

## **CHAPTER 7**

### **SUMMARY OF FINDINGS, DIRECTOR'S DETERMINATION AND RECOMMENDATIONS**

This Chapter summarizes the findings from this report and presents the director's determination of whether the Upper San Pedro Basin should be designated as an AMA based on the statutory criteria in A.R.S. § 45-412(A). Also included are the Department's recommendations on water management, hydrologic investigation and monitoring activities for the Basin.

Under A.R.S § 45-412(C), ADWR must “periodically review all areas which are not included within an active management area to determine whether such areas meet any of the criteria for active management areas...”. The criteria are specific. The director may propose to designate a subsequent AMA if the director determines that any of the following criteria are met: 1) active management practices are necessary to preserve the existing supply of groundwater for future needs; 2) land subsidence or fissuring is endangering property or potential groundwater storage capacity; and 3) use of groundwater is resulting in actual or threatened water quality degradation. A.R.S. § 45-412(A). The area proposed for designation may not be smaller than a groundwater basin, except for the regional aquifer systems of northern Arizona. A.R.S. § 45-412(B).

The USP Basin boundaries are defined by ADWR as “the surface watershed of the San Pedro River from the Republic of Mexico downstream to the area referred to as “The Narrows” north of Benson, and in addition, the upper drainage areas of Hot Springs and Kelsey Canyons which enter the San Pedro River north of “The Narrows.” The USP Basin is divided into two sub-basins: the Allen Flat sub-basin and the Sierra Vista sub-basin, (Arizona Department of Water Resources, 1982). See Figure 2-1 for an overview of the USP Basin.

For the purposes of this report, the Department divided the USP Basin into the “Sierra Vista sub-area” and the “Benson sub-area.” These informal divisions were created by the Department to allow water use by sectors (primarily municipal and agricultural) to be discussed by geographic location. The Sierra Vista sub-area includes the portion of the USP Basin from the U.S. Mexico border to Fairbank. The Benson sub-area extends from Fairbank to “The Narrows,” including the Allen Flat sub-basin (see Figure 3-2).

#### **7.1 Summary of Findings**

Since the Department's previous review of the USP Basin for potential AMA designation (Putman and others, 1988), and the recommendation not to designate the Basin, there has been considerable hydrologic research in the Sierra Vista sub-area. These new studies and groundwater level data collected throughout the Basin are described in Chapters 2 and 5 and have increased the Department's understanding of Basin hydrology and revealed a number of new conditions. Also, there has been an increase in the demand for

water resources and additional water supply management activity in the USP Basin since the last report. These changes are summarized below.

Among the new data is a finding of a significant decrease in the previous estimate of groundwater in storage. As discussed in Chapter 3 of this report, a 1999 USGS study estimated that the thickness of the alluvial fill, which represents the regional aquifer in the Sierra Vista sub-basin, is shallower on average than previously estimated in 1988. In this report, ADWR used the USGS information and lower specific yield estimates to generate a new estimate of groundwater in storage of 20 to 26 million acre-feet in the regional and floodplain aquifer. Total groundwater in storage had previously been estimated by ADWR at about 41 to 48 million acre-feet (San Pedro HSR, 1991a and Putman and others, 1988). Although the estimate is about half that previously estimated, there are still considerable groundwater resources available in the Basin. This is supported by water level measurements in wells, which generally show flat or slowly declining water levels in most areas, and water level rises in some areas.

The artesian heads present in some portions of the regional aquifer underlying the floodplain alluvium of the San Pedro River have decreased somewhat over time due to groundwater development in these areas. In the Benson-Pomerene area, Barnes and Putman (2004) reported a modest water-level decline in the deeper (artesian) aquifer. The shallow floodplain aquifer, which underlies the San Pedro River, has shown no long-term declines in water level.

Between 1990 and 2001, the Fort Huachuca/Sierra Vista cone of depression deepened slightly, but rates of water level decline are less than those reported by Putman and others (1988). Since the previous study, two new cones of depression are forming in the USP Basin in addition to the Fort Huachuca/Sierra Vista cone. The newly identified cones are relatively minor in comparison. One is associated with the Bisbee wellfield and the other with pumping in the Benson area. The Bisbee cone is developing due to a reduction in incidental recharge from the Bisbee mine operations.

There are also natural influences on the Basin's groundwater resources. A shift in summer and winter rainfall patterns have brought less summer rainfall, and drought may have contributed to groundwater level declines in some areas. There has been an increase in the amount of riparian vegetation in the San Pedro Riparian National Conservation Area (SPRNCA) due to the removal of agricultural and grazing activities, although there is likely a net decrease in overall demand from historical agricultural usage levels.

