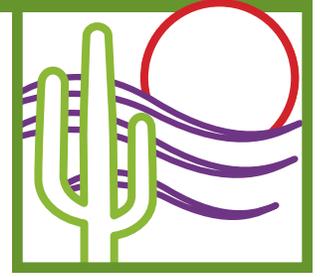




Located in the environmentally rich Sonoran Desert and surrounded by mountains, the Tucson Basin is renowned for its natural resources and beauty.



# THE NATURAL ENVIRONMENT



- **Energy & Climate Readiness**
- **Water Resources**
- **Green Infrastructure**
- **Environmental Quality**

## Introduction

Tucson has grown rapidly over the past 60 years, both in population and geographically. This growth presents challenges to the protection of the natural environment, including water, air, native vegetation, and open space. A healthy environment is critical to ensuring and sustaining a community that is healthy, productive, and resilient.

Tucson is located in the Sonoran Desert at an elevation of about 2,400 feet above sea level. With average annual precipitation of 12 inches per year regionally, conservation and prudent management of water resources is a high priority for the City. The sun shines about 350 days per year, and summers are long and hot, putting a strain on public infrastructure, the power grid, and people. The City must continue its efforts to address and mitigate these effects.

Provision and maintenance of a healthy and abundant tree canopy cover and associated native vegetation create a comfortable pedestrian environment and reduce energy use in buildings. Pursuing solar use makes sense as an alternative energy source for our community, and offers an opportunity for Tucson to become a national and international leader in the development and use of solar power. Tucson was designated a Solar America City in 2007 by the U.S. Department of Energy, making it one of only 25 cities in the United States to have this designation.

The Natural Environment Focus Area presents goals and policies that address the four topics shown above which are important to the future of Tucson's natural environment and the community as a whole. The goals for the Natural Environment are presented together on the next page, followed by policies for each of the referenced topics.

The Arizona State Statute requirements for general plans that are addressed in this chapter include conservation, open space, water resources, energy, and environmental planning.

**A native pincushion cactus in bloom.**





# GOALS

## The City strives for

- 10** A reputation as a national leader in the development and use of renewable energy technologies, water conservation, waste diversion and recovery, and other emerging environmentally-sensitive industries.
- 11** A reduction in the community's carbon footprint and greater energy independence.
- 12** A community that is resilient and adaptive to climate change.
- 13** Abundant and appropriate use of native plants and trees.
- 14** A network of healthy, natural open space managed for multiple benefits.
- 15** A secure, high quality, reliable, long-term supply of water for humans and the natural environment.
- 16** A comfortable, attractive, and pollution-free environment.
- 17** Sound, efficient, ecological policies and practices in government and in the private sector.

Pedestrians benefit from street trees along Scott Avenue in downtown Tucson.





# Energy & Climate Readiness

While the City of Tucson does not regulate or manage energy utilities, it is a major consumer of electricity, natural gas, and fuels, and a contributor to greenhouse gas emissions. Through its internal operations, transportation and land use policies, development standards, building codes and public education, the City of Tucson can have a significant impact on increasing community energy

efficiency, supporting sources of alternative energy, reducing dependence on carbon-based energy, and preparing for a changing and unpredictable climate.

Since the 1990s, the City has pursued energy efficiency standards. It has been a leader in promoting solar energy technologies for residential, commercial and public buildings, and has been active in efforts to understand how climate change may affect the region and to plan for anticipated impacts. The City's Office of Conservation and Sustainable Development and the General Services Department have been actively involved in energy efficiency and solar energy initiatives and projects. Mayor and Council actions have included:

- Adopting the Sustainable Energy Standards (Resolution No. 10178 and 10417)
- Adopting 2012 International Energy Conservation Code (Ordinance No. 11042)
- Adopting 5% solar requirements for City buildings (Ordinance No. 10178)
- Adopting LEED Silver Standards (U.S. Green Building Council) for new City buildings and renovations over 5,000 square feet (Resolution No. 20322)
- Adopting the voluntary Green Building Program (Resolution No. 21369)
- Establishing requirements that all new single family homes and duplexes be "solar ready" for installation of electric

(photovoltaic) and hot water systems (Ordinance No. 10549)

- Endorsing the Mayors' Climate Protection Agreement (Resolution No. 20443)
- Adopting the Framework for Advancing Sustainability (Resolution No. 21012)
- Approving the Phase 1 Climate Mitigation Report and Recommendations (Resolution No. 21838)
- Adopting cost-recovery solar permit flat fee (February 12, 2013, Mayor and Council Study Session)

Beginning in 1999, the City of Tucson has installed photovoltaic (PV) panels on City facilities including council offices, neighborhood community centers, police substations, reservoir decks, and mounted large systems on the ground at more remote City locations. The City

**The Tucson Convention Center solar project, completed in May 2012, placed 591.4 kw of solar panels on the roof which generates approximately 920,604 kWh/year, enough to power about 85 Tucson homes.**





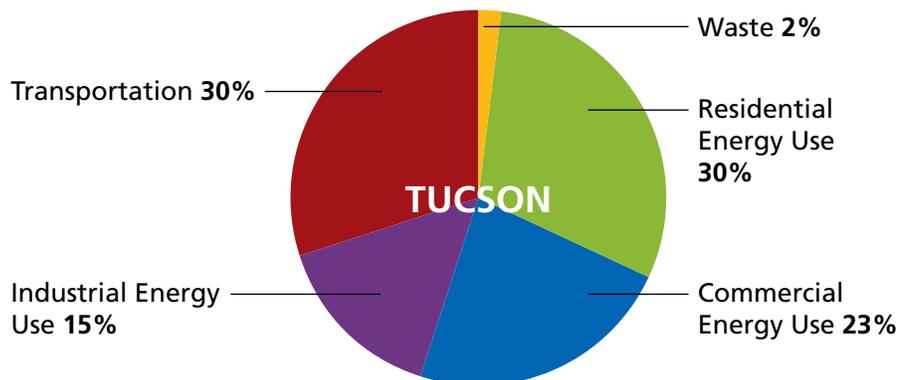
has also installed solar water heating at community gyms, a police and fire training facility, a fire station, and a therapeutic swimming pool. Each of these systems reduces the amount of electricity the City must purchase from energy utilities and sets an example for residents. In addition, the City has sponsored many solar classes and workshops for homeowners to learn more about solar, and working with Pima County, established the Solar One Stop, an educational website for all things solar in Southern Arizona.

The City is committed to removing barriers to solar in the community by streamlining permitting and zoning procedures, protecting solar access, considering solar orientation in new developments, and establishing demonstration programs to facilitate solar installations by businesses and residents. Tucsonans have installed solar in increasing numbers in recent years, including solar panels on homes, on carports at businesses, and on the ground. Solar hot water heaters have become popular and some neighborhoods have installed solar streetlights. The City plans to continue and expand support for solar opportunities in the community.

In 2012 City operations consumed about 150 million kilowatts or \$15 million worth of electricity per year. By increasing energy efficiency and using non-carbon based forms of energy, such as solar, the City and its residents, businesses, and institutions can reduce the cost of energy and decrease greenhouse gas emissions. Most of Tucson’s energy comes from coal-fired power plants, and when coal is burned, greenhouse gases are created. Currently, about 4% of the City’s energy is generated by solar power. The Pima Association of Governments’ Regional Greenhouse Gas Inventory (November 2012) quantified greenhouse gas emissions throughout the region for the period 1990-2010. Total greenhouse gas emissions in Tucson were 7,064,269 million metric tons in 2010, with transportation and residential energy accounting for 30% each of the total (*Exhibit EC-1*). A comparison of per capita greenhouse gas emissions for Tucson and other cities can be found in *Exhibit EC-2*.

Climate scientists understand that human activity is impacting the earth’s climate. Researchers who conducted the recent Southwest Climate Assessment have found that the Southwestern region of the United States has experienced

