SECTION 3

DESCRIPTION OF WATER RESOURCES

INTRODUCTION

This section of the plan is intended to provide an overview of water quality in the region and to identify existing and potential problem areas. Supporting information on surface and groundwater quality standards and assessment reports are contained in appendices.

In a desert environment, water is a precious resource and new management efforts are being developed by the state to ensure long-term, basin wide safe yields for existing ground and surface water in the region. As a consequence of Arizona's arid climate, almost every surface water body and groundwater aquifer is considered significant. The SEAGO region is fortunate to have plentiful supplies of groundwater, and this, combined with new water conserving agricultural practices and artificial recharge procedures, should ensure long-term water availability to foster growth and development in the future.

The focus of this section is on surface and groundwater basins in the region, with a brief discussion on reclaimed water. Reclaimed water is becoming increasingly important in areas with limited water resources as wastewater treatment technology improves.

While this section addresses surface and groundwater separately, it should be recognized there is a very close connection between surface and groundwater, and quality problems in one can affect the other. Groundwater discharge from alluvium to stream channels may occur in alluvial systems, particularly in semi-arid climates, during low flow periods. It may be identified based on presence of springs or perennial flows in small watersheds. Groundwater recharge, on the other hand, generally occurs in wetlands and alluvial systems during high flow events.

The major components of this section will discuss the designated uses and standards for water resources; the currently existing surface and groundwater quality; an assessment of current water quality in meeting designated uses and standards, identification of problem areas, and recommendations to resolve them.

In addition, riparian areas, unique waters and other critical habitats will be identified. The SEAGO region recognizes that the use of reclaimed water is important to sustaining effluent dominated riparian areas and the potential of the effluent for establishing artificial cienegas for agricultural purposes. This section will identify how reclaimed water is being used within the region and include an explanation of how guidelines for its use will be implemented through the WQM Plan consistency review process.

SURFACE WATER

Surface Water Basins

The state of Arizona has twelve surface water basins with boundaries defined following the U.S. Geological Survey (USGS) Hydrologic Unit Code system. These are shown on Map 4. Five of the surface water basins are in the SEAGO region. They are the Rios de Mexico, San Pedro River Basin, Santa Cruz River Basin, Upper Gila River Basin, and the Willcox Playa, which for the purposes of this section will be discussed with the San Pedro Basin.

Designated Uses/Water Quality Standards

Water quality standards for navigable waters are the foundation for all other water quality programs and

are used to establish and regulate both point and nonpoint source controls. The goals of the CWA provide for protection and propagation of balanced population of shellfish, fish, and wildlife, and allow recreational activities in and all navigable waters. Arizona's Environmental Quality Act (EQA) requires ADEQ to establish water quality standards for navigable waters which preserve and protect water quality for existing uses and any foreseeable future uses.

The Clean Water Act (CWA) requires all states to review and revise their water quality standards every three years. New surface water rules were certified for Arizona in February 1992. Arizona Administrative Code (A.A.C) Title 18, Chapter 11 establishes rules concerning standards for navigable waters. The rules include: antidegradation provisions; narrative standards; numeric standards for toxic substances, radiochemicals, and nutrients; designated uses for streams; numeric standards for designated uses; "Unique Waters" and "Effluent Dominated Waters" (EDW) classifications and standards; and other specific limitations or exceptions.

The state of Arizona has determined designated uses for all navigable waters in the state, with "fishable and swimmable" uses as the baseline to meet requirements of the Clean Water Act. A complete definition of designated uses in Arizona are listed in Appendix 3-1.

Arizona has adopted water quality standards to protect the designated uses of its navigable waters. Standards may be narrative or numeric. Numeric standards are specific criteria to protect specific uses, while narrative standards are general standards that are applicable to all surface waters. Arizona law (ARS 49-221) expresses a preference for numeric standards but also authorizes adoption of narrative standards. Standards may be general and apply to all navigable waters or may be waterbody specific standards. Current Arizona water quality standards for surface waters are listed in Appendix 3-2.

The new rules list designated uses for certain stream segments, canals, and lakes. A waterbody, not listed in the rules, but is tributary to a listed water shall be protected by the standards established for the nearest downstream listed water that is not an effluent dominated water. There are many washes and streams, however, which are not named in the standards, which flow into surrounding states and Mexico, and therefore lack designated uses.

In Arizona, all lakes and stream segments named in the rules are protected for aquatic and wildlife uses. The perennial streams are protected for either full body contact swimming or incidental human contact recreation uses; however, such protection is not provided for many of the non perennial streams. There are also many lakes which are not specified in the rules and which do not discharge into streams with designated uses; therefore, these lakes also lack designated uses.

Designated uses of canals have been limited to protecting the water for drinking water, agricultural irrigation and agricultural livestock, and have not been protected for aquatic wildlife inhabiting these waters or recreational uses.

Current standards are more stringent than those in place at the time of SEAGO's 1979 Plan. Major changes include adoption of numeric criteria for 126 priority toxic pollutants listed pursuant to Section 307 of the Clean Water Act and as required by the Environmental Quality Act. Numeric standards have also been established for total ammonia and chlorine residual.

SPECIAL CLASSIFICATIONS

Unique Waters

In Arizona, a surface water may be designated as a "unique water" if it meets certain criteria. A unique water is defined by ADEQ as a navigable water which has been classified as an outstanding state resource water by the Director of Environmental Quality pursuant to A.A.C. R18-11-112. In order to be

classified as a unique water, a waterbody should be of exceptional recreational or ecological significance, because of unique attributes, including but not limited to, geology, flora, fauna, water quality, aesthetic values, or the wilderness characteristics. Additional criteria states that if threatened or endangered species are known to be associated with the water and the existing water quality is essential to the maintenance and propagation of the threatened or endangered species, or the water provides critical habitat for a threatened or endangered species such a water might be classified as a "unique water." Special standards, adopted into rule, often accompany the unique waters designation. Unique waters criteria are listed as Appendix 3-3.

