Arizona Rural Groundwater: Potential Tools for Local Management

Groundwater is a critical resource in Arizona. This is especially true in rural Arizona, where it is often the primary or even only supply of water for residents, agriculture, industry, and other businesses. It is also the source of year-round flow in many of the state's rivers, streams, and springs. Sustaining groundwater supplies is essential for protecting rural livelihoods, sustaining communities' quality of life, and providing for economic vitality and growth.

Yet in Arizona, outside of the five active management areas (AMAs) and three irrigation non-expansion areas (INAs) established by the state, there is essentially no oversight of the pumping or use of groundwater. For example, when a new well is drilled there is no assessment of how the new use will affect the available water supply or other users. Such an assessment is made in most other states in the West. In rural Arizona there are very few tools available to communities that wish to manage their supplies or to prevent or address the consequences of overpumping. Cities, towns, and counties generally cannot act in ways that have not been authorized by the state legislature, and water management in Arizona has primarily been considered the responsibility of the state. This can mean that groundwater supplies, connected rivers and streams, and existing water uses are essentially unprotected.

Groundwater use in some of Arizona's groundwater basins already exceeds what is replenished each year, meaning that the current system cannot be sustained in the long run. Some Arizona communities are already experiencing the consequences of the lack of protection: 1) wells drying up or needing to be deepened (at substantial expense); 2) conflicts arising among neighbors; 3) depletion of aquifers that communities rely on as their water supply for the future; 4) fissures caused by land subsidence; and 5) the diminishment of flow in some rivers, streams, and springs that have existed for centuries.

Addressing these issues will require significant deliberation, innovation, and commitment on the part of those who wish for rural Arizona to survive, grow, and thrive. It will also likely require locally tailored solutions, to appropriately address the unique water supply and demand concerns of Arizona's diverse rural communities.

This document presents information about a variety of tools that have been used to manage groundwater at the local level. It includes tools that have been used in groundwater basins in other states and tools that have been either used or discussed in particular areas of Arizona. State authorization would be needed to access many of the tools discussed. This list is meant to be a resource to help stimulate and inform discussion and action. It can serve as the start of a menu to be considered—and added to—by local community members and leaders who wish to develop solutions that are tailored to the needs of their local areas.

The Water for Arizona Coalition is comprised of Arizonans who support policies and innovative practices to ensure a reliable water supply to meet the state's needs. Collectively, we have over 60,000 Arizona members, as well as hundreds of hunter, angler, business, and outdoor recreation partners around the state. Learn more at waterforarizona.com.

Document prepared for the Water for Arizona Coalition by Jocelyn Gibbon, Freshwater Policy Consulting. This document is intended as a general educational resource and is not legal advice.

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Tools for Local Groundwater Management

The following tools represent a menu of options that have been used across the western United States to manage groundwater at the local or groundwater-basin level. Many states across the west provide local communities with authority or support to manage their groundwater, and a variety of the tools described below are being used in these communities to control the use of the resource. In the context of rural (non-AMA) Arizona, adopting many of these tools, or authorizing a form of "special management area" to adopt such tools in specific groundwater basins or local areas, would require additional state support or authorization.

"Tools" described below include physical tools, management strategies, and related programs, laws, and policies. The list focuses on tools relevant to groundwater quantity—rather than quality. It can be difficult to put these tools into categories, as some serve multiple purposes, and they often work in combination. They are sorted here into seven rough organizational categories.

1. Tools That Set the Stage: Basin Planning

A number of tools are often used to help "set the stage" for local groundwater management by guiding and informing the planning process for a specific groundwater basin or other local area.

