WATER RESOURCES

Although Maricopa County is located in the dry Sonoran Desert, some areas of the county do have an ample water supply to meet current and future needs. Such areas tend to be in the low-lying parts of the county where major rivers and washes converge. However, certain areas – most notably those in higher or rocky elevations – aren't as fortunate to have an abundant supply of needed water. The Rio Verde Foothills planning area is one such area where concerns about water supply and demand are warranted, and where efforts to help address the supply/demand balance is important.

State law requires that Maricopa County include this Water Resources element in its plans as a way to inventory current water supplies and calculate projected demand. This element describes watersheds, ~~and underground~~ water basins and subbasins in and around the Rio Verde Foothills area, projected water demand, and includes goals and policies to address key issues. Best management practices are also included to help guide efficient and effective water use. ~~ensure that water is used as efficiently and effectively as possible.~~

Water Supply Inventory

Surface Water

The planning area is drained by numerous washes that flow towards the Verde River. While normally dry these washes ~~frequently~~ periodically flow as a result of rainfall, and in some instances can overtop during heavy precipitation. Flooding is more likely to occur during the monsoon season lasting from July through September, but may also occur during ~~the~~ winter storms generally from December through February. Individual rainfall event and flooding information is available from the United States Geologic Survey (USGS) and the Flood Control District of Maricopa County (FCD).

The Verde River, which flows year-round, originates in Chino Valley north of Prescott and enters Maricopa County north of Horseshoe Dam near the Mazatzal Mountains. The Verde River drains over 7,000 square miles and meanders for about 140 miles from Sullivan Lake south to its confluence with the Salt River near Fountain Hills. The Verde's flow is regulated by Horseshoe Dam and Bartlett Dam northeast of the study area. Reservoirs~~,~~ operated by the Salt River Project~~,~~ provide flood control and water for use in the Phoenix area.

Central Arizona Project

Since 1985 Colorado River water has been transported to the Phoenix area via the Central Arizona Project Canal (CAP). The CAP was constructed to help Arizona conserve groundwater supplies by importing surface water. With respect to the planning area, no CAP water is currently used and the relatively high cost of CAP water and lack of infrastructure needed to convey it to this region means it is not a viable option. Given the area's low-density residential development pattern CAP water is considered economically unfeasible. ~~The relatively high cost of CAP water and lack of infrastructure needed to convey this water to users who are far from the CAP aqueduct prevents widespread use. However, it is projected that full utilization of CAP water supplies in Arizona will be reached by the year 2040.~~

~~Currently, no water from the CAP is being used in the planning area. While there is no physical infrastructure available to deliver CAP water to the Rio Verde Foothills Planning Area~~However, CAP water can be exchanged for groundwater to members of the Central Arizona Groundwater Replenishment District (CAGRD). The CAGRD has the responsibility to use renewable water supplies to replenish the aquifer for excess groundwater used by its members. Membership in the CAGRD is voluntary, and all costs are to be paid by its members.[1]

Rio Verde Utilities, Inc. has an annual CAP allocation of 812 acre-feet per year for municipal and industrial purposes. The utility company obtains its CAP allocation through an exchange agreement with Salt River Project and is also part of the CAGRD.

While not in the planning area, t~~T~~he nearby Fort McDowell Indian Community (FMIC) has an annual CAP allocation of 18,233 acre-feet. Under a 1990 federal agreement, the FMIC is provided an annual allotment of 35,950 acre-feet of water from the Verde River and CAP. The 18,233 acre-feet of CAP in the water budget may be leased for 100 years or leased off-reservation within Pima, Pinal, and Maricopa counties. A lease of 4,300 acre-feet to Phoenix has already been signed. This settlement also creates a minimum stream flow on the Lower Verde River of 100 cubic feet per second (CFS).

Groundwater

The primary source of water in the planning area is groundwater, the withdrawal and use of which is governed by the 1980 Arizona Groundwater Management Act.[2] The entire study area is within the Phoenix Active Management Area (AMA) which is where the Arizona Department of Water Resources (ADWR) oversees groundwater rights; prohibits the development of new farmland; requires new subdivisions to have long-term, dependable supplies; and requires measuring and reporting of groundwater withdrawals. Assured and Adequate Water Supply requirements are based on demonstration of a 100-year water supply considering current and committed demand, as well as growth projections. There are seven criteria for the Assured Water Supply Program which includes availability of physical, legal, and continuous water. The Assured Water Supply Rules are designed to protect groundwater supplies within each Active Management Area and to ensure that people purchasing or leasing subdivided land within an AMA have a water supply that is adequate with respect to quality and quantity. This means the amount of groundwater pumped from AMA aquifers on an average annual basis must not exceed the amount that is naturally or artificially recharged. These provisions were enacted to help the Phoenix area achieve safe-yield by 2025. Safe-yield would be achieved when no more groundwater is being withdrawn than is being annually replaced. The fourth management plan for Phoenix AMA will be available for draft review from ADWR in late 2016 or early 2017.

The planning area lies within the Fountain Hills Subbasin, one of seven groundwater subbasins in the Phoenix AMA. Located in the northeastern part of the Phoenix AMA, the subbasin covers approximately 360 square miles, all of which drain into the lower Verde River. The subbasin includes the Rio Verde Foothills study area, Fort McDowell Yavapai Nation, the Town of Fountain Hills, and the Rio Verde and Tonto Verde master-planned communities. The amount of recoverable groundwater in the Fountain Hills Subbasin has not been quantified.

[1] Central Arizona Groundwater Replenishment District - A Division of Central Arizona Project. (n.d.). Retrieved February 04, 2016, from http://www.cagrd.com
[2] ARS §45-451

Depth to bedrock (solid rock) in the Fountain Hills Subbasin ranges from a few feet near the basin margins to over 1,200 feet near its center. The regional aquifer consists of two distinct hydrogeological units: an older basin-fill sequence and unconsolidated alluvium deposited by the Verde River. The unconsolidated alluvium that underlies the modern floodplain of the Verde River is approximately one mile wide and at least 90 feet thick.[3] The alluvium, which is the principal source of groundwater, is composed mostly of gravel and sand~~,~~ with floodplains of sandy silt. Water in these aquifers occurs in small pores between the sediment.