Bonita Creek, a tributary to the Upper Gila River in the SEAGO region, has been designated a "unique water." Additionally, data is still being collected and analyzed from other waters in the area to determine their suitability as a unique water. Particular interest is being given to the San Pedro River in Cochise County, and other waters flowing through areas classified as Areas of Critical Environmental Concern, Outstanding Natural Areas and Research Natural Areas. Those waters that meet the criteria will be formally nominated.

Effluent Dominated Waters

In cases where flow in a stream segment consists primarily of discharges of treated wastewater, that surface water segment may be classified as an "effluent dominated water." The following waterbodies in the SEAGO region are currently classified as effluent dominated:

In the Rios de Mexico Basin:

Mule Gulch, from Bisbee Wastewater Treatment Plant (WWTP) to the confluence with Whitewater Draw. Unnamed wash from Bisbee-Douglas International Airport WWTP to Whitewater Draw.

In the San Pedro Basin:

Walnut Gulch from Tombstone WWTP outfall to confluence with the San Pedro River.

In the Santa Cruz River Basin:

Santa Cruz River from the City of Nogales WWTP outfall to Josephine Canyon.

In the Upper Gila River Basin:

Bennett Wash from the Arizona Department of Corrections - Safford WWTP outfall to the Gila River.

Standards for an effluent dominated water are listed in Appendix 3-4.

Wetlands/Riparian Areas

Riparian areas in Arizona are defined as aquatic or terrestrial ecosystems associated with bodies of water, such as streams, lakes, or wetlands, or dependent upon the existence of perennial, intermittent or ephemeral surface or subsurface water drainage. Wetlands are defined, in rule, as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. While riparian areas are not specially classified or protected in Arizona at this time, Executive Order No. 91-6 recognizes the importance of protecting and restoring riparian areas, and establishes an Interagency Riparian Areas Coordinating Council to consider and recommend a statewide Riparian Management Plan. Development

of this plan is to be coordinated by the Arizona Game and Fish Commission. Executive Order No. 91-6 also requires ADEQ to coordinate with other state agencies to develop legislation mandating state riparian area protection.

The SEAGO region contains some key riparian areas, many of which are associated with unique waters or wilderness areas. The 1991 Bureau of Land Management (BLM) Safford District Resource Management Plan identified some or several riparian areas in the SEAGO region.

In addition, BLM has nominated numerous other areas within the region as being Areas of Critical Environmental Concern (ACEC). An ACEC is defined as a public land area where special management attention is required to protect important historic, cultural, or scenic values; fish and wildlife; natural systems or processes; or life and safety from natural hazards. These ACECs can be further categorized as Outstanding Natural Areas (ONA) or Research Natural Areas (RNA).

The Safford District of the Bureau of Land Management's 1990 Resource Management Plan Environmental Impact Statement (EIS) identified several ACEC areas in the SEAGO region as their preferred alternative to the Resource Management Plan. These key riparian and ACEC areas are also listed in Appendix 3-5.

The U.S. Fish and Wildlife Service has identified the following wetlands in the region as priorities for conservation and preservation: Sheehy Springs in Santa Cruz County, Hooker Cienega in Graham County, and Kiper Springs and Leslie Canyon in Cochise County.

SURFACE WATER QUALITY MONITORING AND ASSESSMENT

Monitoring

Lack of data was a problem in developing SEAGO's Water Quality Assessment for the 1978 Water Quality Management Plan (WQMP) and the 1980 update. Early in the 208 planning process it was recognized that while there appeared to be a substantial amount of data describing water quality for the region, the amount of actual water quality data available was actually less than sufficient to produce a comprehensive 208 plan. What water quality data was available consisted of measurements of various parameters at a limited number of sampling points over different time periods. Once this data was collected and collated, it quickly became obvious that the data did not represent a very complete or consistent distribution of data over any particular period of time or water segment. The Arizona State 208 Task Force also recognized that current, accurate data was necessary for water quality management planning in order to identify water pollution problems and develop solutions. Water quality data was usually not adequate for management planning, as variations in seasonal and annual flows required long-term water quality monitoring and data evaluation. The Task Force also recognized that resources necessary to meet the information requirements for effective water quality planning were beyond the scope of existing monitoring programs.

Data collection activities have increased during the past ten years. ADEQ's Water Quality Assessment Reports for surface water are generally based on data collected since October 1, 1984 and include water quality information from a number of agencies. The ADEQ and U.S. Geological Survey (USGS) maintain a network of fixed stations for ambient water quality monitoring at a number of sites in Arizona. Site locations may be changed from year to year, with selection criteria largely following the Arizona Surface Water Monitoring Strategy adopted in 1988.

Designated use support is assessed by comparing surface water standards to recent monitoring data where available. A monitored assessment is based on at least three site-specific ambient samples taken in a one year period or extensive field sampling, which includes chemical analysis of water, sediment or biota, within the last five years. When there is insufficient monitoring data, an evaluated assessment may be made based on land use, location of sources, citizen complaint investigations, site investigation

reports, land use management studies, or other resources which may be used for professional field evaluations.

While data collection has improved significantly since the 1970s, only a portion of Arizona's stream miles have been assessed. The ADEQ reported in its 1992 assessment report that at the end of Water Year 1991, just under 5,000 miles of the estimated 150,000 stream miles in Arizona had been assessed. Of these, 35 percent were monitored and 65 percent evaluated, so, in reality, only about 1.1 percent of the stream miles in the state have actually been monitored.

In the BLM's 1991 Safford District EIS they stated that the surface water quality is generally good, however the lack of adequate data is a major hinderance to assessment of water quality. The Safford District of BLM has established a water quality testing program within its jurisdiction. This information is used to make current and future land management decisions, nominate unique waters, monitor mining pollution, livestock management decisions, and the re-introduction of extirpated fish.

Planning Implications, Surface Water Quality Monitoring

The Water Quality Management Plan should include a process for recommending different or additional monitoring sites. It should also make recommendations for improvements in the water quality monitoring program so that necessary information for water quality planning and program evaluation is developed. It should also consider how best to assess water quality and identify problems in light of some of the weaknesses in the existing program. Several weaknesses were identified by ADEQ in its 1991 report, including:

1. Sampling is often done where there are perceived problems. This may result in finding more exceedances of standards than if sampling were random.