Management plans and management goals: In order to define desired future conditions and guide the selection and implementation of appropriate tools to achieve those conditions, local groundwater management areas in the west often go through a process of basin planning to develop a "management plan" for a specific groundwater basin or other local area. Often such plans are structured around defined "management goals." For example, a management goal might be to achieve "safe yield," where groundwater withdrawals are balanced with the amount of water that is recharged into the aquifer. (This is the management goal for three of Arizona's five AMAs, and there are similar management goals for many basins in other western states—including in Nevada and Utah.) Local management goals can consider local social, economic, and resource values worth protecting, and define the groundwater-related goal to help achieve such protection. For example, a management goal can be defined to protect a certain resource, like continued water availability in a nearby river to sustain existing uses or provide habitat or quality-of-life benefits into the future. A goal could be to ensure long-term availability of groundwater reserves by limiting increases in pumping to a certain amount by a certain date, slow depletion of the resource, or to maintain a specific economic use of the resource. Goals can also be defined to avoid specific undesirable impacts or conditions.

Study and advisory boards: Local groundwater management is often accomplished through a combination of local guidance and state support. Though these dual levels of input and control are structured differently in different places, a frequent feature is a local study or advisory board or council. In Wyoming, in groundwater "control areas" a control area advisory board can make recommendations to the State Engineer about groundwater development in the area, or may institute its own "corrective controls" through an agreement with the state. Texas groundwater conservation districts are governed by a local board of directors. In Arizona's AMAs, a Groundwater User Advisory Council (GUAC) for each AMA provides advice and recommendations

to the Department of Water Resources on groundwater management programs and policies within the AMA. In Mohave and La Paz Counties, study commissions have recently been established to provide recommendations to the legislature about groundwater management in local groundwater basins within each county.

Monitoring and modeling: Understanding local groundwater availability and groundwater use is an important early step in developing a groundwater management strategy, and can set the foundation for prioritizing and successfully implementing some of the other tools described in this document. Monitoring of groundwater levels in order to understand whether levels are increasing or decreasing frequently involves the use of "index wells," wells where water levels are measured on a regular basis. (The Arizona Department of Water Resources measures water levels in a set of index wells across the state, and the US Geological Survey also regularly monitors some wells in Arizona.) In some places, groundwater withdrawals and uses are also monitored, which may involve measuring and reporting requirements for individual uses. Measuring groundwater use is sometimes done through voluntary or mandatory metering, or through other methods of measurement (for example, tracking electrical records to estimate how much water was pumped out of a well based on how much electricity was used for the pumping). Such measurements of groundwater pumping and use may be collected by the state or another entity through a requirement for reporting. Users may, for example, be required to self-report their annual volume of groundwater use. (Sometimes this requirement only applies to wells or uses of a certain size or type.) Data about groundwater use, groundwater supplies, and groundwater flows can usually most effectively be interpreted through creation of groundwater models that use digital information to "see" groundwater resources that are otherwise hidden. Models can help predict how the water supply and connected resources will react under different possible future scenarios, and they can help identify and prioritize the management tools that might be most effective in achieving management goals.

2. Tools That Require or Encourage Conservation by Water Users

Many tools for managing water or groundwater use are intended to conserve, limit, or reduce water use. The tools in this section are generally focused on how much water is used by individual water users or particular "types" of water users, and employ incentives or requirements to help minimize that use.

Conservation ordinances: To reduce water usage, cities, towns, and counties in Arizona and other western states may adopt ordinances that establish various incentives or requirements related to water conservation. These provisions often though not always apply to residents and businesses that are the customers of the local water provider. Conservation ordinances can—to list a few examples—require that residents only water gardens and lawns on certain days; that they not do things like wash their cars or spray down driveways or parking lots when certain drought levels are reached; that restaurants not offer water to customers unless they ask for it; or that misters not be permitted during certain times of year, or even at all. Conservation ordinances can also prohibit waste of water. Some locales have landscaping ordinances that encourage or require landscaping all or part of certain types of properties or new developments with low-water-use plants. And some

jurisdictions have ordinances to encourage or require rainwater harvesting or the use of gray water. Conservation ordinances are often used by local governments and/or water providers to reduce water use by the end user–and are most often related to residential and commercial water use. Conservation ordinances are tools that are already available to local governments in Arizona and are commonly used by individual cities and towns.

