, building, and plumbing codes updated to allow reuse of stormwater for non-potable purposes.	1	1	Section P2601.2 of the Residential Housing code allows grey water to be discharged to an approved gray water recycling system. Section AO102 allows for the use of gray water for toilet flushing with proper disinfection and coloring. General Note: There are no codes specifically regulating the use of stormwater for non-potable uses.
ADOPT INCENTIVES:			
Reduce stormwater management facility requirements for developments employing comprehensive rainwater harvesting.	1	0	Rainwater harvesting container capacities could count towards the required onsite retention volume.
Reduce stormwater utility rates based on the use of harvest and reuse techniques.	1	0	Rates are based on water connection only.
ENACT REGULATIONS:			
Require developments to adopt rainwater harvesting techniques as elements of stormwater management plans.	1	1	City of Phoenix Stormwater Policies and Standards. Developments must retain the 100-year, 2-hour duration storm on-site through varying drainage and water storage techniques. City Code Zoning 507 Tab A Guidelines for Design Review. Surface site drainage and retention should be integrated with overall landscape design.
		3	Out of 5 possible points

5.A.4	QUESTION:	Are provisions available to meet stormwater requirements in other ways, such as off-site management within the same sewershed or "payment in lieu" of programs, to the extent that on-site alternatives are not technically feasible?
	GOAL:	Allow off-site management of runoff while still holding developers responsible for meeting stormwater management goals.
	WHY:	In some cases, it is impracticable or infeasible to treat all or even some of the stormwater runoff on site. In such instances, alternative means should be provided through contribution to off-site mitigation projects or off-site stormwater management facilities (preferably green infrastructure facilities).

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
For infill and redevelopment areas, off-site green stormwater management plans should be developed in cooperation between local government and landowners/developers. Allowing off-site management of stormwater runoff requires sewershed designation within the local government to ensure that true mitigation is possible and realize the equal stormwater management and water quality benefits through off-site management.	2	0	
Retrofit projects that will utilize green infrastructure stormwater management techniques should be identified and prioritized within the sewershed.	1	0	
REMOVE BARRIERS:			
Amend stormwater management regulations and development codes as necessary to allow off-site stormwater management, especially for infill and redevelopment areas.	2	1	Onsite retention requirements are reduced for infill and redevelopment areas, but not transferred offsite. Still must meet first-flush requirements.
ENACT REGULATIONS:			
Establish system that allows/requires payment-in-lieu fees for off-site stormwater management facilities. Fees should be set sufficiently high as to cover the true cost of off-site management. Consider limitations on amount of off-site management allowed (more for infill areas, less for greenfield sites).	1	0	
		1	Out of 6 possible points

5.B MAINTENANCE/ENFORCEMENT

5.B.1

QUESTION: Does your stormwater ordinance include monitoring, tracking, and maintenance requirements for stormwater management practices?

GOAL: Incorporate monitoring, tracking, and maintenance requirements for stormwater management practices into your municipal stormwater ordinance.

WHY: These measures will help ensure that the successful tracking and monitoring of green infrastructure practices remain in proper working condition to provide the performance required by the stormwater ordinance.

Implementation Tools and Policies	Pts. Avail.	Pts. Rec. or N/A	Notes and Local References
ADOPT PLANS/EDUCATE:			
Develop a system to monitor and track stormwater management practices deployed at greenfield and redevelopment sites. Tracking of management practices should begin during the plan review and approval process with a database or geographic information system (GIS). The database should include both public and private projects.	1	1	STR GIS tracks location of both public and private projects
Provide model checklist for maintenance protocols for ease of inspection, tracking, and enforcement.	1	0	
Sponsor demonstration projects for green infrastructure management best practices.	1	1	The City is studying the effect of pervious pavement on stormwater quality (Helen Drake Senior Center). The City is also evaluating the use of green infrastructure techniques used at Taylor Mall and other projects. Through "Greening Lower Grand Avenue", the City is developing a 'green street' design, which will be implemented when funding becomes available.
REMOVE BARRIERS:			
Ensure that proper local agencies have authority to enforce maintenance requirements.	1	1	City Code 32-C 106A. Stormwater Quality Protection Inspections City Code 32-C 107 Stormwater Quality Protection Violations and Penalties City Code 32A-27 Grading and Drainage Violations and Penalties
ADOPT INCENTIVES:			
Create self-inspection maintenance certification program that allows developers/landowners to train/retain private inspectors to certify compliance with stormwater management plans and long-term maintenance.	1	0	PDD has a self-certification program for G&D plan review. (requires certification by a P.E.), but there is not an inspection nor long-term maintenance component.
ENACT REGULATIONS:			
Require long-term maintenance agreements that allow for public inspections of the management practices and account for transfer of responsibility in leases and/or deed transfers.	1	0	
Conduct inspections every 3 to 5 years, prioritizing properties that pose the highest risk to water quality, inspecting at least 20% of approved facilities annually.	1	0	