2. Data on natural background levels is not available. Thus reported exceedances may not be the result of man-caused activity but rather of natural phenomenon. If exceedances are the result of natural causes, they are exempt from state standards.

3. Both monitoring and evaluated data are too limited to provide a sound statistical basis for assessment of water quality.

4. Chemical analysis alone may not be appropriate for assessing the impact of water quality on biological communities.

5. Information for identifying sources of water quality problems was often limited or unavailable.

6. New techniques often result in higher reported exceedance levels.

7. Effluent Dominated Waters (EDW) lack standards for several parameters, and where conflicts with other designated uses arise, EDW standards take precedence. This may mean that other uses are not fully supported.

SURFACE WATER QUALITY ASSESSMENT

This section will summarize the region's surface water quality in supporting designated uses. It is based primarily on ADEQ's 1990 and 1992 Water Quality Assessments. Reference data from the ADEQ reports for the SEAGO region is reported in Appendix 3-6. There is currently no data available for the Willcox Playa Basin, a lightly populated basin with less than 20 miles of perennial stream, so it is grouped with the San Pedro River Basin.

The ADEQ's 1992, Water Quality Assessment report recalculated total stream miles in Arizona based on

digital hydrography at 1:100,000 scale. Approximately 150,000 stream miles occur in Arizona, of which 108,000 are estimated as not being on tribal lands. The report also estimated 134,000 acres of lakes in Arizona of which 128,400 were not on tribal lands.

The 1992 report identified that out of total of 4,462 stream miles assessed, 3,324 miles (74 percent) were impaired and 320 miles (7 percent) were threatened. Threatened implies that the stream fully supports its designated uses but threats to the water quality have been identified. For lakes in Arizona, out of 121,057 acres assessed, 87,988 acres (73 percent) were impaired and 27,989 acres (23 percent) were threatened.

The following is a summary assessment of water quality by surface water basin in the region.

Rios de Mexico Basin

The Rios de Mexico Basin is a composite of three river drainages that flow into Mexico and then out to the Gulf of California: Rio Yaqui, Rio Magdalena, and Rio Sonoita. Map 4A depicts this basin. The rest of Arizona is part of the greater Colorado River drainage system. There are fewer than 45 perennial miles of stream in this basin. A significant portion of this lightly populated basin consists of tribal land Tohono O'odham Nation, west of Tucson, which was not covered in ADEQ's assessment, and is not part of this project.

Seventy stream miles were assessed. The Whitewater Draw/Mule Gulch area is heavily contaminated by mining in the Bisbee area. Monitoring by ADEQ in 1988-89 revealed standards were exceeded for cadmium, zinc, manganese, copper, ammonia, boron, turbidity, as well as low dissolved oxygen. These pollution impacts appear to be created by inadequate mining practices, compounded by improperly operated Wastewater Treatment Plants that discharge to these waters.

Contamination of California Gulch and adjacent Ruby Mine ponds were investigated by ADEQ and the Arizona Game and Fish Department (AGFD) in 1990. Deaths of wildlife and cattle, that may be related to surface water contamination, have been reported in the area. Transport of metals cadmium, copper, manganese, lead, and zinc within the streambed were demonstrated by sediment samples.

The International Boundary and Water Commission (IBWC), in cooperation with Secretaria de Desarrollo Social (SEDESOL) and EPA, is assessing the existing and future public health and environmental threat associated with present industrial and municipal waste water disposal practices in the border area (EPA and SEDESOL, 1992). The governments of Mexico and the United States will determine existing and future infrastructure needs for collection, treatment and disposal, and will conduct preliminary planning and develop preliminary project budgets. In 1992, a IBWC water treatment study focussed on the Agua Prieta/Douglas area.

San Pedro River Basin

The San Pedro River Basin, to include the Willcox Playa, encompasses approximately 3,740 square miles. Map 4B depicts the San Pedro River Basin. This basin is characterized by its varied land uses and small towns. Grazing is widespread throughout the basin, and irrigated agriculture is limited to isolated locations along the San Pedro River. There is a long history of copper, silver, and gold mining in this basin. The current depressed level of mining activity reflects the poor market condition for precious metals and copper.

The San Pedro River flows north into the United States from Mexico to the Gila River. At the border, ADEQ monitoring in 1990-1991 indicated mercury, selenium, lead, copper, and turbidity exceeded surface water standards. At various monitoring points along the San Pedro (Charleston, Curtis, St. David, near Babocomari Creek, and below Aravaipa Canyon), turbidity and metals continue to exceed standards during high flows, 21-24 cubic feet per second. Abandoned and active mines, and accelerated erosion

due to grazing practices, are believed to be the sources of pollutants in this watershed although currently there have been no instances of accelerated erosion observed in the basin.

On the San Pedro River near the Apache Powder Superfund site, ADEQ monitoring revealed that ammonia, mercury, fecal coliform, copper, lead, and turbidity are polluting the river. Contamination seeps along the river bank from an underground aquifer appear to be a source of this contamination. Elevated levels of nitrates have also been detected; however, a surface water standard for nitrates has not been established. The Apache Powder Company has manufactured explosives and fertilizer since 1922. Prior to 1971, all wastewater was disposed of by flushing it into dry washes; since 1971, the company has stored the wastewater in holding ponds. Groundwater and surface water contain nitrates, nitrites, and strontium. Bottled water is being provided where drinking water supplies have been impacted, while site investigations are being completed and cleanup activities planned.

Since 1986, the Bureau of Land Management has acquired, primarily through land exchange, nearly 36 continuous miles of the free flowing San Pedro River corridor. In 1988, Congress recognized the significance of the area by establishing within it the nation's first Riparian National Conservation Area, thereby providing for the conservation of more than 56,000 acres along the river. Recently, the BLM has initiated efforts to conserve several riparian habitat islands along intermittently flowing portions of the San Pedro River. To date, 365 acres have been acquired, and BLM has an option to purchase an additional 305 acres from other private owners, to protect a five-mile length of perennial stream near Cascabel (Laurenzi, 1992). Conservation of these vital and imperiled riparian communities should help prevent further deterioration of water quality, and may result in measurable improvements in water quality through improved land use management.

