

REINVENT PHOENIX

SUSTAINABLE GREEN SYSTEMS STRATEGY FOR THE DISTRICT OF MIDTOWN

Partners:



City of Phoenix



St. Luke's Health Initiatives



GLOBAL INSTITUTE
of SUSTAINABILITY
ARIZONA STATE UNIVERSITY



Sustainable Green Systems Strategy for the Midtown District, Phoenix (2014—2040)

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Executive Summary

The transition strategy in this report is a set of coordinated interventions necessary to create sustainable green systems in the Midtown District. Sustainable green systems strive for fully functional stormwater, biodiversity, and resource management practices, as well as sustainable levels of thermal comfort, energy efficiency, and access to green space. The assessment of green systems indicates concern for high temperatures, low vegetation, and insufficient stormwater management. So, there are clear needs for interventions and investments to achieve sustainability goals. This strategy is based on achieving four specific goals of sustainable green systems, derived from sustainability and livability principles (HUD, 2009). The following table shows the goals with indicators, targets, and distances-to-target that the strategy covers.

Indicator	Sustainability Target	Current State Data	Distance-to-target
Goal 1 – Reduce stormwater loads and harvest water onsite			
Permeable land	80%	36%	44%
Goal 2 – Reduce potable water consumption			
Indoor residential	30 GPCD	25 GPCD	0 GPCD
Goal 3 – Reduce daytime temperatures			
Surface temperatures above 130° F	<1%	10.4%	10%
Goal 4 – Increase green systems benefits to health, mobility, and the economy			
Vegetation coverage	25%	6.9%	18.1%
Green streets	2 miles	0 miles	2 miles

This strategy details the interventions, actions, resources, potential barriers, and specifics on investments necessary to achieve these goals. Interventions are categorized into streets, buildings and sites, and open space. The following is a summary of each intervention and a sample of related critical actions.

Streets Intervention and Critical Actions

The streets intervention invests in green streets and green parking, and will increase length of green streets in the District to two miles through the following actions:

1. Complete green street pilot projects that connect St. Joseph’s Hospital to Park Central Mall.
2. Begin major green streets investments on 3rd Street.

3. Build sustainable financing mechanisms for green streets in the District, such as a business improvement district or an in-lieu fees program for right-of-way and street improvements.
4. Support research that improves evidence for best practices in green streets and green parking implementation, including material use, vegetation and tree selection, and rainwater management.

Buildings and Sites Intervention and Critical Actions

The building and sites intervention invests in water harvesting and reuse, natural and engineered shade, and cooling. The intervention, will reduce indoor residential District potable water use by 10 gallons per person per day, and achieve other vision targets through these actions:

1. Pass code updates that create density-dependent guidelines for water harvesting and reuse, natural and engineered shade, and cooling.
2. Design, finance, build, and test green systems pilot projects along major corridors and in neighborhoods.

Support research on next-generation water harvesting, water reuse, and engineered shade and cooling technologies.

3. Improve and develop incentive programs for cool building materials, water harvesting and reuse technologies, and energy efficiency.

Open Space Intervention and Critical Actions

Neighborhood water retention, green civic space, and green parking are the open space intervention investments. This intervention will increase permeable land by up to 500 acres in the District through the following actions:

1. Create open space pilots projects at Edison, Shaw, and Garfield elementary schools, and St. Luke's Hospital to increase retention capacity with Silva cells, orchards, rain gardens, and other water harvesting and retention mechanisms.
2. Renegotiate the MS4 permit to allow for next-generation stormwater solutions in the District.
3. Create long-term funding structures, such as in-lieu fees for trees and retention, that could be part of neighborhood associations (Garfield Organization, and Eastlake Park Neighborhood Association), Business Improvement District (BID) or Community Development Corporation (CDC).

Conclusion

This strategy also includes a database of implementation tools (financing tools, partnerships, codes, capacity building, and incentives) available to implement each intervention. There is a 5-year action plan with details on achieving critical, early wins, and getting the green

systems transition off to a strong start. In summary, this strategy seeks to guide the District toward green systems that naturally manage stormwater on-site, reduce daytime temperatures, and provide safe, cool spaces for citizen recreation and transportation through interventions in streets, buildings, and open space.

Correspondence to Scope of Work

Scope-of-Work Items	Corresponding Report Chapter
<i>Task 6.2 District and Sustainable Urban Design and Infrastructure Strategies</i>	
Daytime Temperature	Chapters 4.2; 4.3; 4.4
Potable Water	Chapters 4.2; 4.3; 4.4
Spatially-explicit investments	Chapters 3.3; 4
Catalyst investments	Chapter 4
<i>Sub-Task 6.2.a: Green Infrastructure Investments</i>	
Typology	Appendix
Locations	Chapters 3.3; Appendix
Estimates of impact	Chapters 4.2,4.3, and 4.4
<i>Sub-Task 6.2: Recommended GS Investments</i>	
Recommended incentives for city's Green Construction Code.	Chapter 4.1
Recommended zoning, landscaping, engineering, storm water, and building code changes to promote energy and water efficiency.	Chapter 4
Recommended zoning, landscaping, engineering, storm water, and building code changes to remove barriers to Green Infrastructure implementation	Chapter 4 (4.3 mostly)
Estimates of energy and water savings from recommendations	Chapter 4
Estimates of street-level ambient temperature reductions from recommended materials and techniques	Chapter 4
Annotated list of paving materials, building materials, and construction techniques to reduce day and nighttime temperatures and improve street-level thermal comfort and photo example of each material and technique	Vision Typology Document
<i>Deliverables 6.2 Strategy Reports</i>	
Overview of current state	Chapter 3.1
Overview of vision	Chapter 3.2
Livability outcomes	Chapter 3.2
Strategies to reduce the per-capita grid electricity consumption by at least 30 percent	Chapter 4
Strategy	Chapter 4

Chapter 1 – Introduction

1.1 Green systems challenges in the Midtown District

The Midtown Transit District is located between 7th Avenue to the west, 7th Street to the east, Indian School Road to the north, and McDowell Road to the south. The parcels fronting onto the north side of McDowell, including the Phoenix Art Museum, are not included in the Reinvent Phoenix Midtown District.



Figure 1. Major Midtown District streets and landmarks

Land use in Midtown consists largely of building footprints and parking areas, with few patches of landscaped area or vegetation. Thus, the District is confronted with various challenges in achieving sustainable green systems. Stormwater management and efficient water use is of particular concern, because the Valley faces an uncertain water future. Midtown also faces high temperatures from the Urban Heat Island (UHI) effect. Using building footprints and heights, Figure 2 shows shade and areas exposed to direct sunlight. In the summer, the predominant single-story buildings offer very little shade. The north side of the District, characterized by taller buildings, provides the longest shadow coverage.

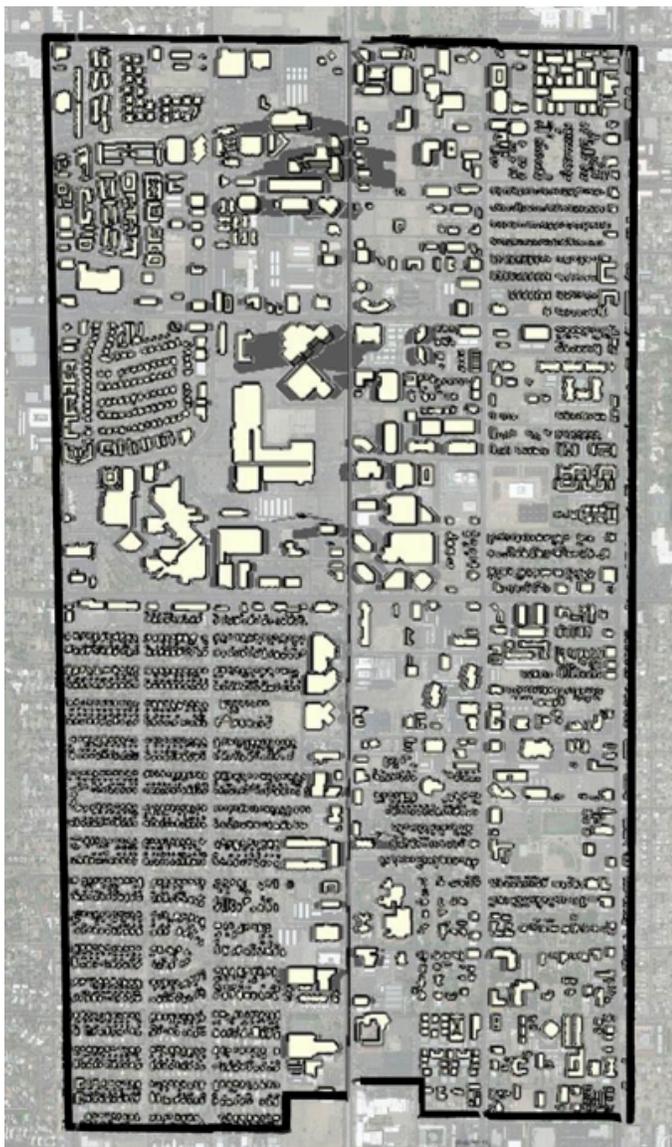


Figure 2. Composite map of summertime shade at 8 AM, 11 AM, 2 PM, and 5PM

The historical Willo neighborhood, with homes constructed in the 1920s and 1930s, is a well-established area with mature vegetation. Those older homes may lack proper insulation and energy efficient appliances, and therefore retain more heat, which contributes to the UHI effect in the area. In addition, many yards have sparse vegetation and no shade. Despite the lush vegetation in other areas, however, temperatures for the neighborhood are generally warmer than the rest of the District.

