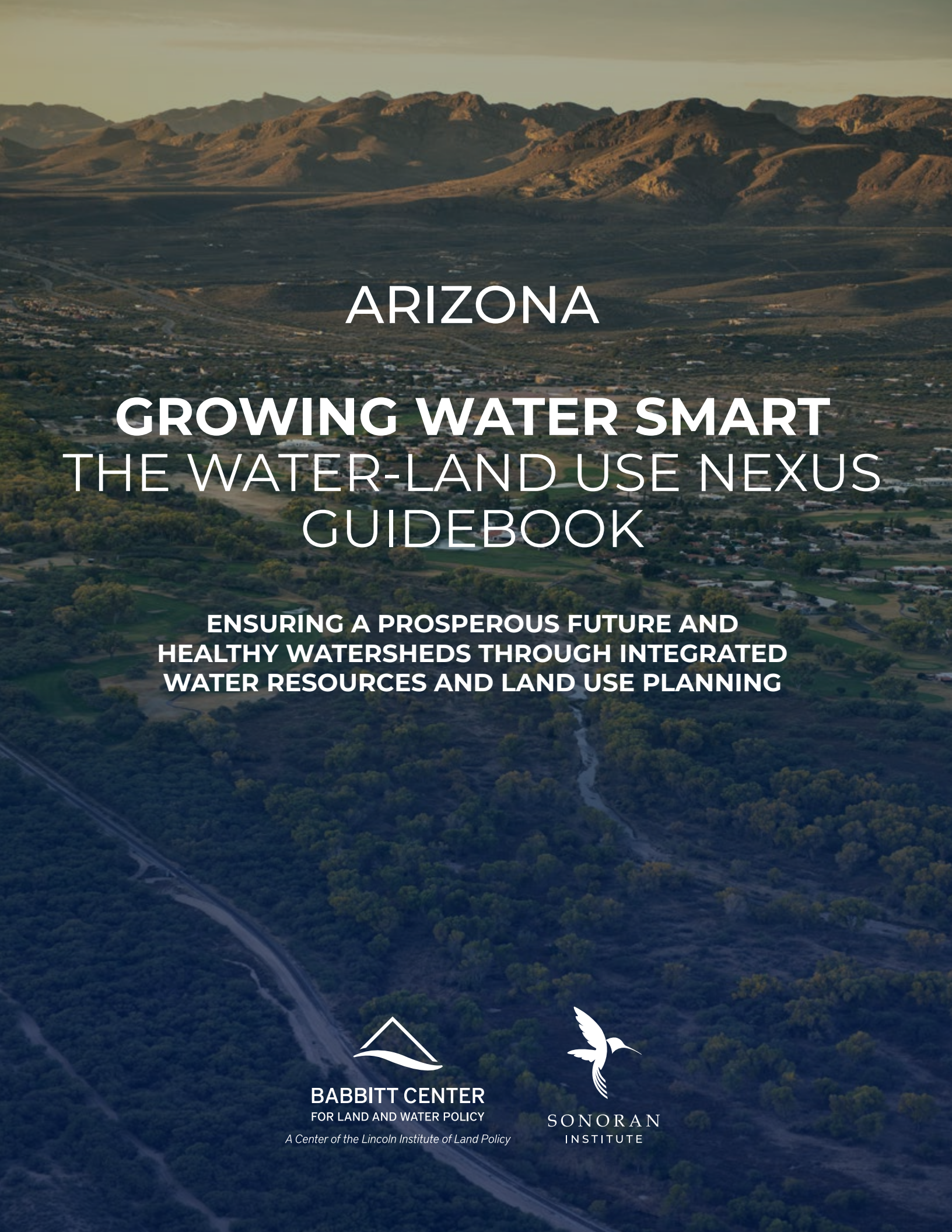

ARIZONA

GROWING WATER SMART
THE WATER-LAND USE NEXUS GUIDEBOOK

ENSURING A PROSPEROUS FUTURE AND HEALTHY WATERSHEDS THROUGH INTEGRATED WATER RESOURCES AND LAND USE PLANNING

BABBITT CENTER
FOR LAND AND WATER POLICY
A Center of the Lincoln Institute of Land Policy

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Our supporters understand that we are all connected within the Colorado River basin. They know that we must come together to find solutions to the problems we all face. Because of this, they are supporting programs like this that make a positive change. Like you, they care about the future of Arizona and envision a more resilient future throughout the North American West. Our shared vision is made possible by generous support from joint-partners, sponsors, public institutions, private funders, and in-kind contributors.

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ABOUT GROWING WATER SMART

Growing Water Smart, a program of the Sonoran Institute and Lincoln Institute of Land Policy's Babbitt Center for Land and Water Policy, introduces communities to the full range of communications, public engagement, planning, and policy implementation tools to realize their watershed health and community resiliency goals. Through Growing Water Smart, Arizona communities learn how they can integrate land use and water planning.

ABOUT SONORAN INSTITUTE

The Sonoran Institute's mission is to connect people and communities with the natural resources that nourish and sustain them. We envision resilient communities living in harmony with the natural world, where flowing rivers and healthy landscapes enable all people and nature to thrive. Our work transcends borders, bringing together diverse communities to promote civil dialogue about complex conservation issues that know no boundaries. All aspects of our work are guided by inclusivity and collaboration to create positive environmental change in the western United States and northwestern Mexico.

ABOUT THE BABBITT CENTER FOR LAND AND WATER POLICY

The Babbitt Center for Land and Water Policy, a center of the Lincoln Institute of Land Policy, seeks to advance the integration of land and water management to meet the current and future water needs of communities, economies, and the environment. The Babbitt Center develops tools and best practices to guide decisions through research, training, and partnerships for management of land and water resources. We recognize that water is the lifeblood of the American West and land use decisions are made every day that shape our water future. Coordination of these land and water use decisions is critical for ensuring resilient and sustainable communities.

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INTRODUCTION

Traditionally, responsibility for water resource management and land use planning has been siloed in different departments or entities. However, the manner in which new development occurs can have a major impact on municipal water demand as well as the health of the watershed in which it resides. This introductory section makes the case for bringing water resource management and land use planning in line with one another. In doing so, our communities can shift their focus from supply- to demand-side management, from unfettered economic growth to holistic watershed health, and from siloed implementation to an integrated water management paradigm.

SHIFTING OUR FOCUS FROM SUPPLY- TO DEMAND-SIDE MANAGEMENT

By 2050, Arizona's population is predicted to increase by half, putting pressure on our state's already limited water resources. A growing population can escalate the costs of operating local utilities and, if the water supply is constrained, the cost of acquiring new sources. It also may prompt the need for enhanced and expanded infrastructure. In the past, water resource managers and water providers have turned to ***supply-side management*** to meet growing demand by investing in water acquisition, treatment, storage, and distribution projects. However, increasing the supply of water comes with a significant price tag and can be more time and resource intensive than other options.

An alternative to these costly investments is to reduce the demand for water by using existing supplies more efficiently. Increasingly, communities are turning to ***demand-side management***, an approach that generally includes:

- **Water Conservation:** reducing water consumption by encouraging water users to modify their behaviors.
- **Water Efficiency:** encouraging or requiring the use of building or site designs or technology that use less water
- **Water Reuse:** treating or converting greywater and blackwater to replace or augment the water supply.

One of the more promising strategies in water demand management is integrating land use planning with water conservation and efficiency. Communities throughout the West have found that by increasing development density, utilizing technological efficiencies, and promoting aggressive conservation programs, they have been able to continue to grow without acquiring new water supplies. Water smart land use planning can reduce the negative financial impacts of increased water demand through efficiency and conservation measures implemented prior to, during, and after construction. This approach increases

the cost-to-benefit ratio of capital investments by using the same amount of water and infrastructure to serve more people per dollar spent. This approach benefits the environment and ensures a more sustainable future, and it is good for the triple bottom line.

SHIFTING OUR FOCUS TO WATERSHED HEALTH

Every community lives within a watershed—a land area that channels rainfall and snowmelt to creeks, streams, and rivers. Many of Arizona's communities were founded along rivers or rely on them for recreational activities. Watersheds are delicate ecosystems, but a tension exists between preserving the natural environment and developing land for residential, commercial, or industrial uses to house residents and promote economic growth. Where development is allowed, many factors such as lot size, density, water conservation measures, and stormwater management all greatly influence the health of the watershed and impact water quality and stream flows. Fortunately, it is possible to plan for future development in a way that also protects the watershed.

Section 4 on Healthy and Resilient Watersheds describes how approaches such as source water protection, pollution and sedimentation controls, riparian buffers or setbacks, native vegetation preservation, stormwater management, and low-impact development can improve watershed health.

SHIFTING OUR FOCUS TO INTEGRATED WATER RESOURCE MANAGEMENT

The earth's water cycle is a closed loop that circulates water between the oceans, the atmosphere, and the land via precipitation, drainage, and evaporation. Just as the natural environment treats water as a cycle, it is important that managers of the built environment view water supply, wastewater, and stormwater as an interconnected loop. Integrated Water Resource Management, also known as One Water, is such an approach. By coordinating the development and management of water, land, and related resources, Integrated Water Resource Management maximizes economic and social benefits while minimizing impacts on the environment. An important step in this process is to change institutional structures to strengthen the coordination and collaboration between water supply and wastewater managers, land use planners, economic development managers, and other key officials. More resources on Integrated Water Resource Management are found in **Appendix B: Growing Water Smart Resources.**

WATER AND LAND USE INTEGRATION OPPORTUNITIES

Each of the planning and regulatory mechanisms guiding how and where a community develops provides an opportunity to strengthen the nexus between water and land use. Determining where to intervene will depend on the community's political readiness and capacity, the water demand management initiatives that have been initiated to date, and the level of aggressiveness desired in achieving water-saving goals. The intervention opportunities include:

POINT OF INTERVENTION	TOOL	PURPOSE
Planning & Policy Making	Water Conservation Plans Comprehensive Plans Capital Improvement Plans	Establishes goals and objectives for managing the intersection of natural resources and the built environment.
Pre-Development	Water Adequacy Requirements Conservation Tap Fees	Links new development to water supply planning.
Development Review	Zoning and Subdivision Regulations Annexation Policies Planned Development Policies Development Agreements	Determines the requirements applied to new development for water resource management, conservation, and efficiency.
Building & Construction	Building, Plumbing and Landscaping Codes	
Post-Occupancy	Water Conservation Rate Structuring Conservation & Efficiency Incentives Outdoor Watering Restrictions Water Budgets & Auditing	Empowers and incentivizes homeowners and renters to reduce water consumption.

THE LAND USE - WATER NEXUS RESOURCE GUIDE

This resource guide is intended to help your community identify the most appropriate intervention points related directly to land use that will help you achieve your community's water resource management goals. It is divided into five sections.

SECTION 1 **Planning & Policy Making**
Summarizes the opportunities provided by integrating water and land use during planning processes.

SECTION 2 **Adequate & Sustainable Water Supply**
Provides a review of the State of Arizona's requirement for new developments to have an adequate and sustainable water supply.

SECTION 3 **Water Smart Land Use Policy**
Introduces planning principles that can make a community's development pattern water smart.

SECTION 4 **Healthy & Resilient Watersheds**
Provides guidance on how to protect your water supply to support community resilience and the health of ecological systems.

SECTION 5 **Conservation Rate Structuring**
Summarizes how a utility can manage household water demand through market-based incentives and pricing mechanisms.

Each section includes:

1. **A rationale** for why a particular approach should be considered.
2. **A case statement** that provides justification for each approach and the expected water savings.
3. **A toolbox** of the specific policy or management actions a community can take to achieve water conservation and efficiency outcomes for this approach.

The **Growing Water Smart Resource Appendix** at the end of the guidebook provides a resource list for more information, including community case studies and policy examples.

SECTION 1:

PLANNING & POLICY MAKING

The sustainability of a community is dependent upon the availability of water; consideration of future water needs must be integral to decision making.

CASE STATEMENT

The State of Arizona provides limited guidance for drafting policy to link land use and water in required plans. Traditionally, these planning processes have been conducted in different departments or agencies; land use planners have focused on how much and what type of growth may take place in their communities, while water resource managers have focused on ensuring adequate water availability. Comprehensive planning, water planning, and capital improvement planning are all interrelated, however, and integrating them will require breaking down the traditional planning and operational silos. Done successfully, an integrated water resource and land use management approach can ensure the following:

- A community's vision for the future considers water and growth together
- Plans for water resource management, capital improvement, and economic development are consistent with both the community's vision for future land use and its goals for sustainability and resilience.
- Development occurs in a way that protects the watershed, including ecological functions and the quality and quantity of water supplies.

TOOLBOX: PLANNING

COMPREHENSIVE PLANNING

By state statute, almost every municipality or county in Arizona is required to create a comprehensive or general plan. These plans guide how a community will manage future land use and its implications for a wide variety of functions, including transportation networks, parks and open space, natural resources, housing, economic development, and future infrastructure needs. One of the greatest values of a comprehensive planning process is that it provides one of the few opportunities for a community-wide dialogue about the future.

