

208
AREAWIDE
WATER QUALITY
MANAGEMENT PLAN UPDATE



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Arizona Department of Environmental Quality

Prepared by the
Central Arizona Association of Governments

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Maxine L. Leather

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GLOSSARY OF ACRONYMS

AAC.....	Arizona Administrative Code
ADEQ.....	Arizona Department of Environmental Quality
ADHS.....	Arizona Department of Health Services
ADOC.....	Arizona Department of Corrections
ADOT.....	Arizona Department of Transportation
ADWR.....	Arizona Department of Water Resources
AGFD.....	Arizona Game and Fish Department
AgI.....	Agricultural Irrigation
AgL.....	Agricultural Livestock Watering
AMA.....	Active Management Area
ANRCD.....	Arizona Natural Resource Conservation District
APP.....	Aquifer Protection Permit
ARS.....	Arizona Revised Statute
ASARCO.....	America Smelting and Refining Company
ASLD.....	Arizona State Land Department
ASP.....	Arizona State Parks
ASUA.....	Arizona Small Utilities Association
A&Wc.....	Aquatic and Wildlife, Cold Water Fishery
A&We.....	Aquatic and Wildlife, Ephemeral
A&Wedw.....	Aquatic and Wildlife, Effluent Dominated
A&Ww.....	Aquatic and Wildlife, Warm Water Fishery
AWQA.....	Arizona Water Quality Assessment
AWQMP.....	Areawide Water Quality Management Plan
BADCT.....	Best Available Demonstrated Control Technology
BLM.....	Bureau of Land Management
BMPs.....	Best Management Practices
BOD.....	Biological Oxygen Demand
BoR.....	Bureau of Reclamation
BTEX.....	Benzene, Toluene, Ethelxylene, Butyl Xylene
CAAG.....	Central Arizona Association of Governments
CAFO.....	Concentrated Animal Feeding Operation
CAP.....	Central Arizona Project
CERCLA.....	Comprehensive Environmental Response, Compensation, and Liability Act of 1990
CDBG.....	Community Development Block Grants
CFD.....	Community Facilities District
CFR.....	Code of Federal Regulations
COG.....	Council of Governments
CDPs.....	Census Designated Places
CPP.....	Continuing Planning Process for Water Quality Management
CSGWPP.....	Comprehensive State Groundwater Protection Program
CWA.....	Clean Water Act of 1972 (amended 1987)
DBCP.....	Dibromochloropropane

DMA	Designated Management Agency
DoA.....	Department of Agriculture
DoD	Department of Defense
DPA.....	Designated Water Quality Management Planning Agency
RASTIC.....	Depth to Groundwater, Net Recharge, Aquifer Media, Soil Media, Typography, Impact of the Vadose Zone and Hydraulic Conductivity
DWS.....	Domestic Water Source
EDB.....	Ethylene Dibromide
EDWs.....	Effluent Dominated Waters
EIS.....	Economic Impact Statement
EPA	Environmental Protection Agency
EPC	Environmental Planning Committee
EQA.....	Environmental Quality Act of 1986
FBC	Full Body Contact
FC	Fish Consumption
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FmHA.....	Farmer's Home Administration
FR	Federal Register
FSN	Fixed Station Network
FY.....	Fiscal Year
GAO	Government Accounting Office
GMA	Groundwater Management Act of 1980
GPD	Gallons Per Day
GWPP	Ground Water Protection Permit
HHW.....	Household Hazardous Waste
HSWA	Hazardous and Solid Waste Amendments of 1984
HWM.....	Hazardous Waste Management
IGA.....	Intergovernmental Agreement
INA.....	Irrigation Non-Expansion Area
IRM.....	Information Resource Management
ISTEA	Intermodal Surface Transportation Efficiency Act
LMPs.....	Land Management Plans
LUST	Leaking Underground Storage Tank
MAG	Maricopa Association of Governments
MCL	Maximum Contaminant Level
METF	Mineral Extraction Task Force
MGD.....	Million Gallons Per Day
MOU.....	Memorandum of Understanding
MSIDD	Maricopa Stanfield Irrigation and Drainage District
MSWL.....	Municipal Solid Waste Landfill
MUSYA	Multiple Use Sustained Yield Act of 1960
NACOG	Northern Arizona Council of Governments
NAWQA	National Water Quality Assessment Program
NEPA.....	National Environmental Policy Act of 1969
NFMA	National Forest Management Act of 1976
NPDES.....	National Pollutant Discharge Elimination System