Clarendon Avenue and 2nd Avenue hosts a mix of cool and warm spots, including an APS substation, one of the hottest points in the District. Lower temperatures in this area include medical offices with turf and vegetation. However, most of the area is concrete and metal, with almost no vegetation. Impermeable surface paving retains heat that increases surface temperatures in the area.

Taller apartment buildings in the District cut both ways. Buildings with paved outdoor walkways and lots of interior AC units increase heat. However, cooler spots of vegetation surround these buildings, a mitigation technique that could be useful in reducing temperatures in other Midtown areas.

The Alvarado historical neighborhood is one of the coolest sections of the District. The sidewalks are surrounded by lush plants, and many yards are high water use areas with lots of vegetation. Although this area reduces surface temperatures, lush individual yards drive up potable water use.

Encanto Park is an urban oasis of public green space located on the boundary of Midtown. Its 222 acres accommodate picnic areas, a lagoon, boating, swimming, and nature trails. For recreation, the park boasts urban fishing, two golf courses, softball diamonds, and basketball and tennis courts. This park is a significant asset for the District as the vegetation contributes to lower temperatures, encourages areas of biodiversity, and provides areas of recreation for Midtown residents.



Figure 3. Encanto Park

The Heard Museum also uses many heat-reduction techniques, including vegetation and shaded structures. It can be a significant example for heat reduction throughout the District as well as a valuable asset to educate residents on green system mitigation.



Figure 4. Shaded arcade/walkway at the Heard Museum

The Phoenix Country Club is another large green area that lowers District temperatures with widespread vegetation and tree canopy. However, the course requires large irrigation inputs and drives high commercial water use in Midtown. In addition, the Country Club is fenced and restricted to the public, offering limited recreation benefits to Midtown residents.

Midtown hosts historical neighborhoods next to modern skyscrapers that create higher and lower surface

temperatures from the mix of landscaping and paving. Limited green spaces in the District help mitigate UHI, offer some recreational opportunities, and support biodiversity. Vacant lots scattered among rich cultural sites (such as the Heard Museum) contribute to higher surface temperatures due to sparse vegetation but also provide areas of opportunity for the development of small parks and open spaces for Midtown residents.

1.2 Profile of the “Reinvent Phoenix” grant

“Reinvent Phoenix” is a City of Phoenix project in collaboration with Arizona State University and other partners, and funded through HUD’s Sustainable Communities program. This program is at the core of HUD’s mission to “create strong, sustainable, inclusive communities and quality affordable homes for all.” It specifically strives to “reduce transportation costs for families, improve housing affordability, save energy, and increase access to housing and employment opportunities” and to “nurture healthier, more inclusive communities” (Office of Sustainable Housing and Communities, 2012). The program explicitly incorporates principles and goals of sustainability/livability (HUD/DOT/EPA, 2009):

1. Enhance economic competitiveness
2. Provide more transportation choices
3. Promote equitable, affordable housing
4. Support existing communities
5. Coordinate and leverage federal policies and investment
6. Value communities and neighborhoods.

In this spirit, from 2012–2015, Reinvent Phoenix aims to create a new model for urban development in Phoenix. The goals for this new model are to improve quality of life, conserve natural resources, and maintain desirability and access for the entire spectrum of incomes, ages, family sizes, and physical and developmental abilities along the light rail corridor. Reinvent Phoenix aspires to eliminate physical and institutional barriers to transit-oriented development. To do so, the grant will work to catalyze livability and sustainability through capacity building, regulatory reform, affordable housing development, innovative infrastructure design, economic development

incentives, and transformational research and planning.

Participatory research design ensures that a variety of stakeholder groups identify strategic improvements that enhance safe, convenient access to fresh food, healthcare services, quality affordable housing, good jobs, and education and training programs. Reinvent Phoenix focuses on six topical elements: economic development, green systems, health, housing, land use, and mobility (corresponding to the Livability Principles). These planning elements are investigated in five transit Districts (from east to west and south to north): Gateway, Eastlake-Garfield, Midtown, Uptown, and Solano. Planning for the Downtown District of the light rail corridor is excluded from Reinvent Phoenix because of previously completed planning efforts, partly using transit-oriented development ideas.

Reinvent Phoenix is structured into planning, design, and implementation phases. The project's planning phase involves building a collaborative environment among subcontracted partners, including Arizona State University, Saint Luke's Health Initiatives, Discovery Triangle, the Urban Land Institute, Local First Arizona, Duany Plater-Zyberk & Company, Sustainable Communities Collaborative, and others. While the City of Phoenix coordinates these partnerships, Arizona State University and Saint Luke's Health Initiatives are working with residents, business owners, landowners, and other relevant stakeholders in each of the grant's five transit Districts. This effort will assess the current state of each District, as well as facilitate stakeholder expression of each District's sustainable vision for the future. Finally, motivated actors in each District will co-create step-by-step strategies to move toward those visions. Transit District Steering Committees, formed in the planning phase, will host capacity building for their members, who will shepherd their Districts through the remaining Reinvent Phoenix phases.

City of Phoenix staff and Duany Plater-Zyberk & Company will lead the design phase. Designs for canal activation, complete streets, and form-based code will complement the compilation of a toolbox for public-private partnerships to stimulate economic development along the light rail corridor. The design phase will take its cues from the public participation in the planning phase, and maintain ongoing monthly contact with Transit District Steering Committees to ensure the visions of each District are accurately translated into policy and regulations. These steps will update zoning, codes, regulations, and city policies to leverage the new light rail system as a major asset. The design phase is crucial for preparing an attractive environment for investment and development around the light rail.

Finally, the implementation phase will use the city's partnerships with the Urban Land Institute, Local First Arizona, and Sustainable Communities Collaborative to usher in a new culture of development in Phoenix. With the help of all partners, transit-oriented development can be the vehicle to renew Phoenix's construction industry, take full advantage of the light rail as a transformative amenity, and enrich Phoenix with a livable and dynamic urban fabric.

1.3. Sustainable Green Systems Research

This sustainable green systems strategy aligns with HUD's Sustainable Communities program goals, as stated above (see Livability Principles above). Sustainable green systems strive for fully functional stormwater, biodiversity, and resource management practices, as well as sustainable levels of thermal comfort, energy efficiency, and access to green space. Sustainable green systems are specified in the following four goals:

1. Reduce stormwater loads and harvest water on-site
2. Reduce potable water consumption
3. Reduce daytime temperatures
4. Increase green systems benefits to health, mobility, and the economy

In pursuit of these goals, we employ a transformational planning framework (Wiek, 2009; Johnson et al., 2011), conducting sustainable green systems research in three linked modules. We start with a thorough assessment of the current state of green systems in 2010/2012 against principles of livability and sustainability (current state assessment); in parallel, we create and craft a sustainable vision for green systems in 2040 (visioning); and finally, we develop strategies for changing or conserving the current state of green systems towards the sustainable vision of green systems between 2012 and 2040 (strategy building). The framework is illustrated below.



Figure 5. Transformational planning framework (Source: Wiek, 2009)

Because of the broad impacts of green systems and the close link with other planning elements, the central meaning of green systems often remains poorly defined. Green systems employ natural elements to perform ecosystem services, such as stormwater management, microclimate modification, and improvement of air and water quality, among others (Benedict & McMahon, 2006; Rouse & Bunster-Ossa, 2013). They include building footprints, rights-of-way, public streets, parking areas, landscaping, vegetation, stormwater, water use, and shade patterns affecting local climate conditions. As articulated in Phoenix's tree and shade master plan, green systems are the interconnected web of parks, streets and canals that help to sustain an active, cool, and healthy city (City of Phoenix, 2010).

Green systems range from passive water harvesting to porous pavers, and from street trees to a large District park. They provide economic, social, and environmental benefits: they reduce energy costs; improve air quality; strengthen quality of place and the local economy; reduce storm water; improve social connections; promote smart growth and compact development; and create walkable neighborhoods. Green systems are solution multipliers that solve many problems with one single investment (City of Phoenix, 2010). According to the U.S. Environmental Protection Agency (2013, website), "green infrastructure is an approach that communities can choose to maintain healthy waters, provide multiple environmental benefits, and support sustainable communities. Unlike single-purpose gray stormwater infrastructure, which uses pipes to dispose of rainwater, green infrastructure uses vegetation and soil to manage rainwater where it falls. By weaving natural processes into the built environment, green infrastructure provides not only stormwater management, but also flood mitigation, air quality management, and much more". With the intent to avoid duplications, overlap, and confusion, we follow in this report with this definition of green systems: natural and engineered systems that provide ecosystem services in a given district (Cook, 2007).