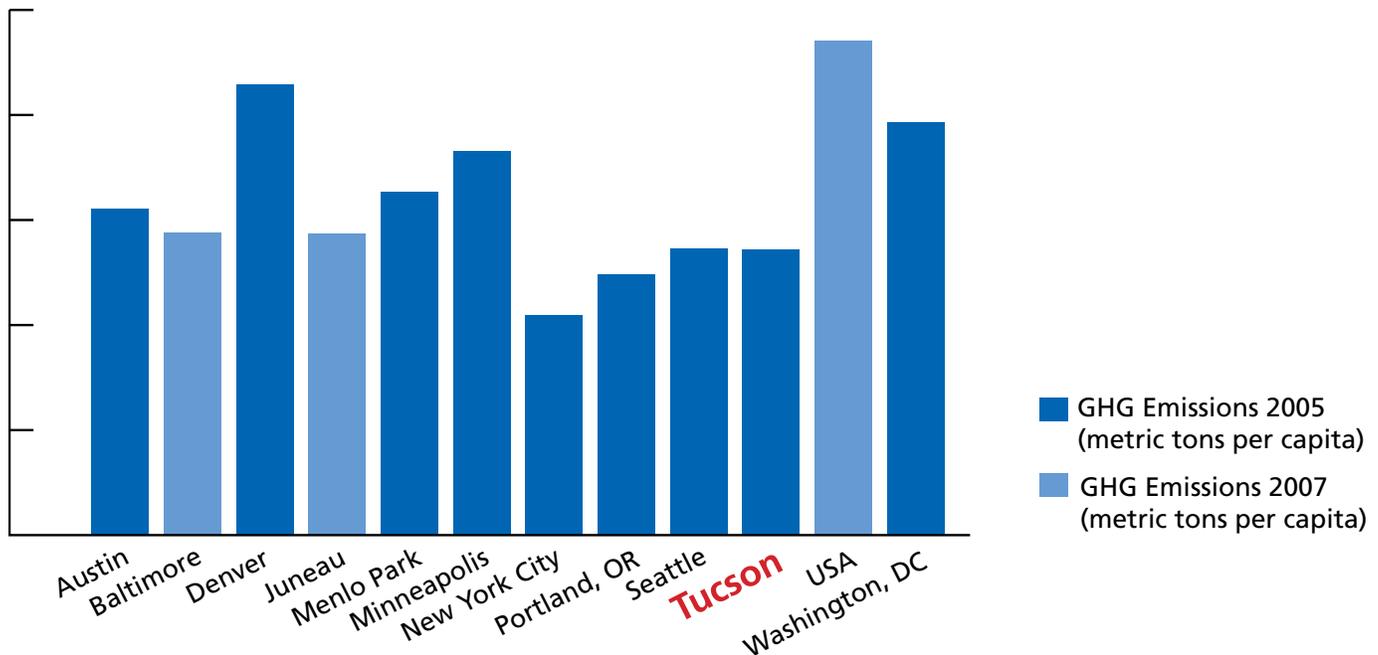
**EXHIBIT EC-1 Tucson Greenhouse Gas Emissions, 2010**



Source: <http://www.pagnet.org/documents/Air/GreenHouseGas-2012-Inventory.pdf>



## EXHIBIT EC-2 Comparison of Greenhouse Gas (GHG) Emissions



Source: Daniel Hoornweg, Lorraine Sugar and Claudia Lorena Trejos Gómez

"Cities and greenhouse gas emissions: moving forward"

Environment and Urbanization 2011 23: 207 originally published online 10 January 2011

average annual temperature increases of about 1.6 degrees Fahrenheit between the years 1901 to 2010.<sup>1</sup> Climate projections from the Southwest Climate Assessment study for the Southwestern region are that the average annual temperature will increase an additional 1-4 degrees between the years 2021 and 2050; 1-6 degrees between 2051 and 2070; and 2-9 degrees between 2071 and 2099. The ranges are due to different greenhouse gas emissions scenarios. Additional projections include an increase in certain season's temperatures—particularly summer and fall.

The amount of rainfall that the region receives may also be affected. Scientists project a decrease in average annual precipitation in the southern part of the

Southwestern region (including Arizona). Spring precipitation is projected to decrease 9-29% between the years 2070 and 2099, depending on the emissions scenario. The region may also experience more rain falling in shorter periods of time. Extreme daily precipitation is projected to increase in the last half of the 21st century, that is, more precipitation may fall in fewer, but more intense, storms.

Other projected climate impacts include more extreme climate-related events, such as prolonged periods of drought, heat waves, and flooding; greater stress on surface and groundwater supplies; climate-related human health risks, including heat stress, aeroallergen-related respiratory illness, rodent- and

<sup>1</sup> Overpeck, Jonathan, Gregg Garfin, Angela Jardine, Dave Busch, Dan Cayan, Michael Dettinger, Erica Fleishman, Alexander Gerunshov, Glen MacDonald, Kelly Redmond, William Travis, and Bradley Udall, 2012. Chapter 1: Summary for Decision Makers. In *Assessment of Climate Change in the Southwest United States: A Technical Report Prepared for the U.S. National Climate Assessment*. A report by the Southwest Climate Alliance [Gregg Garfin, Angela Jardine, Robert Merideth, Mary Black, and Jonathan Overpeck (eds.)]. Tucson, AZ: Southwest Climate Alliance. June 2012 Southwest Climate Summit Draft.

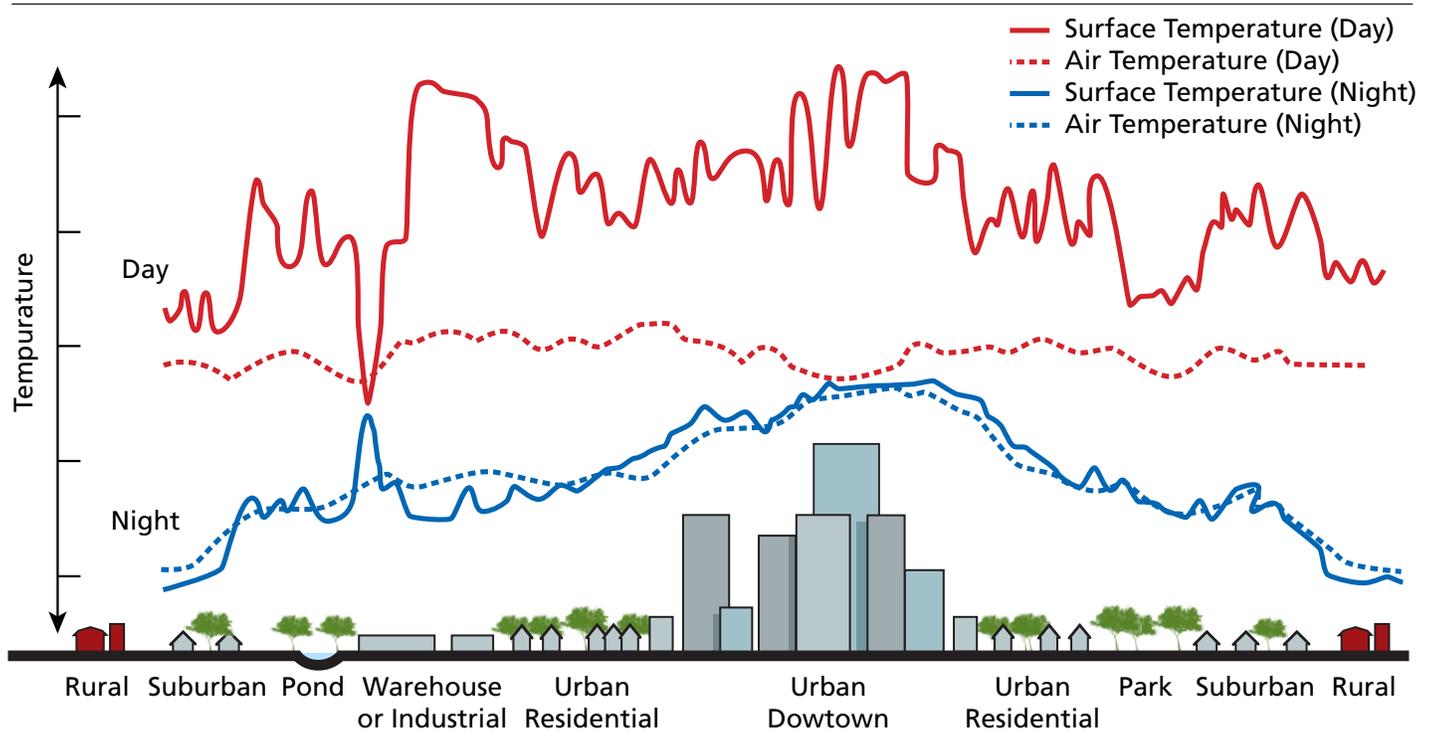


insect-borne diseases; and negative impacts to food affordability and food security.<sup>2</sup> A negative feedback loop is created by an increased demand for air conditioning (and, thus, coal based electricity) as a result of rising temperatures, which further contributes to greenhouse gas emissions. Increased demand for electricity in a warming climate also increases water demand for both electric power plant cooling and for landscaping and agriculture irrigation. In turn, greater water demand requires substantial energy use, mainly to pump, treat, and distribute water supplies.

Land use, urban design, building materials, landscaping, and natural open space all contribute to ambient

temperatures. Cities form “heat islands” because the built environment holds heat longer than surrounding forested and vegetated areas. Heat is retained by concrete sidewalks, buildings, parking lots, roadways, and other structures (*Exhibit EC-3*). When temperatures cool down at night, the developed areas of the city give off heat that has been stored during the day, keeping temperatures higher than in surrounding areas. Areas in the center of a city can be as much as 10-15 degrees warmer than areas outside the city.<sup>3</sup> An analysis of 30 years of temperature data in Tucson indicates that the rate of urban warming is three times greater than warming in the surrounding non-urban areas.

### EXHIBIT EC-3 Urban Heat Island Profile



Source: EPA, Urban Heat Island Effect

<sup>2</sup> Ebi, K.L., F.G. Sussman, T.J. Wilbanks. Analyses of the effects of global change on human health and welfare and human systems. In *A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research*. J.L. Gamble, (ed.). U.S. Environmental Protection Agency, Washington, DC, 2008.

<sup>3</sup> Stiles, Lori. “Heat Island Effect Warms Tucson Faster As City Grows.” *UA News*. September 19, 2000.