NPS	Nonpoint Source
NRC	National Resource Conservation District
NTU	Nephelometric Turbidity Unit
OWP	Overall Waste Program
PBC	Partial Body Contact
PCB	Polychlorinated Bi phenols
PCE	Tetrachloroethylene
PCS	Petroleum Contaminated Soil
POTW	Public Operated Treatment Works
PPA	Pollution Prevention Act of 1990
ppm	Parts per Million
Pri-MCL	Primary Maximum Contaminant Level
RAAC	Riparian Area Advisory Committee
RCAC	Rural Community Assistance Corporation
RCRA	Resource Conservation and Recovery Act of 1976
RC&Ds	Resource Conservation and Development Areas
RMPs	Resource Management Plans
RPA	The Forest and Rangeland Renewable Resources Planning Act of 1974
RV	Recreation Vehicle
SARA	Superfund Amendments and Reauthorization Act of 1986
SCS	Soil Conservation Service
S.D.	Sanitary District
SDW	Safe Drinking Water
SDWA	Safe Drinking Water Act of 1974 (amended 1977)
SEAGO	Southeastern Arizona Governments Organization
SEDUE	Secretaria de Defarrallo Urbano y Ecologia (predecessor of SEDESOL)(EPA for Mexico)
SIC	Standard Industrial Classification
SM	Sludge Management
SMCL	Secondary Maximum Contaminant Level
SRF	State Revolving fund
STORET	Storage and Retrieval Database Maintained by EPA
SWM	Solid Waste Management
SWQA	State Water Quality Assessment
TAS	Treatment as a State
TCE	Trichlorethylene
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TPHC	Total Petroleum Hydrocarbons
TSCA	Toxic Substance Control Act of 1976
UIC	Underground Injection Control
USDA	U. S. Department of Agriculture
USFS	U. S. Forest Service
USFWS	U. S. Fish and Wildlife Service
USGS	U. S. Geological Survey
USNPS	U. S. National Parks Service

Central Arizona Association of Government
208 Areawide Water Quality Management Plan Update 1994
Glossary of Acronyms

USR.....	Underground Surface Recharge
UST	Underground Storage Tank
VOCs.....	Volatile Organic Counpounds (chemicals)
WATAG.....	Watercourse Alteration Technical Advisory Group
WHP	Wellhead Protection Program
WQARF.....	Water Quality Assurance Revolving Fund
WQLS.....	Water Quality Limited Segments
WQM.....	Water Quality Management
WQMP.....	Water Quality Management Plan
WQMWG.....	Water Quality Management Working Group
WWTF.....	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

Chapter 1 EXECUTIVE SUMMARY

The Central Arizona Association of Governments (CAAG) is the designated Areawide Water Quality Management Planning Agency for Gila and Pinal Counties under Section 208 of the Clean Water Act. Section 208 requires development of areawide water quality management plans which must include, at a minimum, (a) identification of municipal and industrial treatment works for a 20-year planning period; (b) a description of program activities to control nonpoint source pollution; (c) identification of agencies necessary to carry out the plan; and, (d) identification of implementation measures.

This Areawide Water Quality Management Plan (AWQMP) is a comprehensive update and revision of CAAG's 1978 Plan for the two-county area. It does not however, address the Indian lands of the Ak Chin, Gila River and Tohono O'odham Indian Reservations located in Pinal County nor the Tonto Apache, White Mountain or San Carlos Apache Indian Reservations located in Gila County although activities on these lands may affect downstream users. (See Map 3/3a in Chapter 3.)