Santa Cruz River Basin

The Santa Cruz River Basin encompasses approximately 8,200 square miles. Map 4D depicts the Santa Cruz River Basin. Most of the population in the Santa Cruz River Basin is clustered around the metropolitan area of Tucson. Agriculture is the dominant land use in the basin. Some of the agricultural land has been converted to urban use or retired where water rights have been purchased by mining or urban interests. Grazing is a widespread land use. Mining activities vary with the current market price. Because of extensive groundwater use throughout the basin, the Santa Cruz River has ceased perennial flows. Tributary streams still flow in the Nogales area and in the immediate vicinity of some mountain ranges, but throughout the rest of the basin, surface water runoff results only from wastewater discharges and major precipitation events.

In 1990-1991, ADEQ had monitoring stations at the international boundaries where the Santa Cruz River both enters Mexico and where it re-enters the United States. Sample results indicated full support of designated uses. Previous monitoring where the river re-entered the United States (1988-1989) indicated that metals, turbidity, and ammonia exceeded standards and low dissolved oxygen occurred. Operating and abandoned mines in Arizona and Mexico along the Santa Cruz continue to threaten water quality.

Abandoned mine sites pollute Harshaw Wash with heavy metals, and thereby, threaten Sonoita Creek downstream. The Patagonia Wastewater Treatment Plant has been on several occasions, in noncompliance with its discharge limits for nutrients, biological oxygen demand, soluble solids, and metals. Downstream of this treatment plant on Sonoita Creek, monitoring established that dissolved oxygen and ammonia are not meeting standards.

A serious public health concern has been the contamination of Nogales Wash with raw sewage from Mexico. As a temporary solution, the wash was channelized and chlorine was added by the International Boundary and Water Commission (IBWC). Since then, the water in Nogales Wash has been diverted to the Nogales International Wastewater Treatment Plant in Arizona for treatment. This does not resolve the serious public health threat to United States residents from exposed sewage in Mexico, nor the inability of the Wastewater Treatment Plant to handle the sewage when rainwater is added to the wash. Also, the

Nogales treatment plant has not been able to meet its permit discharge limits, and surface water standards are being exceeded in the Santa Cruz River below its discharge. The IBWC has been working to resolve these problems. Currently, the Wastewater Treatment Plant is being expanded, the sewer collection system in Mexico is being rehabilitated, and industrial pretreatment is to be provided in Mexico and the United States (EPA and SEDESOL, 1992).

Eight lakes in the basin were assessed based on limited monitoring and Arizona Game and Fish Department reports of lake management problems. High pH and/or excessive weed growth was reported in the summer at all of the lakes, indicating seasonal eutrophication. Where monitoring was conducted, turbidity, ammonia, dissolved oxygen, pH, and occasionally a heavy metal did not meet standards. Several of these lakes receive effluent as well as groundwater. Increased management of these man-made recreational lakes is needed to mitigate eutrophic conditions which can lead to algal and weed blooms, fish and wildlife kills, and noxious odors.

Upper Gila River Basin

The Upper Gila River Basin encompasses approximately 7,400 square miles. A map of the Upper gila is listed as Map 4C. The northern one-third of the Upper Gila River Basin is tribal land and was not assessed in the 1992, 305(b) report. The remainder of the basin is owned by the U.S. Forest Service, Bureau of Land Management, or is state land, except for pockets of private land located along the Gila River in the Safford Valley and Duncan/Virden Valley areas, the Clifton/Morenci area, and the upper San Simon Creek area. The federal and state owned lands are used for grazing and recreation, with a minor amount of silviculture in the national forests. Irrigated agriculture demands for water in the Upper and Middle Gila Basins utilizes a high percentage of the Gila River flow. Mining is concentrated near Morenci/Clifton on the San Francisco River.

In the Upper Gila River Basin, recent monitoring revealed that turbidity, copper, and mercury exceed standards at several locations, and Total Dissolved Solids (TDS) increases significantly as the Gila passes through the Safford Valley. Even before the Gila enters Arizona, a USGS monitoring station at Bedrock, New Mexico a report indicates that copper and turbidity would not meet Arizona's surface water standards. Turbidity, copper, and/or mercury exceed standards at several monitoring sites on the Gila River in Arizona including: Solomon, Safford, Calva, and Clifton. Turbidity also exceeded standards on the Blue River, and is believed to be a significant problem on San Simon Creek. Copper mines, grazing, irrigation practices, and forest roads are believed to be primary sources of this turbidity.

Total Dissolved Solid concentrations averaged 597 mg/l in the Gila River at the head of the Safford Valley, but averaged 1770 mg/l downstream at Calva. Return flows from irrigated agriculture in the Safford Valley discharge into the Gila River, and may be a source of this contamination. Where TDS exceeded 1000 mg/l, EPA's guidance concerning impairment of agriculture irrigation uses was applied for this assessment.

Water and soil samples taken by ADEQ down gradient from Phelps Dodge mine in Gold Gulch off Eagle Creek in 1990 indicated continued environmental contamination by zinc, cadmium, copper, manganese, lead, sulfate, as well as low pH values.

In 1990, Congress passed the Arizona Desert Wilderness Act. Included in this Act was the designation of the Gila Box Riparian National Conservation Area. The BLM is directed to conserve, protect, and enhance the riparian and associated areas within this conservation area. Twenty-three miles of the Gila River 15 miles of Bonita Creek and 1/8 mile of the San Francisco River within the Gila Box are considered eligible for inclusion in the Wild and Scenic River System.

Algal blooms and weed problems have been reported by the Arizona Game and Fish Department (AGFD) at lakes in the Upper Gila Basin. The lakes become eutrophic and the pH rises above surface water standards during the summer. Future watershed studies are needed to determine the contribution of

grazing and land development on nutrient loads for these lakes.