In Arizona, the comprehensive planning requirements for municipalities and counties require that most plans include a water element, but they do not indicate how to link water with land use planning or other elements. Integrating water-related goals into one holistic plan or across plan elements ensures that the complex interrelationships between water systems, human systems, and ecological processes are considered together. Comprehensive plans also offer an excellent educational opportunity for helping the community understand:

- Projections for future population and drivers of growth.
- The type and location of development occurring in the community.
- The source, capacity, and conditions of a community's water supply, distribution systems, and water-related infrastructure.
- Adequacy, sustainability, and vulnerability of the water supply.
- Health conditions of the watershed.
- Current programs and projects.
- The trade-offs required to best achieve the community's goals.

A comprehensive plan can help a community identify opportunities to integrate water into traditionally land use focused comprehensive plans by including goals for:

- Water supply and demand management.
- Wastewater treatment and disposal.
- Watershed processes and health.
- Floodplain and stormwater management.
- Interagency coordination and collaboration.

VISIONING

Some communities incorporate a robust visioning process into their comprehensive plans or water resource management plans. A visioning process identifies how a community can intervene to most positively influence the development of its community in response to change. Some of these visioning exercises take the form of clarifying community values and choosing from among a series of desirable futures. This *normative approach* to long-range planning aims to create a clear vision for the future, most frequently through using visualization tools that illustrate alternative scenarios. These models can assist in decision-making by assessing the impact of different development patterns on indicators such as water demand, air quality, and vehicle trips.

Exploratory approaches to considering the future take a slightly different approach. This approach is most effective when used to consider and strategize responses to uncertainties. Rather than selecting a preferred scenario and developing a plan to achieve that particular future, an exploratory approach envisions how a community may need to adapt and manage different outcomes for a variety of scenarios that are driven by forces which are often out of one's control. Across the West, water and planning departments are using exploratory scenarios to think strategically about water, growth, and climate change.

WATER SUPPLY PLANS, DROUGHT PREPAREDNESS PLANS, AND CONSERVATION PLANS

All community water systems in the state are required to submit a system water plan[1] to the Arizona Department of Water Resources (ADWR). A system water plan generally consists of a water supply plan, a conservation plan, and a drought preparedness plan. Depending on its size and location, however, not all water systems need report on all three.

A water supply plan inventories supply and infrastructure in an evaluation of a system's ability to meet its customers' needs. ADWR's guidelines recommend that the plan should consider probable and worst-case scenarios for surface water and groundwater supplies. A drought preparedness plan is an evaluation of strategies to reduce demand in response to drought conditions and should include specific demand- reduction measures. A water conservation plan increases water efficiency in the system and encourages consumer conservation efforts. The plan should include demand and supply management measures, an educational component, and an evaluation component.

Municipal water providers located inside an Active Management Area (AMA), designated as the regions where groundwater reserves have been historically depleted, are exempt from some of these plan requirements. Instead, they are subject to regulatory requirements dictated by the Arizona Groundwater Code,[2] including mandatory conservation requirements established in the AMA management plans.

1 A.R.S. § 45-342
2 A.R.S. § 45-401 through A.R.S. § 45-704

CASE STUDY

WATER & WASTEWATER INFRASTRUCTURE, SUPPLY & PLANNING STUDY – CITY OF TUCSON & PIMA COUNTY, ARIZONA

Acknowledging the scarcity and uncertainty of their water supplies, the City of Tucson and Pima County recognized the need for "a new paradigm" for water and land planning. In 2008 they launched an unprecedented joint effort to work together toward sustainable water planning, set forth in the **Water & Wastewater Infrastructure, Supply & Planning Study (WISP)**.

WISP outlined an approach that allocates water for environmental restoration, balances water supply and demand management, and builds upon the crucial link between urban form and water resources.

At the heart of the new planning paradigm are public engagement and collaboration between the city and county. A new citizen oversight committee identified community values, detailed four principles of sustainability, created a working definition of sustainability, and provided additional recommendations for future action. Interdisciplinary teams of city and county staff developed a series of technical reports covering a range of topics and produced a lengthy set of recommendations. City/county staff organized the recommendations into a set of four interrelated elements: demand management, water supply, comprehensive integrated planning, and respect for the environment. Water sustainability goals for the 2011-2015 planning horizon emerged from these recommendations.

The City of Tucson and Pima County adopted this framework through city and county resolutions (No. 21478 and 2010-16, respectively).

Following formal adoption, city/county staff drafted the **Action Plan for Water Sustainability.** This implementation plan outlined the activities necessary to meet each of the goals under the four elements, set forth a timeline from 2011-2015, identified the relevant existing programs and partners that would be involved, and described the kinds of new partnerships that would need to be established to ultimately meet all adopted goals.

The efforts of the city and county through the WISP and the Action Plan led to measurable success in both policy and planning as well as the construction of projects focused on recharge and environmental restoration. Policy successes include integrating outcomes from the WISP into the Pima County Comprehensive Plan, wheeling agreements which provide renewable water sources to areas currently relying on groundwater, and the creation of a Water Service Area Policy which guides infrastructure planning and future growth in Tucson.

CAPITAL IMPROVEMENT PLANS

Capital improvement plans (CIPs) forecast and match a community's projected revenues and its capital needs over a multi-year period. Planning departments, parks, public works, and water and wastewater utilities often rely on grants and bonds to invest in green and gray infrastructure improvements or new construction. By creating a long-term investment strategy for the infrastructure improvements identified in a comprehensive plan or water resource management plan, a CIP ensures that resources match community priorities.

STRATEGIES FOR PLANNING & POLICY MAKING

- Link water supply and demand to projected land use patterns—not just growth projections—in both comprehensive plans as well as water plans.
- Use visioning processes and scenario planning to assess vulnerabilities and uncertainties affecting water resources as the future unfolds.
- Create an independent water element in the comprehensive plan or add a water conservation plan as a supplement.
- Use the CIP to ensure investments are made in water management physical infrastructure or in projects including stormwater management, green infrastructure, growth area infrastructure, disaster mitigation, and watershed restoration.

CASE STUDY

PRELIMINARY INTEGRATED WATER MANAGEMENT PLAN – PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT, ARIZONA

In an effort to support the water element of *Pima Prospers*, the Pima County Regional Flood Control District (RFCD) revised the development review process to more fully integrate water planning into the rezoning process. The 2015 comprehensive plan update requires rezoning applicants to submit a **Preliminary Integrated Water Management Plan** (PIWMP), which integrates water supply review at the site analysis and entitlements stage of the planning review process, or a Water Supply Impact Review at the site analysis stage. The content of the PIWMP varies according to the project's water supply:

- Projects providing renewable and potable supplies at the development review stage must meet a certain threshold of actions from a Water Conservation Measures table, which includes indoor water use, outdoor site design, and infrastructure improvements.
- Projects providing non-renewable supplies will have to provide the above, plus RFCD staff will assess the lack of infrastructural access to renewable supply sources and evaluate impacts to environmentally sensitive areas.

The primary goal of the PIWMP is to determine if sensitive areas, including subsidence areas and groundwater-dependent ecosystems like springs, intermittent and perennial streams, and shallow groundwater areas, are being negatively impacted. If the rezoning presents a threat then RFCD will recommend the application be denied unless the project accepts additional water conservation measures.

The 2015 update shifted the project hydrological impact assessment from the applicant to the county to ensure expertise and consistency in the process. After a site analysis, staff prepares an impact assessment, which includes: a) Availability of renewable and potable water supplies; b) Water use estimates for maximum build out under existing and proposed zoning; c) Current and projected depth of groundwater and groundwater trend data at the site or wells serving the site; d) Proximity of site and wells serving the site to known or potential subsidence areas; e) Proximity of site and wells serving the site to groundwater-dependent ecosystems; and f) Hydrogeologic basin, including depth to bedrock. If necessary, the developer proposes mitigation measures which address water sustainability concerns. A second RFCD department reviews the final mitigation plan at the time of permitting/development.

The standardization of protecting sensitive areas in the planning process through linking the form and location of growth with the sustainable allocation of water is an effective method of integrating water into the land-use planning process.

SECTION 2:

ENSURING WATER SUPPLY FOR DEVELOPMENT

Provides a review of the State of Arizona's rules requiring new developments to have an assured or adequate water supply and suggestions on how to develop standards for municipal and county water supply.

CASE STATEMENT

Water adequacy rules link supply-side management to demand-side management. States across the West have adopted statutes intended to ensure that communities have sufficient water supplies for new development, recognizing that:

- New development creates new water demand.
- Government has a role to play in ensuring sufficient and sustainable water supplies for new and existing property owners.
- Growth pressure on water supplies requires stronger connection between land use approval and water planning at the state, regional, and local levels.
- Collaboration between local governments and water providers is essential to ensuring water supply reliability.

TOOLBOX: ASSURED AND ADEQUATE WATER RULES

The Arizona Department of Water Resources' Assured and Adequate Water Supply programs were created to address the problem of limited groundwater supplies in Arizona. Both the Assured and Adequate Water Supply programs evaluate the availability of a 100-year water supply, considering current and committed demand as well as projections for future development and population growth. To ensure the health, safety, and welfare of their constituents, given the scarcity and uncertainty of water supplies, local governments should not permit development in areas where regulated basic and essential services cannot be provided. In addition, it is increasingly important for local actions to consider cumulative impacts to the region's environmental and economic systems that sustain local quality of life.

The Assured and Adequate Water Supply rules apply to subdivisions with six or more plats inside AMAs. Lot splitting into five or fewer lots creates a gap in policy regulation and has contributed to localized water level decline.

ASSURED WATER SUPPLY PROGRAM (WITHIN AMAS)

The Assured Water Supply Program, managed by ADWR, is intended to protect and preserve the limited groundwater supplies within Active Management Areas. Developments are approved only if they can demonstrate a 100-year assured water supply. Individual developments receive a Certificate of Assured Water Supply from the state.

A community water supplier can prove an assured water supply for their service area. By doing so, the service provider obtains a Designation of Assured Water Supply from the state, and thereby become designated providers. A water provider's designation will reflect the water supply status of their entire service area.

Developments within designated service areas do not need be individually reviewed by the state, but the designated water provider must submit a written commitment to serve. The platting agency is responsible to review the service agreement as evidence that the development will receive water service.

ADEQUATE WATER SUPPLY PROGRAM (OUTSIDE AMAS)

The Adequate Water Supply Program applies to most areas outside the AMAs. A water adequacy determination from ADWR is not required prior to recording a plat and initiating lot sales. However, developers may apply to the Department for a water supply adequacy determination before initiating the final plat approval process with the local jurisdiction and prior to filing for a public report with the Arizona Department of Real Estate.

While subdivisions can be approved, even if the water supply is determined to be inadequate, the first buyer of the property must be informed of the inadequate water supply. This process

is intended to protect the consumer from unknowingly purchasing land or a home where there is an unsustainable supply of water. To receive an adequate determination, developers outside of AMAs must prove the first three criteria on the table.

CRITERIA	DESCRIPTION
Physical Water Availability	Sources of water have specific requirements for demonstration of physical availability. A list of those requirements can be found in the Arizona Administrative Code. (See: A.A.C. R12-15-716)
Continuous Water Availability	Water providers or developers must demonstrate that the water supply is uninterruptible for the 100-year period, or that sufficient backup supplies exist for any anticipated shortages. (See: A.A.C. R12-15-717)
Legal Water Availability	An applicant must demonstrate legal rights to all water supplies included in the application. (See: A.A.C. R12-15-718)
Water Quality	Proposed sources of water must satisfy existing state water quality standards and any other quality standards applicable to the proposed use after treatment. (See: A.A.C. R12-15-719)
Financial Capability	Water providers or developers must demonstrate financial capability to construct the water delivery system and any storage or treatment facilities. Financial capability for developers is typically considered through the local government's subdivision review process. A demonstration is also required that adequate delivery, storage and treatment works will be available to the applicant or the applicant's customers for 100 years. (See: A.A.C. R12-15-720)
Consistency with the Management Plan (Assured Water Supply Only)	Each AMA's management plan prescribes water conservation requirements for municipal water providers. Water demand associated with proposed subdivisions is evaluated in accordance with these conservation requirements. (See: A.A.C. R12-15-721)
Consistency with the Management Goal (Assured Water Supply Only)	Applicants must demonstrate consistency with the management goals of each AMA. (See: A.A.C. R12-15-722)

Adapted from the ADWR website **new.azwater.gov/aaws**
Please refer to the Arizona Administrative Code Title 12, Chapter 15 to access the rules listed above.
View the **Guidelines for Hydrologic Studies for Assured and Adequate Water Supplies.**

MANDATORY ADEQUACY PROGRAMS (OUTSIDE AMAS)

To address water resource management outside the AMAs, some Arizona cities, towns, and counties have instated a Mandatory Adequacy Program (ARS 11-806.01.) In these mandatory adequacy jurisdictions, the Arizona Department of Real Estate requires an adequate water supply determination to approve sale of a property.