Develop a plan approval and post-construction verification process to ensure compliance with stormwater standards, including enforceable procedures for bringing noncompliant projects into compliance.	1	.5	City Code 507 Development Review Approval. Plan approval process is in place for ensuring compliance. Although there appears to be no ongoing, regular inspection program for post-construction facilities, the City maintains the right to inspect the facility "*as necessary*".
Inspections of construction sites occur at for at least 25% of permitted projects to ensure proper installation of approved practices.	1	1	
Require conservation/green infrastructure bond/escrow in zoning/subdivision ordinances to ensure installation/maintenance of green infrastructure storm water management facilities.	1	0	
		4.5	Out of 10 possible points

Total score for SECTION 5: ADOPT GREEN INFRASTRUCTURE STORMWATER MANAGEMENT PROVISIONS

= _____23.5_____ (TOTAL POINTS AVAILABLE: 46)

Attachment 4 Example Plant List

Appendix E. Plant List

The following Plant List was developed to aid in the selection of plant material for BMPs in the City of San Diego. Plants listed below for 'Landscape Position 1' are mostly documented in literature, or by vendors, as capable of withstanding brief seasonal flooding. Due to the wide range of species that thrive in San Diego, the designer may have knowledge of additional species that will function well in specific BMPs. In using this plant list as a starting point for selection of plant material, the designer should also consider the requirements of the individual site and its microclimatic conditions before making final plant selections. Only native non-invasive species will be planted in City of San Diego Multi-Habitat Planning Areas (MHPAs), or in areas designated as natural open space.

Plant List for BMPs in the City of San Diego

Trees		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous – D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Acer negundo californicum[4]	**California Box Elder**	**SD**	**1**	**60'x60'**	**M-H**	**SU, PS**	**D**		**A2-3; 1-10, 12-24**
Alnus rhombifolia[4]	**White Alder**	**SD**	**1**	**50-90' x 40'**	**H**	**SU, PS, SH**	**D**	**Y**	**1b-10, 14-21**
Cercis occidentalis[4]	**Western Redbud**	**SD**	**1**	**10-18' x 10-18'**	**M**	**SU, PS**	**D**		**2-24**
Chilopsis linearis[4]	**Desert Willow**	**SD**	**1**	**15-30' x 10-20'**	**L-M**	**SU**	**D**		**3b, 7-14, 18-23**
Gleditsia triacanthos var. internis	Thornless Honeylocust	X	1	35-70'x 25-35'	M-H	SU	D		1-16, 18-20
Ilex vomitoria	Yaupon Holly	X	1	15-20' x 10-15'	H	SU, PS	E		4-9, 11-24
Liquidambar styraciflua	Sweet Gum	X	1	60' x 20-25'	M-H	SU	D		3-9, 14-24
Magnolia grandiflora	Southern Magnolia	X	1	80' x 60'	H	SU, PS	E	Y	4-12, 14-24, H1-2
Metasequoia glyptostroboides	Dawn Redwood	X	1	90' x 20'	H	SU	D		A3, 3-10, 14-24
Myrica californica	Pacific Wax Myrtle	CA	1	10-30 x 10-30'	M	SU	E	Y	4-9, 14-24
Olneya tesota	Desert Ironwood	SD	2	15-30' x 15-30'	N-M	SU	E		8,9,11-14, 18-23