The composition of the older basin-fill is not well defined due to a lack of subsurface data. Data from 1977 indicated that wells drilled in this unit yield from a few dozen to several hundred gallons of water per minute. At the time of the Arizona Water Resources Assessment report (1994) there were very few wells in the Fountain Hills Subbasin and groundwater conditions were not well defined. However, the most recent report published by ADWR documented 1,354 registered wells located within the Fountain Hills Sub-Basin[4]. Most groundwater production is along the corridor of the Verde River or within the Town of Fountain Hills with the exception of exempt wells. The general direction of the groundwater flow is from north to south, parallel to the axis of the subbasin. Available information suggests that the regional aquifer in the Fountain Hills Subbasin is not connected to adjacent subbasins. According to ADWR, the unconsolidated alluvium is hydraulically connected to the Verde River.

ADWR conducted depth to bedrock studies in 2000 that revealed preliminary groundwater conditions in the planning area. A hydrologic boundary is estimated to occur near 136th Street, where hard rock gives way to a trough-like structure filled with decomposed and fractured granites. Groundwater tends to accumulate in this sediment-filled trough. Preliminary studies indicate a thick clay layer ~~that~~ begins roughly in the center region of the planning area, functioning as an opposite edge of the trough. Groundwater is difficult to find east of this region until the clay transitions to alluvium near the Verde River. In addition, ADWR estimates two cones of depression are beginning to form within the trough. Lowering of the groundwater table occurs in times of prolonged drought and in response to significant pumping. ~~That said~~However, the trough and cones of depression are replenished by rainfall and sheetflow that wash across the desert and run off hard rock northwest of the trough, although natural recharge potential is reduced when natural washes are altered, land is paved, or vegetation removed.

Long-term water level records are not available for the subbasin; however, available information suggests that water levels have not been significantly affected by groundwater pumping. Depth to groundwater in 1982 ranged from 16 feet below land surface in the Verde River floodplain south of Bartlett Dam to 490 feet below land surface near the McDowell Mountains. In 1998, depth to groundwater ranged from 19 feet below land surface in the Verde River floodplain south of Bartlett Dam to over 500 feet below land surface near the McDowell Mountains.[5] The Fourth Management Plan for the Phoenix AMA public is ~~on-track~~scheduled for draft review in late 2016 or early 2017. There are no updates to the subbasin since the Third Manage Plan for Phoenix AMA.

[3] Arizona Water Resources Assessment. Arizona Department of Water Resources, Phoenix, 1994
[4] ADWR GIS. (n.d.). Retrieved January 08, 2016, from https://gisweb.azwater.gov/waterresourcedata/
[5] Third Management Plan for Phoenix Active Management Area (2000-2010). Arizona Department of Water Resources, 1999

Currently, groundwater within the Fountain Hills Subbasin is pumped by the Chaparral City Water Company for Fountain Hills, Rio Verde Utilities, Inc. for the Trilogy at Verde River, Rio Verde and Tonto Verde master-planned communities, and an increasing number of domestic wells. Almost all of the groundwater pumping occurs in the southern part of the subbasin. Wells in the lower aquifer contain fluoride levels that exceed drinking water standard, although high quality water from the upper aquifer near the Verde River is blended with water in the lower aquifer to bring fluoride levels down. ADWR has one monitoring well near Jomax Road and 144th Street. Between 1983 and 1998, the well experienced an average decline rate of 3.6 feet per year. There are 98 monitoring wells within the Fountain Hills Subbasin. Hydrostratigraphy (i.e. the study of the structure of subsurface porous materials) for the Fountain Hills Subbasin indicates several types of deposits which cause a confusing mix of water level for wells screened at the same depth when each well encounters different sediment types. Groundwater pumping from individual wells in the planning area is addressed later in this chapter.

Rio Verde Utilities, Inc. has a total of nine wells. The most recent master planned community, Trilogy at Verde River, received its potable water from Rio Verde Utilities, Inc. beginning of 2004. There is an additional groundwater allocation of 4,200 acre-feet per year available to Rio Verde Utilities, Inc. based on the Water Availability Letter issued by ADWR on October 27, 1992.

Another private water company, the Water Utility of Northern Scottsdale (no affiliation with the City of Scottsdale), was ~~initiated~~ formed in 2001 to serve both the Granite Mountain Ranch and Rio Mountain Estates subdivisions. The water company drilled three wells; well #1 was drilled in 1997 to a depth of 1,000 feet and was recorded as having a depth to water of 560 feet. Drilling records were not available for the other two wells. The total committed groundwater demand for these two wells is 92.76 acre-feet/year.

In the Fountain Hills Subbasin, sources of groundwater recharge (additions to the aquifer) include streambed recharge from the Verde and Salt Rivers and their tributaries, and mountain-front recharge. Sources of groundwater discharge (depleting the aquifer) include groundwater pumping, discharge to the Verde and Salt Rivers, and by phreatophytes (plants with roots that extend into the water table).

Effluent (Treated Wastewater)

Effluent, also known as treated wastewater, is used for landscape irrigation (mainly golf courses), cooling at power plants, crop irrigation, and various industrial purposes where non-potable water (i.e. water not safe for human consumption) is acceptable. Effluent production in rural areas is typically low or nonexistent due to the higher occurrence of septic systems, but effluent production in urbanized areas of Maricopa County is increasing. In 2010~~,~~ the Phoenix AMA annual water report identified that there was 310,263 acre feet of effluent available for ~~withdrawal and~~ use~~. ,~~ ~~The~~ although the actual ~~effluent reused in 2010~~ use was closer to 187,580 acre feet (note: One acre-foot of water contains about 326,000 gallons and is roughly the amount of water needed to serve a family of five for one year). ~~Looking at percent utilization~~However, longer term effluent ~~reuse~~ use in the Phoenix AMA has increased from approximately 44% in 1990 to approximately 60% in 2010.[6] ,[7]

[6] Renewable Supplies Issues #1: Availability, Reliability & Utilization of Renewable Supplies. Governor's Water Management Commission-Technical Advisory Committee, Phoenix, Arizona, November 2000
[7] 2010 Annual Report of Phoenix AMA Effluent Usage by ADWR

The Rio Verde Utilities, Inc. serves communities inside and outside of the Rio Verde Area Plan. Trilogy at Verde River is the only community within the Rio Verde Foothills Area that uses the wastewater treatment plant which has a design capacity of 700,000 gallons per day. Effluent from Trilogy at Verde River will gradually become available, eventually maxing out at 1,060 acre ft.–/yr. at full buildout. Effluent flow is higher during winter months and lower in summer months due largely to seasonal usage from ~~retirement communities~~winter visitors. ~~Treated~~ As noted earlier treated effluent is used for irrigation proposes~~;~~ ~~such as the golf course within the Rio Verde planning area. The~~ at capacity the 18-hole golf course at Trilogy at Verde River will use approximately 441 acre-feet of effluent per year for irrigation.