State statute requires that subdivision developers satisfy the first five criteria in the table above to obtain a determination from ADWR regarding water supply availability before marketing lots. If there is an inadequate water supply, this must be disclosed in the public report and in any promotional or advertising material provided to potential first purchasers.

A jurisdiction's elected officials must unanimously agree to become a mandatory adequancy jurisdiction. If a county adopts this rule, it applies to all jurisdictions within it. Individual towns and cities can also adopt this rule. Yuma County, Cochise County, the Town of Patagonia, and the City of Clarkdale have all adopted a requirement that ADWR determines adequate water supply before final plat approval.

BEST PRACTICES FOR WATER SUPPLY STANDARDS

Assured and adequate water supply standards require development to demonstrate that a new project has a legally and physically adequate quantity of water that is reliable into the future. Though much of development approval is handled by the state, or delegated to designated water providers, land use planners can work concepts into their land use code and plan review process to reinforce water supply longevity. Best practices for water supply standards include:

1. **Definition of Terms:** clear definition expectations of water quality, quantity, dependability, and availability. Communities are updating their regulations to include these definitions as well as any other relevant additional descriptions of these indicators.
2. **Articulation of Water Source(s):** definition of and clearly identified allowable water sources, whether from a water provider, individual wells, shared wells, or cisterns.
3. **Development Water Demand Projections:** a projection of the amount of water (water budget) that a proposed development will likely require at full buildout for proposed development. Many communities are now including a specific methodology for determining this projection to reduce burden on developers, to avoid underestimates, increase consistency, and add transparency.
4. **Water Efficiency, Conservation, or Demand Management Practices:** include pre-development requirements or incentives for developments to reduce projected water demand through efficiency and conservation practices
5. **Specific Area Application:** effective development regulations apply to all new

development or define specific zones where water resources are particularly scarce or where there are variations that trigger specific requirements (e.g., recharge zones, high water tables, water provider service areas, hydrological zones, etc.). Include maps of geographic locations or zones where different adequacy requirements or review processes apply.

6. **Defined Review Processes:** specificity on what is required for the review, when in the process it occurs, and who conducts the reviews. For individual wells, review by the ADWR should occur to verify the permit as well as comment on water supply adequacy prior to final plat.
7. **Engineering Standards for Water Distribution System:** except for individual wells, the engineering requirements for a water system connection or distribution system clearly articulated in development regulations or reference to specific guidelines.

TOOLBOX: WATER BUDGETING

While in the hydrological cycle, a "water budget" is an estimation of water flows into and out of a system, in land use water budgets refer to estimates of total water demand or to a maximum allowable amount of water use. Water budgets can be applied at the individual unit or subdivision development scales and across indoor and outdoor use.

When using as a development review tool determine a standard calculation methodology. The state provides calculators to estimate water budgets (one for developments in AMAs and a Generic Demand Calculator for outside water use), but you may make adjustments to reflect the lifestyles, densities, and other demographic characteristics in your community.

In long range planning, calculating a "water budget for buildout," rather than demand projections based solely on population, can allow a community to more carefully craft a vision within the constraints of its water supplies. Like financial budgeting, every line item of water supply and demand should be accounted for and the trade-offs and opportunity costs carefully considered when allocating resources. This macro budget provides guidance for approvals at the development or site scale. A community that adds water budgets to site development review processes seizes an opportunity to optimize site performance, aligns with the community's vision, and stewards the overall water budget for buildout.

STRATEGIES FOR WATER BUDGETING

- Align methodologies and data sources across partners. Often different departments or water providers will use different data sources or methodologies. Agreeing on a set of common understandings and assumptions will reduce uncertainty in your projections.
- Connect water billing and actual land use data using Geographic Information Systems (GIS). This helps to better understand how a rezoning proposal could impact water demand. It also helps to understand the water use patterns and trends of land uses and densities.
- Shift your units of demand measurement. Moving from a "per-acre" scale to a "per-unit" or "per square foot of building area" scale can help account for increasing density in residential and commercial developments.

TOOLBOX: WATER ALLOCATION POLICIES

Water allocation rules are policies, laws, and mechanisms that offer municipalities a formal means to direct growth by strategic dedication of their water resources in accordance with their community's needs, vision, and overall water budget. Allocation policies link water supply to land use, economic development, and community revitalization plans. They can be tailored to suit the strategic goals of a community.

Without a water allocation policy, supply agreements are often made on a "first come, first serve" basis, which can unintentionally lead to resource-intensive development without compensatory benefit to the supporting community. Whether they have limited supplies or a projected surplus, cities can benefit from water allocation strategies geared toward sustainability and quality of life.

CASE STUDY

PROJECTING WATER DEMANDS USING ENTITLEMENTS – CITY OF GOODYEAR, ARIZONA

Estimating future water demand is a challenge, and cities and private utilities use many different methods. Relying on population projections alone is not ideal, since these estimates will not capture the range of land uses, industry needs, the type of crops grown, or the type of landscaping in citizens' front yards. To understand these characteristics, cities can link their population projections with the underlying land uses for a more comprehensive analysis.

The more granular the community's data inputs, the more accurate its projections will be. Many communities measuring underlying land use characteristics will look to their zoning codes, which typically allow a range of permitted uses and densities. However, development "entitlements" offer a more precise alternative to zones because they are development plans and permits legally approved by the local regulatory department and include rezoning, variances, and special use permits. Entitlements are unbuilt but committed developments that have a right to water, such as Planned Area Developments and Master Planned Communities. They are key sources of high-resolution data that refine land use zones and enhance water demand projections.

In **using entitlements** to refine its projections, the City of Goodyear fostered collaboration between the planning department and water resources department. First, the city used billing records co-located with land use and other data to estimate its base demand, then added non-revenue water use. Non-revenue water includes well waste, operational use, flow tests, system losses, and city department use (e.g., fire, street cleaning). This is not insignificant; the City of Goodyear's non-revenue water is approximately 14% of its annual total water production.

Next, Goodyear developed a growth model by integrating multiple data layers in ArcGIS model builder and assigning a tiered "water service commitment level" according to the status of entitlement:

> Tier 1: Lands with entitlements.
>
> Tier 2: Lands with preliminary entitlements and state land zoning process initiated.
>
> Tier 3: State land within the planning area without zoning, and other areas without entitlements.
>
> Tier 4: All other land within the planning area, using the general plan to inform assumptions on land use and base demand.

Finally, the city projected water demand by geographic area and entitlement level using the tiered priority system. This approach shows where, when, and how much new water supply is needed, based on commitment level. Using entitlements increased the level of confidence. The process also shows how growth patterns align with the Goodyear general plan vision--all at a higher resolution than a projection based on land use zones alone.

CASE STUDY

WATER ALLOCATION POLICY – CITY OF CHANDLER, ARIZONA

Commercial and industrial water demands vary wildly with each user. Variation introduces uncertainty in water use projections and places the resiliency of a community's water supply at risk. An effective way to create greater predictability, whether a community is fast-growing or built out, is to create a water allocation policy. By pairing a community's water resources with its economic development goals, allocation policies mitigate threats from extremely high water users.

In 2015, the City of Chandler adopted a **water allocation policy** that manages plan approvals for large-volume water users. By creating greater certainty about the city's future water supply, this policy has proven to be an attractive economic development tool. At 80% build-out, the City of Chandler has the water supply to accommodate all projected growth, giving it credibility as a long-term investment. The city is using its remaining unused "quality of life" water supply to incentivize economic development projects that offer the most support to its residents.

The community's process started with an examination of its general plans, master plans, and water budget. To understand how much of its supply was committed, the city projected water consumption using the average water use at a square foot unit rate of existing buildings under each land use type. The remaining unallocated portion of its water supply was re-branded as "quality of life" water to reflect its intended use.

The city developed a tiered framework for allocating water supplies to new development projects:

Tier 1: The base allocation is applied to all Chandler non-residential water users. The city anticipates that the Tier 1 supply allocation will meet the water demand of almost all projects.

Tier 2: New high-volume users that need additional supply beyond the Tier 1 allocation will receive additional water from the city if they support the city's economic goals. The city council defined its "quality of life" priorities as:

- Technology and knowledge-based industries and the expansion of existing business.
- Adaptive reuse of buildings within existing neighborhoods.
- Revitalization in downtown and north central areas, including specific transit needs.

Tier 3: Projects with water demand that exceed the base allocation in Tier 1 but do not support the "quality of life" priorities in Tier 2 are approved only if they provide additional water supply to the city. This may include reimbursing the city for purchasing the water at market rate.

Several other communities in Arizona are using allocation policies, including the Town of Mesa, Town of Gilbert, and City of Surprise.

TOOLBOX: WATER DEMAND OFFSET PROGRAMS

Water demand offset programs can be a way to meet future water demand by requiring new development to offset water demand either through conservation in existing development or transfer of water rights. The demand management initiatives could occur on-site or elsewhere within the water supply system. The goal is that all new development, including the expansion of existing homes or businesses, can be "water neutral" in the water supply system. This concept can also apply to offsetting energy, wastewater, air quality, historic preservation, or watershed health impacts.

Best practices for water demand offset programs consider:[3]

- A water bank: a water bank authority must be established to monitor and administer the program.
- An offset ratio: a ratio of 1:1 will maintain the status quo, and a 2:1 mitigation ratio will factor in water-stressed environments. Wastewater reclamation projects are more reliable and are given a 1:1 offset value, and supplies created through demand management are considered temporary and are given a 2:1 ratio.
- Costs: if fee-based, the charge must reflect costs of implementing the offset and administrative costs. Costs of developing new supplies are borne by the entity needing to offset demand. Fee schedules can be a flat rate or based on percentage.
- Verification: require verification of sufficient water supplies and water budgets. Work completed by developers much include documentation and verification by local program administrators.
- Timing: consideration of timing of when the offset fee is paid. Allow enough time to procure supplies with those fees by the time the new demand is created by the development.
- Spatial location: to promote infill development, new demands on land within the service areas may be given prioritiy access to new supplies over land outside the service area boundary. Consider maximizing development opportunities within the boundary before approving development in new regions.

3 Alliance for Water Efficiency. **Water Offset Policies for Water-Neutral Community Growth.** (2015).

CASE STUDY

WATER SMART SUPPLY – SANTA FE COUNTY, NEW MEXICO

Santa Fe County, New Mexico, has been working for nearly forty years to integrate water and land use planning by applying a development suitability lens to reduce natural resource degradation.

The county's efforts began in 1980 with the Santa Fe County General Plan. The growth management approach was to locate new growth in places with adequate services and infrastructure, while trying to minimize growth in areas constrained by limited or low-quality water and natural hazards. In areas dependent upon groundwater, the county was divided into four hydrologic zones where a minimum lot size (base zoning) was set to reduce. Within these zones, the county required a 100-year water supply, with demand calculated based on an estimate of one acre-foot per lot, the groundwater depletions same as permitted by the state. The minimum lot sizes for the four zones included: 160 acres, 80 acres, 40 acres, and 10 acres. The development code was updated to include a requirement for new developments to conduct an analysis of land suitability, available infrastructure, and water resources. Developers could increase density if they completed a geo-hydrological study or entered into an agreement to use less than the allowed one acre-foot of water articulated in a conservation plan.

A 1999 update to the comprehensive plan continued to link new development to locations with suitable water, services, and infrastructure. In 2001, the county's **Sustainable Development Growth Plan** (see pg. 189) changed direction. After thirty years of trying to protect natural resources by linking lot size and hydrological zones, the county adopted new zoning districts and development standards intended to better protect sensitive land, preserve open space, and ensure high-quality infrastructure and services. The new approach identified three growth tiers:

- A priority growth area to accommodate new compact development served by surface water or community system and adequate public facilities and services.
- A future development area for infill development likely to occur within the limits of groundwater availability.
- Low-density agricultural land, environmentally sensitive land, and conservation areas.

The code includes a Water Supply, Wastewater and Water Conservation requirement (Chapter 7 Section 7.13.) that defines how developers can satisfy the need for an adequate water supply. The location and scale of the development, the lot size, and proximity to water infrastructure determine whether a development uses a community water system or well. If applicants are connecting to the county utility, the only requirement is a written agreement to provide services. However, if the

applicant is not on the county utility, a more stringent set of requirements must be met. For a minor subdivision over five lots that is zoned to permit an individual or shared well, the county requires a valid Office of the State Engineer's well permit and a hydrological study. Standards for the hydrological study include proof of an adequate water supply for 99 years and well test requirements for pump rates and recovery days linked to the different hydrological formations.

As part of development review, a **Water Service Availability Report** (see pages 6-12) summarizes how a development meets the requirements for an adequate water supply. The WSAR includes an analysis of the following: existing system capacity of the public water or wastewater supply proposed for use; well field capacity or stream, spring, or other source of raw water supply; historical average and peak use of potable water; the number of hookups and the estimated potable water demand per hookup; and the number of hookups for which contractual commitments have been made or previous development orders have been approved.