1.4. Objectives of the Strategy Study

The strategy presented in this report dictly refers to the green systems challenges detailed in the assessment report (Golub et al., 2013). It proposes interventions that address these challenges, significantly improve green systems, and achieve the vision and goals of sustainable green systems in the District (detailed in the visioning report). In accordance with the mandate of Reinvent Phoenix to contribute to sustainable community development, this strategy study actively pursues the improvement of green

systems conditions, following sustainability and livability principles (Gibson, 2006; HUD/DOT/EPA, 2009).

The guiding question of the sustainable green systems strategy study is: *What evidence-supported interventions provide fully functional stormwater, biodiversity, and resource management practices, as well as sustainable levels of thermal comfort, energy efficiency, and access to green space in the District?*

The specific objectives are:

1. Link sustainable green systems goals and targets to evidence-supported interventions and investment options.
2. Detail interventions with the actions, actors, assets, and coping tactics (for barriers) needed to achieve sustainable green systems goals and targets.
3. Highlight investment options designed to achieve sustainable green systems goals and targets.
4. Compile a set of exemplary implementation tools for the investment options.
5. Outline a five-year action plan to implement the interventions and investment options.

Additional objectives include:

1. To develop a process and content template for sustainable strategy development research that can be reproduced in the other four transit districts and thus guide the Reinvent Phoenix strategy development activities.
2. To enhance capacity in strategy development among planning professionals and collaborating partners to use in subsequent initiatives and projects.
3. To enhance capacity in strategy development for students and faculty to use in other research projects, teaching programs, and professional projects.

Chapter 2 – Research Design and Data Sources

We acknowledge that the term strategy is being used in a variety of contexts. In context of Reinvent Phoenix, a strategy is defined as a set of *interventions coordinated among different stakeholders with the intent to transforming the current state of a system* (e.g., a city, a neighborhood, a company) into a sustainable one (Wiek & Kay, 2013). The following document details the coordinated interventions necessary to achieve a sustainable state for green systems in the District. Each intervention includes investments and implementation tools that residents, businesses, organizations, and city government need to employ in order to achieve the desired outcomes. Conceptually, we differentiate different levels of the strategy, including interventions, investment types, and investment tools (Fig. 3). The strategy is composed of several (coordinated) interventions. An Intervention offers several investment types. For realizing an investment types, different implementation tools can be used.

The specific procedures for building a transition strategy have been detailed in Wiek and Kay (2013) and Kay et al. (2013), and are here applied to green systems as follows:

1. Summarizing the inputs or ingredients for the strategy, i.e., the current state assessment, the vision, and a theory of change. All three elements need to be specified such that progress can be measured. Key information pertains to the gaps between the current state and trends for green systems on the one hand, and future goals and targets (vision) on the other hand. For example, for the indicator “indoor residential potable water use,” the current state might be 46 gallons per capita per day, but the target is 30 gallons per capita per day. The 16-gallon gap between the current state and the target state specifies the gap the strategy needs to bridge.
2. Developing a set of coordinated interventions to achieve desired outcomes. Each of the specific goals for sustainable green systems requires specific interventions. For example, to achieve the goal of reducing daytime temperatures, the intervention of shade and cooling on streets and parking lots seems promising. The transformational planning framework is goal oriented and thus the vision, the current state assessment, and the strategy all start with stating the goals of sustainable green systems. Yet, the strategy

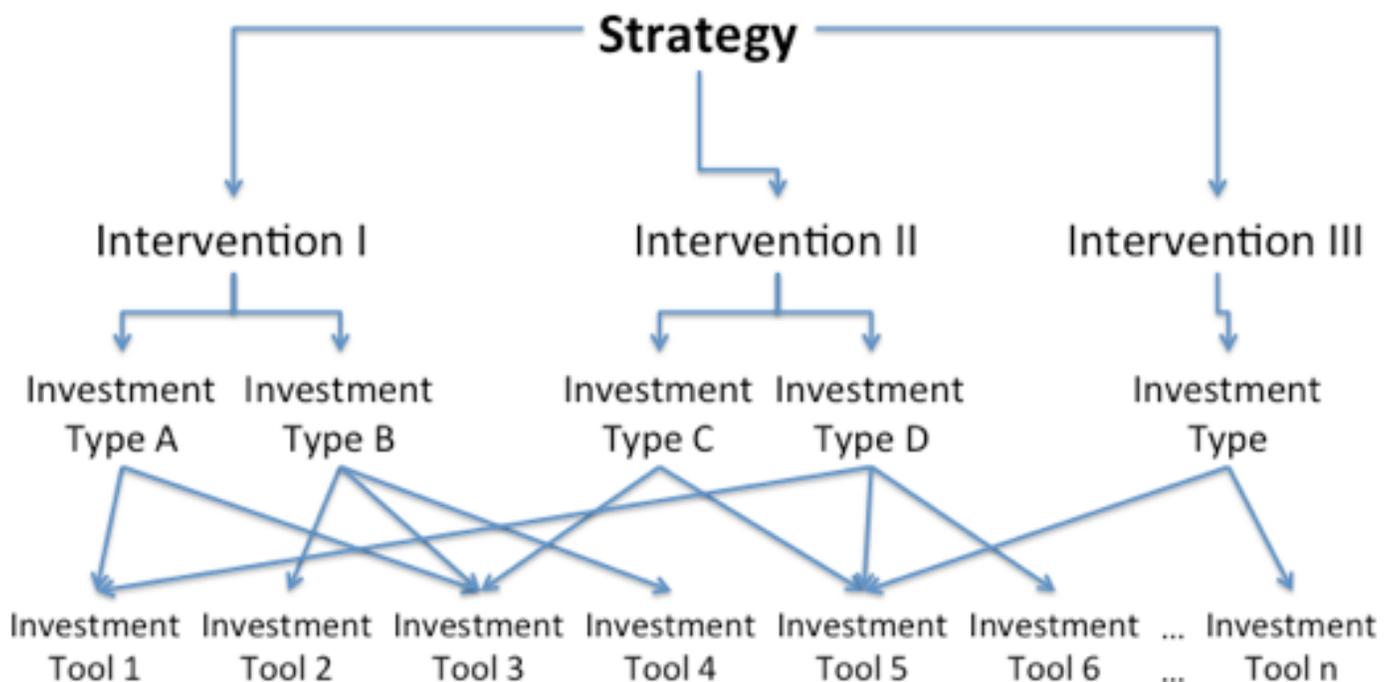


Figure 6. Hierarchical structure of the strategy for sustainable green systems

aims at coordinating interventions that achieve multiple objectives at the same time. For example, shade and cooling on streets and parking lots does not only pursue reduced daytime temperatures, but can also contribute to stormwater management with vegetative shade. Thus, from the perspective of implementation it is more useful to use the interventions as organizing principle, and design interventions in ways that they contribute to as many goals as possible. Thus, we describe each major intervention separately by:

- a. Stating the goals and targets the intervention pursues.
 - b. Identifying the intervention points, i.e., drivers that cause the problematic current state. Systemic relevance of the intervention point and feasibility of intervention at this point are important criteria for the selection of intervention points. A potential intervention point could be building codes that lack to incentivize cooling technologies.
 - c. Specifying key components of each intervention, i.e., intervention actions, actors, available assets, resources needed, potential barriers, and implementation tools. Components can be identified through using best practices examples across the United States, interviews with city staff, residents, local experts, and academic literature.
 - d. Describing specific investment types that offer different pathways within an intervention. For example, the streets intervention captures both green streets and green parking (two different investment types). For realizing an investment type, different implementation tools can be used.
 - e. Describing implementation tools, clustered in tools for financing, capacity building, partnerships, rules (codes), and incentives. We provide key information on the implementation tools, so that residents, developers, and city staff are able to select among available tools. Similar to interventions and investment types, the majority of tools can be used to implement multiple investments. For example, a community development corporation can be used to support green streets efforts.
3. Providing evidence for the effectiveness and efficiency of the proposed interventions, investments, and implementation tools. Evidence is required to ensure that intervention, investments, and implementation

tools are selected that are likely to be capable of “getting the job done.” Evidence can be provided by local experts, academic literature, or cases of other cities.

4. Detailing actions for a specific 5-year action plan that specify the roles and responsibilities for residents, developers, and city staff, as well as for the Steering Committee.

Data for this strategy document comes from two primary sources:

1. Data inputs for the strategy are drawn from multiple sources as this study builds from the current state assessment and the visioning study.
2. Data about the core components of the strategy is based on input from local experts (see acknowledgements, above) and academic literature.

Chapter 3 – Strategy Inputs

The following chapter includes a summary of the current state and the vision for sustainable green systems in the Midtown, as well as a specific theory of change that are the inputs for the strategy.