Trees		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous - D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Platanus racemosa[4]	**California Sycamore**	**SD**	**1**	**30-80' x 20-50'**	**M-H**	**SU**	**D**	**Y**	**4-24**
Populus fremontii[4]	**Western Cottonwood**	**SD**	**1**	**40-60' x 30'**	**H**	**SU**	**D**		**1-12, 14-21**
Quercus agrifolia[4]	**Coast Live Oak**	**SD**	**1**	**20-70' x 20-70'**	**N-L**	**SU**	**E**	**Y**	**7-9, 14-24**
Quercus engelmannii*	Engelmann Oak	SD	2	40-50' x 70'	N-L	SU	E		7-9, 14-24
* Species not recommended for areas of coastal influence. Better suited to locations east of I-15 (north Hwy. 52) and areas east of Hwy 125 (south of Hwy. 52).									
Salix gooddingii[4]	**Western Black Willow**	**SD**	**1**	**20-40'x20-30'**	**H**	**SU**	**D**		**-**
Sambucus mexicana[4]	**Mexican Elderberry**	**SD**	**1**	**10-30' x 8-20'**	**M-H**	**SU, PS**	**SE**		**2-24, H1**
Taxodium ascendens	Pond Cypress	X	1	50-60'x10-15'	L-H	SU	D		-
Taxodium distichum	Bald Cypress	X	1	50-70' x 20-30'	L-H	SU	D		2-10, 12-24
Umbellularia californica	California Bay	CA	1	20-25' x 20-25'	L-H	SU, PS, SH	E	Y	4-9, 14-24
Washingtonia filifera[4]	**California Fan Palm**	**SD**	**1**	**60' x 20'**	**L-M**	**SU**	**E**		**8,9,10,11-24,H1-2**

Shrubs		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous - D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Baccharis pilularis 'Pigeon Pt.'	Dwarf Coyote Bush	CA	3	1-2' x 6'	L-M	SU	E	Y	5-11, 14-24
Baccharis salicifolia[4]	**Mulefat**	**SD**	**1**	**4-10'x8'**	**M-H**	**SU, PS, SH**	**SE**		**-**
Carpenteria californica	Bush Anemone	CA	1	4-6' x 4-6"	L-M	SU, PS	E		5-9, 14-24
Heteromeles arbutifolia	Toyon	SD	3	6-10' x 6-10'	M	SU, PS	E	Y	5-9, 14-24
Ilex burfordii 'Nana'	Dwarf Burford Holly	X	1	6' x 6'	H	SU, PS	E		4-24
Mahonia aquifolium 'Compacta'	Compact Oregon Grape	CA	1	2-3' x 5'	L-H	SU, PS	E		2-12, 14-24
Mahonia repens	Creeping Oregon Grape	CA	2	1' x 3'	N-L	SU, PS	E		2B-9, 14-24
Philadelphus lewisii	Wild Mock Orange	CA	2	4-10' x 4-10'	M-H	SU, PS	E		1-10, 14-24
Rhamnus californica 'Little Sur'	Dwarf California Coffeeberry	SD	2	3-4' x 3'	N-M	SU, PS	E	Y	4-9, 14-24, H1, H2
Rosa californica[4]	**California Rose**	**SD**	**1**	**3-6' x 6'**	**M-H**	**SU, PS, SH**	**SE**	**Y**	**-**
Ruellia peninsularis	Desert Ruellia	X	3	4' x 6'	N-M	SU, PS	E		12-13, 21-24
Russelia equisetiformis	Coral Fountain	X	2	5' x 5'	M-H	SU, PS	E		14, 19-24, H1, H2
Russelia x St. Elmo's Fire	Red Coral Fountain	X	2	4' x 6-8'	M-H	SU, PS	E		-
Styrax officinalis	Snowdrop Bush	SD	2	6-8' x 5'	H	SU, PS	D		4-9, 14-21
Symphoricarpos mollis	Southern California Snowberry	SD	2	1-3'x3'	L-M	PS	D	Y	2-10, 14-24