Developments must also meet water conservation requirements and file a signed water restrictions agreement and covenants with the plat or site development plan committing to not using more than 0.25 acre-foot per year per lot. Water conservation requirements include:

- Low-water landscaping/xeriscapes.
- Drip irrigation and mulching.
- Kentucky bluegrass is prohibited; non- native grass is limited to 800 sq. feet and must be watered by water harvested or greywater.
- Water is permitted for new landscaping for up to two years, but thereafter only for viability.
- Between May and November, outdoor watering is prohibited between 11 a.m. and 7 p.m.
- Rain sensors.
- Fugitive water prohibition.
- Rainwater catchment for all new construction to capture a minimum of 85% of the roof area drainage.
- A domestic well-metering program and submetering of landscape water use.
- WaterSense certified or equivalent toilets, urinals, lavatory faucets, and shower heads.
- Energy Star certified or equivalent dishwaters, washing machines.
- Water- and energy-efficient hot water systems.
- For food service, water available only upon request.
- For lodging services, daily linen services only upon request.
- Conservation signage and literature distribution.

SECTION 3:

WATER SMART LAND USE POLICY

Policies and programs that govern where and how development occurs can greatly impact the management of water resources.

CASE STATEMENT

Water demand is a function of household size, income, residence, and lifestyle habits. But water demand is also a function of how we plan, design, and maintain our communities. Research indicates that when it comes to saving water, where and how we build really matters. Efficiencies can be found in density of development patterns, building, site and systems design, and especially landscaping. We know that:

- Certain building types and development patterns consume or conserve more water than others.
- Certain land use types consume more water than others.
- Certain types of landscaping plants and trees either consume or conserve more water than others.
- Newer appliances and plumbing fixtures are more water efficient than old ones.
- Households that conserve water save money for themselves and the water provider and water for other people and nature.

To use less water, the best approach is to make water smart development the easiest and most incentivized type of development to build. Three key tools are available to do so:

1. Promote higher density and compact development, especially where existing infrastructure already exists.
2. Promote high performing, water efficient plumbing and building standards.
3. Promote water saving and climate appropriate landscaping standards and maintenance practices.

TOOLBOX: COMPACT DEVELOPMENT

While most water conservation and efficiency efforts related to land use have primarily focused on outdoor watering and indoor plumbing fixtures, there are considerable benefits to encouraging more compact development patterns. Water usage studies have consistently demonstrated that in urban areas, the largest consumption of water is by large-lot single-family homes where 70% or more[4] of the water consumed is used for outdoor use during spring and summer. Alternatively, higher density development can result in less water consumption. Research from **Colorado** and **Arizona** has demonstrated that developments between 3-8 units per acre have the greatest gains for water conservation and that even small adjustments can yield large water savings for cities.

Promoting water-efficient land use patterns provides many benefits other than simply saving water. It can also support the more efficient use of existing infrastructure, protect natural resources, promote walkability, control flooding, and enhance neighborhood or community vibrancy.

STRATEGIES FOR PROMOTING COMPACT DEVELOPMENT

- At pre-development review, make rezoning, annexations, and Planned Unit Development applications conditional on meeting water conservation standards.
- Develop future land use plans that establish designated future growth areas, both infill and greenfields, where adequate infrastructure exists for accommodating growth at higher and/or more urban densities.
- Change the zoning code to permit smaller lot sizes and higher densities by right in designated districts.
- Reduce or remove development standard barriers to compact development, such as parking requirements, minimum lot sizes, and lot setbacks. As for height limitations, water demand begins to climb at the point at which a cooling tower is needed for the building. Craft your code for your climate and context.
- Change zoning code to permit multiple types of residential development (e.g., multiplex, townhomes, apartments, accessory dwelling units) by right in designated growth areas to provide a diversity of housing options.
- Change zoning code to permit compact mixed-use development by right in designated growth areas.
- Change zoning code and use green infrastructure to promote public open space, shade, placemaking, and active living.
- In exurban and rural areas, change zoning code to permit and incentivize cluster and conservation development by right.

4 **new.azwater.gov/conservation/landscaping**

CASE STUDY

LEADERSHIP OUTSIDE OF AMAS – CITY OF FLAGSTAFF

Communities outside of Active Management Areas have fewer state-level regulations and guidelines to follow, but there are significant benefits to going beyond what is required of them. Without state-level tools and information to guide them, however, it is up to communities outside AMAs to proactively implement their own water resource management plans. The City of Flagstaff is a leader in this effort, creating forward-thinking policies that link land use and water resource planning.

Flagstaff's population is rapidly expanding. With surface water from snowmelt variable and unreliable, and about 60% of its water supplies coming from groundwater, the city understood that in addition to securing new water supply, it needed new development to manage water efficiently and effectively.

Flagstaff Regional Plan 2030, the comprehensive plan for the city and county, cites goals and policies prompting water smart development strategies, green infrastructure, and water infrastructure financing. By 2030, the aim is to manage water supply through conservation, reuse, innovative treatment technologies, and smart development choices.

Best practices in Flagstaff include:

- Impact analyses. Every site plan or zoning request must determine if existing water infrastructure is sufficient, whether the plan requires a new well, and how it will impact the city's water budget.
- Compact and cluster development to preserve open space. Higher-density, mixed-use infill projects utilize existing infrastructure and steward water supplies, energy, and other resources more than single-family residential.
- Stormwater management/low-impact development. All new subdivisions are required to control runoff and recharge on-site. The city provides low-impact development and stormwater manuals.
- Landscaping code. Code requires native/xeric plants; the use of hydrozones (organizing plants according to water demand and microclimate); and the use of rainwater, greywater, or reclaimed water (non-potable) for irrigation.
- Rainwater harvesting. Flagstaff was the first city in Arizona to pass **rainwater harvesting guidelines** in 2012. The ordinance adds a rainwater harvesting requirement to existing low-impact development ordinances, making active rainwater harvesting systems mandatory in new residential development unless it demonstrates low outdoor water demand.

- Manage commercial uses by making water-intensive uses, such as car washes, nurseries, etc., conditional instead of by right. Permit based on standards to meet water conservation and efficiency standards such as water recycling.
- Provide incentives for increased densities using development or utility fee reductions/waivers and density bonuses.

TOOLBOX: WATER-EFFICIENT LANDSCAPING

In Arizona, outdoor watering for urban landscapes accounts for 70 percent[5] or more of the total annual water demand during spring and summer. Some communities can see their peak demand triple in the summer, requiring storage and infrastructure to provide a reliable supply. Communities working to make landscaping water smart from the start can integrate tools to reduce water demand from new construction. There are numerous tools available to local governments that integrate best practices into their development code for water conservation and efficiency. These include:

- The types of plants that are best suited for the climate and irrigated by hydrozones.
- A total amount of landscaping permitted based on lot size percentage or square footage.
- The type and amount of turf allowable based on square footage or total landscaped area.
- Low-flow and efficient irrigation system technology, including drip, bubblers, or low- flow sprinklers.
- Rain sensors with a shutoff device to reduce watering during natural rainfall events.
- Evapotranspiration (ET) sensors to adapt irrigation to changing weather and soil conditions.
- A water budget for outdoor water use, ideally tied to tiered rate structuring that sends a price signal to the rate payer.
- Soil enhancements and mulching.
- Scheduled timing of irrigation to limit evapotranspiration.
- Code enforcement and fines for violations of standards.
- Training for landscape professionals on water-saving landscaping.
- Model Maintenance Standards and Agreements for Home Owners Associations and others to use in contracting landscape services.

Since mandatory requirements significantly increase water savings, the goal of a community committed to water conversation should be to require all new developments and retrofits meet water efficiency standards.

5 Arizona Department of Water Resources **new.azwater.gov/conservation/landscaping**

STRATEGIES FOR PROMOTING WATER-SAVING LANDSCAPING

- Conduct an assessment of saving potential by comparing annual water demands on a new property against an older property or properties with comparable area, plantings, and irrigation methods.
- Develop a landscaping design manual that provides specific guidance to individuals and developers on water-saving tree and plant types and sizes, planting seasons, soil enhancement, mulching, and watering times appropriate for the local climate.[6]
- Promote and/or incentivize the use of individual household rainwater harvesting for outdoor irrigation.
- Incentivize the removal of water-intensive landscaping by offering landscaping conversion rebates.
- Provide incentives for developers to use water-efficient or xeric landscaping through the reduction of tap fees.
- Change your subdivision code to include residential, commercial, and public landscaping standards that reduce use of water for irrigation by regulating:
    - Irrigated lot coverage.
    - Plant types.
    - Irrigation system efficiency.
    - Rain sensors and/or evapotranspiration (ET) sensors that adjust watering to changing site conditions.
    - Watering schedules (e.g., before 8 a.m. and after 8 p.m., scheduled by zones and day of the week).
    - Soil amendments.
    - Water loss limits.
- Change property owner behavior through education managed by the water provider:
    - Rebate programs for water-efficient plumbing fixtures such as low-flow toilets and shower heads, and front-loading washing machines.
    - Rebate programs for turf removal and replacement with low-water-use.
    - Education about xeriscaping and water-efficient irrigation systems.
    - Water audits that educate property managers and evaluate systems.

6 Water Smart Landscaping Principles are widely promoted in educational programs as well as adopted into landscape and water conservation plans. **wateruseitwisely.com/100-ways-to-conserve/landscape-care/principles-of-xeriscape-design**

CASE STUDY

ADOPTING A WATER CONSERVATION CODE TO REDUCE OUTDOOR WATER USE – THE CITY OF BUCKEYE, ARIZONA

Located within the Phoenix metro area, the City of Buckeye relies almost entirely on groundwater to fulfill its water demand. It is also one of the fastest-growing cities in the nation, increasing in population from 6,000 in 2000 to 96,000 in 2021. This rapid growth highlights the necessity of integrating water and land use planning.

Along with its population rise, Buckeye has experienced a steep increase in outdoor water use. Approximately 70% of Buckeye water demand is outdoors. This is higher than the 50-60% that the City reported seen in comparable cities. In addition to high outdoor water use consumption, a combination of geography, geology, and water treatment infrastructure design makes effluent reuse difficult for Buckeye. Where other cities can use alternative water sources for irrigation of residential and commercial landscaping, city parks, and sports fields, Buckeye must use its valuable potable water.

After conducting an analysis of **Buckeye's water use** and participating in the 2020 Growing Water Smart workshop, city officials drafted a new city water conservation code that seeks to reduce outdoor water use.

Some of the code elements would include restricting residential and commercial turf size and placement and banning turf in city rights-of-way, water-smart seasonal turf seeding and irrigation system design, and native plant lists. Areas with 10 or more acres of irrigated land would submit a water conservation plan to the city, which would include: (a) the acreage of turf versus low-water- use landscaped areas, (b) annual water use budget broken down by landscape type, (c) the source of the water, and (d) steps to improve water efficiency and waste reduction.

As Buckeye continues to grow, water used in construction presents an opportunity to use alternative supplies. The city worked with general contractors to create a construction water conservation plan, which is completed in the permitting process to connect with cheaper alternative water sources and introduce conservation techniques in the construction phase. The Plan also collects information which will support Buckeye to make data-driven decisions about their water supplies.

The process of brainstorming, drafting, and gaining feedback on these codes and plans promoted collaboration between the city and prominent stakeholders such as developers, homeowner's associations (HOAs), general contractors, and builders' associations. The stakeholder input process revealed support among HOA leaders for increased city-level regulation at the residential scale. The roll out of the city's codes will provide ample opportunity for resident education around water conservation in Buckeye.

TOOLBOX: WATER SMART PLUMBING FIXTURES AND BUILDING EFFICIENCY

Reducing indoor water use in residences and businesses can be accomplished through water-efficiency standards for indoor plumbing fixtures. Arizona's maximum water efficiency rates for indoor plumbing fixtures are higher than federal standards (A.R.S. 45-312 and 45-313). WaterSense labeled products are not required to be installed by new development, so local jurisdictions can incentivize water-efficient plumbing in local ordinances and in retrofit programs.

FIXTURE	E.P.A. WATERSENSE PRODUCTS	ARIZONA STATUTES (45-312)	FEDERAL STANDARDS
Residential toilets	1.28 gallons / flush	1.6 gallons / flush	1.6 gallons / flush
Bathroom faucets	1.5 gallons / minute	3.0 gallons / minute	3.0 gallons / minute
Shower heads	2 gallons / minute	3.0 gallons / minute	2.5 gallons / minute

STRATEGIES FOR PLUMBING FIXTURES AND BUILDING EFFICIENCY STANDARDS

- Use the green plumbing code as a guide or adopt the green plumbing code requiring high-efficiency faucets, shower heads, and toilets in the plumbing code.
- Adopt building code standards that permit the use of water recycling systems.
- Adopt building code standards for submetering of multifamily units.
- Incentivize the replacement of older, less-efficient toilet and faucet technologies with water wise ones through rebates or free fixtures.
- Create incentives for developers to receive lower tap fees for meeting water efficiency standards beyond the building code.
- Link tap fees to water budgets to guarantee that the low demands projected when tap fees are paid will be observed over time.
- Empower staff, HOAs, and maintenance companies with a command of desert plants, soil health, and watering best practices. Like any infrastructure, it requires ongoing maintenance to maintain efficacy.