3.1 Summary of the Current State Assessment of Green Systems in Midtown

The current state assessment is based on four goals of sustainable green systems, derived from sustainability and livability principles (HUD, 2009):

1. Reduce stormwater loads and harvest water on-site
2. Reduce potable water consumption
3. Reduce daytime temperatures
4. Increase green systems benefits to health, mobility, and the economy

The current green systems conditions in Midtown are poor overall. Of particular concern are high temperatures, low vegetation, and water consumption and management. Midtown struggles with unsustainable states in each of the four goal domains, while there are few positive aspects.

1. *Insufficient stormwater* is managed on-site by green systems. Natural systems capture far less than a half of the sustainable level of stormwater run-off, and there is nearly no rainwater harvesting in the District. Water quality targets were unattainable.
2. *Sustainability of potable water consumption is low.* Indoor residential potable water use is a very high distance-to-target, though outdoor use easily exceeds the target. However, there are trade-offs between outdoor use for sufficient vegetation coverage and water conservation. Given commercial and industrial diversity, water consumption targets for these sectors were unattainable.
3. *Daytime temperatures are high in places.* Midtown fulfills the sustainable target for low temperatures, and high temperatures have only a medium distance-to-target. However, those areas with high temperatures worsen the Urban Heat Island (UHI) effect, and drive a

variety of health problems.

4. *The health, mobility, and economic benefits of green systems can improve significantly.* The District has no green streets, low tree canopy cover, and a high distance-to-target for green open space. Adding green streets, shade, and strategically placed parks to the District would help achieve the preceding goals, as well as improve health, mobility, and the economy.

In summary, the District is in need of green systems that naturally manage stormwater on-site, reduce daytime temperatures, and provide safe, cool spaces for citizen recreation and transportation. Thereby, tradeoffs between different green systems features require special attention when crafting sustainable green systems visions and strategies. For example, vegetation that cools and beautifies residential homes also increases water use.

Data from our Midtown stakeholder engagement efforts confirm that more shade is still needed. There is support for shaded green streets that increase walkability, especially along Central Avenue and 3rd Street. Some residents feel that Midtown could improve storm water management in order to further cool the neighborhood. In concert with safety concerns (Hager et al., 2013), these factors make green systems in Midtown insufficient to provide safe and comfortable recreation and mobility for citizens. Though stormwater management poses challenges, stakeholder input prioritized temperatures and shade.

Interpreting the assessment results in light of HUD's livability principles indicates the following set of priorities:

Stormwater management, high temperatures, green space, green streets, and shade are indicators that have a high distance to target, and are closely tied to the principles.

- Livability Principle 1 aims at *providing safe transportation options*. The current state data indicates insufficient shade for comfortable bus stops, which may reduce ridership. There are also no green streets in the District.
- Livability Principle 3 aims at *economic competitiveness*. Green systems provide higher quality of life through better health outcomes, increased recreation options, and better urban aesthetics. Current state data shows

low tree canopy cover and no green streets, leading to economic disadvantages relative to places with more robust green systems.

- While Livability 6 aims at *valuing communities and neighborhoods*. Current state data for the Midtown District paint an un-shaded, hot, un-walkable picture, in direct contradiction to HUD's wish to "invest in healthy, safe, walkable neighborhoods."

The analysis of the driving forces behind the unsustainable states summarized above suggests a variety of promising intervention points outlined in this report.

3.2. Summary of the Vision for Green Systems in Midtown

The vision for green systems in the Midtown District is to sustain a network of buildings, open spaces, streets, and canals that support healthy and prosperous neighborhoods through vegetation, building materials, quality design, and water management. The vision for green systems is part of the overall vision for the Midtown District (Wiek et al., 2013), which describes a sustainability future for the District. Key excerpts are provided below:

In 2040, the Midtown District is a vibrant community characterized by strong independent businesses, cool and comfortable neighborhoods, diverse housing options, and transportation infrastructure that allows for easy movement via bicycle, foot, and transit.

While existing neighborhoods have been preserved and their character maintained, new development is predominantly mixed-use and adaptive reuse. In new mixed-use buildings, small independent businesses complement residential spaces. Although there is District-wide interest in mixed-use buildings, design and execution look different in each transition area.

The specific vision for sustainable green systems in the Midtown District is derived from this vision and is aligned with the five sustainable green systems goals mentioned above (1.3). It reads:

In 2040, Midtown is cool with reduced temperatures and sun exposure. As a result, residents and visitors lead comfortable, outdoor lifestyles throughout the year. Both young and old enjoy outdoor walks, relaxation, and chatting with neighbors. Mature trees line streets and sidewalks where people browse shops shaded from the sun. Aesthetic

landscaping makes the area beautiful, and invites residents out to enjoy their community.

In addition to tree cover, cool pavements further reduce temperatures. Instead of using black asphalt that absorbs heat, streets, parking lots, and driveways have colored surfaces that reflect heat and lower temperatures.

Through the visioning process, three transition areas were selected in which to make the vision spatially explicit:

1. In 2040, *Park Central* is connected to surrounding neighborhoods. Along bordering streets like Thomas Road, bike lanes and wider sidewalks have replaced automobile lanes to allow bicyclist and pedestrian access [W1; W2; VPS]. Within Park Central, streets are designed for slower traffic with narrow lanes, bike lanes, and sidewalks [W1; W2; VPS]. Wide, green sidewalks [W1] and shaded bus stops [SE1; SE4; W1] provide comfort to pedestrians walking to and within Park Central, and residents that live farther away can ride free circulator buses [W1; VESC]. People feel safe using well-lit streets and bus stops at any time of day [W1]. Inside Park Central, a promenade orients pedestrians to outdoor mall retail [W1; VESC]. The proximity of businesses, restaurants, and office spaces, and residences helps mall-goers meet their needs without having to travel far.
2. With more people living and doing business on Central Avenue in 2040, the corridor has become more walkable and bikeable to reduce traffic. Central Avenue features two lanes of traffic in either direction, but the lanes have been slightly narrowed, and the service lane buffering the light rail from the road has been removed to provide space for a bike lane. Wide sidewalks have facilitated a streetscape project with shade trees and storefront enhancements.
3. Not only is Central Avenue more accessible to pedestrians and cyclists, but the corridor also offers more attractions for visitors. Small pocket parks provide relaxation spaces, and cafes with outdoor patios occupy the ground floor of many high-rises. With trees lining the road and sidewalk, the corridors public spaces are cool and shaded. Residents now have restaurants at which they can enjoy lunch, and residents have many options for dinner.
4. In 2040, 3rd Street is a walkable and bikeable promenade. In each direction, one lane of traffic has

been replaced by a bike lane and wide sidewalk. This development slows and diverts traffic away from the corridor. As a result, residents near 3rd Street comfortably walk and bike to the shops along the road. To reinforce the connection between walkability and local commerce, 3rd Street is closed to cars every Sunday for a public market and community events.

Along the corridor, small portions of open space are dedicated to relaxation activities. With wider sidewalks and shade trees in 2040, 3rd Street has become a green corridor between Steele Indian School and Hance Parks. Between new trees and cool pavement, which reflects heat from the sun, 3rd Street is a hot spot for walking and biking.

A more detailed map captures desired green systems development in three interventions: *streets, buildings and sites, and open space.*

In order to craft actionable strategies, the qualitative descriptions of a sustainable state for green systems in the Midtown District should include quantitative targets. For each of the four green systems goals, Table 1 contains one or two critical targets that the strategy is designed to achieve.

Table 1. Greens systems vision target table

Indicator	Sustainability Target	Current State Data	Distance-to-target
Goal 1 – Reduce stormwater loads and harvest water onsite			
Permeable land	80%	36%	44%
Goal 2 – Reduce potable water consumption			
Indoor residential	30 GPCD	25 GPCD	0 GPCD
Goal 3 – Reduce daytime temperatures			
Surface temperatures above 130 °F	<1%	10.4%	10%
Goal 4 – Increase green systems benefits to health, mobility, and the economy			
Vegetation coverage	25%	6.9%	18.1%
Green streets	2 miles	0 miles	2 miles

3.3. Theory of Change

The theory of change of this strategy is that additional investments in green systems can support increased vegetation, which can decrease surface temperature and support quality of life and economic development. This strategy includes interventions of *streets, buildings and sites, and open space*.

Streets, vacant lots, and open spaces are intervention points where rainwater retention, cooling capacity, and social benefits can be increased with green systems investments. The desired outcome of increase permeable surface, reduced daytime temperatures, increase vegetation coverage can be achieved through the interventions of *streets, buildings and sites, and open space*.

Investments in improving the stormwater collection on streets, and cooling highly trafficked corridors are important early priorities that will move the District towards the permeable surface target. Investments in using open space for District water retention, incorporating next-generation cooling technologies, and moving towards storing and/or using all stormwater on site may take more time to implement, but could have significant impact on achieving the green systems sustainability targets, such as reaching the desired reduction in surface temperatures. The following strategy will describe how these interventions and corresponding investment types can be enacted over the next 30 years to produce sustainable green systems in the District.