Hauled Water

Numerous homes in the planning area are neither connected to a public water system nor a well to pump groundwater. In such instances residents rely on hauled water where above or below ground cisterns/large water tanks are installed at the home and filled periodically based on water use. This typically requires a fee service with a water hauling company to truck large amounts of water to individual homes. Hauled water can be a good option for homes where wells are not productive, or as alternative to the expense of well construction and maintenance.

Greywater Reuse/Rainwater Recapture

In places like the Rio Verde Foothills planning area the reuse of greywater and rainwater can be a beneficial choice for certain activities such as irrigation, landscaping and other uses not requiring potable water. Greywater is water from sinks, dishwashers, washing machines, showers and other household items that is retained and reused on site for irrigation and ornamental plants. Greywater systems can be installed on homes to help improve water efficiency, reduce overall water use and even prevent pollution in septic systems.

There are various ways to recapture rainwater, the most common of which is through underground cisterns and/or above ground tanks and barrels. During rain events water is funneled to these containers until needed. Such water is excellent for irrigation and even fire suppression. In general, every inch of rain that falls on a 1,000 square foot catchment area will result in about 600 gallons of water.

WATER SUPPLY ANALYSIS

This section analyzes historical and future groundwater use in the planning area. Recoverable groundwater amounts for the entire Fountain Hills Subbasin have not been quantified within the Third Management Plan for the Phoenix AMA. Future updates to this area plan and the Fourth Management Plan would provide new information that may provide better insights to the available groundwater.

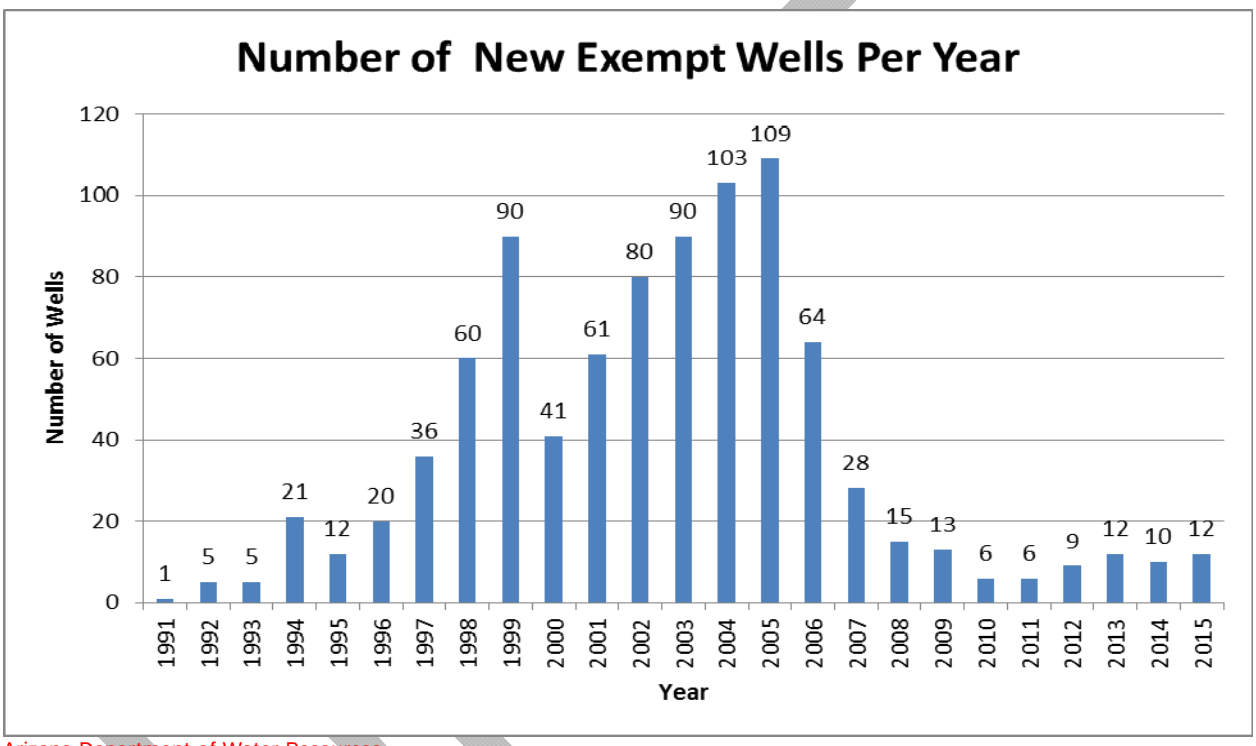
Historical Water Demand

Historical water use is estimated more accurately than groundwater supplies because of well records and pumping data recorded by ADWR. ADWR divides wells into two reporting categories: *exempt* and *non-exempt*. Exempt wells are those with a pump capacity of 35 gallons per minute or less and are exempt from ADWR reporting requirements. These smaller wells are generally for home use or livestock watering purposes. Non-exempt wells are those with a pump capacity of greater than 35 gallons per minute and are required to report annual

pumpage if within an active management area. Most non-exempt wells are used for agricultural irrigation or belong to a city, town, or private water company. There are only a few of these large capacity wells in the planning area, including those operated by the Water Utility of Northern Scottsdale.

Figure 1 shows the number of new exempt wells each year in the Rio Verde planning area as recorded by the Arizona Department of Water Resources.

Figure 1: Historic Well Data from 1991 to 2015 in the Rio Verde Area



Arizona Department of Water Resources

Per state law cities, towns and private water companies have the right to withdraw and transport groundwater within their service area for the benefit of landowners and residents.[7] ADWR classifies water providers that deliver 250 acre-feet or less for non-irrigation use annually as small municipal providers. Small providers are required to use water efficiently and must not operate groundwater distribution systems in a manner such that lost and unaccounted for water exceeds 15 percent of the total quantity of water from any source that enters the provider's groundwater distribution system. Large providers that serve more than 250 acre-feet of water annually are regulated either under the Gallons per Capita per Day (GPCD) program, or the Modified Non Per Capita Conservation Program (MNPCCP) both of which are overseen by ADWR.