The analysis finds that Tucson's urban temperatures have climbed 5.5 degrees over average temperatures 100 years ago. Most of the increase in temperature (3.5 degrees) has occurred in the last 30 years. Higher temperatures put additional stress on people, utilities, infrastructure, water, and vegetation.<sup>4</sup>

An outcome of the Tucson Mayor and Council's endorsement of the U.S. Mayors' Climate Protection Agreement and the adoption of the Framework for Advancing Sustainability in 2008, was the creation of the Climate Change Citizens' Advisory Committee to address the multiple dimensions of climate change in a strategic manner. The Committee is charged with the creation of a Climate Change Mitigation and Adaptation Plan (MAP) that will include recommendations and action steps to achieve the City's greenhouse

gas emissions reduction commitments under the Mayors' Climate Protection Agreement.

Climate change has significant implications for the Tucson community, including impacts on electric utilities, emergency management, public infrastructure, ecosystem health, human health, and the economy. The City of Tucson can contribute to a more sustainable future by reimagining its internal policies, practices, and operations and by promoting energy conservation and the use of renewable energy sources through land use and transportation policies, development standards, building codes, and public education.

The policies that follow, as well as other policies in this document, are intended to contribute to this effort.



**Trees help ameliorate the urban heat island.**

<sup>4</sup> [http://www.southwestclimatechange.org/impacts/people/urban\\_heat\\_island/statistics](http://www.southwestclimatechange.org/impacts/people/urban_heat_island/statistics). University of Arizona Institute for the Environment. Accessed August 30, 2012.



# POLICIES

## Energy & Climate Readiness (EC)

- EC1** Require new and existing City infrastructure, facilities, and operations to use best energy efficiency technologies and energy conservation practices and strive for net zero energy facilities.
- EC2** Require increased energy efficiency in new private building construction and facilitate the transition of new private construction toward net-zero buildings.
- EC3** Reduce the urban heat island effect by minimizing heat generation and retention from the built environment using a range of strategies.
- EC4** Increase the use of low carbon and renewable energy sources, high fuel efficiency vehicles, and non-motorized transportation.
- EC5** Develop community energy conservation education and energy efficiency retrofit programs and identify appropriate new financing opportunities for energy efficiency and solar energy installations.
- EC6** Increase the use of solar power and other renewable energy sources for City infrastructure, facilities, and operations.
- EC7** Facilitate community use of solar power and other renewable energy sources.
- EC8** Assess and prepare for the effects of climate change on City infrastructure, facilities, and operations.
- EC9** Assess and address the vulnerability of the community's health and safety, economy, and natural resources to climate change, and develop assurances that vulnerable and disadvantaged populations are not disproportionately impacted by climate change.

## Other Related Policies

ELEMENT	Policy #	PAGE #
Housing	H1, H3, H4	3.11
Economic Development	ED1, ED3–ED5, ED9	3.20
Public Safety	PS9	3.25
Parks & Recreation	PR8, PR9	3.30
Arts & Culture	AC3, AC9	3.37
Public Health	PH1, PH4, PH8	3.41
Urban Agriculture	AG1–AG4	3.45
Education	E3, E7	3.50
Governance & Participation	G1-G12	3.56
<b>Energy &amp; Climate Readiness</b>		<b>3.66</b>
Water Resources	WR2–WR4, WR6 -WR11	3.71
Green Infrastructure	GI1–GI6	3.77
Environmental Quality	EQ1–EQ3, EQ7	3.83
Historic Preservation	HP1, HP3	3.93
Public Infrastructure, Facilities & Cost of Development	PI2–PI4	3.101
Redevelopment & Revitalization	RR1, RR3, RR5, RR6	3.108
Land Use, Transportation & Urban Design	LT1, LT3, LT4, LT9–LT17, LT19, LT22	3.126



# Water Resources

Water is an essential resource to sustain human life, a healthy environment, and a strong economy. Since its early days, Tucson has relied on the same underground water source. In the mid-1940s, the city began to grow rapidly, which resulted in a significant lowering of the groundwater table with both economic and environmental consequences. Today there is competition for

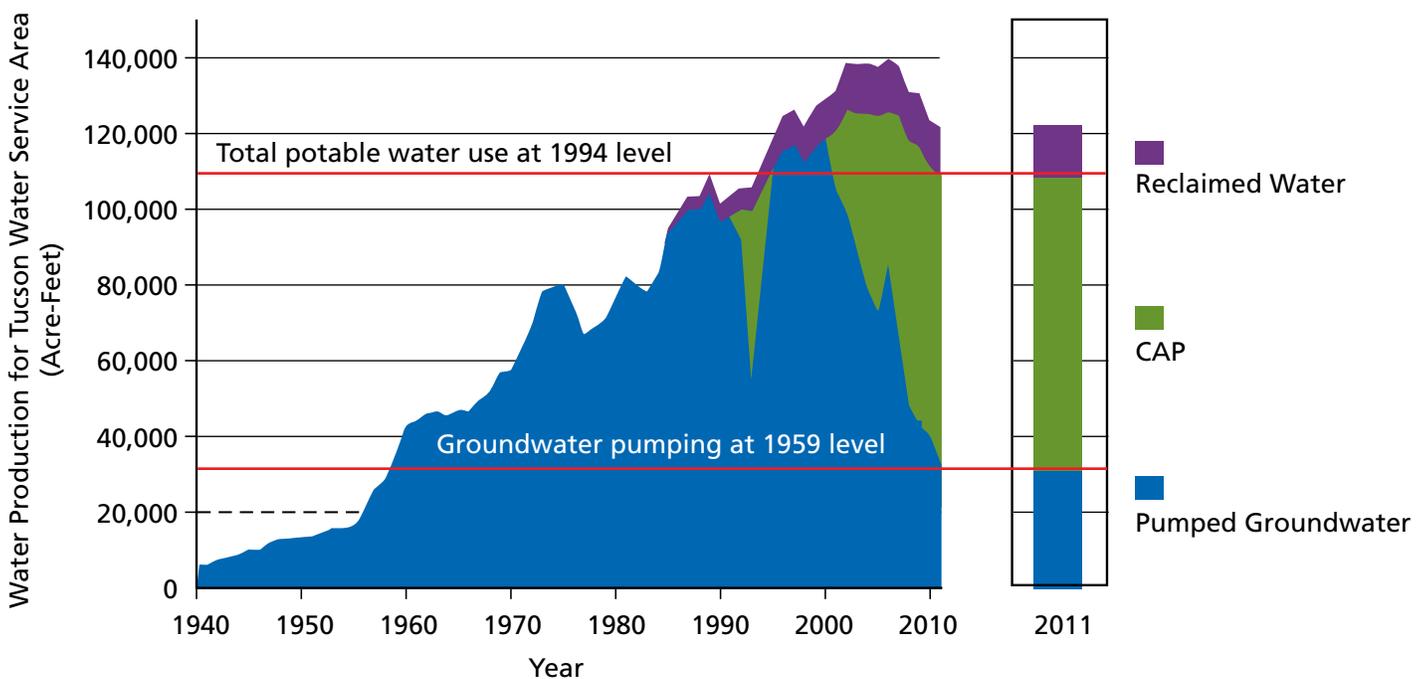
limited water resources—including potable water, reclaimed water, and rainwater—among commercial, industrial, and residential sectors, water companies, and private well owners.

One important long-term goal for water managers is the attainment of what is called “safe yield,” meaning that no more water is withdrawn from the groundwater aquifer than is replenished. Tucson has decreased its use of groundwater in recent years, and two-thirds of its current water supply now comes from recharged Colorado River water (*Exhibit WR-1*). As the largest municipal water provider in the region, Tucson Water, a department of

the City of Tucson, plays an important role in assuring a long-term, high quality, dependable supply of water. The City’s Environmental Services Department is responsible for monitoring and protecting groundwater and stormwater at 23 abandoned landfills within the City limits.

Defining a sustainable water future will require changes in how water is used and managed in Tucson and throughout the region. In 2009, the City of Tucson and Pima County released the results of a joint project called the Water & Wastewater Infrastructure, Supply & Planning Study. This study was the result of unprecedented regional cooperation to plan the area’s water future. The

**EXHIBIT WR-1 Transition to Renewable Supplies**



Source: City of Tucson Water Department



study defines a new paradigm for water resource planning and management that:

- recognizes scarcity and uncertainty
- includes the natural environment as a recipient of water
- balances water supply and demand
- builds upon the link between urban form and water use
- elevates public discussion of water resource planning to a central position in the future.

The three essential pillars of long-term water planning identified in the Water & Wastewater Study include aggressive demand management, the development of new water supplies, and guiding growth in terms of urban form, density, and location.