Chapter 4 – Sustainable Green Systems Strategy for the Midtown District

4.1. Linking Sustainable Green Systems Goals to Interventions and Investment Options

As described before, the overall and specific sustainable green systems goals are the reference point for developing the strategy and its interventions. Yet, the strategy aims to coordinate interventions that achieve multiple objectives at the same time. The interventions of streets, buildings and sites, and open space all contribute to achieving the four goals of sustainable green systems. Thus, from the perspective of implementation it is more useful to use the interventions as organizing principle, and design them in ways that they contribute to as many goals as possible. Therefore, we describe each intervention separately in the subsequent sections, detailing the specific investments, actions, resources, implementation tools, etc.

Goal	Strategy		
	Streets Intervention	Buildings and Sites Intervention	Open Space Intervention
1. Reduce stormwater loads and harvest water onsite	Widespread use of porous materials, and right-of-way bioswales will reduce impervious surfaces, will allow rainwater to be stored in the right of way.	Water capture and reuse is critical throughout the District, but will look different in different areas. Shade and cooling investments can capture and store excess rainwater.	Neighborhood water retention, green parking, and green civic spaces can reduce rainwater loads.
2. Reduce potable water consumption	Green streets and street parking will reuse rainwater, lower reliance on irrigation, and lower temperatures and UHI.	Next generation living buildings use rain and greywater. Shade and cooling investments can capture and store excess water on site, reducing potable water irrigation. Water-saving appliances can also contribute to reducing indoor potable water consumption	Green civic spaces and parking investments on open space will lower reliance on potable water irrigation. Lower temperatures might also reduce water consumption.
3. Reduce daytime temperatures	Green streets, shade, and cooling (including using cool construction materials) can all reduce daytime temperatures. Zoning and codes can cool hot blocks though promoting shade, and cool material usage.	Engineered and natural shade and cooling (e.g. white roofs) can reduce temperatures	Natural and engineered shade and cooling used in green civic space and green parking lots can reduce temperatures.

4.2. Streets Intervention

Street and right-of-way improvements are critical interventions for the Midtown sustainable green systems strategy. Green streets and green parking investments manage stormwater and increase permeable land, vegetation, and cooling capacity.

4.2.1. Core Components

The following describes the impacts, actions, resources needed, potential barriers, and timeline for the streets intervention.

Aspired Sustainability Impacts

Through this streets intervention, the following *specific* sustainable green systems targets will be achieved by 2040:

- 2 miles of green streets
- 150 more acres of permeable land
- 10% increase of District vegetation coverage (~120 acres)
- Less acres of temperatures greater than 130 °F

Intervention Points

Currently, the extensive street system contributes to high temperatures (urban heat island), and reduced economic and social activity in the Midtown District. By promoting cooling, the streets intervention creates more walkable corridors. The streets intervention can also divert water from the streets, buildings, and sites to bioswales in the right-of-way and in neighborhood water retention areas.

Intervention Actions

The following actions are critical for accomplishing the targets outlined above. These are critical actions that will likely need to take place in the first ten years of the transition. Further details on the actions necessary in the first five year are available in Section 3.5. The following actions are critical in meeting the milestones set in the timeline below.

- Complete green streets that connect St. Joseph's

Hospital to Park Central.

- a. Complete the 3rd Avenue green street pilot project with St. Mary's School.
 - b. Work with St. Joe's Hospital to create model green streets near and on their campus and develop green parking on existing parking lots.
- Make major green streets investments on 3rd Street
 - a. Seek city, state, and philanthropic funding for Van Buren Street improvement and create a long-term maintenance and street conversion fund with adjacent property owners.
 - b. Market importance of the investment of a green street connection from Hance Park to Indian School Park to incentivize development and services along 3rd Street.
 - Build sustainable financing mechanisms for green streets in the Midtown District.
 - a. Create a business improvement district (BID) along Central Avenue and 3rd Street that can pool money from local businesses, landowners, and organizations to pay for addition street improvements.
 - b. Neighborhood associations contribute to creating street water retention systems with shade trees (building off the 9th Street example in the Garfield neighborhood with the support of Watershed Management Group).
 - Support research that improves evidence for best practices in green streets and green parking implementation, including material use, vegetation and tree selection, and rainwater management.
 - Design and seek funding to develop green street projects that build off successes along 3rd Street and near schools.
 - a. Build off of success of 3rd Street initiatives to finance and design Osborn, Thomas, and 3rd Avenue Street green street improvements.
 - b. Produce a feasibility study for neighborhood water

retention on green civic spaces at local schools, parks, and hospital campuses.

- Create educational programming on the multiple benefits of green streets and parking at Phoenix College and local elementary schools, businesses, and non-profits.

Resources

The following resources are needed to support the streets intervention. Assets (resources that already exist) are in italics:

- *Arizona Public Service (APS) and Salt River Project (SRP) Tree and Shade Program*
- *City of Phoenix Departments*
 - o *Neighborhood Services (NSD) to work with schools and neighborhoods*
 - o *Streets and Transportation (STD) to work on design and engineering*
- *Educational Institutions that can be involved in pilot projects*
 - o *Edison, Shaw, and Garfield Elementary Schools and the Phoenix Elementary School District*
 - o *The Global Institute of Sustainability (GIOS)*
- *MAG funding to study green street interventions on Van Buren Street*
- *Willo Neighborhood Association (Can support pilot projects)*
- *Midtown Museum District (Can support pilot projects)*
- *Watershed Management Group (WMG) (Can support pilot projects)*
- More staff and capacity for organizations like WMG that can support and develop funding for pilot projects
- Development of state and federal funding streams for street improvement, air quality mitigation, and urban heat island reduction

Barriers

- Lack of a funding mechanism to design, build, and maintain green streets
- Current codes and standards that include restrictive rules (i.e. concerning water harvesting)
- Concerns that street retrofits will disturb automobile flow
- Concerns about rain water management in streets
- Existing infrastructure and utilities often prevent planting trees and shaping basins/swales
- Lack of education and understanding about green streets

Intervention Timeline

This timeline outlines a transition towards Midtown's sustainable green systems vision driven by streets over the next 30 years. Much can change during this time; thus, this transition strategy must be revisited and updated. Some of the actions listed as happening by 2025 or 2030 may be feasible before the stated date and could possibly be addressed sooner. The purpose of this timeline is to demonstrate a possible sequence (pathway) to achieve the 2040 vision, with the recognition that some things may come faster or slower. The "By 2020" section includes major milestones that could be accomplished if all of intervention actions in the list above are implemented or at least underway.

By 2020

- Make 3rd Street a regional model for green streets and green parking.
- Design and finance green street improvements on 3rd Avenue and Osborn Street.
- Include durable green parking materials in the above projects.

By 2025

- Neighborhood associations and the 3rd Street BID have their own green street programs that have

privately funded several green streets

- Complete 3rd Avenue and Osborn Street green street improvements.
- Green streets around Van Buren Street are demonstrating positive impacts.

By 2030

- Design and finance green street improvements Thomas, Indian School, and Central Avenue.
- Local BID and neighborhood associations have designs and financing models to finish all target green streets by 2040.
- All street parking in the District is green parking due to material used and proximate shade trees.

4.2.2. Investment Types

4.2.2.1. Green Streets

Green streets use small-scale, vegetated bioswales along streets to help control stormwater. These constructed elements create on-site infiltration, while providing attractive streetscapes, increased canopy coverage, lower temperatures, and supporting biodiversity. They also improve a neighborhood’s livability by adding park-like elements that serve as urban greenways.



Green Streets can support an increase in permeable surfaces, on-site infiltration, and improved stormwater quality. Green streets have the added benefits of providing attractive streetscapes, increased canopy coverage, lowering temperatures and supporting biodiversity.

Implementation Tools (See Section 4.5. for details on each tool)

- *Financing* - Capital investments, Department of Transportation (DOT) funding (i.e. TIGER grants), and private investment
- *Partnerships* - BIDs and neighborhood initiatives
- *Codes* - Right-of-way codes
- *Capacity Building* - Watershed management training
- *Incentives* - Tax credits and expedited permitting

4.2.2.2. Green Parking

Green Parking is on-street or on-site parking that redirects and/or stores stormwater, usually through the use of pervious surfaces. Green parking can include stormwater management tools such as bioswales and rain gardens. Green parking offers a cleaner alternative to traditional parking lots that contribute to poor water quality and flooding.



Green parking can significantly increase pervious surfaces, and contribute to better stormwater quality. Green parking can also support shade and cooling efforts.

Implementation Tools (See Section 4.5. for details on each tool)

- *Financing* - Capital investments, DOT funding (i.e. TIGER grants), BIDs, Community Development Block Grants, HOME Investment Partnerships Program, and private investment

- *Partnerships* - CDCs and neighborhood initiatives
- *Codes* - Land use ordinance, capacity building, and watershed management training
- *Incentives* - Tax credits and expedited permitting

4.3. Buildings and Sites Intervention

The building and sites intervention for the Midtown sustainable green systems strategy addresses the significant potable water use, and contributions to high surface temperatures from buildings and sites. Water harvesting and reuse, and natural and engineered shade and cooling systems are important investments that can be made in new construction and retrofits of buildings to reduce potable water use, and surface temperature, and increase vegetation and social benefits.