Table 1 shows historic pumpage from smaller, exempt wells in the planning area. Because exempt wells do not have reporting requirements for water withdrawals, an assumed general

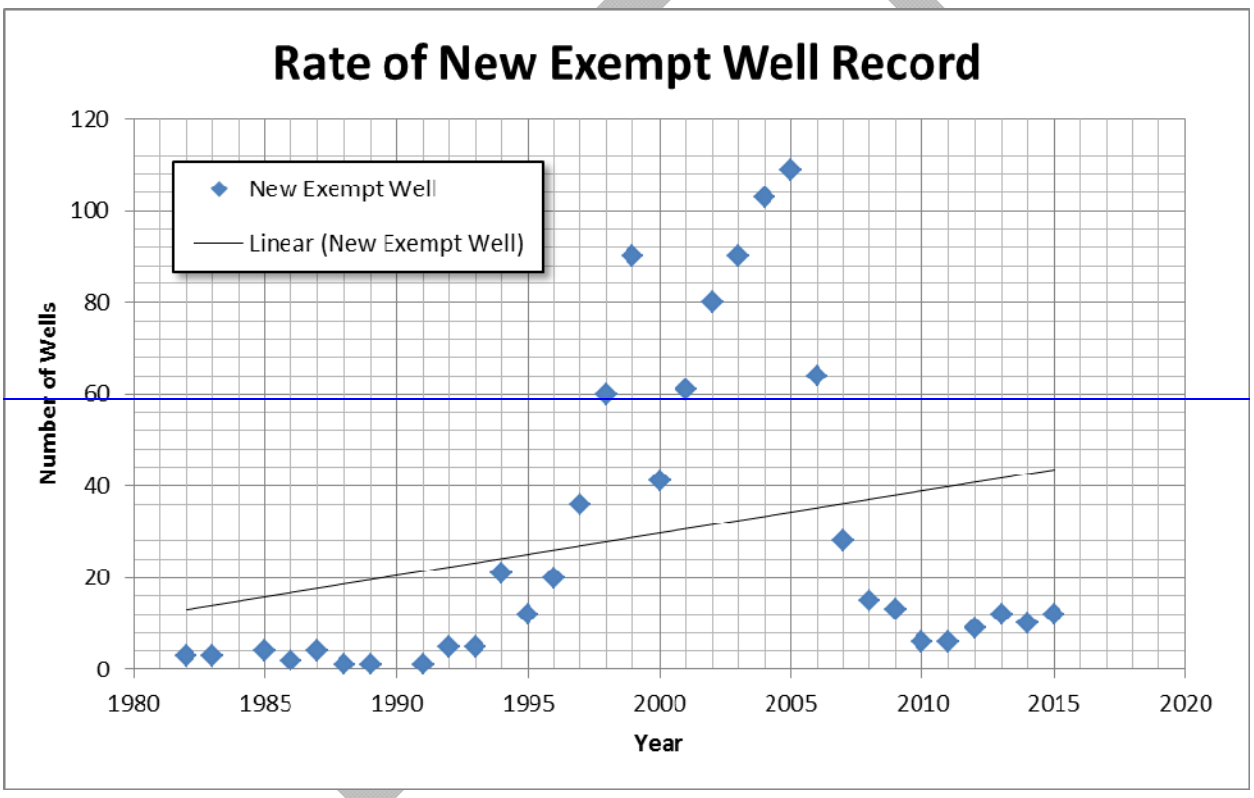
[7] A.R.S. § 45-492

assumption is made that each exempt well pumps one acre foot of water per year for either domestic (residential) uses or stock watering purposes.

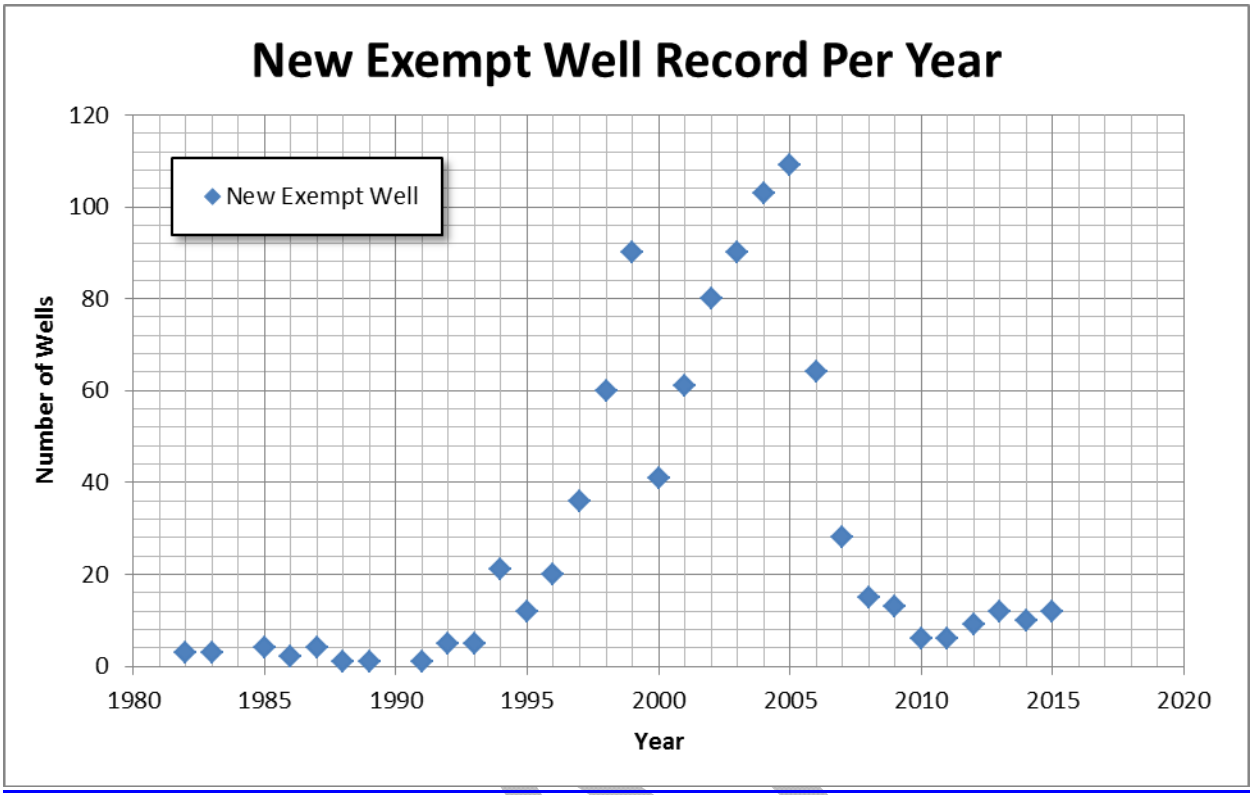
Table 1: Exempt wells Pumpage (Acre feet)[8]				
Year Reported	**1990**	**2000**	**2010**	**2015**
Estimated Acre Feet	21	272	887	936