CASE STUDY

GREEN BUILDING DESIGNATION AND INDOOR WATER USE – CITY OF SCOTTSDALE, ARIZONA

While legislation is currently under consideration, high-efficiency fixtures are not required in Arizona. Some local jurisdictions, however, have passed their own local ordinances or have implemented rebate programs to incentivize high-efficiency WaterSense products. The City of Scottsdale was a pioneer in this effort, beginning with its 1998 general plan update. Under the guiding principle "Seek Sustainability," Scottsdale created an interdepartmental committee to explore sustainable community initiatives like a **green building designation program**.

Staff launched the program when an environmental builder and environmental products manufacturer approached the city to recommend such a program as part of a new pilot home project, citing customer support and local buy-in. A green building advisory committee formed, composed of citizens, architects, designers, home builders, state environmental office representatives, utility representatives, and members of academia. The committee modeled its educational and outreach components on the Civano Sustainable Community in Tucson and on green building programs from Austin, Texas; Denver, Colorado; and Kitsap County, Washington. The committee created regionally based standards and established the first citywide green building program in Arizona.

Under the program, City of Scottsdale buildings receive a designation if they meet a threshold of site, water, energy, indoor environmental quality, and material resource standards. Currently, these include but are not limited to:

- Kitchen faucets with a default maximum flow rate of 1.8 gallons per minute.
- Roof with 50% runoff diverted into landscape areas.
- Smart irrigation controller that regulates irrigation based on weather or soil moisture conditions.
- All primary building entrances protected from direct summer sun (east, west, south) with recessed or covered elements.
- Minimum 5% improvement over the city energy efficiency code.
- Commercial buildings include individually submetered supplies for water features, swimming pools, irrigation, and cooling towers.

Since the voluntary program was established, the City of Scottsdale amended its **plumbing code** to require that new residential and commercial buildings use the same water efficiency rates as WaterSense products. Updates include:

- High-efficiency toilets, urinals, lavatory faucets, and shower heads. This plumbing code amendment goes beyond the federal standard for low-flow fixtures. It was easy to pass, because the local market had already shifted to HE as the norm, and many builders were already unwittingly meeting this standard.
- Water Heaters. In order to deliver hot water faster and more efficiently,

water heaters need to be located near the point of use (i.e., bathrooms, kitchen, laundry room) or be configured with a whole-house manifold system where each plumbing fixture is supplied with a dedicated hot water line directly from the water heater, analogous to an electrical circuit panel. A demand-controlled hot water recirculation loop and pump is required when the most remote plumbing fixture hot water supply line exceeds 21 feet for ¾-inch pipe, 32 feet for 5/8-inch pipe, 43 feet for ½-inch pipe, and 50 feet for 3/8-inch pipe.

- Green Construction Code. Scottsdale adopted the 2015 International Green Construction Code for commercial buildings in specified zoning districts as a condition of zoning bonuses. If a developer wishes to increase building height beyond the maximum allowed limits in downtown and mixed-use/commercial zones, they must follow the green construction code.

Note, there is a distinction between “low-flow” and “high-efficiency.” When “low-flow” fixtures (e.g., 1.6 gallons/toilet flush) were federally mandated in the early to mid-1990s, they were very inefficient because manufacturers only made inconsequential changes to meet the standards. The faulty design often required multiple flushes to remove waste. Alternatively, “High-Efficiency” fixtures (1.28 gallons/flush) have been completely re-engineered and tested to meet updated standards.

Today, several other green building programs and water smart certification programs have been established in the state.

SECTION 4:

HEALTHY & RESILIENT WATERSHEDS

The effects of increasing development, climate change, and natural hazards can all degrade the quality of the watershed, impacting both water yield and water quality.

CASE STATEMENT

In addition to managing water use it is important to safeguard a community's water supply. The quality and quantity of a community's water is inextricably linked to the health of the watershed. Human and naturally occurring factors can degrade ground and surface water quality and quantity, including:

- Pollution from urban and agricultural runoff and natural disasters.
- Sedimentation due to soil disturbances, vegetation loss, and erosion from roads and new development.
- Destruction of riparian areas due to development and changes in climate.
- Increased stormwater due to increase in impervious surfaces from development.
- Decrease or lack of water infiltration resulting from impervious surfaces and more rapid runoff.
- Inconsistency in water supply caused by periodic droughts.

TOOLBOX: WATERSHED PROTECTION

Landscape-scale changes resulting from both human and natural forces have a significant impact on natural ecosystems and water resource availability. Safeguarding available water resources through watershed protection standards and policies is an important, but often overlooked, goal in Western communities. Watershed planning and protection has often been considered a function of collaboratives and non-profits working with local governments to restore ecological processes and functions. The way communities develop and redevelop can either escalate the threat to our watersheds or nurture nature and harvest the returns.

Watershed-sensitive planning focuses on minimizing negative impacts as new development occurs. Watershed protection goals are generally included in a wide variety of community plans, such as comprehensive plans, emergency management plans, watershed plans, water resource management plans, and open space plans. Converting these goals into concrete policy in development codes is essential to preventing watershed degradation and enhancing community resiliency.

STRATEGIES FOR WATERSHED PROTECTION STANDARDS

- Map all sensitive areas, including wetlands, riparian corridors, infiltration zones, water supply watersheds, groundwater basins, and areas prone to natural disasters.
- Adopt plans for wildfire mitigation, watershed management, stormwater management, and floodplain management that designate sensitive areas and goals for mitigation.
- Minimize development in sensitive areas through clustering or limited development densities and design standards--or at least guidelines.
- Create zoning districts with lower densities and/or cluster development to protect surface and groundwater-sensitive areas.

- Adopt development standards for stream buffers and setbacks to protect water quality and shallow groundwater areas.
- Adopt vegetation protection standards that minimize disturbance to vegetation within the riparian corridor.
- Adopt stormwater management and site design standards that utilize best practices for low-impact design, reducing storm event runoff and increasing water infiltration.
- Adopt site-level soil erosion mitigation standards for new development to reduce sedimentation and runoff, and to protect water quality from land disturbance.
- Protect existing and potential sources of drinking water supplies by adopting surface and/or groundwater districts with standards to minimize contamination of streams and shallow aquifers.
- Participate in collaborative efforts to restore watershed functions through watershed-restoration projects.

CASE STUDY

WATERSHED PROTECTION PROGRAM – CITY OF FLAGSTAFF AND COCONINO NATIONAL FOREST, ARIZONA

Whether a mountain or a desert town, Arizona communities are often surrounded, at least partially, by natural open space. Even if outside your jurisdiction, the health of those natural lands can help or hinder water management.

The City of Flagstaff has been successful in restoring forest lands within and adjacent to the city in order to mitigate fire risk and the associated flood and water quality issues. Much of the land was state or federally managed, yet in 2012 voters supported a $10 million bond to support key watershed restoration work. This is a rare example of federal land restoration being funded by a municipality, and the only known instance where such an effort is funded by municipal bonds. Funds are managed by the **Flagstaff Watershed Protection Program.**

The City of Flagstaff is groundwater dependent, and their water supply is highly dependent on the precipitation and run off from the San Francisco Peaks. Fires can create major water quality and quantity concerns: a wildfire and subsequent erosion could impair up to 50% of the city's water supply.

Another immediate concern was public safety. Flood risks dramatically increase after forest fires. Streetside signage was placed throughout town to indicate the extent of flooding likely to occur without intervention. This public messaging campaign was key in building community support for this unprecedented bond election.

CASE STUDY

SEEKING SUSTAINABLE YIELD IN THE SIERRA VISTA SUBWATERSHED – COCHISE COUNTY, ARIZONA

Over the last two decades, Cochise County has implemented collaborative and forward-thinking approaches to conserving water, protecting riparian habitat, and preserving regional economic viability through integrated water and land use planning. The county, City of Sierra Vista, and Fort Huachuca, working collaboratively, catalyzed innovative zoning and policy structures that pushed the boundaries of water policy in Arizona and resulted in effective water conservation.

In 1998, a joint planning commission between Cochise County and the City of Sierra Vista brainstormed regulations and policies to promote water conservation in the Sierra Vista Subwatershed (SVS), a hydrologic area where groundwater pumping was affecting the flow of the San Pedro River and potentially impacting the riparian habitat of the Congressionally designated San Pedro Riparian National Conservation Area (SPRNCA). The county incrementally enacted these conservation measures, progressing from targeted regulations on golf courses to countywide regulations on waterless urinals, commercial development landscaping, and residential pools. This group evolved into the 21-member Upper San Pedro Partnership, formed to guide policies, funding, research, and monitoring of water impacts in the SVS.

By 2002, several local events indicated a need for more targeted regulations in the SVS. About 70% of the county's total population is in the SVS. In 1999, the United States Geological Survey showed an approximately 15,000 acre-foot overdraft of groundwater resources in the area, which was likely impacting the federally protected San Pedro River. Fort Huachuca, the main economic driver of the region, was then sued under the Endangered Species Act for its role in groundwater overdraft. At the same time, the rate of development in the county was increasing, ultimately peaking in 2008.

The county's role in the coordinated response was its 2002 Water Action Plan for the SVS. County staff cited A.R.S 11-821C3, which allows all counties to plan for development and water resources, as its legal basis for integrating water and land use planning.

An initial strategy from the County was the adoption of key comprehensive plan policies and site development standards countywide and intergovernmental agreements with cities in support of water conservation. The county and the City of Sierra Vista leveraged the Extraterritorial Jurisdiction statute (**A.R.S 9-461.11**) to propose extending the city's existing water conservation zoning regulations up to 20 miles[6] beyond its municipal jurisdiction into unincorporated areas in the SVS.

A follow-up strategy was to amend the comprehensive plan to include the 2006 **SVS Water Conservation and Management Policy Plan**. In this amendment, the county tied water impacts to its discretionary re-zoning approval process: proposals that increase density above the one unit per four acres base zoning in rural areas must incorporate water-saving elements into the design until the projected per capita water demand matches the projected base zoning demand. Another key policy of this plan also prohibits density increases if they are proposing to pump groundwater within two

miles of the San Pedro Riparian National Conservation Area.

At the same time, the SVS Water Conservation and Management Policy Plan allowed the county to build upon the Extraterritorial Jurisdiction statute to create the **SVS Overlay Zone** (see page 146), which established new regulations and included the entirety of the SVS. An overlay zone is an additional "layer" that adds or modifies regulations to the existing zoning of a particular geographic area. Though typically used to guide development in specific areas like central business and historic districts, overlay zones are also effective tools in natural resource protection. Within the SVS Overlay Zone, new residential and non-residential construction must adhere to site development standards, including:

Residential

- Toilets and other fixtures must be WaterSense-labeled.
- Greywater plumbing stub-out must be available for optional use by the homeowner.
- On-demand hot water must be located at the point of use.

Commercial, Industrial, Multi-family, and Public Development

- All urinals must be waterless.
- Car washes must recycle a minimum of 75% of the water used.
- All dishwashers and clotheswashers, water softeners and drinking water systems must be Energy Star rated or otherwise efficient.
- Multi-family developments over four units must be submetered.
- New artificial water features such as lakes/ponds are prohibited. Decorative fountains must recirculate and use harvested rainwater.
- Turf and irrigation systems are subject to new restrictions

The SVS Overlay Zone is one of the tools Cochise County has employed to protect its groundwater reserves. The county is also a founding member of the **Cochise Conservation and Recharge Network (CCRN)**. The CCRN identifies and facilitates riparian habitat protection and groundwater recharge projects like retiring agricultural land, constructing effluent recharge and stormwater detention basins, and protecting land from future development in sensitive environments adjacent to the San Pedro River and its tributaries. At the beginning of 2020, CCRN had completed seven projects over 6,344 acres, which cumulatively recharge 3,000 acre-feet per year (AFY) and prevent 3,000 AFY of groundwater pumping. This collectively amounts to approximately 2 billion gallons per year.

Through the SVS Overlay Zone, the CCRN, and other water conservation measures, the county hopes to attain sustainable yield within the watershed. Beyond the "safe yield" goal of the Phoenix, Prescott, and Tucson AMAs, "sustainable yield" lies at the nexus of human and natural ecosystem needs because it seeks to recharge the groundwater table to maintain riparian habitat while also meeting the needs of human residents.

TOOLBOX: GREEN INFRASTRUCTURE OR LOW-IMPACT DEVELOPMENT

Green infrastructure (GI), or low-impact development (LID), is the retention or restoration of natural hydrologic patterns by using landscape and site design to keep as much rainwater as possible from leaving the site. Instead of designing a site to funnel stormwater off-site as fast as possible, LID uses natural vegetation, detention basins, and porous materials to "slow the flow" and encourage the infiltration and harvesting of stormwater.

Some of the many benefits of green infrastructure include:

- Reducing peak flooding and treating stormwater on-site reduces downstream flood intensity, pollutant loads and decreases risk of sewer overflow.
- Reducing the need for outdoor irrigation and landscaping; native plants can revegetate channels and basins, relying solely on naturally occurring rainfall.
- Planting trees and other plant materials mitigates heat by providing shade, sequestering carbon, and absorbing radiation from the sun.
- Allowing stormwater to infiltrate into vegetation and soils increases groundwater recharge.
- Providing access to green spaces fosters active, healthy lifestyles through increased neighborhood beautification and increased shade.
- Adding natural vegetation along streets aids with traffing calming.