4.3.1. Core Components

Aspired Sustainability Impacts

Through the buildings and sites intervention, the following sustainable green systems targets will be achieved in Midtown by 2040:

- Potable water use reduction of ~70 gallons to 30 gallons per capita per day
- 300 more acres of permeable land
- 5% -10% increase of District vegetation coverage (~120 acres)
- Less acres with surface temperatures greater than 130°F

Intervention Point

Buildings are a good mechanism for engineered shade and cooling, while sites are excellent opportunity for natural shade and cooling. Building and sites present important intervention points for reducing potable water consumption, partially through well-designed rainwater harvesting and reuse mechanisms. Building and sites that use natural and engineered shade and cooling investments have the opportunity to produce positive environmental, social, and economic benefits, such as meeting places, enjoyable retail opportunities, and increased biodiversity.

Intervention Actions

The following actions in the first ten years of the transition are critical for accomplishing the impacts listed above. Further details on the actions necessary in the first five years are available in Section 3.5. The following actions are critical in meeting the milestones set in the timeline below.

- Pass code updates that create density dependent guidelines for water harvesting and reuse, and natural and engineered shade and cooling that is dependent on the density of the area. Form-based codes designate transect zones densities from 1 (least dense) to 6 (most dense).
- Design, fund, and build strong examples of water harvesting and shade and cooling investments on private property.
 - a. Create clear urban examples of onsite retention and cooling in transect zones 3–6.
 - b. Market building and sites green systems success stories.
 - c. Deliver education and capacity building programming that uses pilot projects to teach the benefits of water harvesting and reuse, and natural and engineered shade and cooling.
- Create an awards program that honors the most successful uses of the new code.
- Use the success of pilot projects to pass more progressive building and site codes for the District.
- Support research into next-generation water harvesting, water reuse, and engineered shade and cooling technologies.
- Improve and develop incentive programs for cool building materials, water harvesting and reuse technologies, and energy efficiency.
- Experiment with additional benefits of natural shade and cooling, such as food production, (e.g. on-site citrus or mesquite groves).

Resources

The following resources are needed to support the building and sites intervention. Assets (resources that already exist) are in italics:

- *City of Phoenix Departments*
 - o *Planning and Public Works for code updates*
 - o *Neighborhood Services for enforcement*
- *Reinvent PHX for new code*
- *Private property owners for investment*
- *American Society of Landscape Architects (ASLA) for design and developer consultations*
- Research to prove impact of water harvesting, and shade and cooling investments
- Training for builders and tradesman
- Incentive structures such as tax credits for use of certain materials or water systems

Barriers

- Lack of financing mechanisms
- Current codes
- Lack of education and understanding (designers & city staff)
- Climate change including increasing UHI impacts could make using natural vegetation more water intensive
- Lack of resources for maintenance
- Expense of cooling technologies

Intervention Timeline

This timeline outlines a transition towards the District's sustainable green systems vision driven by building and sites over the next 30 years. Much can change during this time; thus, this transition strategy must be revisited and updated. Some of the actions listed as happening by

2025 or 2030 may be feasible before the stated date and could possibly be addressed sooner. The purpose of this timeline is to demonstrate a possible sequence (pathway) to achieve the 2040 vision, with the recognition that some things may come faster or slower. The "By 2020" section includes major milestones that could be accomplished if all of intervention actions in the list above are implemented or at least underway.

By 2020

- A new form-based code with effective rules and regulations for water harvesting and reuse, and natural and engineered shade and cooling
- Successful engineered cooling, and water harvesting pilot projects for single-family homes the Garfield neighborhood, and mixed-used developments along Van Buren.
- A marketing campaign that includes awards for effective implementation of water harvesting and reuse, and natural and engineered shade and cooling.
- Funding secured for Arizona State University for research on next-generation technologies (for water harvesting, and engineered cooling), with some money for smaller scale research projects at elementary schools in the District.

By 2025

- New projects that test the effectiveness of next generation technologies, such as nanotechnology enhanced cooling materials, and innovative building monitoring systems
- Experiments with multi-functional natural cooling systems, such as school based mesquite groves and citrus orchards.
- Research relative educational outcomes for schools investing in building and site green systems, and relative talent retention of businesses who make similar investments.
- Creation of an incentive program that promotes the use of best available technologies.
- A marketing campaign that highlights the second

phase of successful pilot projects and experiments in the District.

By 2030

- Updated code that builds upon lessons learned from pilot projects and uses new heat mapping to target areas in the District where aggressive cooling investments are needed.
- A regenerative code that adjusts standards for cooling and water management projections.

4.3.2. Details on Investment Options for Buildings and Sites

4.3.2.1 On-Site Reuse and Harvesting

Bioretention basins, tree pockets, water harvesting, and greywater systems are landscape and building elements that collect, filter, and slowly release water. Reusing “greywater” from non-toilet inside uses and capturing and “harvesting” rainwater both reduce potable water use in and around buildings. Greywater includes wastewater from bathtubs, showers, bathroom sinks, washing machines, and laundry tubs. (It does not include wastewater from kitchen sinks, photo lab sinks, dishwashers, or laundry water from soiled diapers.) Greywater is typically used for landscaping outside, or for flushing toilets inside. Water harvesting captures and stores rainwater for later use in landscaping around the building.



This investment contributes to potable water use reduction with appliances that use less water, and substituting the use of outdoor potable water with stormwater and greywater when possible. This investment can also increase permeability promote cooling. In general,

properly designed and constructed retention cells achieve excellent removal of heavy metals, moderate storm water discharge, enhance wildlife habitats, and act as windbreaks and noise absorption.

Implementation Tools (See Section 4.5. for more details)

- *Financing* - Capital investments, Maricopa County flood control funding
- *Partnerships* - BIDs and neighborhood initiatives
- *Codes* - Building codes (plumbing requirements)
- *Capacity Building* - EPA training, Water Use it Wisely Campaign
- *Incentives* - Tax credits

4.3.2.2. Natural Cooling and Shade

Trees and other vegetation help cool the environment and reduce UHI. They help lower surface and air temperatures, with shaded surfaces 20–45 °F cooler than areas without shade. Trees and other plants are most useful when placed in strategic location where they shade buildings and fenestrations. They may also be placed in parking lots and along the street where surfaces may be hotter.



Trees and vegetation can reduce surface temperatures and support thermal comfort. Cooling effects can reduce UHI and energy use.

Investment Tools (See Section 4.5. for more details)

- *Financing* - Private financing
- *Partnerships* – BIDs and neighborhood initiatives
- *Codes* - Building codes
- *Capacity Building* - APS and SRP Tree Programs
- *Incentives* - Tax credits

4.3.2.3. Engineered Shade and Cooling

Mitigation strategies start with the location of buildings, and their orientation to the path of the sun. Facades can limit sun exposure where necessary. The placement of buildings may also create passive cooling systems, which reduce the demand for energy. Engineered cooling materials and practices also include choice of materials, vegetation, and other green infrastructure components (Giguere, 2009). Green roofs, walls and parking lots may be both reflective and pervious, especially in parking lots (Giguere, 2009). Cool zones with misters and other engineered cooling technologies can also be used. All of these components help provide shade and reduce energy demand and temperatures. Shade prevents heavier materials from absorbing the sun’s energy and contributing to UHI.



Engineered shade and cooling can support thermal comfort and reduce surface temperatures, energy use, and UHI.

Investment Tools (See Section 4.5. for more details)

- *Financing* – Capital investments, and private investment

- *Partnerships* – BIDs and neighborhood initiatives
- *Codes* – Building codes (cool material and shade requirements)
- *Capacity Building* – Cool material training
- *Incentives* – Tax credits

4.4. Open Spaces Intervention

The open space intervention refers to investments at large sites including parks, parking lots (or other underutilized lots), and open space on publicly-owned land, such as hospitals and schools.

4.4.1. Core Components

Aspired Sustainability Impacts

Through the open space intervention, the following sustainable green systems targets will be achieved by 2040:

- 500 more acres of permeable land
- 5% increase of District vegetation coverage (~60 acres)
- 200 less acres with temperatures greater than 130° F

Intervention Points

Open spaces are a critical point of intervention to cool the District, provide social and economic benefits, and retain rainwater runoff. Given that open space is often publicly owned, it is possible to make the argument that this space needs strong investments to maximize its benefit to residents, and businesses in the Midtown District. Schools, hospitals, and new construction of large-scale mixed-use development are important open spaces to make initial investments.

Intervention Actions

The following actions are critical in the first ten years of the transition for accomplishing the impacts listed above. Further details on the actions necessary in the first five years are available in Section 3.5. The following actions are critical for meeting the milestones set in the timeline

below.