Figure 2 shows the rate of change in the number of new wells recorded by ADWR, which includes a combination of monitor, injection, exploration, geotechnical, stock and other wells. Although the number of new exempt wells has increased since 1980, it is unlikely that the rate of growth between approximately 1997 and 2007 will be replicated in the foreseeable future. Moreover, many of the well permits issued during this "boom" period were never actually executed. Since 2010 the number of new permits has regressed to the longer-term trend.

Figure 2: New Exempt Well Permits - ~~ADWR from~~ 1980 to 2015.



[8] ADWR GIS. (n.d.). Retrieved January 08, 2016, from https://gisweb.azwater.gov/waterresourcedata/



Arizona Department of Water Resources

Table 2 shows Non-Exempt Well pumpage from 2001 to 2013. The Water Utility of Northern Scottsdale is the only provider geographically located entirely within the Rio Verde Foothills planning area, so the sum of the water withdraw from the Water Utility of Northern Scottsdale is used below to demonstrate Non-Exempt well pumpage.

Table 2: Non Exempt Well Pumpage[9]

Year Reported	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Acre Feet	49.07	0	5.57	5.91	11.89	23.55	37.24	0	39.50	0	47.21	45.98	47.64

While the Water Utility of Northern Scottsdale is the only large water provider aside from Rio Verde Utilities in the planning area, this provider only serves the Granite Mountain Ranch and Rio Mountain Estates subdivisions. ADWR data seems to suggest that certain years were free of well pumpage, but this likely due to reporting discrepancies rather than actual water use.

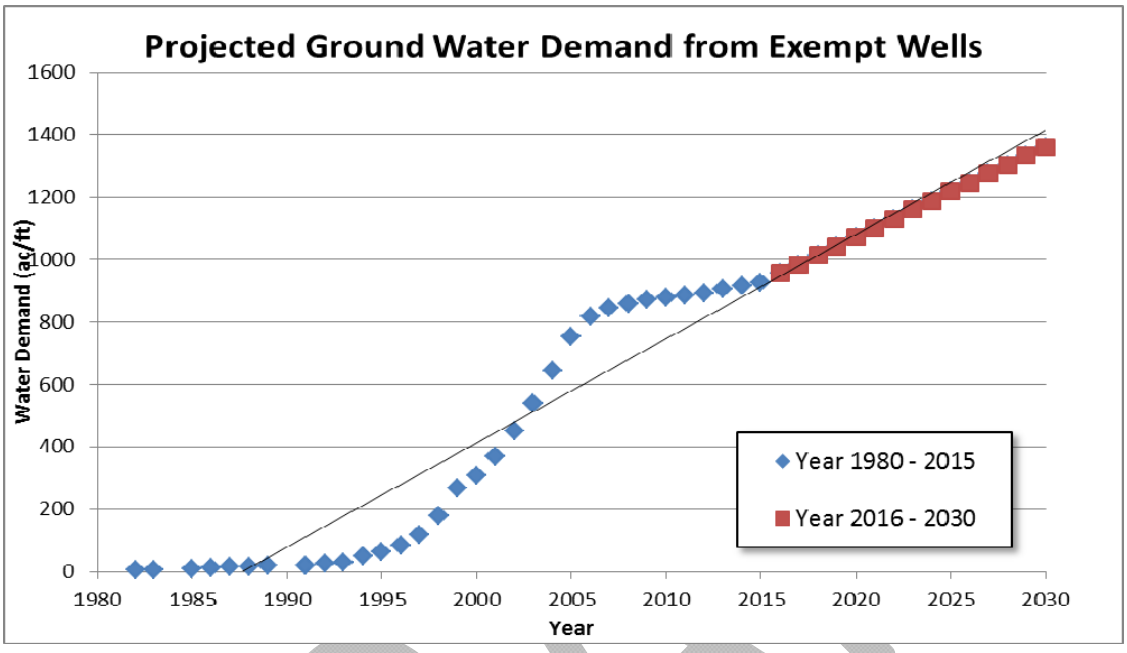
Projected Water Demand

Water demand projections in the planning area are based on historical exempt well data for lot split properties, as well as the Granite Mountain Ranch Rio Mountain Ranch subdivisions and proposed full buildout of Trilogy at Verde River. Aside from residential demand the largest user of water will likely be the golf course in the Trilogy at Verde River community, which is the only golf course located inside the planning area. Using the long-term (1980-2015) average rate of 29 new exempt wells annually, the total number of exempt wells by 2030 can be estimated. Using this method, the number of exempt wells in the planning area could increase from 936 in

[9] ADWR GIS. (n.d.). Retrieved January 08, 2016, from https://gisweb.azwater.gov/waterresourcedata/

2015 to approximately 1,362 in 2030. However, filtering for the 'boom' years of the mid-2000 decade a more reflective number of around eight exempt wells per year would result in a more modest increase to approximately 1,050.