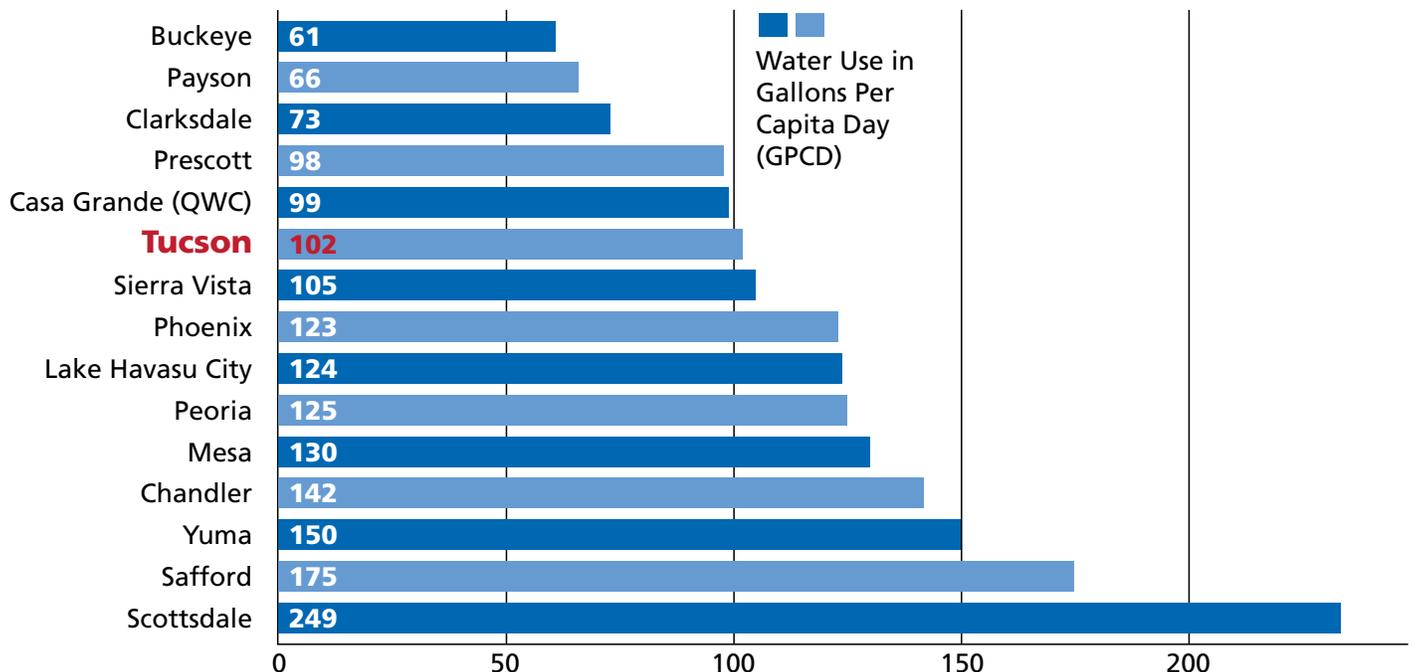
A historic disconnect between land use planning and water resource and infrastructure planning has had negative impacts on the region, including declines in the groundwater level and growth in places that lack

adequate water infrastructure and other public infrastructure and services. The region’s urban growth patterns have contributed to subsidence, habitat loss or degradation, groundwater contamination, and increased flooding. The cost of this growth has been born by local governments, other service providers, and taxpayers.<sup>5</sup>

An outcome of the Water & Wastewater Study was the adoption of a Water Service Area Policy by the Tucson Mayor and Council in 2010 (Resolution No. 21602). This policy establishes a water service boundary for Tucson Water as shown in *Exhibit WR-2* on the next page. Requests for water service outside this boundary will be carefully evaluated and the impact on existing and future obligated customers will be assessed following an established set of criteria.

Along with guiding growth to better manage water use, Tucson Water has actively and successfully sought ways to decrease water demand. Tucson has been

### EXHIBIT WR-3 Single-Family Residential Water Use (GPCD), 2008

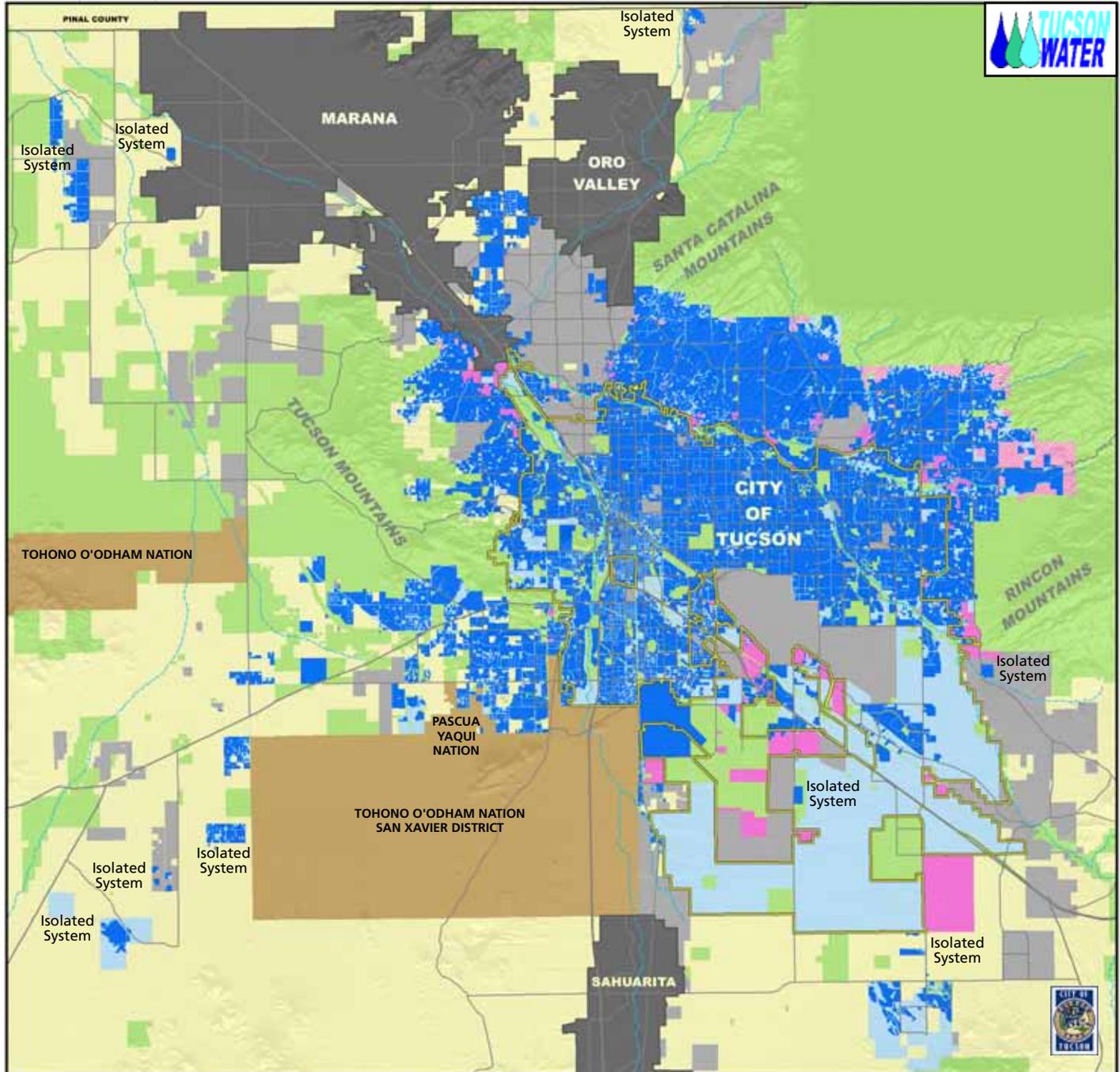


Source: Western Resource Advocates, *Arizona Water Meter: A Comparison of Water Conservation Programs in 15 Arizona Communities*. 2010.

<sup>5</sup>City of Tucson and Pima County. "Integrating Land Use Planning with Water Resources and Infrastructure." Technical Paper, July 2009.



**EXHIBIT WR-2 Tucson Water Service Area, Established 2010**



Source: City of Tucson Water Department



**Existing Obligated Service Area**

- Current Service Area
- Obligated Area (currently not served)

**Expansion Areas**

- Proposed Service Area—Annexation required
- Proposed Service Area—Annexation may be required

**Non-Expansion Areas**

- Unincorporated Pima County
- Other Water Provider
- Other Jurisdiction
- Reservation
- Parks and Government Uses



at the forefront of water conservation efforts in Arizona and in the country for three decades. Tucsonans use less water per person than many other communities in Arizona (*Exhibit WR-3*).

Public awareness of the importance of limited water resources and increases in water conservation behavior, greater water efficiency and conservation by public agencies and water utilities, and local regulations have all contributed to a decrease in the demand for water. The Commercial Rainwater Harvesting Ordinance (No. 10597) and the Residential Gray Water Ordinance (No. 10579) both encourage greater use of alternative supplies of water for non-potable uses. The City's reclaimed water system provides water for non-potable uses to many Tucson Water customers.

Rainwater that falls onto Tucson's streets and buildings has the potential to contaminate groundwater through

a process called "non-point source pollution." Rains wash oil, grease, animal waste, and other contaminants from the street into storm drains which then empty to washes and rivers. The Stormwater Quality Ordinance passed by the Mayor and Council in 2005 (No. 10209) gives jurisdiction over management of stormwater quality in the city to the Department of Transportation. Under the Ordinance, the City can inspect businesses, facilities, and construction sites to ensure that pollutants such as oil, grease, sediment, and trash do not get picked up by stormwater runoff and transported to the region's fragile washes.

The following policies support the continuation of water planning to achieve a long-term, high quality, dependable water supply.



A rain water cistern captures water for non-potable use.