Tiered water rates: Tiered water rates are used by some water providers to incentivize water conservation by the end user. Under a tiered rate structure, the cost per gallon of water delivered by a utility is lowest for those who use the least amount of water. Larger water users must pay more per-gallon for larger volumes of water. Tiered water rates have been demonstrated to be effective in decreasing the amount of water used by particular water users and in particular service areas, while providing affordable water supplies to meet basic needs. Tiered water rates are already in use by many Arizona local governments and water providers.

Best management practices: In some areas, best management practices are identified, and sometimes incentivized or required for certain water users. These best management practices can vary depending on the type of water user. In Arizona's AMAs, for example, there are lists of best management practices that water users in different sectors (e.g., mining, turf, municipal, agricultural) can choose to adopt, or in some cases are required to adopt. Some users are given the option of adopting best management practices or keeping their water use within a particular water duty or quantity of use. Best management practices are often aimed at achieving increased water conservation or improved efficiency of water use.

Limits on quantities of individual uses: Many places limit the amount of water that can be used or withdrawn each year by individual water users. These quantities are often based on historical use or water needed for a specific type of use, sometimes while also factoring in overall water availability and other water rights or uses. A water user might be authorized to use a certain quantity of groundwater for a specific use— for example, a "water duty" that allows a landowner to withdraw and use up to a specific quantity of water per acre on irrigated acres of land. In some places, there is a "production allowance," which limits the amount of water that can be withdrawn from a well each year. As described further in section 3 below, sometimes these limits on quantities of individual uses are made in a way that gives the groundwater user a water right or other defined interest to continue the use, and that may also allow for transfers and trading.

Limits on certain types of uses: Limits are also sometimes put on particular types of water uses. For example, no expansion of irrigated agricultural acreage is permitted in Arizona's five active management areas (AMAs) or in its three irrigation non-expansion areas (INAs). In certain groundwater basins in Nevada, specific types of uses are considered "preferred" and others are more restricted, depending on the management needs of the particular region. In Utah, certain basins are closed to new uses if those uses are of a certain size. On a smaller scale, sometimes water use for very specific purposes like man-made lakes or golf courses is restricted or subject to certain conditions or limits.

3. Tools to Allocate the Available Resource While Allowing for Transfers

In contrast to tools that focus on the behavior of individual water users, some tools focus on "allocating" (dividing up or distributing) the available supply. One way to do so is to assign defined water rights or similar interests to individual users. Allowing for trading of these water rights or interests means that new and changed uses are possible even after the available supply is fully allocated.

Assignment of defined water rights or interests: In most western states, users of groundwater receive a defined water right that entitles them to pump and use groundwater. Other types of defined groundwater allotments have been used or considered in some places, including "production allowances," "certificates of historic use," or groundwater "shares." While the language and details are different in different states and basins, these terms all refer to ways to assign a defined "interest" in a groundwater allocation to an individual user. In some cases, the amount of water associated with the right or other interest is fixed; other systems are set up to allow the amount of water to be periodically adjusted depending on conditions or water availability. Often groundwater rights are connected with the water user's land and automatically transfer to new landowners. Specific requirements may be associated with obtaining a new water right or similar interest—for example, a requirement that there is sufficient water available, that issuance of the right is in the public interest, that the water will be put to beneficial use, or that it not interfere with existing rights or harm certain water resources or supplies. Some aspects of water rights or other such interests may vary according to the type of use or user—for example, there may be special provisions related to water rights for municipalities or other public water providers. In many states and basins, when a certain limit is reached, no further withdrawals are authorized within the groundwater basin or other local area. A system of groundwater rights, permits, and authorities exists in Arizona's AMAs and includes several types of "grandfathered groundwater rights" assigned to individual users based on their historic use of groundwater.