COMMON LOW IMPACT DEVELOPMENT AND GREEN INFRASTRUCTURE TECHNIQUES

Application	Description
Bioretention basins, stormwater harvesting basins and rain gardens	Small to large scale planting areas within the hardscape containing shrubs, trees and grasses.
Bioswales	Shallow and uncovered channels that induce meandering, and are placed inline within a drainage channel.
Curb extensions and chicanes	Traffic calming measures which widen the sidewalk and/or narrow the street for a short distance.
Curb openings	Drainage inlets that divert stormwater into bioretention basins.
Detention ponds	Basins that provide flow control by collecting stormwater runoff.
Permeable pavement, gravel, or pavers	Methods of paving that allow infiltration and can be used in low to moderately trafficked areas like sidewalks and parking lots .

STRATEGIES FOR GREEN INFRASTRUCTURE

- Work with transportation and civil engineering professionals to update development standards. Map streets, bike paths, and other areas that have the highest flood potential. When possible, use the minimum street width and direct runoff from pavement and buildings to vegetation-lined channels.
- Design all aspects of landscaping—from the selection of plants to soil preparation and installation of irrigation systems—so as to reduce water demand, retain runoff, decrease flooding, and recharge groundwater.
- Incorporate water holding areas into the landscape, such as creek beds, recessed athletic fields, ponds, cisterns, and other features.
- Preserve regional open space by clustering development, maximizing unpaved areas for stormwater retention. Use permeable surfaces for hardscapes.
- Map all sensitive areas including wetlands, riparian corridors, infiltration zones, water supply watersheds, groundwater basins, and natural disaster-prone areas, such as flood, drought, and wildfire areas. Adopt development standards for stream buffers and setbacks to protect water quality. Create zoning districts with lower densities and/or cluster development to protect sensitive areas.
- Adopt plans for wildfire mitigation, watershed management, stormwater management, and floodplain management that designate sensitive areas and goals for mitigation. These plans should reference other plans so that priorities and objectives build on each other and that the environment is viewed holistically.

CASE STUDY

PLANNING & FUNDING GREEN INFRASTRUCTURE – TUCSON

Stormwater harvesting programs and policies often focus on green infrastructure (GI), which includes using natural spaces within the built landscape to capture stormwater, to reduce fugitive water (i.e., water runoff from a site), and to mitigate urban flood risk.

The **City of Tucson Green Streets Policy**, passed in 2013, requires Tucson Department of Transportation to incorporate green infrastructure into the design of public roadways during new construction and for reconstruction projects that include a landscaping element. It also requires that GI costs and benefits be evaluated and incorporated into project budgets. The main goal of this policy was to address flooding issues in Tucson's street network. Secondary benefits included heat island mitigation, improved streetscape aesthetics, and traffic calming.

While construction of the GI features has been successful, maintaining them is another matter. Initially, the transportation department was responsible for GI maintenance, but when the department proved to be too constrained by funding limitations, the city shifted this responsibility to residents and neighborhood groups. It eventually became apparent that neighborhood groups are ill-equipped to handle maintenance projects, and the poorly maintained basins became ineffective at stormwater harvesting, further diminishing street safety and aesthetics.

In 2019, voters approved the City of Tucson Green Stormwater Infrastructure Plan and **Green Stormwater Infrastructure (GSI) Fund** to support the maintenance of existing GI features as well as the planning and construction of additional stormwater harvesting basins in new areas of the city.

Tucson Water used the recommended maintenance cost rate of $2.84 per square foot of GSI features per year, plus a thorough inventory of the existing 317 GSI features in the city to estimate overall costs. The approved fund added a flat-rate charge which ranges from approximately $1.00/month for low- income families to around $2.00/month for commercial users. The total annual budget for this program is approximately $3 million, covering program administration, feature maintenance, and capital improvements.

Additional benefits of the GSI fund include centralizing responsibility for citywide integrated implementation, helping to avoid duplicated and counter-productive efforts. This initiative of Tucson Water is consistent with several goals of the voter-approved Plan Tucson: City of Tucson General and Sustainability Plan 2013 and Tucson Water's One Water management strategy.

SECTION 5:

WATER CONSERVATION RATE STRUCTING

Utility pricing, or rate structuring, can incentivize consumers to use less water, maximizing conservation benefits.

CASE STATEMENT

Many factors influence water demand, including size and type of property, seasons, weather, income, education, and conservation habits. For individual households and businesses sensitive to the price of water, rate structuring is one of the more effective ways to prompt conservation behaviors. Most water providers use declining block or uniform water rate structures that do not encourage conservation. Rate structuring aims to incentivize water conservation by charging higher prices as a household or business uses more water. Common goals for adopting water conservation rate structures include:

- Reducing daily peak usage.
- Reducing seasonal peak usage.
- Reducing total system demand.

When well executed, rate structuring can produce significant water savings and expedite shifts in water use behavior.

TOOLBOX: CONSERVATION RATE STRUCTURING

Water utilities set rates to collect the revenue they need to operate the water utility, invest in its infrastructure, and protect public health. With a revenue goal identified, utilities can develop a rate structure to meet additional objectives, including water conservation and acquisition of supplies. Prioritizing conservation and mitigating water demand can ensure lower costs by allowing any water supply acquisition or storage to be right-sized to the lower level of demand.

Water rates are determined by two factors, fixed and variable costs. The fixed costs of water are determined by the costs of water acquisitions and the costs to establish, operate, and maintain the infrastructure to convey the water. A variable cost is based on the amount of water consumed by a consumer. If it is possible that customer conservation may exceed the point where it would present a revenue challenge with the current price of water, consider having a public dialogue to design solutions and rate structures that reflect the community's values. Also consider how less demand pressure can result in considerable cost saving over time by reducing strain on water system infrastructure, thus delaying the need for maintenance, retrofitting, or expanding infrastructure. There are a variety of rate structuring options:

- **Drought Demand Pricing:** rates are higher during drought periods.
- **Excess Use:** rates are higher for above-average water use.
- **Inclining Block:** rate per block increases as water use increases.
- **Indoor/Outdoor:** using separate meters, rates for indoor use are lower than rates for outdoor use.
- **Penalties:** customers are charged for exceeding allowable water usage limits.
- **Scarcity Pricing:** the costs of developing new supplies is added to bills.
- **Seasonal Pricing:** water rates are higher during the season with the most demand.
- **Sliding Scale:** the unit price increases based on an average consumption.
- **Spatial Pricing:** water rates are determined by the actual costs to supply water to specific locations.
- **Time-of-Use:** water rates are higher during peak days or specific hours of the week.
- **Water Budget:** block rate is defined for each individual customer based on efficiency projections/expectations for that customer.

STRATEGIES FOR CONSERVATION RATE STRUCTURES

- Develop a utility water conservation plan to clarify water conservation goals.
- Conduct a rate assessment to determine options for rate structuring.
- Develop a rate structuring plan and conduct community education and outreach to minimize opposition to potential rate increases.
- Adopt a conservation rate structuring strategy.

CASE STUDY

TIERED RATE STRUCTURES & CONSERVATION FEES – TUCSON WATER

Water rates are a key tool for managing demand as well as generating sufficient revenue for operations, maintenance, and capital improvement projects. A key challenge for water providers is finding ways to maintain financial sustainability as customers embrace water conservation.

Tucson Water uses an inclining block rate structure for its residential customers' potable water delivery; as water volume use increases, so does the price per centum cubic feet (CCF). This **rate structure** incentivizes water users to conserve water and avoid paying higher rates.

Single Family Residential Block Rate, Charge per CCF

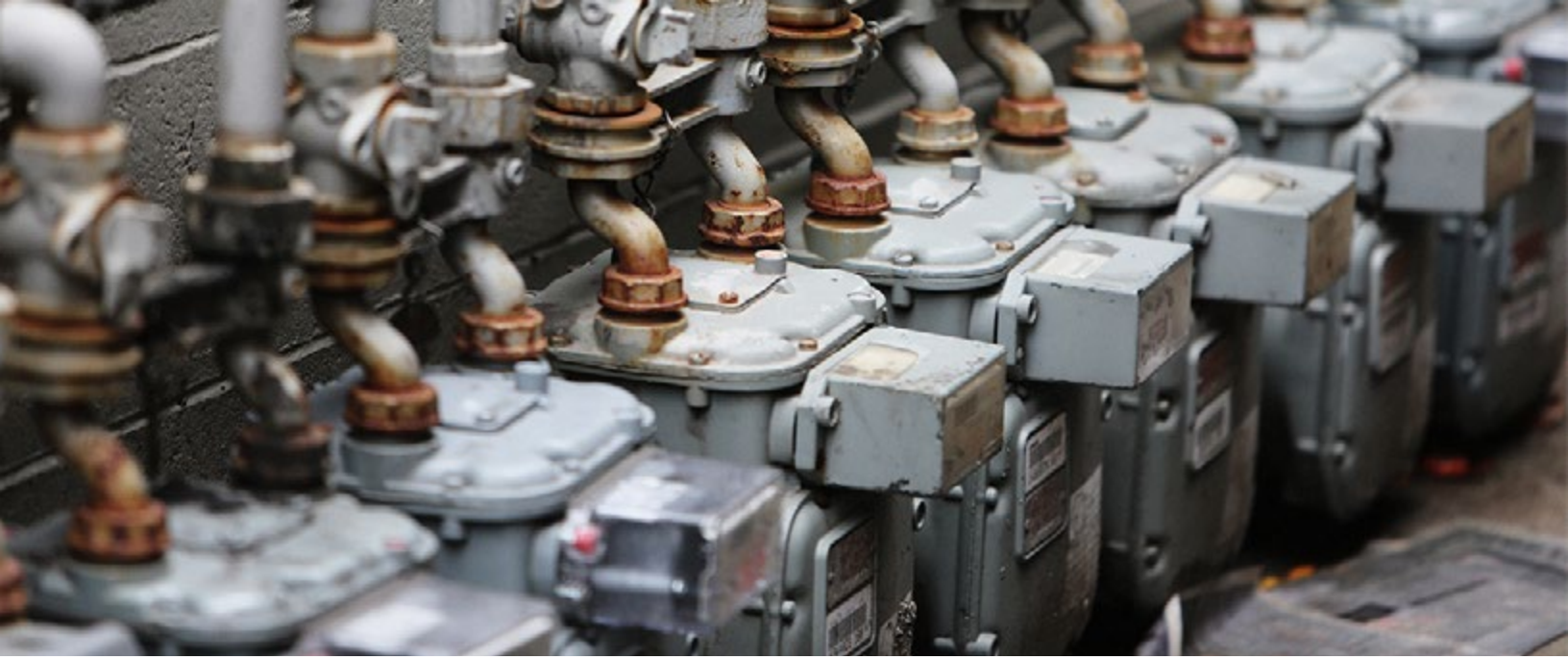
1 – 7 CCF	$2.07
8 – 15 CCF	$3.82
16 – 30 CCF	$8.39
Over 30 CCF	$12.93

Higher income households are less sensitive to rate fluctuations, inclining blocks can occaisionally disproportionately impact low income residents or other entities with financial barriers. An unforeseen challenge with Tucson's system was the impact on community gardens.

Initially, community gardens were categorized as a residential customer in Tucson Water's tiered rate system. However, gardening in the summer is quite popular and a community garden with several users will have a significant water demand. Being charged at the highest block rate in the summer presented a significant financial barrier and caused many gardens to close during the summer months.

In response, Tucson Water designed a three-year **pilot program** to offer community gardens a more affordable rate of $3.36 per CCF, which is somewhere between the lowest and second lowest block rate. Gardens qualify for this program if they have a designated irrigation meter and backflow prevention devices. Tucson Water estimates that this can save gardens up to $2,000 in water bills.

The City of Tucson utility bill also includes a conservation fee, which covers the operating expenses for Tucson Water's conservation initiatives. These activities include research, training and education, conservation audits, rebate programs, rainwater harvesting, and stormwater management programs. Tucson Water started its conservation fee of $0.03 per CCF of potable water sales in fiscal year 2008/09. The fee has increased gradually over time and is currently set to $0.10 per CCF, with exceptions for low-income households.



TOOLBOX: MESSAGING STRATEGIES

Utility bills often include an educational insert or other content to inform the reader about policy changes and to encourage water savings tips and tricks. Some include warnings and fear-inducing messages designed to curb water use. These messages often miss the mark, since people tend to defend themselves from fear or negative self-images by ignoring this messaging or rationalizing why the new information does not apply to them. Instead, studies show that the following messaging techniques are more effective in changing behavior.