Debris and contaminants from streets may be washed into washes during flooding.



# POLICIES

## Water Resources (WR)

- WR1** Continue to plan and manage the City's water supplies, quality, and infrastructure for long-term reliability and efficiency.
- WR2** Expand the use of alternative sources of water for potable and non-potable uses, including rainwater, gray water, reclaimed water, effluent, and stormwater.
- WR3** Expand effective water efficiency and conservation programs for City operations and for the residential, commercial, and industrial sectors.
- WR4** Ensure an adequate amount of water to meet the needs of riparian ecosystems.
- WR5** Protect groundwater, surface water and stormwater from contamination.
- WR6** Integrate land use and water resources planning.
- WR7** Collaborate on multi-jurisdictional and regional water planning and conservation efforts.
- WR8** Integrate the use of green infrastructure and low impact development for stormwater management in public and private development and redevelopment projects.
- WR9** Provide opportunities to supply alternative water sources for sewer system flush.
- WR10** Continue to manage the City's Water Service Area, considering service area expansion only when it furthers the long-term social, economic, and environmental interest of City residents.
- WR11** Conduct ongoing drought and climate variability planning.

### Other Related Policies

ELEMENT	Policy #	PAGE #
Housing	—	3.11
Economic Development	ED3, ED5, ED10	3.20
Public Safety	PS9	3.25
Parks & Recreation	PR2, PR8, PR9	3.30
Arts & Culture	AC9	3.37
Public Health	PH1- PH3, PH6, PH8	3.41
Urban Agriculture	AG1–AG4	3.45
Education	E7	3.50
Governance & Participation	G1-G12	3.56
Energy & Climate Readiness	EC3, EC7- EC9	3.66
<b>Water Resources</b>		<b>3.71</b>
Green Infrastructure	GI1–GI6	3.77
Environmental Quality	EQ1, EQ2, EQ6, EQ7	3.83
Historic Preservation	HP4, HP5	3.93
Public Infrastructure, Facilities & Cost of Development	PI1–PI6	3.101
Redevelopment & Revitalization	RR1–RR3, RR5	3.108
Land Use, Transportation & Urban Design	LT1, LT3, LT4, LT7, LT8, LT10, LT12, LT18–LT21, LT25	3.126



# Green Infrastructure

The City of Tucson plays a large role in the development and maintenance of green infrastructure. The Urban Landscape Framework, endorsed by the Mayor and City Council in 2008, identifies eleven departments with some level of responsibility for landscape issues. The City entities with the greatest role in providing and maintaining green infrastructure are the Parks and

Recreation Department, which plans, develops and maintains green infrastructure in parks, and along trails, and manages undeveloped open space; Tucson Water, which provides water for cultivating and maintaining green infrastructure and manages open space; the Planning and Development Services Department, which develops policy, regulations, and standards affecting green infrastructure; and the Office of Conservation and Sustainable Development, which develops habitat conservation plans, prepares environmental policy, assists with riparian habitat restoration, and administers the urban landscape program. The Landscape Advisory

Committee serves in an advisory capacity to the Mayor and Council on policies, planning, design, management, and public education related to the landscape and vegetation resources.

The term “green infrastructure” came into usage in the mid-1990s and refers to strategically planned and managed networks of natural lands, working landscapes, and other open spaces that conserve ecosystems and provide associated benefits to people. The term is expanded here to encompass the urban landscape comprised of street trees and associated vegetation sometimes referred to as the “urban forest.” Green infrastructure includes the “patches” of vegetation found in and around a city, as well as the “corridors,” often washes and trails, which connect these patches. Green infrastructure can also be small-scale agriculture and community gardens.

Low-impact development, closely associated with green infrastructure, treats stormwater as an important resource to support urban vegetation, and not as a waste product to be discarded quickly. A sustainable urban form includes green infrastructure throughout a community which helps mitigate the impacts of development and higher density.

Research has shown significant community benefits from green infrastructure, including improved air and water quality; decreased flooding; urban heat island reduction; wildlife habitat; greater resilience to climate change; increased exercise and

**Native trees provide shade helping to reduce heat and provide habitat and visual interest.**





### EXHIBIT GI-1 Value of Street Trees in Tucson

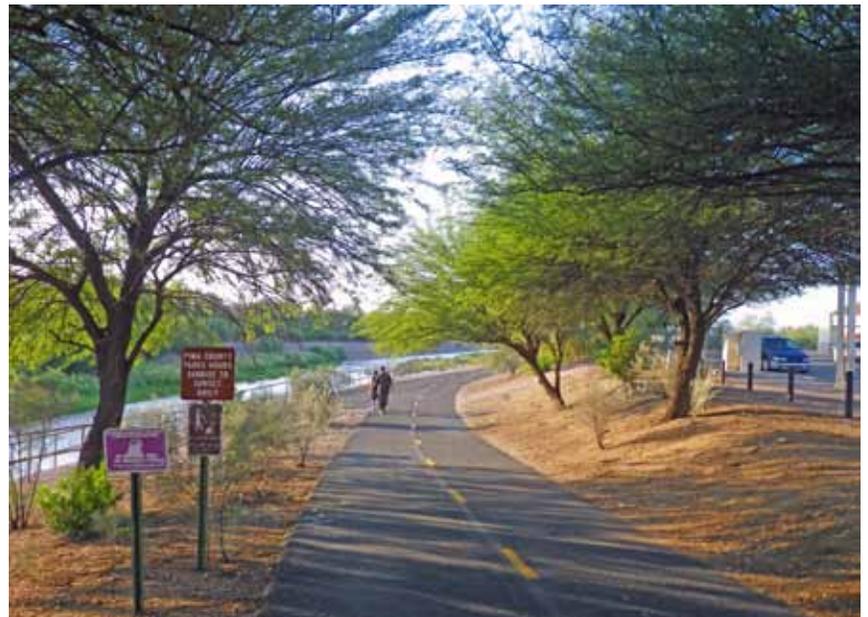
Value	Downtown Trees <sup>1</sup>	Major Streets & Routes Trees <sup>2</sup>
<b>Number of trees counted</b>	1199	18,840
<b>Reduction in energy usage</b>	115 megawatt hours/year (~ 9 households)	2,224 megawatt hours/year (~172 households)
<b>Reduction in ground-level ozone (O3)</b>	126 pounds per year	4,274 pounds per year
<b>Removal of nitrogen dioxide (NO2) per year</b>	224 pounds per year (~ emissions from 6 cars)	6,020 pounds per year (~emissions from 158 cars)
<b>Sequester and reduce carbon dioxide (CO2)</b>	161,780 pounds per year (~emissions from 14 cars)	20,057,544 pounds per year (~emissions from 2243 cars)
<b>Intercept stormwater</b>	600,391 gallons/year	15,112,900 gallons/year
<b>Total economic benefits</b>	\$52.29 per tree/year or \$62,696 total/year	\$72.31 per tree/year or \$1,362,320 total/year

recreational opportunities; community cohesion; economic investment; reduced crime; psychological and spiritual renewal; and more attractive and comfortable public spaces. Significant economic benefits can be realized from an extensive and healthy tree canopy cover. As shown in *Exhibit GI-1*, street trees in the downtown area and along major streets and routes in Tucson provide about \$1.5 million in ecosystem service benefits.

In Tucson, natural washes and riparian areas are major components in a green infrastructure network. Riparian areas provide a wide range of benefits including wildlife habitat and linkages; storm water conveyance; flood reduction; biological treatment of urban water runoff; groundwater recharge; recreational use; removal of carbon from the atmosphere; and aesthetic enhancement. Washes are often the only open space in some highly

urbanized areas of central Tucson, and these washes are a primary conduit for the urban trail system developed by the City's Parks and Recreation Department and the Department of Transportation in collaboration with Pima County. In addition to the 13 miles of trails