In addition, the USP Basin groundwater resources are impacted by activities within the portion of the Basin that extends into Mexico. There are concerns about existing and expanding agricultural and mining activities in the Cananea, Sonora area although the extent of the potential impact is not fully understood.

A groundwater budget, an accounting of aquifer inflows and outflows, was developed for this report. Major inflows to the groundwater system come from recharge of water along the mountain fronts (including ephemeral channel recharge), groundwater flowing across

the Mexican Border, and recharge of flood flows of the streams in the Basin. Secondary sources are recharge of water from recharge projects, septic tanks, and golf courses. Outflows include demand by the water use sectors and riparian vegetation, and baseflow and underflow between sub-areas and out of the Basin. The difference between inflows and outflows results in a change in groundwater in storage. In 2002, it is estimated that outflows exceeded inflows resulting in a Basin storage deficit of -9,500 acre-feet; approximately -8,350 acre-feet in the Sierra Vista sub-area and -1,320 acre-feet in the Benson sub-area. Note that the Basin total is not equal to the sum of the sub-basin totals due to intra-basin transfers.

Cultural water demand and supply was evaluated in Chapter 4. The primary water demand sectors in the Basin are municipal and agricultural water users. A relatively small volume of water demand is attributable to industrial users. In 2002, municipal demand was the largest water use sector in the Basin at 18,800 acre-feet of which 13,700 acre-feet did not return to the aquifer through incidental or artificial recharge (net use groundwater). Agricultural consumptive use was 9,800 acre-feet and industrial sector use was 2,100 acre-feet of which 2,000 acre-feet was net use groundwater.

Since 1985, there has been a significant shift in demand from agricultural water use to municipal water use, and this trend is projected to continue as population increases. The agricultural demand decline of over 40% between 1985 and 2002 is attributable to several factors. These factors include creation of the SPRNCA and associated cessation of agricultural activities, purchase of agricultural lands to establish conservation easements that reduce irrigation and other pumping near the San Pedro River, subdivision of agricultural lands and economic factors. By 2030, the Basin population is projected to increase to 110,000 and total demand to 40,000 acre-feet, of which 26,900 acre-feet is projected to be net use groundwater.

There has been an increase in demand and supply management activity in the USP Basin since the previous study. Effluent is being further utilized for golf course irrigation and is also being recharged at two locations between pumping centers and the San Pedro River. Stormwater recharge projects have been constructed at Fort Huachuca. Implementation of conservation measures has influenced water demand in the Basin. Fort Huachuca has reduced its use by almost 45% between 1993 and 2002 due to irrigation efficiency, installation of low water use plumbing fixtures, replacement of high water use landscaping and education. Water conservation programs and ordinances have been implemented in the Sierra Vista area but as population has increased, so has water use. Municipal demand has increased by over 5,000 acre-feet between 1985 and 2002 and the basin-wide per capita rate has not changed appreciably.

The Department reviewed past predictive studies of the Basin and compared them to the Department's recent findings (Chapter 5). This review demonstrates that caution must be exercised when utilizing model results since all of the studies reviewed made one or more predictions that differ substantially from current conditions.

The potential effect of AMA practices on the Basin groundwater supply was evaluated in detail in Chapter 6. These practices include a groundwater rights system that restricts groundwater withdrawals, prohibits the development of new irrigated farmland, requires that new subdivisions have long-term dependable water supplies, requires that groundwater withdrawals be measured and reported, requires mandatory conservation for agricultural, municipal and industrial users, and develops management plans to achieve the management goal. AMA practices, however, would not affect all water users, would not prohibit growth, and would not significantly restrict current groundwater use. In the USP Basin approximately 27% of the current water demand would not be subject to AMA practices. Municipal per capita conservation requirements would apply to approximately 47% of the municipal water demand in the Basin. Total municipal water demand could increase as the population increased and new water service areas could be formed. Because water providers in AMAs are not required to demonstrate an assured water supply for their existing water service area, an assured water supply program would likely apply only to new subdivisions.

The occurrence of land subsidence or fissuring in the Basin was also investigated for this report (see Chapter 3). The two primary factors controlling whether subsidence will occur are the magnitude of the water table change and the percentage of fine-grained material (clays/silt) within the aquifer system. The potential for land subsidence exists within the Basin if these conditions are met. However, there are no known documented occurrences of land subsidence caused by aquifer system compaction and subsidence does not seem likely for most portions of the Basin given the comparatively small water-level changes from pre-development conditions.