Figure 3: Projected Ground Water Demand from Exempt Wells from 1980 to 2030



Since ~~most~~ many ~~single-lot residences~~homes in the planning area use exempt wells for water consumption, the number of wells in the area should roughly reflect the water usage in the planning area. However, some residents ~~may~~ also haul water to their homes which can ~~increase~~ affect total water demand. Although several different companies deliver water to the planning area, there is currently no accurate way to track utilization rates and its effect on demand. Likewise, there is currently no accurate way to track the amount of rainwater and greywater recapture that is occurring, or its potential effect on offsetting other water sources. Any ranching and equestrian operations would be accounted for within the exempt wells usage. Using the previous assumption of historical water demand of one acre feet per year for each well, the Rio Verde area could use approximately 1,300 acre feet per year (approximately 424 million gallons per year or approximately 1.2 million gallons per day) by 2030. However, a draft version of the 4th Manage Plan of the Tucson AMA shows a reduced water usage factor of half acre-foot per year per well for water usage. This factor was estimated based on population along with interior and exterior models by ADWR. Therefore, a more conservative potential estimate of water demand using the 4th Manage Plan would be approximately 650 acre feet per year by 2030, or approximately 212 million gallons per year.

Two of the three subdivisions served by the Non-Exempt wells of the Water Utility of Northern Scottsdale are Granite Mountain Ranch and Rio Mountain Estates. The projected 2030 usage can be ~~based~~ estimated based on the annual build-out demand per Certificates of 100-year Assured Water Supply. Trilogy at Verde River is an on-going development with full build-out expected sometime around 2022. Each approved subdivision is required to secure the

Certificates of 100-year Assured Water Supply and Analysis of Assured Water Supply by Rio Verde Utilities every 10 years.

Table 3: Projected 2030 Water Demand	
	2030 [1,2]
GRANITE MOUNTAIN RANCH	49 AF/YEAR
RIO MOUNTAIN RANCH	44 AF/YEAR
TRILOGY AT VERDE RIVER	1,386 AF/YEAR
EXEMPT WELLS	650 to 1,300 AF/YEAR
TOTAL	2,129 to 2,779 AF/YEAR

[1] Projected annual build-out demand per Certificates of 100-year Assured Water Supply
[2] Memorandum of Ground-water Availability Tegavah Development by Southwest Ground-water Consultants, Inc.

ISSUES

Projected Water Level Trends

Substantial water level decreases have been documented in the Carefree and North Scottsdale areas northwest of the planning area. The Carefree Subbasin, northwest of the Fountain Hills subbasin, has experienced water level declines exceeding 10 to 12 feet per year due to increased use and less precipitation. Projected decline rates of up to eight feet per year have been projected for the extreme north Scottsdale area. There are no watersheds in severe drought status in 2015, except the Verde River watershed, as wet monsoon and winter seasons of the past few years have generally improved the water conditions in Arizona. Seasonal changes in pumping rates ~~can~~ also cause local fluctuations in groundwater levels.

The Groundwater Site Inventory (GWSI) is the main repository for statewide groundwater information and water level by ADWR. However, there are few GWSI points available to determine the groundwater flow of the Rio Verde Foothills planning area. There is significant variability in measured water levels and groundwater flow from driller logs in the planning area. Because of the low number of GWSI wells available for analysis, regional decline rates and water levels cannot be accurately represented. Hydrologic reports generally show that groundwater flows largely northwest to southeast towards the Verde River.

While Arizona's Groundwater Management Act and the Assured Water Supply (AWS) rules are some of the strongest in the nation, they do not prevent legal groundwater pumping. For example, new exempt wells can be drilled for residential uses and do not require impact analyses. All new subdivisions in the Phoenix AMA must demonstrate the use of renewable supplies or join the Central Arizona Replenishment District if they plan to use groundwater. Although groundwater can be recharged into AMA aquifers, it may not necessarily replenish the local aquifer from which it was withdrawn. Also, the AWS rules allow groundwater levels to decline to 1,000 feet below land surface over 100 years; a level that could negatively impact the aquifer.

Population growth is ~~a significant~~an important factor in projecting future demands on an aquifer. The Rio Verde Foothills Area Plan recommends maintaining the current pattern of low density residential development, but even densities of 1 residential unit per acre or less could ultimately result in over 8,000 homes in the planning area, not including already approved subdivisions. To help ensure a sustainable future water supply, the AWS provision prohibits the sale or lease of subdivided land in an Active Management Area without demonstrating that

there is sufficient water of adequate quality for at least 100 years. A subdivision is defined as land divided into six or more parcels with at least one parcel having an area of less than 36 acres. This includes subdivisions for residential, commercial and industrial use.

The AWS provisions were strengthened with the adoption of the Assured Water Supply Rules in February, 1995. Subdivided land must now demonstrate the use of renewable water to meet most of the demand of the development for 100 years. Renewable supplies include surface water, Central Arizona Project water and effluent. The 1995 rules also raised the physical availability (depth-to-water) standard from 1,200 to 1,000 feet below land surface. The ~~Arizona Department of Water Resources (~~ADWR~~)~~ administers the ~~Assured Water Supply~~ AWS program.

There are several ways in which a subdivision or a water provider can meet ~~the consistency with~~ the management goal, including using renewable supplies and/or extinguishing groundwater rights. However, it is possible for ~~the subdivisions or~~ water providers to pump groundwater to serve a development if ~~the subdivision or water provider enrolls~~ enrolled in the ~~Central Arizona Groundwater Replenishment District (~~CAGRD~~)~~. The primary purpose of the CAGRD is to recharge CAP water into AMA aquifers to replace "excess" groundwater used by its members. However, replenishment does not necessarily take place within the same subbasin from which groundwater was withdrawn. At the time of this report no recharge sites were located in the Rio Verde Foothills area.

The Granite Mountain Ranch project obtained a ~~Certificate of~~its AWS ~~from ADWR~~ in March, 2000 and Rio Mountain Estates obtained ~~a Certificate in~~their in October, 2001. The master planned community Trilogy at Verde River received ~~Certificates of Assured Water Supply (CAWS)~~a CAWS for each approved subdivision.

Water Availability

Numerous homes have been built in this area; some with drilled wells and others using hauled water. Development in the eastern part of the planning area will likely continue to be slower than in the west. Trilogy at Verde River is the exception which will be served by Rio Verde Utilities, Inc. In response to the water availability concerns residents are exploring alternative sources of water that could be used to serve this area, such as drilling deep wells or entering into a water exchange agreement with the Salt River Project that could enable surface water to be used. Should a dependable source of water be developed, this could provide an impetus for further ~~land divisions and~~ development.