Trading of groundwater rights or interests: Groundwater rights, allowances, shares, or other interests are often, though not always, tradable. Transfers and trading are particularly useful in places where available groundwater has been fully allocated. In these states or basins, new water users typically need to either locate and provide a "new" water supply, or purchase someone else's existing right, share, or available allowance. A set of rules usually defines the process and requirements for trading or transferring rights or interests. Many states have requirements that transfers cannot harm existing water users or other rights, and sometimes transfers must be found to be in the public interest. The Salt Lake Valley Ground-Water Management Plan includes restrictions on transfers of water rights from certain geographic areas to others—for example, transfers to places within the basin that are already experiencing heavy withdrawals or where there is known groundwater contamination. In Arizona's AMAs, certain types of rights and withdrawal authorities are tradable while others are not. Tradable rights or interests can allow an area to limit the total amount of water withdrawn from a groundwater basin or other area but still allow for new or changed uses through voluntary transactions with willing sellers.

4. Tools to Protect Existing Uses or Resources

The tools described in this section, while they have multiple functions, are structured to help protect specific existing uses or resources from the impacts of new wells or groundwater uses.

Groundwater mitigation or offset programs: In certain groundwater basins in the West, new groundwater uses must be "offset," or their impacts made up for or balanced out. Groundwater mitigation or offset programs are often used in situations where there is a desire to allow for new uses in a fully allocated system. They balance the impact of the new water use on the aquifer or connected river or stream by facilitating trades, reducing or retiring a nearby use, or contributing to a recharge project, for example, to stabilize the amount that is being withdrawn or prevent impacts to a river, stream, or groundwater system. Such programs can be particularly useful in places with both groundwater and surface water resources. While the language and details vary from place to place, in certain areas in Montana, Colorado, New Mexico, Washington, and Oregon, certain kinds and sizes of new groundwater uses are not authorized unless the use or its impacts are offset by purchasing "credits" or supplying "mitigation" or "augmentation." In the Verde Valley in Arizona, water users interested in offsetting their impacts can voluntarily purchase "water offset credits" through a voluntary pilot program. These programs are sometimes run by regional or local agencies through "banks" or "clearinghouses" or through other non-governmental organizations.

Well or groundwater withdrawal permitting: In many western states, a permit from the state is required either to drill a new well or to initiate a new groundwater use. This tool can have many functions, including establishing or enforcing water rights or allocations (described in section 3 above), enforcing standards to protect the water supply, and/or helping to protect existing uses or resources. In various western states and groundwater basins, permitting requirements for new groundwater wells or withdrawals include, for example, an assessment of whether the applicant already has a groundwater right or has met the requirements for a new groundwater right or use; whether the well or withdrawal will interfere with other groundwater or surface water rights or uses; whether it will have water quality impacts or affect areas of groundwater contamination; or whether the withdrawal is consistent with other goals and requirements established for the area. (Some of these considerations addressed through permitting processes are based on requirements for water rights or other assigned interests—see section 3. The permitting process can be a way of implementing multiple other requirements or "tools.") Permitting requirements can also include well-spacing requirements as described in the next section, below. In rural Arizona (outside of AMAs and INAs), a permit is required to drill a new well, but unlike most other places in the West, the permit requirements relate to the drilling and construction of the well itself and do not relate to potential impacts of the groundwater withdrawal or use.

Well-spacing requirements: This tool helps to prevent certain impacts or damage from the siting of new wells. Many places require that any new wells be drilled a minimum distance away from existing wells to avoid issues like localized areas of drawdown or interference with neighbors' existing wells. In Arizona's AMAs, a new well is typically not authorized if it will cause "unreasonably increasing damage" to surrounding land or other water users because of its proximity to other wells. Before a water user may develop and pump from most types of new non-

exempt wells, the Arizona Department of Water Resources assesses whether a well will significantly decrease water levels in neighboring wells. If the decrease will be too substantial—or if the well will cause additional subsidence or groundwater contamination that is found to be unreasonable—then the well is either not permitted or must be placed elsewhere. As noted above, in other states and basins, assessments of the impact of a potential new well also can also include other considerations, such as impacts on surface water resources or on the total available groundwater supply.