#### Trail along the Santa Cruz River.

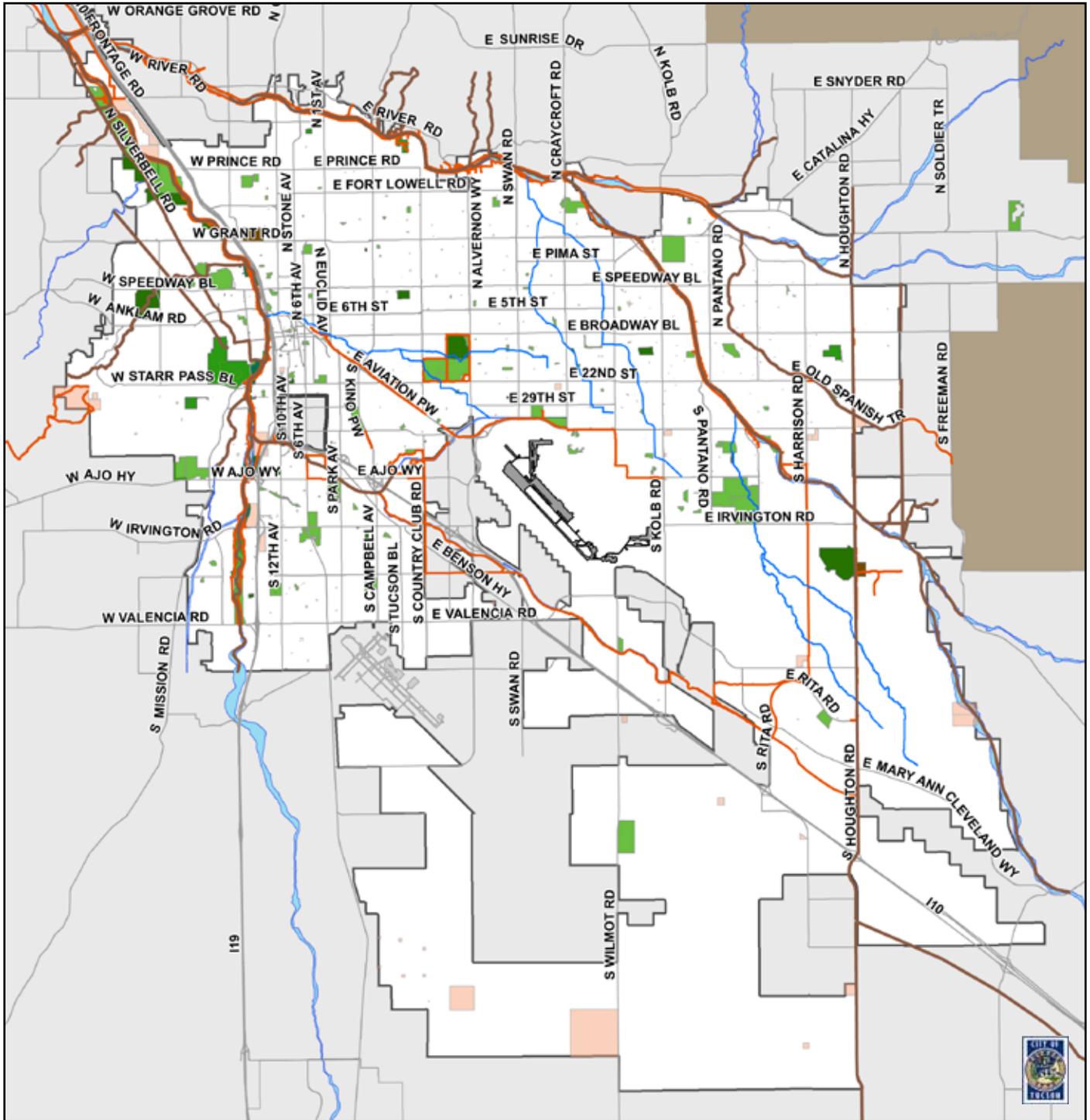


<sup>1</sup>Meadow, Alison M., Urban Forest Effects and Values: Downtown Comprehensive Street Tree Plan Area, iTree Streets Ecosystem Analysis, City of Tucson, Office of Conservation and Sustainable Development, May 2011

<sup>2</sup>Meadow, Alison M., Urban Forest Effects and Values: Major Streets and Routes, iTree Streets Ecosystem Analysis, City of Tucson, Office of Conservation and Sustainable Development, December 2010.



EXHIBIT GI-2 Parks, Washes, Trails & Open Space



Source: City of Tucson IT GIS Section



- Trails
- River Park System
- School Parks
- City Parks
- Tucson Water Property
- Major Washes
- Natural Resource Parks
- Undeveloped Park Property
- City of Tucson
- Federal Lands
- Other Jurisdictions



within Tucson, the Parks and Recreation Department manages 4,631 acres of recreational land and 552 acres of undeveloped open space. Many urban washes have been impacted by human activity and development, and require rehabilitation. Non-native, invasive species dominate many urban washes and wildlife habitat is isolated and degraded. *Exhibit GI-2* shows the range of open space in Tucson.

The City's Office of Conservation and Sustainable Development, in consultation with technical and stakeholder committees, has prepared two Habitat Conservation Plans to comply with the Endangered Species Act (*Exhibit GI-3*). These plans—one for the Avra Valley and the other for the Greater Southlands area—document the occurrence of endangered, threatened, and vulnerable species while also describing conservation strategies to mitigate possible future development impacts to those native species. The Office also participated with Pima County in the Lee Moore Watershed Basin Management Study to ensure that land use planning, development, water resources, public infrastructure, and

habitat preservation needs were identified before development occurs in the Lee Moore Watershed.

Green infrastructure is especially useful in the Southwest to reduce the impacts from high and increasing temperatures. One challenge is how best to provide water for riparian areas and landscape plants in public areas given limited water supplies and human needs. Green infrastructure, along with passive rainwater harvesting, is one way that rainfall can provide the water needed for native trees and plants along streets and in parks and other public spaces. Green infrastructure for stormwater management can also reduce flooding by slowing down the flow of water in high precipitation events and encouraging on-site rainwater infiltration. A second challenge is securing the financial resources to maintain the urban landscape and rehabilitate and preserve natural open space. The City is exploring ways to increase private-public partnerships and community support for the maintenance of urban green infrastructure.

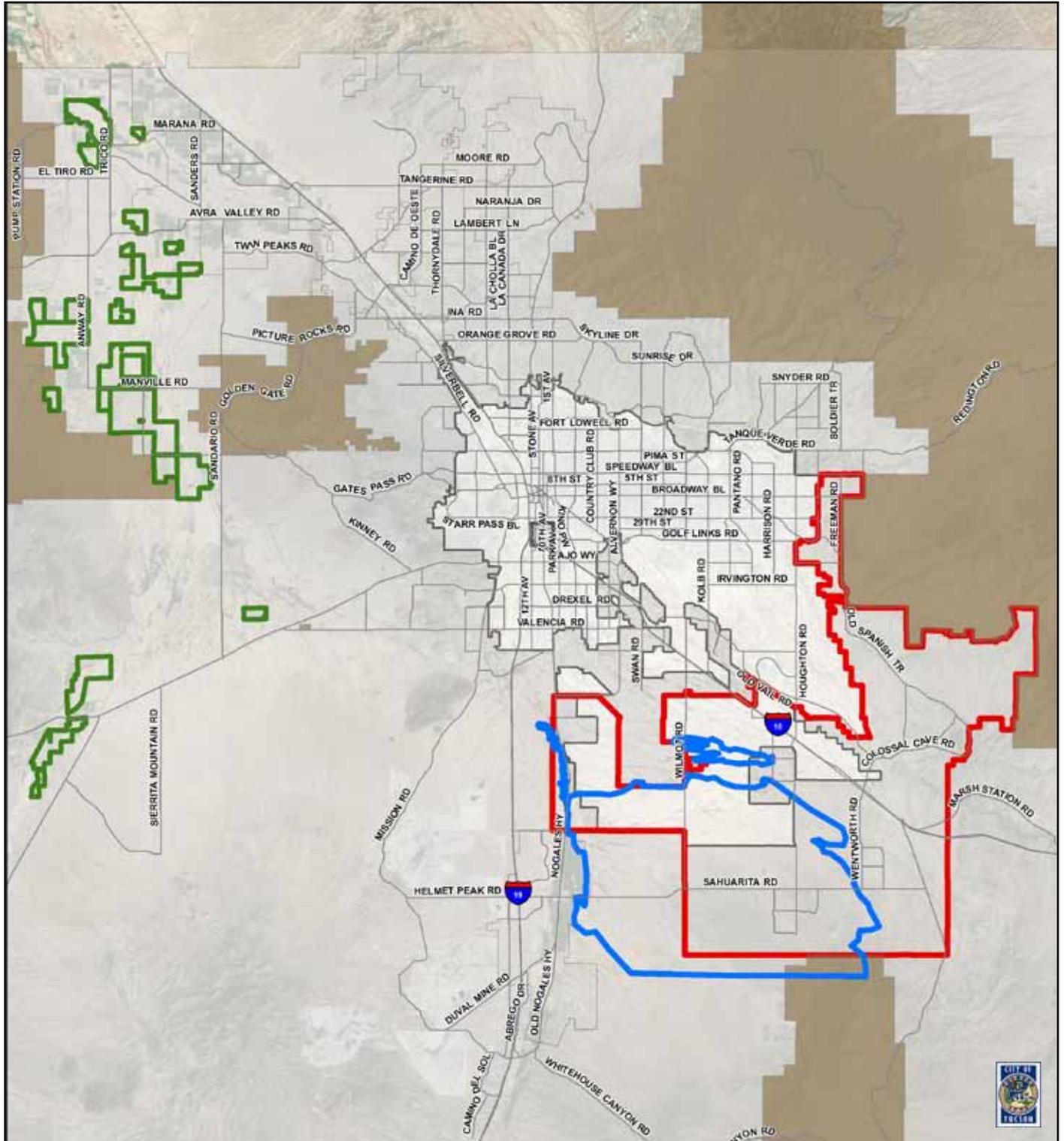
The policies that follow, as well as other policies in this document, are intended to enhance green infrastructure.