STRATEGIES FOR EFFECTIVE MESSAGING:

- **Sense of Control:** Help your reader feel they have control or influence. Provide tangible acts or decisions they can make to "move the needle" toward a goal.
- **Social Incentives:** People generally want to be either the same or better than their peers. Offer comparisons or share high compliance figures (e.g., nine out of ten residents follow these irrigation best practices to save water).
- **Immediate Rewards:** Near-term rewards make people feel good. This reward structure can even motivate behavior changes that relate to long-term goals or outcomes that are not immediately visible. The reward can be external or intrinsic.
- **Positive Framing:** People are more likely to believe and act on positive rather than negative information. So, when given an opportunity to describe a trend, note progress toward goals.

CASE STUDY

PUBLIC-PRIVATE PARTNERSHIPS – ARIZONA WATER COMPANY AND CITY OF CASA GRANDE, ARIZONA

The City of Casa Grande has partnered with Arizona Water Company (AWC), its largest water provider, to build a water conservation program that will help make the continued growth of Casa Grande possible while ensuring that current and future residents have access to sustainable water resources. The partnership combines current water conservation efforts by Casa Grande and AWC into a single, integrated demand management program to help coordinate and prioritize water when making future planning and development decisions.

Over the last decade, conservation measures have already reduced the city's per capita water consumption by 10%. However, with the city's population and water demand projected to double by 2050, Casa Grande and AWC are working together to reduce per capita water use by an additional 15% by then. Scalable conservation programs will be key to reaching their goals. Once piloted in Casa Grande, the demand management programs will be scaled up and adapted for use in the Arizona Water Company's other service areas throughout the state, potentially reaching 250,000 people across 22 communities.

The partnership is launching two new post-occupancy efficiency program elements.

The **SAVE IT!** program is a digital public outreach and education campaign designed to reduce residential and commercial demand while also satisfying the public relations requirements in the Pinal AMA's 4th Management Plan. As the face of the integrated demand management program, SAVE IT! educates residents and businesses about the water conservation measures of Casa Grande and AWC through unique branding, online resources, monthly conservation messages, and events.

The Water Wise Outside (WWO) program is designed to reduce outdoor water use in commercial and industrial sectors. A third-party company analyzed historic water use trends on a customer-by-customer basis and a profile with relevant conservation measures is created for each user. Next, WWO will initiate an outreach and collaboration phase to determine the most appropriate conservation actions based on users' circumstances and behavior and citywide demand reduction targets. Examples include replacing portions of irrigated turf with walking paths or native vegetation, developing water-efficient irrigation schedules, investing in artificial turf for recreation facilities and sports complexes, increasing shaded areas, and using non-potable water for irrigation. Finally, water use will be tracked to determine if the conservation actions are implemented and effective. Continued data collection will guide future changes to WWO with the goal of increased efficiency and conservation.

TOOLBOX: SMART WATER METERING

Water metering is a method of measuring water consumption. Advanced metering technology, called “smart meters,” ease the data collection process and increase the specificity of the data. This increased granularity of information creates the opportunity for easily justifiable rate structures, rapid leak detection, and customized demand management programs. Utilities that pair metering and commodity rate structures report a 15% to 30% reduction in water consumption.

Furthermore, sub-metering multi-family, commercial, and outdoor uses can provide data granularity to empower refinement and optimization of water policies, rates, and fees. The value of this information may be worth more than the cost of installing an extra meter.

CASE STUDY

ADVANCED METERING INFRASTRUCTURE – CITY OF TEMPE, ARIZONA

System-wide data collection in real time assists communities with rapidly responding to water emergencies, regulating usage, and helping customers manage their water demand by providing consumer water use trends down to the hour. Advanced Metering Infrastructure (AMI) systems for water are straightforward to install, and costs are decreasing with improving technology.

The **City of Tempe** was the **first in the Valley to use AMI** to track residential customer water use. Digital “collectors and repeaters” installed on light posts across the service area read and transmit customer water use data to the service provider.

Until this big jump to AMI, the City of Tempe had been manually reading each of its 43,000 water meters. The city can now tailor its conservation incentive program to target customers who could benefit most from free consultations and water audits. The automated system increases customer satisfaction by enabling easy access to data and making billing periods consistent.

Tempe residents can monitor their use in real time and see the peaks in their demand at hourly intervals. This data encourages self-moderation and will also show the real time benefits from the improvement measures they take. Customers can identify leaks by looking for water use that occurs during periods when the property is vacant or during sleeping or working hours. Customers can compare themselves to the neighborhood average or citywide average.

CONCLUSION

The toolboxes outlined in this workbook highlight some of the most effective strategies communities can employ to manage local water demand. Ultimately, by linking land use (and landscaping) to water demand, we can wisely manage our limited resources in a way that sustains thriving economies, healthy environments, and vibrant communities in Arizona for future generations.

Tracking the results of water and land use integration are an important component to determining whether community goals are being met. **Growing Water Smart Metrics: Tracking the Integration of Water and Land Use Planning** offers a set of baseline data that can be assessed for year-over-year trends to empower adaptation. Ten "progress" metrics track things such as the development of long-range plans, implementation of water conservation and efficiency programs, adoption of landscaping and building codes, implementation of adequate water supply rules, and regionalization efforts. Fourteen metrics are then recommended to measure the "impact" of your community's strategies by assessing trends in land use, development patterns, and water demand.

Appendix B describes the growing number of resources that can aid communities and water providers in the goal of better integrating water and land use.

APPENDIX A: SUMMARY OF RELEVANT LEGISLATION

This appendix summarizes the key points of state legislation that relate to integrated water and land use planning. Many of the following policies cover additional topics outside the scope of Growing Water Smart, so links are provided for more information.

GROWING SMARTER ACT AND GROWING SMARTER PLUS ACT

Signed into law in 1998 and revised in 2000, the HB 2361 Growing Smarter and Growing Smarter Plus Act compels Arizona's cities, towns, and counties to adopt a general or comprehensive plan and, depending on the population size, include water resources planning as an element in the plan:

- Cities and towns with more than 10,000 people must plan for water resources in their general plan.
- Counties with more than 125,000 people must plan for water resources in their comprehensive plan.

The water resources section of the plan must address the legally and physically available surface and groundwater, along with the effluent supply. Additionally, the future demand for water must be addressed through an analysis that shows how current resources will meet demand or how additional resources will be secured. This legislation added public participation standards, requirements that future rezoning comply with the general plans.

azleg.gov/legtext/47leg/2r/summary/h.hb2294_03-01-06_asengrossedandaspassedhouse.doc.htm

GROUNDWATER MANAGEMENT ACT

Ratified in 1980, the Groundwater Management Act (GMA) seeks to preserve Arizona's economic vitality by reducing serious overdraft of groundwater supplies in certain areas of the state through long-term water planning. These areas, defined as Active Management Areas (AMA), contain 82% of Arizona's population and include portions of Maricopa, Pinal, Pima, Santa Cruz, and Yavapai counties.

The Assured Water Supply program (A.R.S § 45-576) operates within the AMAs and ensures that new residential developments will have enough water to meet the needs of residents for the next 100 years. Depending on the location, these developments can be served by dedicated wells or by a private or municipal water provider. If served by dedicated wells, the developer must obtain a Certificate of Assured Water Supply (CAWS) prior to plat approval.

Individual developers do not need to procure a CAWS if their development will be served by a Designated Provider. A Designated Provider has already received a CAWS from the ADWR and demonstrated the ability to continuously provide water to its current and future customers for the next 100 years. This designation must be periodically renewed.

Page 24 of the Arizona Administrative Code R12-15-710 outlines the steps of the Designated Provider approval process.

apps.azsos.gov/public_services/Title_12/12-15.pdf

ADWR AMA MANAGEMENT PLANS

AMA management plans are an essential part of the GMA and govern the use of water resources in the AMAs. The GMA stipulated that a series of five management plans be prepared between 1980 and 2025. Each plan is designed to be more rigorous than the previous one, in order to guide the evolution of Arizona's water use toward long-term water management goals and water sustainability.

The AMA management plans allow each AMA to achieve the goals of the GMA while responding to its unique needs and characteristics.

Large municipal providers are governed by special conservation measures. They are required to meet an annual total gallons per day per capita limit or to adhere to the requirements of alternative conservation programs. These conservation requirements and other AMA management tools can be found on the ADWR website.

new.azwater.gov/sites/default/files/media/AMAFACTSHEET2016%20%281%29_0.pdf

UNDERGROUND WATER STORAGE, SAVINGS, AND REPLENISHMENT ACT

For decades in Arizona, groundwater was pumped from its aquifers more quickly than it could be naturally recharged. To reduce this imbalance, the Underground Water Storage, Savings, and Replenishment Act, enacted in 1986 and refined in 1994, allows entities with surplus water resources to store it as groundwater for use at a later time. The general purpose of this law, as stated in A.R.S § 45-801.01, is to:

- Protect the general economy and welfare of this state by encouraging the use of renewable water supplies, particularly this state's entitlement to the Colorado River water, instead of groundwater through a flexible and effective regulatory program for the underground storage, savings and replenishment of water.
- Allow for the efficient and cost-effective management of water supplies by allowing the use of storage facilities for filtration and distribution of surface water instead of constructing surface water treatment plants and pipeline distribution.

new.azwater.gov/recharge

PERMITTED USES OF EFFLUENT AND GREYWATER

Effluent is water that has been collected in a sewer and subsequently treated in a wastewater treatment plant. After treatment, effluent is also sometimes classified as reclaimed water or recycled water. Effluent has three general purposes:

1. Direct Reuse – irrigation of parks/golf courses.
2. Environmental Enhancement – discharge into waterways in order to sustain historical riparian ecosystems.
3. Aquifer Replenishment – used to recharge groundwater supplies in specific areas, this water is "banked" under the Underground Water Storage, Savings, and Replenishment Act.

The extent of effluent treatment varies across each system. Higher levels of treatment allow for a wider range of permitted uses, including Direct Potable Reuse. It is useful to know that effluent, recycled water, and reclaimed water are interchangeable terms.

Additional information about effluent can be found here:

- Environmental Quality, Chapter 9 Water Pollution Control **apps.azsos.gov/public_services/title_18/18-09.pdf**
- Memorandum on Effluent Terminology **azwater.gov/docushare/dsweb/Get/Document-10129/ADWR%20memorandum%20regarding%20effluent%20terminology.pdf**

Greywater is defined by ADEQ as wastewater, "collected separately from your sewage flow, that originates from a clothes washer, bathtub, shower or sink, but not from a kitchen sink, dishwasher or toilet." Greywater is different from blackwater, which originates from toilets, kitchen sinks, and dishwashers. Blackwater should not be reused in the home. Greywater reuse is governed by ADEQ guidelines and is typically reused for residential landscape irrigation upon the property from which it originated.

legacy.azdeq.gov/environ/water/permits/download/graybro.pdf

DROUGHT MANAGEMENT PLANS

Arizona has experienced three significant droughts since 1900, including the current one which began in the mid 1990s. Additionally, the Colorado River, which supplies about 40% of the state's water, has been under severe drought conditions since 2000. In response, the ADWR, in conjunction with other Colorado River water users, has taken numerous steps to avoid and/or delay future shortages to the state's water supply.

The need for drought planning has led to requirements for all water systems across Arizona, not just those in AMAs and INAs, to prepare the following:

- An Annual Water Use Report, which allows providers to evaluate their system and plan for future need.
- A System Water Plan that helps water providers assess and diminish their drought vulnerability by analyzing water supply, water conservation, and drought planning. The drought plan section requires water providers to define their drought triggers, emergency water sources, and public communication approach.

new.azwater.gov/drought/arizona-drought-planning

CONSERVATION OF WATER AND PRESERVATION OF WATER RIGHTS

Water rights in Arizona and many Western states are allocated by Prior Appropriation, or "first in time, first in right." To maintain water rights, water must be put to "highest and best use," or junior rights holders can petition to claim rights to any unused portion. This system has historically disincentivized water conservation or leaving water in the environment, since doing so would risk loss of rights to water.

Passed in February 2021, HB 2056 addressed this process limitation with an added clause that water rights holders can file a water conservation plan with the state to preserve water without it constituting an abandonment or forfeiture of the water conserved pursuant to that plan. This amendment gives a legal framework for using water conservation as a tool for practical and economical resource management as well as environmental health.

azleg.gov/legtext/55leg/1R/laws/0022.pdf

GUIDES TO ARIZONA WATER LAW

For more information on these and other water-related laws, please refer to the following resources:

- The University of Arizona's Water Resources Research Center Laypersons Guide to Arizona Water Law (2004). **wrrc.arizona.edu/sites/wrrc.arizona.edu/files/Layperson%27s_Guide_to_Arizona_Water.pdf**
- Section 2 of the 2015 Arizona Town Hall report, Keeping Arizona's Water Glass Full (2015). **aztownhall.org/resources/Documents/107%20Keeping%20Arizona's%20Water%20Glass%20Full%20FINAL%20Report%20web.pdf**
- Arizona Administrative Code, Title 12: Natural Resources, Chapter 15: Department of Water Resources. **apps.azsos.gov/public_services/Title_12/12-15.pdf**

APPENDIX B: GROWING WATER SMART RESOURCES

This section highlights some of the best research, tools, guidebooks and policies from Arizona, other western states, federal agencies, and non-profit organizations that relate to land use and water resource management.