Water Quality Limited Waters

Section 303(d) of the Clean Water Act provides for Water Quality Limited Segments (WQLS) where it is known that applicable water quality standards are not being met in a stream segment and/or the segment is not expected to meet applicable water quality standards, even after the application of technology-based effluent limitations.

The 1992 Water Quality Assessment now refers to waterbodies that are not fully supporting all of their designated uses as Water Quality Limited Waters (WQLW). All WQLW have been prioritized for Total Maximum Daily Load (TMDL) analysis, pursuant to Section 303(d) of the Clean Water Act. A TMDL is defined as the sum of the existing or future individual wasteload allocations for point sources of pollution and load allocations for nonpoint and natural background sources. The TMDLs are required when technology-based effluent limitations are not stringent enough to achieve water quality standards for such waters.

The report has developed a 303(d) list, indicating the priority ranking for TMDLs for WQLW in Arizona. New guidance provided by EPA was used to determine this list and resulted in many more bodies being listed than have been previously included on an Arizona WQLS list. The priorities are as follows:

TARGET TMDLs - Waterbodies targeted for TMDL development within two years of inclusion on the 303(d) list.

These are watersheds containing a high density of waterbodies assessed as "non-support," where there is adequate monitoring data available. The SEAGO region currently has no Target TMDLs.

HIGH PRIORITY TMDLs

These are watersheds containing a high density of waterbodies assessed as "non-support," based on monitoring data. However, more monitoring data will be required in order to develop actual TMDLs. Priority for developing these TMDLs will depend on the type of contaminants taking toxicity into consideration, public interest and available resources.

A second group of High Priority TMDLs is waterbodies assessed as not supporting uses because of NPDES facilities in noncompliance due to discharge violations. These waterbodies must be scheduled for TMDL development and NPDES permit review, with in-stream monitoring above and below discharge points in order to determine TMDLs.

MEDIUM PRIORITY TMDLs

There are three groups of waterbodies for Medium Priority TMDLs, any of which could be shifted to high priority due to increased public interest or new information.

1. Waterbodies with existing TMDLs that need to be revised. In some cases, they may be meeting existing surface water quality standards.

2. Waterbodies designated as "not supporting" uses based on an evaluated assessment rather than on monitoring data. More monitoring data is needed.

3. Waterbodies for which a water quality problem is being mitigated through other state or federal programs. The TMDLs will be completed on these waters as necessary, but at this juncture may not be appropriate.

LOW PRIORITY TMDLs

Waterbodies assessed as partially supporting their uses are low priority for TMDL development due to resource limitations.

A listing of the TMDLs in the SEAGO region are found in Appendix 3-7.

Planning Implications, Surface Water Quality Assessment

Section 303(d) of the Clean Water Act establishes a process to provide for more stringent water quality based controls for water quality limited segments using "total maximum daily loads," or TMDLs. States are required to develop and implement TMDLs for all WQLWs, to establish load reductions and Best Management Practices (BMP) for nonpoint sources of pollution, to provide for more stringent limits on NPDES permits and requirements for improvements to wastewater facilities and the establishment of other local controls.

States are required to rank by priority all waters needing TMDLs, so that efforts and resources may be directed toward the most serious problems and most valuable and threatened resources first. The Water Quality Management Plan should set current priorities and identify a process for setting regional priorities in the future. It should also identify a process for developing, implementing and evaluating TMDLs in the region.

TOXICS

Section 304(l) of the Clean Water Act requires states to identify waters adversely affected by toxic pollutants and to develop individual control strategies to control point source discharge of toxic pollutants. These lists help prioritize waterbodies and facilities in Arizona for corrective action.

The Arizona Priority Pollutant Program consists of a multi-agency effort to survey and assess surface water quality. The program is designed to test water, sediment, and fish tissue for the presence of EPA Section 304(l)(C) priority pollutants. Toxics testing is done on selected waterbodies in Arizona based on their suspected pollution potential. Sites were chosen but testing has not been done since 1989. The SEAGO region has no waterbodies being monitored at the present time.

GROUNDWATER

This section of the plan will provide a description and assessment of the water quality conditions in the region's aquifers. Its objective is to summarize groundwater quality conditions and water quality sampling results in the region, identify areas with specific groundwater contamination problems, discuss programs designed to protect groundwater, describe any applicable studies for the region, review major sources of groundwater contamination and describe any trends in groundwater quality.

Groundwater quality is a major concern because it is the principal source of many public water supplies. Approximately one-half of Arizona's drinking water is derived from aquifers, which in turn supplies 65 percent of the population. In 1985, about 74 percent of the water pumped was used for agriculture and the remainder was used for public, industrial, domestic, and stock purposes. Rapid population growth has resulted in cropland retirement and conversion of water supplies to urban uses. Availability of suitable quality water has had a major affect on the location of cities and croplands in Arizona. Agriculture depends heavily on irrigation because annual rainfall is low. Many cities depend entirely on wells for water supply, notably the state's second largest city, Tucson.

Surface water delivery and combined conservation efforts cannot meet continually increasing demands. Groundwater remains a primary source, and therefore, its quality must be understood and protected. All aquifers throughout the state are initially classified for drinking water use (A.R.S. 49-224.B). The ADEQ

has established Aquifer Water Quality Standards (AWQS) consistent with federal primary drinking water standards (A.R.S. 49-223.A). Arizona's AWQS are the cornerstones for the state's comprehensive Groundwater Protection Program.

Groundwater contamination is closely related to land use, with only a very small percentage of contamination incidents due to naturally occurring causes. Contamination may occur in slowly developing pockets or plumes emanating from point sources such as landfills, waste lagoons, or industrial dump sites. A general deterioration of water quality over a wide area may occur as a result of nonpoint sources of pollution such as agricultural fertilizer, pesticide application, or mining activities.