**Stormwater management through green infrastructure.**



EXHIBIT GI-3 Habitat Conservation Plan Areas, 2012



Source: City of Tucson Office of Conservation and Sustainable Development and City of Tucson IT-GIS Section

- Avra Valley Planning Area
- Greater Southlands HCP Planning Area
- City of Tucson
- Federal Lands

City of Tucson  
 Other Jurisdictions

0    5    10    20
  
 Miles



# POLICIES

## Green Infrastructure (GI)

- GI1** Require green infrastructure and low impact development techniques for stormwater management in public and private new development and redevelopment, and in roadway projects.
- GI2** Rehabilitate and enhance natural drainage systems, water detention and retention basins, and other infiltration areas for multiple benefits, such as recreation, wildlife habitat, and stormwater management.
- GI3** Create and maintain a connected urban greenway system for non-motorized mobility and to provide human and environmental health benefits.
- GI4** Expand and maintain a healthy, drought-tolerant, low-water use tree canopy and urban forest to provide ecosystem services, mitigate the urban heat island, and improve the attractiveness of neighborhoods and the city as a whole.
- GI5** Create, preserve, and manage biologically rich, connected open space; wildlife and plant habitat; and wildlife corridors, including natural washes and pockets of native vegetation, while working to eradicate invasive species.
- GI6** Protect, restore, enhance, and manage trees for their long-term health, including providing guidance on proper planting, care, and maintenance.

## Other Related Policies

ELEMENT	Policy #	PAGE #
Housing	H1	3.11
Economic Development	ED1, ED3, ED5	3.20
Public Safety	PS10	3.25
Parks & Recreation	PR2, PR4, PR9, PR12	3.30
Arts & Culture	AC2–AC4, AC9	3.37
Public Health	PH1, PH2, PH5, PH8	3.41
Urban Agriculture	AG1–AG4	3.45
Education	E7	3.50
Governance & Participation	G1–G12	3.56
Energy & Climate Readiness	EC3, EC5, EC8, EC9	3.66
Water Resources	WR2–WR5, WR8, WR10, WR11	3.71
<b>Green Infrastructure</b>		<b>3.77</b>
Environmental Quality	EQ3	3.83
Historic Preservation	HP4, HP5	3.93
Public Infrastructure, Facilities & Cost of Development	PI4	3.101
Redevelopment & Revitalization	RR5	3.108
Land Use, Transportation & Urban Design	LT1, LT4–LT6, LT10, LT12–LT14, LT20, LT21	3.126



# Environmental Quality

Environmental Quality as used here focuses on solid and hazardous waste, potentially contaminated sites (brownfields), air quality, noise, and light pollution. Water quality issues are covered in the Water Resources section. The City of Tucson, along with private haulers and other regulatory authorities is responsible for waste management and environmental protection services within the City's boundaries.

The Environmental Services Department owns and manages the regional Los Reales Landfill, runs programs for recycling and waste reduction, provides oversight of groundwater cleanup and methane controls at abandoned city landfills and spills, and ensures City Departments' compliance with air quality and industrial waste discharge requirements. Environmental Services leads the citywide Environmental Management Program that provides a set of management processes and procedures for use by City departments to analyze, control, and reduce the environmental impact of its activities, services, and programs. The Planning and Development Services Department ensures that outdoor lighting design complies with the dark skies ordinance

and that land use and development plans consider designated high noise areas in the vicinity of Davis-Monthan Air Force Base and Tucson International Airport. The Housing and Community Development Department enforces noise violations through its Code Enforcement Unit.

An efficient and effective waste collection system is a critical part of the City's infrastructure. Waste collection and disposal contributes to the general public health by establishing a clean, attractive community. The City's Environmental Services Department provides weekly residential trash and recycling collection for 137,000 customers within the city limits. Trash collected by the Department is taken to the Los Reales Landfill which is a lined waste disposal facility accepting more than 1,500 tons of trash daily. Methane gas generated by garbage decomposition within the landfill is collected and sold to Tucson Electric Power Company through a contract with a third party. Commercial establishments, multi-family dwellings, and industrial facilities are not required to use the City's trash collection services.

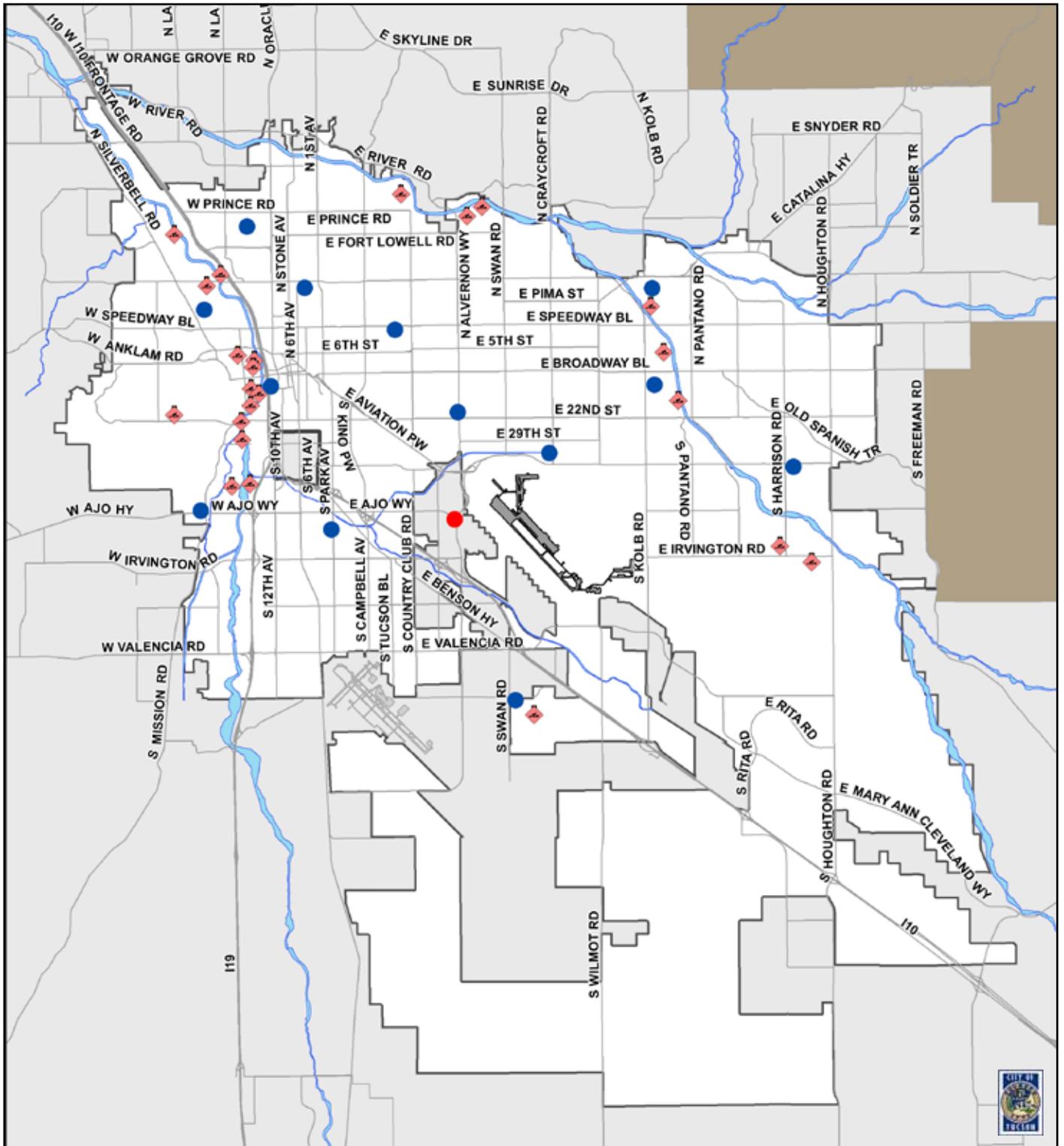
The City promotes recycling through its Blue Barrel program and provides 13 neighborhood recycling centers where individuals or small businesses may take their recyclables. Once collected, recyclables are taken to a Materials Recovery Facility. Proceeds from the sale of recycled materials are shared with the

**Brichta Elementary School children help sort items for recycling.**





**EXHIBIT EQ-1 Landfills & Recycling Centers**



Source: City of Tucson IT GIS Section

- Neighborhood Recycling Centers
- Materials Recovery Facility (Non-Public)
- ◆ Landfills
- Streets





Old paint is dropped off at a household hazardous waste collection site.

operator of the Facility. The City has received as much as a million dollars per year, depending on market conditions. *Exhibit EQ-1* shows the location of landfills and recycling centers.

The City also has established locations for the disposal of household hazardous waste, including florescent light bulbs, pesticides, and motor oil. Ninety-eight percent of household hazardous waste collected through this program is recycled. Twice a year, the City offers a popular, bi-annual brush and bulky pickup for its customers.

Many communities are moving toward a policy called “zero waste,” which focuses on “upstream” solutions to stop waste before it is created. Zero waste programs maximize recycling, minimize waste, reduce consumption, and endeavor to see that products are made to be reused, repaired, or recycled back into nature or the marketplace. Zero waste changes the focus from “waste management” to “resource recovery,” with the goal that any waste that is created can and should be recovered as a potential material to be recycled or reused. This approach requires a fundamental shift in how products are manufactured and the criteria consumers use in making purchasing decisions.