Perennials		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous - D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Achillea millefolium[4]	**Common Yarrow**	**SD**	**1**	**3' x 2'**	**L-M**	**SU**	**SE**	**Y**	**A1-A3, 1-24**
Anemopsis californica[4]	**Yerba Mansa**	**SD**	**1**	**1'x2-4'**	**H**	**SU, PS, SH**	**D**		**-**
Aquilegia formosa	Western Columbine	SD	2	1-3' x 1.5'	H	SU, PS	SE		A1-3, 1-11, 14-24
Artemisia palmeri[4]	**San Diego Sagewort**	**SD**	**2**	**2-3'x3'**	**H**	**SU, PS**	**SE**	**Y**	**-**
Asarum caudatum	Wild Ginger	CA	2	1' x 3'	H	SH	E		4-6, 14-24
Dietes iridioides	White Fortnight Lily	X	2	3' x 3'	M-H	SU, PS	E		8-9, 12-24, H1, H2
Epilobium californica[4]	**California Fuscia**	**CA**	**1**	**1-2'x3-5'**	**L-M**	**SU**	**SE**		**2-11, 14-24**
Fragaria chiloensis[4]	**Beach Strawberry**	**CA**	**1**	**4-8" x spreading**	**H**	**SU, PS**	**E**	**Y**	**4-24**
Hemerocallis spp.	Daylily	X	2	2-4' x 2-4'	H	SU, PS	E	Y	1-24, H1, H2
Iris douglasiana	Pacific Coast Iris	CA	1	2' x 2'	M	SU, PS	E	Y	4-9, 14-24
Iris missouriensis	Western Blue Flag Iris	SD	1	2' x 2'	M-H	SU, PS	D		1-10, 14-24
Iva hayesiana[4]	**San Diego Marsh Elder**	**SD**	**2**	**1' x 5'**	**N**	**SU, PS**	**SE**	**Y**	**17, 23-24**
Jaumea carnosa	Jaumea	SD	1	<1' x spreading	H	SU	E		-
Polystichum munitum	Western Sword Fern	CA	2	2-4' x 2-4'	H	SH	E	Y	A3, 2-9, 14-24
Potentilla glandulosa	Sticky Cinquefoil	SD	1	2' x 3'	M-H	SU, PS, SH	E	Y	-
Ribes viburnifolium	Evergreen Currant	SD	3	3-6' x 12'	N-M	SU, PS	E	Y	5,7-9,14-17, 19-24

Perennials		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous - D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Salicornia pacifica (or virginica)[4]	**Pickleweed**	**SD**	**1**	**1-2' x spreading**	**H**	**SU**	**SE**	**Y**	**-**
Salvia uliginosa	Bog Sage	X	2	4-6' x 3-4'	M-H	SU	E		6-9, 14-24
Satureja douglasii	Yerba Buena	CA	2	<1' x 3'	H	PS	E		4-9, 14-24
Satureja mimuloides	Monkeyflower Savory	CA	1	1-3' x 1-3'	M-H	SU, PS	D		-
Sisyrinchium bellum[4]	**Blue-eyed Grass**	**SD**	**1**	**6-18" x 6-18"**	**M-H**	**SU, PS**	**E**	**Y**	**2-9, 14-24**
Trifolium wormskioldii	Coast Clover	SD	1	2' x spreading	H	SU	D		-
Zantedeschia aethiopica	Common Calla	X	2	2-4' x 2-4'	H	SU, PS	E		5-6, 8-9, 12-24, H1, H2

Grasses & Grass-Like Plants		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous - D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Bouteloua gracilis	Blue Grama	CA	2	1-2' x 1'	L	SU	D		1-3, 7-11,14,18-21
Buchloe dactyloides 'UC Verde'	'UC Verde' Buffalograss	X	1	6-8" x spreading	L-H	SU	D		-
Carex praegracilis	California Field Sedge	SD	1	1' x 2'	M-H	SU, PS, SH	E	Y	-
Carex spissa[4]	**San Diego Sedge**	**SD**	**1**	**5' x 5'**	**H**	**SU, PS**	**SE**	**Y**	**7-9, 14-17, 19-24**
Chondropetalum tectorum	Small Cape Rush	X	1	3-4' x 3-4'	M-H	SU, PS	E	Y	8-9, 14-24
Cyperus eragrostis[4]	**Umbrella Sedge**	**SD**	**1**	**2-3'x spreading**	**H**	**SU, PS**	**SE**		**-**
Distichlis spicata[4]	**Salt Grass**	**SD**	**1**	**1' x 3'**	**M-H**	**SU, PS**	**D**	**Y**	**-**
Eleocharis macrostachya[4]	**Common Spike Rush**	**SD**	**1**	**1-3' x 2'**	**H**	**SU, PS**	**E**	**Y**	**-**
Elymus glaucus[4]	**Blue Wild Rye**	**SD**	**1**	**2-4' x 5'**	**L-M**	**SU, PS**	**SE**		**-**
Equisetum hyemale ssp. affine	Horsetail Reed	SD	1	4' x spreading	H	SU, PS	E		1-24
Festuca californica	California Fescue	CA	1	2-3' x 1-2'	M-H	SU, PS	E	Y	4-9, 14-24
Festuca rubra	Creeping Red Fescue	CA	1	1-2' x spreading	H	SU, PS	E		A2-3, 1-10, 14-24
Juncus effusus	Soft Rush	SD	1	2.5' x 2.5	M-H	SU, PS	E		1-24, H1
Juncus mexicanus[4]	**Mexican Rush**	**SD**	**1**	**2' x 2'**	**M-H**	**SU, PS**	**E**		**-**
Juncus patens[4]	**California Gray Rush**	**CA**	**1**	**2' x 2'**	**L-H**	**SU, PS**	**E**		**4-9, 14-24**