There are multiple sources of groundwater recharge into the Fountain Hills Subbasin ~~which include~~including infiltration of water along the mountain front, through ephemeral stream channels, and losing reaches where the flow of water decreases downstream of the Verde River. Such losses may be the result of streambed infiltration, evaporation, evapotranspiration, diversions, groundwater withdrawals, or a combination thereof.[10] In 2003 HydroSystems Inc. estimated the volume of mountain-front recharge to the basin at approximately 2,700 acre feet per year.[11] Ephemeral stream recharge estimates ranged from 760 acre feet per year for ~~camp creek~~ Camp Creek to approximately 13,000 acre feet per year for Sycamore Creek. Both ~~camp~~ Camp Cereek and Sycamore creek contribute water into the Verde River generally northeast of

[10] Subsurface Geologic Investigation of Fountain hills and the Lower Verde River Valley 2003

[11] HydroSystems, Inc., 2003. Numerical Groundwater Flow Model of the Fountain Hills Sub-Basin of the Phoenix Active Management Area, Maricopa County, Arizona, Consultant Report.

Verde River. The average annual groundwater recharge contribution from the Verde River was estimated to be 9,104 acre feet/yr. The estimated groundwater discharge from the Fountain Hills Subbasin is approximately 4,150 acre feet/yr.[12]

Water Quality

Groundwater quality data indicate that most of the groundwater in the Fountain Hills Subbasin is suitable for most uses. Deeper aquifer wells in the Rio Verde Utilities reportedly ~~area~~ have higher than recommended fluoride levels ~~as reported by the Southwest Groundwater Consultants letter and within the water availability letter for Rio Verde Utilities. T~~, but these levels are lowered to meet drinking water standards by mixing with high quality water from the upper aquifer near the Verde River. Water quality tests for the Water Utility of Northern Scottsdale (no affiliation with the City of Scottsdale) well #2 indicate a fluoride concentration of 1.4 mg/l, below the recommended standard of 2.0 mg/l. Tests indicate less than 2 parts per billion (ppb) for arsenic, which is well below the new standard of 10 ppb. A nitrate concentration of 1.6 mg/l was found in the tested well, below the required standard of 10 mg/l.

~~Agriculture, industry, wastewater treatment plants, motorized recreation, landfills, and resource extraction are typical contributors to surface water pollution. However, in~~ In the planning area possible sources of water pollutants include livestock ~~operations~~, construction ~~sites~~, fertilizer use and septic systems. When deep percolation water reaches the groundwater the upper part of the aquifer can be contaminated. Best management practices, such as proper waste disposal from livestock operations, can reduce the amount of pollutants entering ~~drainage ways~~water. The Maricopa County Environmental Services Department now requires the use of leach trenches for residential septic systems because of unique soil properties and to prevent aquifer contamination. Prior to 2001, seepage pits with depths of 30 feet or more were allowed; however, new state Aquifer Protection Program rules require that disposal systems be designed to prevent any movement of pollutants into the aquifer. The new shallow systems (no deeper than 60") result in a higher quality of water that goes back into the ground.

Riparian Habitats

There are no true riparian habitats in the planning area, although some desert wash habitats are considered semi-riparian. Trees and shrubs in desert wash habitats are generally taller and denser than those in the desert and support more bird species than other habitats. Dense vegetation also provides food and cover for wildlife. Riparian areas can be negatively affected by diversion of the natural water channel or the excessive drawdown of an aquifer. Desert wash habitats should be protected for their habitat value, flood mitigating functions and recharge potential.

True riparian habitat is located along the adjacent Verde River. Preserving healthy riparian habitat along the Verde is important to maintaining the high water quality present in the river. The riparian habitat plays a critical role in filtering pollution and sediments, mitigating channelization of streams, and reducing rapid flow rates ~~of a river~~.

[12] HydroSystems, Inc., 2011. MorDo Ranch, Maricopa Count, Arizona, Hydrologic Report.

Use of Renewable Water

Groundwater is the primary source of water used in the planning area which, in most cases, is less expensive and easier to obtain than surface water and effluent. Rio Verde ~~Services~~ Utilities, Inc. obtains water from shallow wells near the Verde River (considered surface water from the exchange program), and from deep wells that are considered groundwater. Trilogy at Verde River will use treated effluent to irrigate its golf courses and landscaping. No other surface water or treated effluent is currently being used in the planning area.

Water Runoff / Drainage

Although this element focuses primarily on existing and future water supply, brief mention of a different water issue is important: water runoff. During heavy rain events the planning area can experience significant flooding which can damage or interfere with property and infrastructure. To help mitigate such impacts using Low Impact Development (LID) principles can help transform water runoff into a beneficial asset to be managed. The basic principle behind LID is to manage rainfall at the source through runoff prevention and mitigation strategies, and treatment controls to remove pollutants. There are five core design concepts for LID:

- Conserve natural areas where possible and limit paving;
- Minimize impacts of development on hydrology;
- Prevent runoff from leaving a site;
- Use techniques that help infiltrate, store, evaporate and/or detain runoff close to its source;
- Use pollution prevention and maintenance techniques.

LID can be an important part of both managing potentially damaging runoff and helping ensure that water reaches underground aquifers in the planning area.

SUPPLYING FUTURE POPULATION

For the foreseeable future groundwater will likely be the primary source of water for current and future residents. However, groundwater is limited in certain locations in the planning area so alternative sources will likely play an increasingly important role in the future. Fortunately, making use of these alternate sources will likely become more efficient and economical as time goes by. ~~On a regional scale the~~ The effluent treatment process will continue to be enhanced, making it an increasingly valuable source of water. In June 2001, the Arizona Department of Environmental Quality adopted new standards that allow private residential reuse of ~~gray~~ greywater if certain standards are met.[13] Water hauling will also continue to be an important source for properties where wells are non-productive, and rainwater and greywater recapture also have an important place in the overall water supply solution, particularly for outdoor irrigation.

~~Groundwater will likely be the primary source of water used in the Rio Verde Foothills area. Effluent and poor quality groundwater will be treated to meet potable water standards, but there are opportunities for residence of the area to use greywater and rainwater capture system for landscaping and other non-consumptive home uses.~~ It's important that water planning in the Rio Verde Foothills area be coordinated with regional ~~planning~~ efforts ~~to consider~~to address water quantity, quality, conservation~~ methods~~, and ~~flood control~~drainage ~~issues~~. ~~Low Impact~~

[13] Arizona Administrative Code R18-9-711, Reclaimed Water General Permit for Residential Use

~~Development~~LID principles could be especially important in the planning area to both mitigate flooding and erosion, and to harvest an important water source.