Protection zones: In some unique cases where there are sensitive resources (for example, a river, spring, riparian area, or a significant or vulnerable water supply) "protection zones" have been created where groundwater pumping is limited around the vulnerable resource. For example, under a number of different Native American water rights settlements in Arizona, protection zones have been created to assure that the groundwater or surface water dedicated to the Native American Tribe in the settlement isn't pumped away by neighboring groundwater wells. Similar provisions have also been used to protect important environmental resources. This concept is also somewhat similar to one used in Arizona's AMAs on a smaller scale, where new exempt wells generally may not be placed within 100 feet of the distribution system of a municipal water provider—which among other objectives may provide some protection to municipal supplies. In some locales, "overlay" zoning districts have been created to manage new developments within areas with unique water-related features or values. The term "protection zone" is not always the name used for these diverse tools—but we use it here to refer to the creation of a certain geographic zone in which groundwater use is more highly controlled or restricted.

5. Tools to Allow and Encourage Reuse and Replenishment of Water

Tools that encourage or facilitate the reuse or replenishment of water can help reduce pressures on the groundwater supply or even restore water back to the aquifer (the rock or geologic area containing the groundwater) that is the source of the supply.

Use of recycled water: In many western states, including Arizona, use of recycled or "reclaimed" water is growing. Reclaimed water is increasingly seen as a valuable component of local water supplies. Some cities, towns, counties, or regions use recycled water for irrigating golf courses, parks, or other outdoor turfgrass. Some water providers make recycled water available to water users for construction, irrigation, energy production, or other industrial use. (For example, recycled water is used for cooling at the Palo Verde Generating Station in Phoenix.) In other places recycled water is recharged back into the ground to help replenish the aquifer (see "aquifer recharge" below), or it is put back into a river or stream before being used again. Increasingly, some water providers are exploring the possibility of directly using recycled water—which is called "direct potable reuse." There are a number of places in the country where direct potable reuse is already taking place. Various incentives and requirements can be employed to encourage, facilitate, or require the use of recycled water for different purposes.

Aquifer recharge: Through aquifer recharge, water is intentionally replaced into the aquifer, increasing water levels. This recharge can occur on a large scale through either infiltration basins or injection wells. Recycled water is often used for aquifer recharge, but other water can be

recharged as well. Some areas, including Cochise County, are exploring the benefits of enhancing recharge of stormwater—for example, slowing the movement of stormwater through a wash in order to increase the amount that is recharged into the ground. Municipal water providers are sometimes the project leads for aquifer recharge projects to benefit the water supplies that support their service area. Sometimes multiple parties come together to develop and implement recharge practices, as in the Cochise Conservation and Recharge Network in southern Arizona. Some communities opt to turn their effluent recharge sites into a community amenity by creating parks or trails around recharge basins. Practices can also be implemented (and potentially incentivized) to enhance rainwater or stormwater recharge on individual landowners' properties, or to enhance on-farm recharge.

Aquifer storage and recovery: When a water provider or water user recharges the aquifer with the intention of storing the water and then later pumping it back out of the ground to put it to use, this is generally referred to as "aquifer storage and recovery" or "ASR." Within the AMAs, Arizona has one of the most sophisticated systems for aquifer storage and recovery in the country. Water users and water providers can store water underground in "underground storage facilities" (generally, permitted sites where the underground geology is good for storing water). The water can then be recovered, or pumped, for use in that same year—or stored for multiple years through creation of what are called "long-term storage credits" that are tracked in a water user's "long-term storage account." In this way, the water user who puts water into the aquifer gets the benefit of pumping it back out and using it later. In Arizona there is generally a small percentage of the stored water that is kept in the ground and not recovered (referred to as a "cut to the aquifer"). Aquifer storage and recovery works best in areas where there are limits on groundwater pumping, so that water stored in the aquifer can be protected there and used at a later date by the entity that stored the water.