- Create pilot open space projects at St. Mary's School and St. Joe's Hospital to increase retention capacity with silva cells, orchards, rain gardens, and other water harvesting and retention mechanisms.
- Design, finance, and construct a civic space pilot project using silva cells that tests capacity for structured water management in a dense area of the District, such as Central Avenue and Thomas.
- Fund research on the effectiveness of technologies and vegetation in pilot projects.
- Commence a campaign to market pilot project successes, emphasizing the importance of water management and the need for increased public space.
- Renegotiate MS4 permit to allow for next-generation stormwater solutions.
- Create long-term funding structures, such as in-lieu fees for trees and retention, which could be part of a neighborhood association (i.e. Wilow), BID (along Central Avenue), or CDC (i.e. Downtown Phoenix Partnership).
- Produce a feasibility study for neighborhood water retention on green civic spaces at parks and hospitals.

Resources

The following resources are needed to support the open space intervention. Assets (resources that already exist) are in italics:

- *Reinvent PHX to provide goals, and best practices*
- *APS & SRP shade tree program for increase trees*
- *Global Institute of Sustainability (GIOS) to research effectiveness of investments*
- *Watershed Management Group to develop pilot projects*
- *American Society of Landscape Architects to design projects and create an awards program*

- Private capital
- Nurseries for discounted trees and vegetation
- Schools (Garfield, Shaw, Edison, and ASU Prep) to grow additional plants
- Construction companies for discounted or pro bono work to reduce grade

Barriers

- Labor and time requirement to regrade schools and parks
- Existing infrastructure (expensive and challenging to retrofit existing spaces)
- Lack of capacity and understanding of developers who favor cost-cutting mechanisms
- Lack of current organizational capacity (BIDs, CDCs, and neighborhood associations) to manage and finance needed investments

Intervention Timeline

This timeline outlines a transition towards Midtown's sustainable green systems vision driven by open space over the next 30 years. Much can change during this time; thus, this transition strategy must be revisited and updated. Some of the actions listed as happening by 2025 or 2030 may be feasible before the stated date and could possibly be addressed sooner. The purpose of this timeline is to demonstrate a possible sequence (pathway) to achieve the 2040 vision, with the recognition that some things may come faster or slower. The "By 2020" section includes major milestones that could be accomplished if all of intervention actions in the list above are implemented or at least underway.

By 2020

- A new form-based code with effective rules and regulations for water harvesting and reuse, and natural and engineered shade and cooling that supports using open space for green systems (e.g. using open space as retention for zones 5–6)
- Successful pilot projects at parks and schools that

lower the grade of large portions of each property to improve its water retention capacity

- A marketing campaign including awards for effective implementation of silva cell-based civic space, neighborhood water retention, green parking on open space
- New MS4 permit that allows for neighborhood retention

By 2025

- Experiments with multi-functional natural cooling systems and water retention, such as school based mesquite groves and citrus orchards
- Updated code that builds on lessons learned from pilot projects and uses new heat mapping to target areas in the District where aggressive cooling investments are needed
- Invest in 2–3 new open space opportunities, such as an urban forest in Edison Park

By 2030

- A regenerative code that adjusts standards for cooling and water management projections
- A new marketing campaign that highlights successful the second generation pilot projects and experiments in the District, and gathers support for public investment in open space projects critical for ensuring cooling targets will be met by 2040

4.4.2. Details on Investment Types for Open Space

4.4.2.1. Neighborhood Retention Basins

Neighborhood retention basins are landscape elements that collect large amounts of water (e.g. parks, golf courses, or other uses). They filter water and slowly release it back into ground water. This investment can be placed near a dense urban area where on-site retention is not possible due to building density.



This investment contributes to permeability, and can be used to promote cooling. In general, properly designed and constructed retention cells achieve excellent removal of heavy metals, moderate storm water discharge, enhance wildlife habitats, and act as windbreaks and noise absorption.

Implementation Tools (See Section 4.5. for more details)

- *Financing* – Capital investments and Maricopa Flood control funding
- *Partnerships* – BIDs, CDCs, and neighborhood initiatives
- *Codes* - Land use ordinances, capacity building, watershed management training
- *Incentives* - Tax credits and expedited permitting

4.4.2.2. Green Civic Spaces

Green civic spaces include parks, plazas, open space, and public greens that redirect and/or store stormwater with pervious surfaces, bioswales, rain gardens, and vegetation (including trees). Green public spaces allow the Eastlake-Garfield District to be intentional in using open space and stormwater to beautify and contribute to cooling.



Green open space can significantly increase the amount of pervious surfaces in a District, and can contribute to higher stormwater quality. Green open space can also support shade and cooling efforts.

Implementation Tools (See Section 4.5. for more details)

- *Financing* - Capital investments, DOT funding (i.e. TIGER grants), BIDs, and private investment
- *Partnerships* - CDCs and neighborhood initiatives
- *Codes* - Land use ordinances
- *Capacity Building* - Watershed management training
- *Incentives* - Tax credits and expedited permitting

4.5. Details on Implementation Tools for Green Systems

Technical Program Title	Sub Type	Intervention Investment Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
FINANCING											
Community Development Block Grant Program	Grant	Buildings, open spaces	Federal	State / City	Any	Unspecified (Locate near transit to reduce transportation cost burdens)	http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs	X	X	X	X
New Market Tax Credits	Tax Credit	Buildings, open spaces	Federal	CDC / Community Development Entity	Any	Distressed Areas – HUD Designated Renewal Communities (RCs), Empowerment Zones (EZs) and Enterprise Communities (ECs)	http://www.communityfundinggroup.org/nmtc-overview.html	X	X	X	X
Program Energy Innovation Fund	Loans	Buildings, open spaces	Federal	Homeowners or property owners	Any	Unspecified	portal.hud.gov/hudoc/2010eif-ppnofa.pdf	X	X	X	X

Technical Program Title	Sub Type	Intervention Investment Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
PowerSaver Pilot 203(k) Program											
Neighborhood Stabilization Program	grant	All	City	Homeowners or property owners	Any	Unspecified	http://www.nhsphoenix.org/neighborhood_stabilization.html	X	X	X	X
PARTNERSHIPS											
Community Land Trust	Resident-based	All	Local	Residents	Any	Unspecified (Locate near transit to reduce transportation cost burdens)	http://www.newtowncdc.org/?page_id=168	X	X	X	X
Community Development Corporations	Business-or resident-based	All	Local	Residents and/or businesses	Any	Unspecified (Locate near transit to reduce transportation cost burdens)	http://www.phxrevitalization.org/about-us.html	X	X	X	X
Condos with a Homeowner	Resident-based	All	Local	Residents and/or	Any	Unspecified		X	X	X	X

Technical Program Title	Sub Type	Intervention Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
Association				businesses							
Neighborhoods and Associations	Resident-based	Open spaces, streets	Local	Residents	Any	Unspecified		X	X	X	X
Partnerships for energy efficiency in multifamily housing	Property-owner based	Buildings	Local	Residents and/or businesses	Any	Unspecified	http://www.cntenergy.org/media/Engaging-as-Partners-in-Energy-Efficiency-MF-Housing-and-Utilities-Final-012512.pdf	X		X	X
Code and guidelines Enforcement	City	All	City	Residents, Contractors, Developers, Landlords, Property Managers	Any	Unspecified	http://phoenix.gov/pdd/devcode/buildingcode/index.html	X	X	X	X
Community Benefit Agreements	Contract between developer, city and	All	City	City, Developers, Neighborhood	Any	Unspecified	http://communitybenefits.blogspot.com/ http://www.azcentral.com/news/election/topstories/articles/	X	X	X	X

Technical Program Title	Sub Type	Intervention Investment Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
	neighborhood						0630jacksonstreet0630-CP.html				
Community Amenities (Parks, community centers, libraries)	Amenities	Open Spaces	City	City, Developers, Neighborhood	Any	Unspecified (Locate near transit to reduce transportation cost burdens)		X		X	X
Support for Neighborhood Events	Programs	Open Spaces	City	City, Neighborhood	Any	Unspecified					X
CODES											
Frontage Codes	Zoning Codes	Buildings, open spaces	City	Planning Department	Any	Unspecified	http://www.formbasedcodes.org/taxonomy/term/21	X	X	X	X
City of Phoenix Street Planning and Design Guidelines	Guidelines	Streets, Open Spaces	City	City	Any	Unspecified		X		X	X

Technical Program Title	Sub Type	Intervention Investment Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
City of Phoenix Streets and Sidewalk	Standards	Streets, Open Spaces	City	City, Developers, Contractors, Residents	Any	Unspecified	http://www.codepub.lishing.com/AZ/phoenix/html/Phoenix31/Phoenix31.html	X		X	X
City of Phoenix Subdivision Code	Zoning Codes	All	City	Developers, Contractors, Residents	Any	Unspecified	http://www.codepub.lishing.com/AZ/phoenix/html/Phoenix32.html	X	X	X	X
City of Phoenix Stormwater Policies and Standards	Standards	All	City	Developers, Contractors, Residents	Any	Unspecified	http://www.codepub.lishing.com/AZ/phoenix/html/Phoenix32C.html	X		X	X
City Shade Standards	Standards	All	City	Developers, Contractors, Residents	Any	Unspecified		X		X	X