Groundwater Basins/Aquifers

The principal aquifers in Arizona are comprised of unconsolidated alluvium (alluvial aquifers), consolidated sedimentary rocks (sandstone aquifers), and crystalline igneous and metamorphic rocks (bedrock aquifers). The ADEQ has adopted groundwater basin boundaries developed by the Arizona Department of Water Resources (MAP 5). These basins were designated on the basis of physiography, surface drainage patterns, subsurface geology, and aquifer characteristics. As a result of the passage of the Groundwater Management Act in 1980, four Active Management Areas (AMAs) were designated to encompass the largest population centers in the state, where most of the water use occurs and groundwater resources are imperiled by overdraft. The 50 groundwater basins including the Active Management Areas have been grouped into 10 planning regions that represent areas of Arizona where there are similarities between water supply, water use, and other factors relevant to water resource management.

Aquifer boundaries are identified by hydrologic basins and sub-basins. Aquifers are difficult to characterize since they may be heterogeneous, discontinuous, or fractured. Moreover, groundwater moves and mixes slowly making a particular water sample less representative of a defined area. Groundwater occurrence and quality are dependent upon the geology, mineralogy, drainage patterns, and physiography of the three physiographic provinces. The majority of groundwater basins in the SEAGO region fall within the Basin and Range and Central Highlands Provinces. Aquifers in the Basin and Range Province consist of alluvial fill in heterogeneous layers and have large amounts of generally good quality water. Aquifers in the Central Highlands Province are smaller than those in the Basin and Range Province but are composed of similar valley-fill deposits. Some groundwater also occurs in fractured crystalline bedrock. Shallow alluvial aquifers along major watercourses are important local sources of drinking water. Groundwater basin statistics are listed in Appendix 3-8.

Designated Uses/Aquifer Water Quality Standards

All aquifers in Arizona are currently protected for drinking water use, and federal drinking water standards, known as Maximum Contaminant Levels, or MCLs, have been adopted as aquifer water quality standards. Numeric standards have been established for several organic and inorganic chemicals as well as radionuclides, microbiological pollutants and turbidity. These standards are listed in Appendix 3-9. Narrative standards have also been adopted for discharges which may cause pollutants which endanger human health or impair existing or future uses of aquifers or which could violate surface water quality standards.

In addition to these enforceable aquifer water quality standards, Arizona Department of Health Services has issued health based state action level guidelines for a number of organic contaminants, primarily Volatile Organic Chemicals (VOCs), which may possess toxic and carcinogenic properties. These will continue as guidelines until additional MCLs or state Aquifer Water Quality Standards are adopted.

Monitoring and Assessment

The Water Quality Assessment for SEAGO's 1979 Water Quality Management Plan focused on surface

water rather than groundwater problems, in part because of the inadequacy of groundwater data at that time. The primary information base available at that time was a survey conducted by the USGS in 1968 which, along with other studies, was used by the Arizona Water Commission to develop maps showing quality of groundwater in terms of dissolved solids, changes in water levels, amount of groundwater pumpage and storage, water surface elevations, and direction of water flow. However, the level of detail was inadequate to describe local situations in the region.

The ADEQ now maintains a Groundwater Quality Database which includes data from a number of agencies monitoring and reporting on groundwater quality. These include ADEQ, ADWR, EPA, USGS and various local and regional agencies. Activities include ambient groundwater monitoring, monitoring of public water supply systems, and focused monitoring for compliance, source investigations and regulatory cleanup actions. Accuracy and completeness of data in the ADEQ database depends on the existence of monitoring wells and the level of agencies' compliance with state reporting requirements. Most monitoring reported in ADEQ's Water Quality Assessment Report for 1990 was in the state's four Active Management Areas where most of Arizona's population and wells are found. For Water Years 1988-1989, over 900 wells were sampled for at least one parameter.

The ADEQ includes a report of groundwater quality in its annual Water Quality Assessment Reports (305(b) and 205(j) Reports). At the time ADEQ prepared its 1990 report, the groundwater quality database management system was in the process of being developed and not all available data was included. No additional data was included in ADEQ's 1991 Water Quality Assessment (205(j) Report). Information reported is incomplete and will be updated as new data becomes available. Discussion of groundwater quality in the SEAGO region will be supplemented by other reports as they are available. Sampling results as reported by ADEQ in its 1992 report are shown in Appendix 3-10. Results are broken down by major group of contaminants and by groundwater basin for planning regions. Two numbers are provided for each category. The first number represents the number of wells within a particular groundwater basin which were tested for a "water quality parameter group." The second number represents the total of wells in that groundwater basin that reported measurable results for that parameter, defined as "hits." Well numbers are not duplicated, so that figures do not represent multiple sampling events of the same well.

A number of major studies have been completed in the past few years which have focused on problems with groundwater quality. Two such studies of particular concern to the SEAGO area are the Nogales Wash and Apache Plant studies.

Nogales Wash

Nogales Wash has long been a receiving water for uncontrolled sewage and other waste flows as mentioned in the prior discussion of surface water contamination and wastewater treatment improvements. Direct public exposure to waters within the wash as well as groundwater contamination through percolation are of public concern.

Shallow groundwater exists within the alluvial aquifer along the wash, with water table depths ranging from about 10 to 25 feet. Groundwater flow is generally to the north. Municipal wells supplying Nogales, Arizona are deep, not located close to the wash and not likely to be influenced by pollutants at the surface or in shallow groundwater. Several public water supply systems serving mobile home parks and produce warehouses have wells close to Nogales Wash, and ADEQ and Santa Cruz County have identified more than 89 private wells tapping the shallow aquifer.

The ADEQ nominated the Nogales Wash area as one of the original WQARF (State Superfund) sites and contracted with Earth Technology Corporation to perform an investigation completed in 1988, determining levels, area extent and potential sources of industrial solvent contamination in groundwater along the wash. Eighteen wells and several surface water locations were sampled. Organic constituents found included PCE, TCE, TCA, DCA, and DCE. Although no federal primary drinking water standards were

exceeded in the wells, four of them showed PCE concentrations exceeding the Health Based Guidance Level (HBGL) of 1.0 part per billion (ppb). The highest level observed for PCE was 2.2 ppb. The study did not identify any significant sources of solvents on this side of the border, but did propose that the wash is a potential route of contamination. The WQARF report did not assess the potential for pathogen contamination.