~~*Additional Information*~~ RIO VERDE HORSEMEN'S ASSOCIATION – SUMMARY OF FINDINGS OF THE RVHA WATER TEAM

The Rio Verde Horsemen's Association (RVHA) completed significant research regarding water use in the planning area which culminated in a report titled *Summary Findings of the RVHA Water Team*. Included ~~with~~ in ~~this~~ the ~~report~~ research is a survey of residents' wells, use, and other pertinent information. While Maricopa County cannot independently verify the results, this report does provide insight and data about some of the following:

- ~~Because the planning area is outside the urban service area, only ground water and shared/hauled water are available for use.~~

- ~~Ground water availability is inconsistent based on location most notably the limited success drilling in the eastern and northern parts of the planning area. While parts of the area seemed to have good quality and active wells, others are challenged by water quality, wells that dried up seasonally or permanently, costly drilling attempts, and declining water levels that require deeper drilling or casing extension.~~
- Hydrologists' consensus is that the primary groundwater source is a "perched aquifer with fingers" on the north and east slopes of the McDowell Mountains;
- The eastern portion of the planning area is affected by an aquifer that's influenced by the Verde River;
- The general trend in the planning area is toward increasing depth to potable water;
- Water in the eastern portion of the planning area is generally not potable due to silt;
- There are fewer successful wells than the total number of permitted wells;
- Approximately ¼ of residents rely on hauled water;
- Groundwater availability varies by location throughout the planning area.

As part of their research t~~T~~he RVHA conducted a survey of their members and the broader planning area which included 112 ~~properties~~responses. The following is a summary of their findings:

- 69 people reported having a working well on their property;

- 58 respondents reported being on shared wells (wells that supply water to multiple properties), with just under 4 households per well on average;

- ~~5~~ Five wells were reported as having gone completely dry;

- ~~12~~ Twelve respondents reported having a change in flow from their well~~.~~, ~~9~~ nine of which came from private wells~~,~~ and the other ~~3~~ three from shared wells~~,~~ (~~"~~c~~C~~hange in flow~~"~~ refers to any fluctuation or change in quality);

- 26 reported that hauled water is their primary or only source of water;

- Less than 81% of well permits were actually executed (771 of 954 permits). "Executed permits" refer to permits granted for which a well was drilled.

The ~~complete report and findings~~Summary Findings of the RVHA Water Team report ~~are~~ is available from the Rio Verde Horsemen's Association.

GOALS AND POLICIES

~~The~~ This Water Resources element includes goals and policies to help ensure an adequate water supply is available to meet future growth needs, and to ~~provide~~ support ~~for~~ sustaining ~~the~~ existing water resources ~~of the Rio Verde~~in the planning area. Since most aspects of water quantity and quality ~~water supply and distribution~~ are ~~regulated~~ overseen at the state level, strategies in this element instead ~~target~~ focus on ways in which current and future residents can help conserve, protect and use water ~~conservation and water quality protection efforts~~wisely.

Goal A-1: Protect and preserve existing water resources and minimize flood hazards.

Policy A-1.1: Carefully consider the types and locations of uses which rely on large amounts of groundwater.

Policy A-1.2: Encourage groundwater recharge and use treated effluent and greywater recapture for water features, landscaping and irrigation.

Policy A-1.3: Encourage the use of drought tolerant and low water consumptive landscape ~~Materials~~materials, as well as LID principles for site design.

Policy A-1.4: Discourage ~~structures~~ site designs that increase water ponding and sheetflow.

Policy A-1.5: Discourage development within floodways and significant floodplains.

Policy A-1.6: Encourage greywater and rainwater recapture practices in site design and construction.

Goal B-1: Reduce impacts on water quality.

Policy B-1.1: Support ongoing depth to groundwater monitoring conducted by the Arizona Department of Water Resources.

Policy B-1.2: Support existing guidelines for single-lot development that help limit impacts to ~~existing~~ natural washes, erodible soils, desert vegetation, and landforms.

Policy B-1.3: Encourage ~~voluntary~~ efforts that protect and preserve the watershed, and safeguard current and future groundwater quality in the planning area.

Goal C-1: Protect equestrian uses and ~~utilize~~ use natural landscapes.

Policy C-1.1: Encourage natural grazing and pasture areas which can help with reduced water consumption and runoff.

Policy C-1.2: Discourage land clearing and removal of the natural environment.

BEST MANAGEMENT PRACTICES

There are many ways that planning area residents can help conserve water ~~in the planning area~~. While ~~not~~ neither ~~required~~mandated nor all-inclusive, the following is a list of some practices that can help:

- Captured water: Use gutters and other catchment methods on roofs ~~and other catchment methods~~ to funnel water to ~~store~~storage ~~water in~~ tanks for rainwater harvesting. Also, use ~~Greywater~~ recapture methods to retrieve greywater from showers, sinks, washing machines, and other water-generating ~~activities~~ fixtures ~~can also be used for~~ for applicable irrigation ~~in certain instances~~.

- Landscaping: Use xeriscape and other ~~low water consumption~~drought-tolerant landscaping ~~practices~~.

- Equestrian: The Rio Verde area is known for its strong equestrian history. To help reduce water use and runoff, pastures and grazing areas can ~~be kept with~~maintain natural landscape as much as possible. Land clearing and ~~uprooting and removal of~~ removing plant roots is discouraged.

- Well Monitoring: ADWR provides information ~~for~~ about well data in the Rio Verde Area. By knowing this information individuals can make informed decisions about water use and well ~~availability~~potential.

- Grading and Paving: When grading or paving is necessary, certain permits may be needed if the proposed changes alter drainage patterns that could affect other lots in the vicinity. Grading and paving that alters natural drainage patterns is discouraged unless properly engineered.

- LID: Use LID practices in new site design.

CONCLUSION

The Rio Verde Foothills area, like many dry and arid desert regions, is challenged with respect to sustainable water supplies. But like other areas awareness of the necessity of water conservation and careful long-term use can result in a sustainable, dependable supply for current and future residents. With proper planning and action the picturesque Rio Verde Foothills area can achieve safe yield and continue to thrive as a beautiful community for the future.