### Contaminated Sites

Brownfields are abandoned, idled, or underused properties for which redevelopment is complicated by real or perceived contamination. The properties may be contaminated by hazardous waste, but can be reused once they meet standards for safe use. The Brownfields

Program, managed by the Environmental Services Department, seeks to reclaim brownfields so they can be redeveloped for productive public or private use. Remediating and reusing brownfield sites promotes economic growth, improves and protects the environment and public health, and preserves undeveloped land. As of 2011, the City of Tucson had received \$2.5 million in grants from the U.S. Environmental Protection Agency for work on a number of sites, primarily in the downtown area.

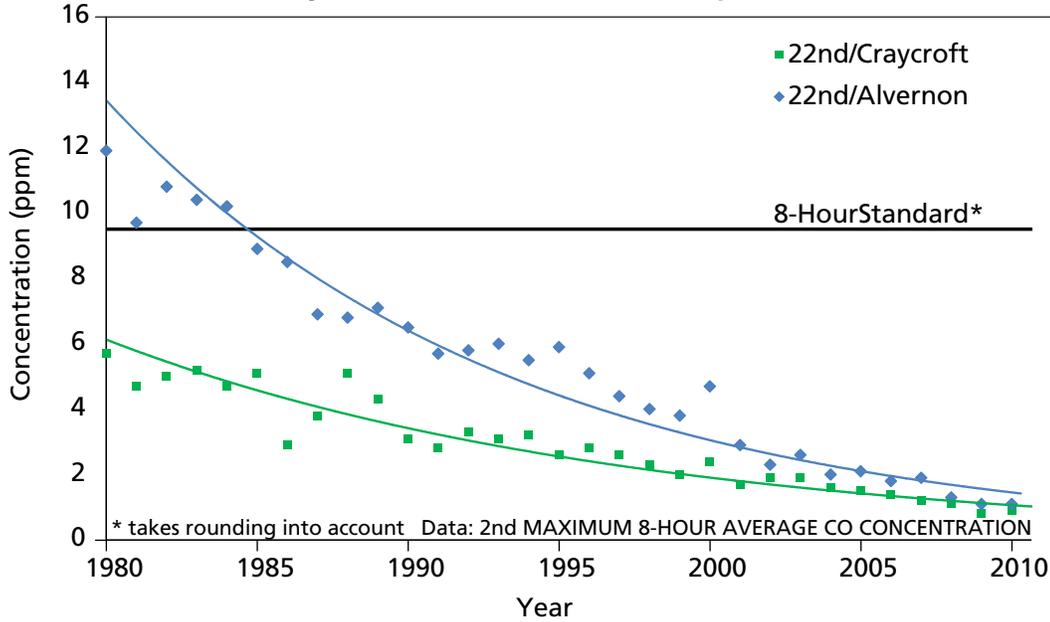
### Air Quality

The Pima Association of Governments (PAG), which is funded through contributions from all jurisdictions in Pima County, is the designated air quality planning agency for eastern Pima County. PAG’s Air Quality Planning Program develops regional air quality plans, analyzes air quality conformity of transportation plans, and ensures that air quality programs comply with federal, state, and local requirements. The City’s Environmental Services Department assists other City departments with regulatory compliance on their air quality permits, and manages a Title V permit, a requirement of the federal Clean Air Act, for the Los Reales landfill which is a large stationary source of air pollution.

The Tucson region has made significant improvements in air quality over the past 30 years. Carbon monoxide levels have declined consistently since 1980 (*Exhibit EQ-2*). Ozone, however continues to be a concern. Currently, Pima County’s ozone levels are at 90 percent of the federal standard (*Exhibit EQ-3*). An anticipated change to the ozone standard by the U.S. Environmental Protection Agency in 2013 may lower the allowable ozone limit and could place Pima County in violation. The result would be environmental and monetary sanctions. The level of



**EXHIBIT EQ-2 Carbon Monoxide Levels, 1980-2011**



Source: Pima County Department of Environmental Quality, 2012

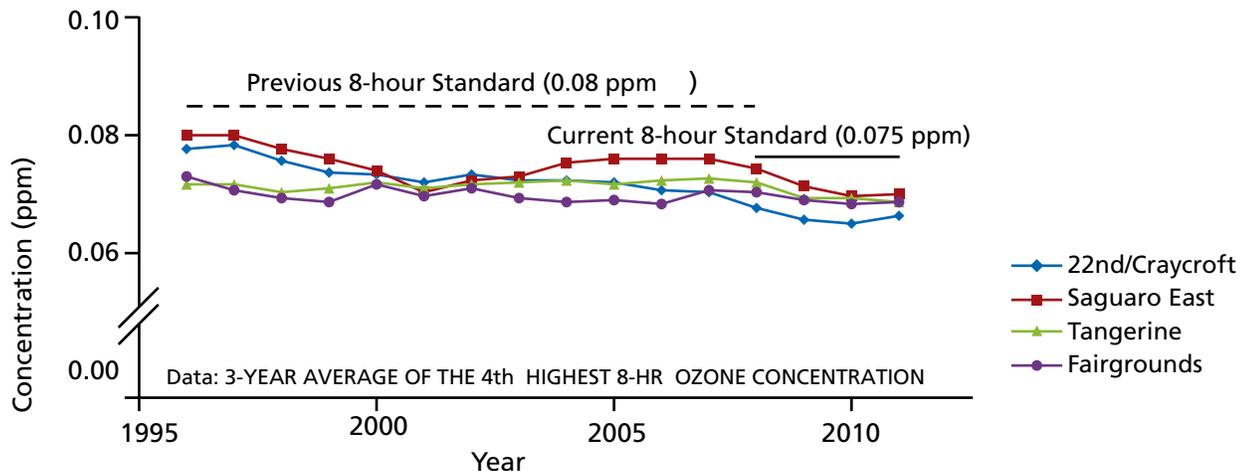
particulate matter in the air can also be a health concern when there are high winds and large earth moving activities. The City of Tucson can help the region meet air quality standards through the design and operation of its transportation system, support for alternative modes of transportation, and internal procurement and administrative policies.

**Noise**

Noise at excessive levels can affect the quality of life and natural environment in Tucson. Localized noise, such as

the sound of a leaf blower or loud motorcycle, can be a nuisance. The City’s Neighborhood Preservation Ordinance establishes maximum permissible sound levels and standards for residential, commercial, and industrial use areas, as well as enforcement actions and penalties associated with violation of the ordinance. Enforcement is the responsibility of the Code Enforcement Division of the City’s Housing and Community Development Department. Roadway noise is addressed by the City’s Department of Transportation

**EXHIBIT EQ-3 Ozone Levels in Pima County, 1996-2011**



Source: Pima County Department of Environmental Quality, 2012



in its design guidelines for roadways, which include methods to reduce and abate traffic noise when constructing a new roadway or widening an existing roadway.

To address noise, land use compatibility, and safety issues related to airports, the Arizona Department of Commerce and United States Department of Defense commissioned the Joint Land Use Study (JLUS) for Davis-Monthan Air Force Base (DMAFB). Preparation of the JLUS, which included representatives of property and business owners, DMAFB, Tucson International Airport, Pima County, and the City of Tucson, was completed in 2004. Subsequently, the Tucson Mayor and Council adopted the Airport Environs Overlay Zone (AEZ). The AEZ establishes a boundary around Davis-Monthan Air Force Base and Tucson International Airport within which only compatible land uses are allowed. (*Exhibit LT- 5, pg. 3.117*). Within the Zone, acoustical treatment of buildings is required to reduce exposure to high levels of airport noise.

Additional information about land use in the AEZ can be found in the Land Use, Transportation, and Urban Design section of this Plan.

### Light Pollution

The City of Tucson and Pima County have been on the forefront of preventing light pollution through a jointly developed Outdoor Lighting Code passed in 1994 and updated in 2012 to ensure the continuation of Tucson's reputation as a dark skies destination. Amateur astronomers, local residents, and visitors enjoy the unique desert environment where stars and constellations are visible at night. When lighting is poorly planned and designed, it can obliterate the ability to view the night skies. This is particularly important for the retention of the astronomy industry in Southern Arizona, which supports about four thousand jobs and brings about a quarter of a billion dollars per year into the local economy.<sup>1</sup> The policies that follow are intended to strengthen efforts to improve the community's overall environmental quality.

The night sky as seen from Kitt Peak Observatory.



<sup>1</sup> Christopher Francis. Pima County approves updated Dark Skies Ordinance. KOLD Tucson News Now, Posted: Mar 13, 2012 11:12 AM



# POLICIES

## Environmental Quality (EQ)

- EQ1** Strive for a “zero waste” model for solid and hazardous waste through integrated waste management and waste reduction.
- EQ2** Implement a comprehensive strategy and program for brownfield assessment, mitigation, and redevelopment.
- EQ3** Assess and address the impact of governmental operations and actions on air quality.
- EQ4** Reduce and mitigate noise in neighborhoods, along roadways, and near industrial and airport zones through enforcement of existing codes, use of noise reducing and mitigating materials and designs, and deliberative decisions regarding compatible land uses and related zoning.
- EQ5** Protect night skies from light pollution through building codes and design standards.
- EQ6** Promote recycling as well as the responsible disposal of electronics and hazardous waste, and reduce other environmentally-damaging forms of waste.
- EQ7** Develop practices to reduce utility, fuel, and procurement costs and to improve environmental performance through process, technological, and behavioral changes to demonstrate City leadership in sustainable practices and improve operational efficiencies.

### Other Related Policies

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