GENERAL: THE IMPORTANCE OF INTEGRATING WATER AND LAND USE

- The American Water Resources Association March/April 2021 **IMPACT Magazine** special issue includes several articles dedicated to the why and the how of integrating water and land use (2021). **online.flippingbook.com/view/446296713/**
- Western Resource Advocates' **New House New Paradigm** provides an explanation of the benefits integrating water and land use. **westernresourceadvocates.org/publications/new-house-new-paradigm**

INTEGRATED WATER RESOURCE MANAGEMENT

- The **One Water initiative** of the US Water Alliance is working to integrate water resource management in a holistic and coordinated manner. The website serves as a hub for the One Water Council, leadership insights, webinars, and more. **uswateralliance.org/one-water**
- **Integrated Water Resource Management** is about the management of water in all its forms – drinking water, stormwater, wastewater and source water. American Rivers has a compilation of resources on this topic: **americanrivers.org/conservation-resources/integrated-water-management**
- The American Planning Association has a **KnowledgeBase Collection** of resources on Integrated Water Resource Management. **planning.org/knowledgebase/watermanagement**
- **Planners and Water PAS 588** is an American Planning Association report that focuses on the One Water rationale for managing water supply, wastewater, and stormwater as one resource (2017). **planning.org/publications/report/9131532**

SECTION 1: PLANNING & POLICY MAKING

COMPREHENSIVE PLANNING

- A manual from the Babbitt Center for Land and Water Policy describes how to include water in Colorado's local planning documents. **Incorporating Water into Comprehensive Planning: A Manual for Land Use Planners in the Colorado River Basin** (2019). lincolninst.edu/publications/other/incorporating-water-comprehensive-planning
- The Sonoran Institute's Is Arizona Growing Smarter reviews plans in Arizona to evaluate the effectiveness of the "Arizona Growing Smarter" Act and includes a useful summary of planning requirements and a range of successful planning examples. (2009.) sonoraninstitute.org/resource/is-arizona-growing-smarter-growing-smarter-statues-and-recommendations-for-improving-growth-management-in-arizona-10-02-2008/
- The American Planning Association has several guides for comprehensive planning:
  - **Sustaining Places: Best Practices for Comprehensive Plans** (2015). planning.org/publications/report/9026901
  - **Policy Guide on Water** (2016). planning.org/policy/guides/adopted/water

WATER EFFICIENCY + DROUGHT PREPAREDNESS PLANNING

- The State of Colorado provides water providers and local governments with a water efficiency plan guidance document, which includes best management practices for Implementing Water Conservation and Demand Management Through Land Use Planning Efforts. cwcb.colorado.gov/municipal-water-efficiency-plan-guidance-document
- The National Integrated Drought Information System Planning and Drought report outlines the impacts of drought and what planners can do to mitigate drought impacts (2013). drought.gov/documents/planning-and-drought

EXPLORATORY SCENARIO PLANNING AND VISIONING

- The Lincoln Institute of Land Policy and Sonoran Institute have been working to help integrate exploratory scenarios into land and water planning. Resources include:
  - **Videos and facilitator training videos** on exploratory scenario planning can be found on resilientwest.org. resilientwest.org/exploratory-scenario-planning-2
  - Joe Marlow. **Integrating Exploratory Scenario Planning into a Municipal General Plan Update** (2015). lincolninst.edu/sites/default/files/pubfiles/marlow-wp15jm1.pdf
  - Stapleton, Jeremy. **How to Use Exploratory Scenario Planning.** (2020) incolninst.edu/publications/policy-focus-reports/how-use-exploratory-scenario-planning-xsp

SECTION 2: ENSURING WATER SUPPLY

DEMONSTRATING AN ASSURED OR ADEQUATE WATER SUPPLY

- Arizona Department of Water Resources provides **guidance for hydrologic studies for Assured and Adequate Water Supplies** (2007). new.azwater.gov/sites/default/files/media/Guidelines%20for%20Hydrologic%20Studies%20for%20Assured%20and%20Adequate%20Water%20Supplies.pdf
- A comparison of **Assured Water Supply Laws in the Western States** by Anne Castle (2016). colorado.edu/law/sites/default/files/attached-files/castle_final.pdf

PROJECTING WATER DEMAND FOR LAND USE

- The Alliance for Water Efficiency **Cooling Tower Estimating Model** is a tool for developing a cooling-tower inventory and to calculate a coling tower water efficiency program (2021). allianceforwaterefficiency.org/resources/topic/ctem
- The Pacific Institute released **A Community Guide to Calculating Future Water Demand** (2016). It outlines some of the methodological concerns with water demand forecasting, provides a checklist for reviewing water demand projections (pages 3-6) for accuracy, a summary of the methodologies used in water demand forecasts, and the best practices for water demand forecasting (2016). pacinst.org/publication/community-guide-evaluating-urban-water-demand-forecasts
- The Arizona Department of Water Resources **Water Supply Calculators**
  - Assured Water Supply Calculator new.azwater.gov/aaws/frequently-asked-questions
  - Non-AMA Demand Calculator new.azwater.gov/sites/default/files/media/Generic Demand Calculator %28updated 11-24-15%29.xls
- A Northern California Water Association guidebook describes methods for **projecting water demand by dwelling unit or per acre** (2007). norcalwater.org/res/docs/NCWA-guidebook-final.pdf
- EPA **Water Budget Tool** and Resources epa.gov/watersense/water-budget-tool
- The **Water Efficiency Rating System** (WERS) is a tool developed and used by the City of Santa Fe and Green Builders Coalition but is now available for universal use. WERS is a third-party verified tool that is used by developers to predict water use for new and existing properties, identify water efficiency goals and determine what design modifications will allow them to reach that water demand goal. wers.us

TAP FEES

- Western Resource Advocates **A Guide to Designing Conservation Oriented Water System Development Charges** (2018). westernresourceadvocates.org/wp-content/uploads/2018/07/WRA_Guide-to-Conservation-Oriented-SDCs_web.pdf

SECTION 3: WATER-SMART LAND USE POLICY

- Western Resource Advocates partnered with Pace University's Land Use Law Center to describe opportunities for developing water-smart land use policy, **Integrating Water Efficiency Into Land Use Planning in the Interior West** (2018). westernresourceadvocates.org/publications/integrating-water-efficiency-into-land-use-planning
- Colorado Water Wise Technical Guide. **Guidebook of Best Practices for Municipal Water Conservation in Colorado** (2010) coloradowaterwise.org/Resources/Documents/BP%20Project/CWW%20Best%20Practices%20Guide%20-%20FINAL.pdf
- The Northwest Colorado Council of Governments Water Quality and Quantity Committee recently published the **Water Savings Resource Guide and Model Provisions for the Colorado Headwaters Region** (2020) dropbox.com/s/aitu1nswknz2kpw/QQ-Water-Savings-Guide-Final.pdf?dl=0

EFFICIENT DEVELOPMENT PATTERNS

- This **Smart Growth America** guide illustrates the most effective zoning and ordinance strategies for more efficient development patterns. epa.gov/sites/production/files/2014-01/documents/2009_essential_fixes_0.pdf
- Community Builders' **Place Value** report (2016) provides the rationale for thinking about vibrant neighborhoods as ways to build a thriving economy and save water. communitybuilders.org/insights/place-value

WATER SMART LANDSCAPING AND PLUMBING CODES

- City of Flagstaff, AZ Landscaping Standards integrates hydrozones. flagstaff.az.gov/DocumentCenter/View/13972/Division10-5060_Landscaping_CCApproval_2011Jun7?bidId
- Local jurisdictions can incorporate these lists of low-water use plants into local ordinances and design standards.
  - Arizona Department of Water Resources new.azwater.gov/conservation/landscaping
  - Arizona Municipal Water Users Association amwua.org/plants
- EPA WaterSense Water Efficiency Management Guide: Landscaping and Irrigation epa.gov/sites/production/files/2017-12/documents/ws-commercialbuildings-waterscore-irrigation-landscape-guide.pdf

WATER-NEUTRAL DEVELOPMENT

- A model ordinance for **water neutral development** from Net Blue. allianceforwaterefficiency.org/resources/topic/net-blue-supporting-water-neutral-growth
- City of Santa Fe **water demand offset ordinance summary**, including their nationally recognized toilet retrofit requirement. santafenm.gov/archive_center/document/2124

SECTION 4: HEALTHY & RESILIENT WATERSHEDS

WATERSHED PROTECTION

- The University of Arizona's **NEMO Watershed-based plans** identify areas that are susceptible to water quality problems and pollution, sources that need to be controlled, and management measures that must be implemented to protect or improve water quality. repository.arizona.edu/handle/10150/139113
- The University of Arizona Water Resources Research Center (WRRC) outlines the best methods for quantifying environmental flow needs in the Arizona **Environmental Water Needs Methodology** Guidebook. wrrc.arizona.edu/publications/arizona-environmental-water-needs-methodology-guidebook
- The US Water Alliance **One Water Roadmap:** uswateralliance.org/sites/uswateralliance.org/files/publications/Roadmap FINAL.pdf
- **Protecting Water Resources with Smart Growth** (2004) is for audiences already familiar with smart growth who are seeking more ideas for protecting water resources. The document compiles 75 policies designed to protect water resources and implement smart growth strategies. epa.gov/ smartgrowth/protecting-water-resources-smart-growth
- The **Arizona Rivers Project** from Western Resource Advocates seeks to support vibrant communities, economies and environments through protecting Arizona's rivers. westernresourceadvocates.org/projects/arizona-rivers
- The U.S. Environmental Protection Agency has an example ordinance for establishing **Groundwater Quality Overlay Districts** (2015). epa.gov/sites/production/files/2015-12/documents/model_groundwater_ordinance.pdf

GREEN INFRASTRUCTURE AND LOW-IMPACT DEVELOPMENT

- **Watershed Management Group** provides numerous resources including green infrastructure plans and Design Standards watershedmg.org/learn/resource-library
- EPA **Operation and Maintenance of Green Infrastructure** epa.gov/sites/production/files/2016-11/documents/final_gi_maintenance_508.pdf
- **ASU Green Infrastructure and Low Impact Development Handbook** includes technical standard details and specifications for GI and LID projects (2019). sustainability.asu.edu/sustainable-cities/resources/lid-handbook
- This compilation of **green infrastructure and transportation projects resource library** co-authored by Pima Association of Governments, Watershed Management Group, and America Rivers, includes guidance for integrating GI into project planning, funding GI, and design, implementation, and maintenance (2020). americanrivers.org/conservation-resource/sonoran-desert-green-infrastructure-resource-library

SECTION 5: POST-OCCUPANCY STRATEGIES

WATER CONSERVATION RATE STRUCTURING

- **Building Better Water Rates** for an Uncertain World provides the background and concepts needed to develop, evaluate, and implement an effective rate structure. financingsustainablewater.org/tools/building-better-water-rates-uncertain-world
- A Guide to **Designing Conservation-Oriented Water System Development Charges** from Western Resource Advocates. westernresourceadvocates.org/projects/water-system-development-charges

PUBLIC EDUCATION & INCENTIVES

- The **Arizona Water Meter** is an analysis of water conservation practices of 15 communities across Arizona from Western Resource Advocates. (2010) westernresourceadvocates.org/publications/arizona-water-meter
- The **Water—Use It Wisely** campaign provides opportunities to integrate conservation education into your website. wateruseitwisely.com/jump-in
- **American Water Works Association** communication strategies for utilities awwa.org/Policy-Advocacy/ Communications-Outreach/Public-Communications-Toolkit
- This **poll of US water users** identified which values and messages resonated the most in water messaging (2016). sheltongrp.com/posts/water-conservation-is-the-next-big-thing-have-consumers-gotten-the-memo

WATER EQUITY

- The US Water Alliance **Water Equity Clearinghouse** describes how water stress and challenges vary in different regions and community types and the progressive solutions designed to address water inequities. uswateralliance.org/wec
- Arizona State University explores the **10 Tenets of Water Equity** for community water systems (2021). morrisoninstitute.asu.edu/sites/default/files/water_equity_2021.pdf

CONCLUSION: MEASURING RESULTS & COLLABORATION

- **Growing Water Smart Metrics: Tracking the Integration of Water and Land Use Planning** (2020) is Sonoran Institute's guide to 10 progress and 14 impact metrics to help measure the integration of water and land use. resilientwest.org/2020/growing-water-smart-metrics-guide
- **Navigate the Flood** provides technical guidance stakeholder engagement planning navigatetheflood.org/guide/stakeholder-engagement-plan

Be Resilient.

ResilientWest.org

Growing Water Smart Workshops are helping leaders build capacity and implement action plans to steward their community's future by ensuring clean, reliable water for people, nature and industry.

Through our Growing Water Smart workshop series, In the last five years we've trained over 150 community representatives and impacted the lives of over 3,200,000 Coloradans and 700,000 Arizonans. We have expanded our program to also serve California communities.

By continuing to support Growing Water Smart, more communities will get to take advantage of our expertise and to share in lessons we have learned over nearly thirty years of shaping the future of the West.

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