Recommendations provided by Earth Technology included: 1) curtailing use of blending for several wells exceeding HBGLs; 2) sampling wells south of the border; 3) completing the source survey of industrial facilities with follow-up site audits; 4) installing monitoring wells near the border to serve as a pollutant migration warning system.

The Udall Center for Public Policy Studies at the University of Arizona has been conducting studies under a grant from the Ford Foundation relating to water resources in the Ambos Nogales area, integrating information and studying public network relationships on both sides of the border. In the summer of 1990, to collect background information, the Udall Center, with personnel and lab support from ADEQ, conducted a water resource inventory on both sides of the border. Wells, drinking water systems, surface water, and wastewater were sampled for Safe Drinking Act inorganics, VOCs and bacteria. Representatives of Mexican agencies and universities participated in the sampling and analysis.

Results of the Udall Center Study have been released to the public. In Mexico, while most of the wells and water systems showed little concern other than traces of bacteria, significant levels of contaminants were identified in three wells in the central area of Nogales, Sonora. PCE and TCE in the 10-20 ppb range and TCA in the 100 ppb range showed up in three of the shallow public supply wells sampled. DCE and DCA also were present in trace quantities. These wells also contained nitrate and coliform bacteria above standards. At this time, a source or sources of the contamination are not easily identified.

With concern about the potential impact of surface flows on groundwater, ADEQ and Santa Cruz County personnel conducted a sampling program for bacteria to screen private wells located along Nogales Wash. During October 1990, some 89 wells were sampled extending along the wash from the border to as far north as Tumacacori. Those wells with bacterial detection were resampled at least twice. Thirty-eight wells consistently showed detection of coliform bacteria. Nine wells were found to contain fecal coliform in excess of the drinking water standard of 4 CFU/100 ml. The ADEQ sampled three of these wells for parasites and viruses and none were present. The source of the bacterial problem is still not known since sources other than Nogales Wash, such as septic systems and livestock, are prevalent in the area.

In January 1991, IBWC began chlorination of surface flows in the main channel of Nogales Wash approximately one mile south of the border. The state's chlorination systems were subsequently removed. Testing during summer of 1991, indicated that the chlorination was effective. The Arizona Department of Health Services will review all the data collected in the Nogales area and perform a comprehensive risk assessment. All potential routes of exposure are to be considered.

A collaborative sampling effort involving ADEQ, IBWC, Santa Cruz County Health Department, City of Nogales, and the University of Arizona was organized to identify and assess environmental and public health impacts in the surface water and groundwater along Nogales Wash. This effort is still on going as of the summer of 1993.

St. David

The EPA funded 205(j) grant in the St. David area was undertaken to ascertain the source of high nitrate readings in both surface and groundwater. Two series of tests were run. The first of these was inconclusive in regard to the source of the nitrate contamination but did serve to focus the second series of tests in the groundwater aquifer and to the west of the San Pedro River, which serves as a divider of the groundwater or shallow aquifer.

From the information obtained in the second test series, a nitrate contamination plume was extrapolated using well locations, the level of nitrate present, and the underground water flows as previously mapped by the USGS. This plume seemed to indicate a source located at the Apache Powder manufacturing facility.

During the study, land use was examined to identify any potential point source by use. Again, Apache Powder was the only local source of nitrate in the levels demonstrated. In addition, the most common source of nitrate contamination, agricultural fertilizer, exhibits a diffuse pattern rather than a plume.

The Nitrates Task Force reviewed the test data and other information that was provided by its members as well as the SEAGO office. Their conclusions indicated Apache Powder is the most likely source of the groundwater contamination. Their recommendations included providing another source of domestic water for those residences with water exceeding the state's nitrate levels, possible methods of aquifer clean-up, proposed notification to prevent any additional domestic well development in the affected area, and to correct the contamination problem at its source.

Aquifer Water Quality Assessment

The SEAGO region falls within two of the six groundwater planning regions and contains 13 groundwater basins. Most surface water in the region drains to the Gila River. However, waters from three basins, the Douglas, San Rafael and the San Bernardino Valley, drain southwest towards Mexico. For simplicity, the 13 basins can be divided into secondary groupings based on geographic location and geohydrologic characteristics:

Southeast Arizona Planning Region

Tributaries or contributors to the Safford Basin:

- Duncan Valley Basin
- Morenci Basin
- Bonita Basin
- Safford Basin

Tributary to the San Pedro/Gila River:

- Upper San Pedro Basin
- Lower San Pedro Basin
- Aravaipa Canyon

Tributary to Santa Cruz River:

- Cienega Creek Basin

Basins with Mexican outflow:

- San Bernardino Valley Basin
- Douglas Basin
- San Rafael Basin

Closed basin with internal drainage:

- Willcox Basin

Active Management Planning Region

- Tucson AMA

Throughout the region, groundwater generally meets drinking water standards mandated by federal and state legislation. However, there are some instances of isolated groundwater contamination problems within the region, and these problem areas are listed in Appendix 3-11.

Potential Threats to Groundwater in the SEAGO Region

While groundwater in the SEAGO region as assessed in Water Year 1988-1989 was generally good and in compliance with aquifer water quality standards, additional contaminants have been identified in the report for Water Years 1990-1991 and that good quality could be further threatened in the future.

Leaking Underground Storage Tanks (LUST)

Petroleum, diesel fuel and hazardous chemicals are often stored in tanks buried underground. In many cases, the tanks are old and either the tanks or associated piping is leaking or may leak in the future. These leaks can cause fires or explosions, and can also result in contamination of groundwater. Underground Storage Tanks are regulated by the EPA and the state, and ADEQ maintains a listing of tanks and reported releases, or leaks, from these tanks.

The ADEQ issues an Annual Report for Water Quality and Waste Programs that provides information on reported releases. Data from the current report is summarized for the SEAGO region in Table 3-1. Of the 2,246 leaks reported in Arizona, 133 or about 6 percent, are in the SEAGO region. The most are in Cochise County, and almost half of all the leaks in the County were reported in the Ft. Huachuca/Sierra Vista area.