Technical Program Title	Sub Type	Intervention Investment Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
Grey water ordinances	Standards	All	City	Developers, Contractors, Residents	Any	Unspecified	http://cms3.tucsonia.gov/files/dsd/Codices-Ordinances/Ordinance11089.PDF http://cms3.tucsonia.gov/pdsd/codes-ordinances/building-codes	X			
City of Phoenix Green Construction Code	Standards	Buildings	City	Developers, Contractors, Residents	Any	Unspecified		X			
Capacity Building (Knowledge)											
Shade Tree programs	Skills, materials, and knowledge	All	City or County	Property owners	Any	Unspecified	http://www.aps.com/en/residential/save-money-and-energy/cooling-heating/Pages	X	X	X	X

Technical Program Title	Sub Type	Intervention Investment Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
	ge						/shade-tree-program.aspx				
Solar Systems Residential Guidelines	Knowledge	Buildings	City	Developers, Contractors, Property owners	Property owner, renter	Unspecified	http://phoenix.gov/webcms/groups/internet/@inter/@departments/web_content/dsd_trt_pdf_00367.pdf			X	
Water Conservation Education	Knowledge	All	City, County, State	Property owner, renter	Property owner, renter	Unspecified	http://www.azwater.gov/azdwr/StatewidePlanning/Conservation2/	X			
Landscape Design Review Guidelines (Residential)	Knowledge	All	City	Developers, Contractors, Property owners	Property owner, renter	Unspecified	http://phoenix.gov/pdd/development/sitcivil/landscape/index.html	X	X	X	X
Landscape Design Review Guidelines(Commercial)	Knowledge	All	City	Developers, Contractors, Property owners	Property owner, renter	Unspecified	http://phoenix.gov/pdd/development/pdmits/residential/resdocs/resguides/in	X	X	X	X

Technical Program Title	Sub Type	Intervention Option	Source	Applicant	Beneficiaries Resident Type	Location	Sources / Examples / Links	Reduce Stormwater Loads and harvest water on site	Reduce potable water consumption	Reduce daytime temperatures	Improve the social and economic benefits of green systems
							dex.html				
Phoenix Tree and Shade Master Plan	Knowledge	All	City	Developers, Contractors, Property owners	Property owner, renter	Unspecified	http://phoenix.gov/parks/shade.html	X	X	X	X
Incentives											
Green Construction Incentives	Financial	Buildings	City	Developers, contractors or property owners	Any	Unspecified	http://transform.gov.org/en/Article/100607/Phoenix_AZ_Offers_FirstEver_Reduced_Permit_Fees_for_Green_Building	X	X	X	
Capital Improvement Program (CIP)	Financial	All	City	Developers, contractors or property owners	Any	Unspecified		X	X	X	X

4.6. Synthesis – 5-year Action Plan for Sustainable Green Systems in Midtown

The following plan details the aforementioned intervention actions that government, non-profits, businesses, residents, and members of the Steering Committee can take to implement the sustainable green systems strategy. Actions are not sequential, but the sub-actions (a, b, c, etc.) are sequential. Actions are designated short-term (year 1), mid-term (1–3 years), or long-term (3–5 years).

Work with local schools and their districts on green systems pilot projects and educational outreach

1. Complete a 3rd Street green street pilot project with street trees, bioswales, and engineered shade. (1–3 years)
2. Create educational programming about the evidence for multiple benefits of green systems at St. Mary’s School with Arizona State University, businesses, and non-profits. (1–3 years)
 - a. Partner the Global Institute of Sustainability with local school Districts and Gateway Community College to create a green systems educational working group (GIOS)
 - b. Gather data from local pilot projects
 - c. Create initial round of testing materials and test with students
3. Create pilot open space projects at St. Mary’s School and Phoenix College with silva cells, orchards, rain gardens, and other water harvesting and retention mechanisms. (3–5 years)

Streets and Transportation Department, Planning Department, and Downtown Phoenix Partnership work on large-scale green streets and civic space projects

1. Seek city, state, and philanthropic funding for 3rd Street improvement and create a long-term maintenance and street conversion fund with adjacent property owners. (year 1)
2. Make major green streets investments on 3rd Avenue to connect St. Joe’s and Park Central. (3–5 years)

3. Design, finance, and construct a civic space pilot project using silva cells that tests capacity for structured water management in a dense area of the District, such as Park Central. (3–5 years)

Incentivize and market to developers to create open space and building and sites green systems investments

1. Pass code updates that create density dependent guidelines for water harvesting and reuse, and natural and engineered shade and cooling that is dependent on the density of the area. Form-based codes designate transect zones densities from 1 (least dense) to 6 (most dense). (Planning Department) (year 1)
2. Renegotiate MS4 permit to allow for next-generation stormwater solutions. (Public Works Department) (year 1)
3. Create an awards program that honors the most successful uses of the new code, including new technologies (Planning Department) (1–3 years)
4. Develop, Design, and building buildings with state of the art green systems technologies (3–5 years)
 - a. Create clear urban examples of onsite retention and cooling in transect zones 3–6.
 - b. Market building and sites green systems success stories.
 - c. Deliver education and capacity building programming that uses pilot projects to teach the benefits of water harvesting and reuse, and natural and engineered shade and cooling.

Chapter 5 – Discussion and Conclusions

5.1. Strengths of the Current Transition Strategy

This sustainable green systems strategy has been developed based on a community-informed sustainability vision, a detailed sustainability assessment, and a theory of change. These inputs were then processed into evidence-supported interventions and investments to transition green systems in the District from its current state to a sustainable state of fully functional stormwater, biodiversity, and resource management practices, as well as sustainable levels of thermal comfort, energy efficiency, and access to green space. The strategy adopts a long-term perspective that needs to be coordinated with short-term actions and clear roles and responsibilities to be successful.

5.2. Testing Strategy, Interventions, Investments

More work needs to be done to further understand the drivers of the green systems challenges, and to specify the vision for sustainable green systems in order to further enhance the effectiveness and efficiency of interventions and investment options. Further research needs to scrutinize barriers to implementation and potential coping strategies, such as less expensive ways to improve the grade of properties for water retention or how to overcome common maintenance challenges with street trees. This strategy report is intended to provide a basis for use-inspired research that will lead to a culture of evidence-supported policy making as it pertains to sustainable green systems in Phoenix.

Testing interventions and investments is critical to the success of the strategy. The Steering Committee and supporting staff needs to monitor which interventions are the most effective and efficient. Pilot projects can help determining the sustainability impacts of each investment. For example, an early pilot project in the investment of green streets near District schools can help develop an understanding of the ability of that investment to achieve the specific targets, including shade and porosity. If financing, design or construction of those pilot projects proves to be difficult, then investment in green systems on buildings and property may be a better investment to reach those targets. A culture of experimenting with and testing of investment options can lead to effective and

efficient policy making that demonstrates the highest impact with limited resources.

5.3. Coordination Across Strategies

There is the need for a broader transition strategy across all sectorial strategies (six planning elements), as the green systems strategy depends on other strategies. For example, strong economic development strategies will allow for more resources to be used to improve the green system of the District. If the economy of the District is strong, then businesses and property owners may be willing to pay in-lieu fees for water retention or street trees, but if economic development is weak then it is much less likely that adequate resources will be available to achieve the goals of this strategy. If these strategies are not pursued in concert, it is possible that these targets will not be reached.

5.4. Anticipating the Next Set of Interventions, Investments, and Implementation Tools

Interventions, and investments are not static. It is most likely that over the course of the next several decades that different interventions, investments, and implementation tools need to be used to achieve the green systems targets set forth. The Steering Committee and supporting city staff should attempt to anticipate possible future interventions, investments, and implementation tools that are not yet utilized in the current strategy. It is also likely that new financing mechanisms such as crowdsourcing or TIFs become viable options, and could be essential implementation tools to reach targets of green systems. While this strategy provides a solid set of intervention and investment options, it is important that these options are continual tested and monitored, while emerging options are explored.

5.5. Crafting the Next 5-year Plan

It is also important to understand that there is a lot of uncertainty about what will occur in the future that might make aspects of this strategy obsolete. Therefore, it is important that the strategy is regularly revisited and revised. Every 5-year cycle should give the Steering Committee, City of Phoenix Departments, and other stakeholders the opportunity to revisit progress towards

the goals and targets, and craft a new five year plan. This will give stakeholders an opportunity to decide on critical actions that include what roles and responsibilities need to be fulfilled in the next five years. Lessons from the previous five years should inform the creation of the next five years, so that realistic expectations are set for what the group can accomplish in this timeframe. While the long-term view of this strategy is important in terms of 'keeping the eyes on the prize', it is critical that the Steering Committee and other stakeholders in the District organize their efforts around short-term action plans.

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