Grasses & Grass-Like Plants		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous - D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Muhlenbergia rigens[4]	**Deer Grass**	**SD**	**1**	**2-4' x 3-4'**	**L**	**SU**	**E**		**4-24**
Sesleria nitida	Gray Moore Grass	X	2	18"x15"	M	SU, PS	E		-
Schoenoplectus californicus[4]	**California Bulrush**	**SD**	**1**	**10' x spreading**	**H**	**SU, PS, SH**	**E**		**-**
Sporobolus airoides	Alkali Dropseed	CA	1	3' x 3'	L-M	SU	D		1-24
Zephyranthes candida	Rain Lily	X	1	12"x12"	H	SU, PS	E		4-9, 12-24, H1, H2

Annuals and Short-Lived Perennials		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low[1], 2 - Mid[2], 3 - High[3]	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous - D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	Sunset Zones City of San Diego zones: 21, 23 and 24
Limnanthes douglasii	Meadowfoam	CA	1	6-12" x 6-12"	H	SU	-		1-9, 14-24
Limnanthes gracilis ssp. Parishii	Parish Meadowfoam	SD	2	6-12" x 6-12"	H	SU	-		-
Lupinus succulentus[4]	**Arroyo Lupine**	**SD**	**2**	**3'x3'**	**M-H**	**SU**	**-**		**7-24**
Oenothera elata[4]	**Yellow Evening Primrose**	**SD**	**1**	**2-3' x 2-3'**	**L-H**	**SU, PS**	**E**		**5-7, 14-24**
Pluchea odorata[4]	**Salt Marsh Fleabane**	**SD**	**1**	**2-3' x 1-2'**	**H**	**SU, PS**	**SE**		**-**
Vines									
Vitis californica	California Grape	SD	1	30'	N-L	SU, PS	D		4-24

Footnotes

1. Landscape Position 1 (Low): These areas are the base or lowest point of the BMP and experience seasonal flooding. Seasonal flooding for bioretention areas is typically 9" deep, for up to 24 hours (the design infiltration period for a bioretention area). If parts of the bioretention area are to be inundated for longer durations or greater depth the designer should develop a plant palette with longer term flooding in mind. Several of the species listed as tolerant of seasonal flooding may be appropriate, but the acceptability of each species considered should be researched and evaluated on a case-by-case basis.

2. Landscape Position 2 (Mid): These areas are typically along the side slopes of the BMP and may be low but are not expected to flood. However, they are likely to have saturated soils for extended periods of time.

3. Landscape Position 3 (High): These areas are generally on well-drained slopes adjacent to stormwater BMPs. These areas will not be inundated and will typically dry out quickly after the storm event.

4. **Bolded species have been observed within the City of San Diego and are know to be suitable for the recommended landscape position.**

General Notes

1. The Landscape Position is the lowest area recommended for each species. Plants in areas 1 and 2 may also be appropriate for higher locations.

2. When specifying plants, availability should be confirmed by local nurseries. Some species may need to be contract-grown and it may be necessary for the contractor to contact the nursery well in advance of planting as some species may not be available on short notice.

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