The ADEQ has also developed a database with information about Underground Storage Tanks (USTs), such as tank age, construction and corrosion protection, which has been used to estimate the number of USTs that may leak. According to EPA information, USTs over 15 years old and constructed of uncoated, bare steel pose a high risk for release. The ADEQ reports that 7,627 of 22,758, or one-third of USTs in the state fall into this category. More information on LUSTs is contained in the nonpoint source pollution section covered later on in the plan.

Mining Operations/Tailings

While past mining operations have primarily affected surface water quality in the region, as might be expected there are several instances of groundwater impacts caused by mining operations in the Bisbee and Safford areas. Groundwater quality problems due to anthropogenic and naturally occurring contaminations can be found throughout the state. These include fluoride, hexavalent chromium, arsenic and selenium as well as radiochemicals. The Bisbee/Naco area has unusually high sulfate levels, a condition commonly associated with mining. Information about mining and sand and gravel operations in the region is contained in the nonpoint source section of the plan.

Septic Systems

Septic tanks can be responsible for surface and groundwater contamination, primarily from nitrates. Rural communities generally depend on on-site sewage disposal systems as their primary means of wastewater treatment. These systems may be in various states of disrepair, and even approaching failure. Many of these failing systems are located in older neighborhoods and were installed prior to any mechanism being developed for an on-site system approval process. In some rapidly growing rural areas, the incidence of individual system failures may be sufficiently serious enough to threaten the aquifer, and local drinking water supplies.

Elevated levels of nitrates have been identified in some locations in SEAGO, primarily where areas are growing rapidly, and where only portions of some communities are served by centralized wastewater treatment systems. Historically, septic and sewage disposal systems have caused water quality problems in the Bisbee area, but have been eliminated by the construction of a central sewage treatment system. Otherwise, septic systems are not a severe problem for Cochise County but failures are starting to occur in various locations. Additionally, there is still considerable construction taking place in the unincorporated areas of Cochise County, and these areas must be monitored to ensure that problems don't develop.

Septic systems have been identified as having a direct impact on both surface and ground water quality within the Santa Cruz River Basin. Santa Cruz County in particular has been experiencing problems with septic system failures, and in several subdivisions new development has been halted until the problems can be resolved. In the northern part of the region, several communities rely largely on septic systems for wastewater treatment, including Bowie, Fort Thomas, Pima and Solomon. More information about septic system concerns is contained in the point source section of the plan.

Planning Implications, Aquifer Water Quality Monitoring

Potential impacts from on-site wastewater treatment systems and septage disposal must be addressed in areas with increasing development and growth of permanent and/or seasonal population. This seasonal or transient population will have a growing impact if the region is successful in developing the tourism industry or the Free Trade Agreement results in an increase in migrant farm workers in the region. The waste management and nonpoint source sections of the plan must address groundwater as well as surface water impacts. The plan should include recommendations for establishing wellhead protection programs in areas where groundwater supplies are threatened.

RECLAIMED WATER SECTION

Wastewater Treatment Facilities (WWTF) all generate effluent, and the disposition of this effluent is a continuing issue for the region. Facilities have a number of options in disposing of the treated wastewater. An increasingly popular method of disposal is the reuse of the reclaimed water within their service area. Reuse is regulated under A.A.C. Title 18, Chapter 9, Article 7, and limits are based on the type of reuse proposed.

Facilities reusing the treated effluent must obtain a reuse permit from the Arizona Department of Environmental Quality. The reuse permit defines the requirements and effluent limitations for both the waste treatment facility and the user of the effluent. Pasture irrigation, livestock watering, irrigation of landscaped areas and some types of agricultural crop production are allowable reuse of effluent. Reuse of effluent from wastewater treatment facilities is becoming an increasingly important method of effluent disposal in the SEAGO region. Regardless of how it is regulated, the use of reclaimed water in the region will take on increasing significance.

The following are important considerations in determining the feasibility of using reclaimed water, or the land application of effluent.

Hydrology

Understanding the hydro-geochemical components or groundwater's relationship to the geological surrounding and the possibility of chemical leaching of a site is important in developing plans for the reuse of reclaimed water. Additionally, a knowledge of area aquifer characteristics, flow direction, and velocity are important factors in reuse planning.

Climate

The area's growing season is an important factor in determining soil application rates and times. This, coupled with area precipitation and evaporation rates play an important role in planning for the reuse of effluent.

Soils

Soil characteristics, depth, slope, texture, drainage, permeability and organic matter content, determine the soil's ability to store nutrients and any potential contamination. Land application of effluent requires computation of loading rates for water, nitrogen, heavy metals, and organic materials. A loading rate is defined as the amount of wastewater or pollutants placed on the soil during a specified period of time. If wastewater is applied at a proper rate, crops can absorb and use pollutants such as nitrates, thus preventing them from entering the groundwater.

Wastewater Characteristics

A complete analysis of the wastewater or effluent to be applied is necessary prior to its application to soil or crops. Although many of the potentially toxic elements in the reclaimed water will receive treatment, some heavy metals, Synthetic Organic Chemicals (SOCs) and Volatile Organic Chemicals (VOCs) may be retained in the soil and have a detrimental effect on crops, livestock, or the groundwater.

Crops

Crop selection is important when using reclaimed water. Aquifer protection hinges on the ability of the selected plants and soil to consume the total amount of reclaimed water as well as any nutrients or pollutants contained in the effluent.

Planning Implications, Reclaimed Water

The reuse of effluent should be encouraged in areas where water availability is a problem but the impacts of this reuse must be considered. Modifying a discharge system for reuse may have an adverse impact on riparian areas in effluent dominated waters. Different applications for reuse will have varying degrees of importance to the region.

Facilities in the SEAGO region currently possessing reuse and NPDES permits are listed in Table 3-1.

TABLE 3-1
REUSE FACILITIES IN THE SEAGO REGION

FACILITY NAME	REUSE PERMIT NUMBER
CITY OF SAFFORD	R0003-05
TOWN OF DUNCAN	R0003-06
BELLA VISTA RANCHES	R0004-02
HOLY TRINITY MONASTERY	R0016-02
CITY OF WILLCOX	R0023-02