In addition, the Department evaluated water quality data for the Basin as discussed in Chapter 3, to determine if actual or threatened water quality degradation resulting from use of groundwater was occurring. Contamination from mining, municipal, industrial, military, and commercial activities has occurred in the Basin and could potentially threaten groundwater resources, however, the threats are localized and are being addressed through local, state and federal efforts.

## **7.2 Director's Determination**

Following is the director's determination on whether to propose to designate the USP Basin as a subsequent active management area pursuant to the criteria in A.R.S. § 45-412(A), based on the Department's findings.

**Criteria 1:** Are active management practices necessary to preserve the existing supply of groundwater for future needs?

Because there are sufficient groundwater supplies in the USP Basin to meet the future needs of municipal, industrial and agricultural water users, the director has determined that AMA practices are not necessary.

**Criteria 2:** Is land subsidence or fissuring endangering property or potential groundwater storage capacity?

Based on the hydrogeology and studies of the Basin, the director has determined that there is no evidence that land subsidence or fissuring is endangering property or potential groundwater storage capacity in the USP Basin.

**Criteria 3:** Is use of groundwater resulting in actual or threatened water quality degradation?

Based on an evaluation of water quality data, the director has determined that the use of groundwater is not resulting in actual or threatened water quality degradation in the USP Basin.

Because the director has determined that none of the statutory criteria have been satisfied, the director does not propose to designate the USP Basin as an active management area at this time.

### **7.3 Recommendations**

Although the director has determined that the statutory criteria for designating the Basin as an AMA do not presently exist, the Department recognizes the need for water management and continued hydrologic investigation and monitoring in the Basin. The following section discusses the Department's recommendations.

- The Department will continue to measure groundwater levels in the Basin. Groundwater level measurement locations should recognize expected development patterns in the Basin to the extent possible. Cooperation of local governments, water companies, and residents is vital in this effort.
- A cooperative water-level measurement program should be developed to cover the San Pedro drainage area between Cananea, Sonora and "The Narrows," north of Benson. Annual groundwater withdrawal data and information about groundwater use in the Mexican portion of the Basin would be useful in understanding the entire San Pedro Basin.
- Riparian water use and mountain front recharge in the USP Basin are among the largest and least certain components of the water budget, particularly for the Benson sub-area. Research to determine the water needs of the riparian community should be continued. Research should also include groundwater level monitoring in the floodplain aquifer and the underlying regional aquifer, as well as studies to better quantify mountain front recharge.
- The Benson sub-area has received less scientific attention than the Sierra Vista sub-area. More research focusing on hydrologic processes in this part of the USP Basin is encouraged.

- The USGS streamflow gaging stations within the USP Basin should be continued. The feasibility of re-installing a gaging station at “The Narrows” should be investigated to provide a measure of Basin outflows and to permit construction of a more accurate water budget.
- Groundwater models, together with updated water demand and supply information, may be used to guide basin-wide water management decisions. Assumptions regarding water demands and recharge should continue to receive rigorous scrutiny when evaluating model results.
- Water conservation efforts and implementation of recharge projects have positive benefits in reducing groundwater overdraft as indicated by modeling studies and by recent data collected by the Department. Such local efforts should be continued throughout the Basin.
- The Department will continue to work with the Upper San Pedro Partnership as a Partnership member on local water management and planning efforts. These efforts should be continued and supported at the local, state and federal level.
- The Department will facilitate the Upper San Pedro Partnership’s efforts to attain its sustainable yield goal under Section 321 of the National Defense Authorization Act of 2004 and will work with the Partnership to identify the role the State may play in support of this effort.
- The Benson sub-area is projected to experience population growth with three master-planned communities proposed in the sub-area. ADWR should encourage and provide technical and planning support to Benson-area stakeholder water management efforts.
- Area watershed groups should investigate sources of alternative water supplies for the Basin as a long-term water management strategy.
- Metering and consistent annual reporting of water demands by all large water users in the Basin would provide a more accurate source of data for planning and monitoring purposes. This option should be explored by local stakeholders and ADWR.
- Well spacing criteria could provide hydrologic benefits by managing the location of new pumping in some areas. This option should be explored by ADWR and local stakeholders.
- The Department will provide support to local stakeholders for legislative changes to facilitate those water management efforts considered necessary by local stakeholders and ADWR.

Although the director does not propose to designate the Basin as an AMA at this time, the Department believes that the recommendations described above provide useful water management tools for the future. The Department will continue to work at the local, state and federal levels to promote solutions to water management issues in the Basin.