6. Tools to Plan and Manage Water and Connected Land Uses

The tools described in this section focus particularly on how water use is connected to land use, and especially to new development.

Assured or adequate water supply program: Arizona has an "assured water supply" program in the AMAs and an "adequate water supply" program outside of the AMAs. Programs like these, which exist in a few other places in the west, are sometimes referred to as "show me the water" programs. In general terms, they are meant to assess whether there will be enough available water before allowing for new development. In Arizona's AMAs, the assured water supply program requires demonstration of a 100-year supply of water before new subdivisions are developed, and use of the supply must be consistent with the AMA's management goal. Cities, towns, and counties outside of the AMAs can vote to become "mandatory adequacy jurisdictions," where new subdivisions are not permitted when an adequate 100-year supply is not demonstrated. (The laws and regulations governing these programs include detailed definitions of "assured" and "adequate" water supplies.) Outside of the AMAs and mandatory adequacy jurisdictions, new subdivisions are allowed whether or not there are 100 years of water, but that information must be made available to inform initial buyers if the supply is considered inadequate.

Integrated local land and water planning: State legislatures usually grant cities, towns, and counties a number of authorities over land use planning, and some authorities related to water planning. But these functions of local government are often conducted separately from each other. There are several ways that local jurisdictions can better tie their land use planning actions to water planning. This can range, for example, from establishing building codes that require water-efficient fixtures in newly constructed homes and buildings; to fast-tracking or offering other incentives in local planning processes for "green building" that includes low-water-use features, or for "cluster development" that creates open space around higher density housing; or establishing "overlay zones" where a developer may not increase density of new development beyond what it is zoned for unless the development meets certain water-related standards.

Conservation easements: A conservation easement is a tool through which an organization—often a conservation organization or a land trust—pays a landowner to agree to certain terms about the use of the land. Often, the agreement provides that land used for agricultural or open space purposes will not be subdivided in the future. In return for placing a permanent restriction on their land, property owners receive financial compensation. Conservation easements are usually used to preserve open space and agricultural lands. In some cases, they are structured to incorporate provisions related to water or may be used to help protect specific areas where development would result in especially significant or undesirable increases in groundwater pumping.

7. Tools to Help Other Tools Work Better: Financial, Educational, and Informational Tools

Financial, educational, and informational tools are often part of the "suite" of tools used in local groundwater management and can increase the effectiveness of other tools.

Financing mechanisms: Often, local groundwater management is accomplished through creation of a district or other special management area set up to manage groundwater in a particular groundwater basin or other local area. These districts or management areas, if not managed and funded entirely by the state, often receive some state funding or state-funded technical or administrative assistance. They are also often structured to be able to generate a local source of revenue, including through taxes, fees, or surcharges. Taxes are frequently based on property ownership within the district; fees might be based on property ownership within the district or on the amount of water used. In Arizona's AMAs, there is a per-acre-foot withdrawal fee paid by each non-exempt groundwater user within the AMA. The fee is used to help offset the cost of managing water, to fund water banking, and also for conservation assistance and augmentation projects.

Educational programs and community engagement events: Some areas that manage their groundwater locally also develop and host educational programs and community engagement events to improve stakeholders' and water users' understanding of local water resources and how they can be engaged in decision making and in water conservation and stewardship at the individual level.

Data tools and informational websites: In some areas that manage groundwater locally, this management is accompanied by data tools that help allow local water users to understand and participate in this management. For example, informational websites can help water users understand the condition of the aquifer, best practices or management tools in place, how decisions are made, and what resources are available to them. Data tools can also help local areas to understand things like how much water is being used or whether management goals are being achieved—or can even be the basis of platforms to electronically share information or find opportunities to transfer rights or permits. When groundwater modeling is used to help understand the condition of an aquifer and how that might change over time, data tools can help communicate the result of the modeling to local stakeholders. For Arizona's AMAs, the Department of Water Resources has created annual water supply and demand and inflow-outflow dashboards that help communicate conditions in each AMA and progress towards local management goals.