The AWQMP considers changes in federal laws and programs as well as impacts of new state programs developed as a result of the 1986 Environmental Quality Act. It also considers changes which have occurred in the region since 1978, and regional AWQMP goals and objectives.

The planning process for this plan revision began in early 1991, and the opportunities for public involvement were offered during issues identification and development of the project scope of work; after development of background material and to review project direction, and during public review and comment on the draft plan. Public review and comment took place during the summer of 1994. The plan is organized into eight major sections:

1. An Executive Summary of the AWQMP.
2. The state and federal laws, regulations and programs affecting water quality.
3. A description of the planning area.
4. A description of the water resources in the planning area.
5. A point source management plan element.
6. A nonpoint source management plan element.
7. A drinking water section.
8. A regional continuing planning process section.

Much current data is contained in the appendices to the plan and these are designed to be removed and updated as new information is available.

1.1 CHAPTER 2: STATE AND FEDERAL LAWS, REGULATIONS AND PROGRAMS AFFECTING WATER QUALITY

CAAG's AWQMP reviews federal and state laws and programs for protection of water quality and identified implications for water quality management planning in the region.

Major federal and state laws that form the basis for state water quality management programs include the 1972 Clean Water Act (CWA) with major amendments in 1987, which focuses primarily on protection of surface water; the Safe Drinking Water Act (SDWA) as amended in 1986 with a focus on protection of public drinking water supplies; Arizona's 1986 Environmental Quality Act (EQA) (please note that at the printing of this document, federally adopted and state proposed

amendments are in process) which created the Arizona Department of Environmental Quality (ADEQ) and requires that programs be adopted by rule to protect both surface and groundwater; and, Arizona's 1980 Groundwater Management Act (GMA) which established the Arizona Department of Water Resources (ADWR) to manage groundwater resources.

The 1987 amendments to the CWA placed increased emphasis on control of nonpoint source pollution and expanded the NPDES permit program to include municipal and industrial storm water discharge. State programs developed under the EQA include the Aquifer Protection Permit (APP) Program and programs to control nonpoint source pollution through implementation of Best Management Practices (BMPs). The 1986 amendments to the SDWA place more stringent requirements on drinking water supply systems for treatment, monitoring and reporting.

1.2 CHAPTER 3: PLANNING AREA DESCRIPTION

CAAG's plan also reviews land ownership, land use and population in the region. Patterns of growth as seen in 1980 and 1990 Census Data are different from those projected in the 1978 Plan. The major difference is a much lower growth rate in the region, particularly in the Copper Basin area, where the decline in mining and the elimination of over 4,000 mining jobs has had a negative impact on growth. The Town of Florence, located in Pinal County shows a high increase in population growth resulting from their annexation of the State Prison. Also, much of the growth experienced in both counties has been in the unincorporated areas where retirees have been drawn to newly developed subdivisions. These higher rates of growth place increased demands on infrastructure, including need for water supply and wastewater treatment systems in those areas.

1.3 CHAPTER 4: WATER QUALITY ISSUES

CAAG's AWQMP revision includes a review of ADEQ Assessment Reports for surface and groundwater quality in the region. In its 1994 Draft Water Quality Assessment Report, ADEQ identified and prioritized a number of surface waters where water quality standards to protect designated uses are not being met. For the highest priority stream segments, ADEQ intends to develop "Total Maximum Daily Loads" (TMDLs) which will be used to establish load reductions for nonpoint sources of pollution and to provide the basis for more stringent limits for point source (NPDES) permits, and provide for planning inputs in the future.

ADEQ's 1994 Draft Water Quality Assessment Report has no "Target TMDLs" the highest priority for development of TMDLs, for streams in the CAAG region. It does however, list a number of other streams as high priority for TMDL development. All Water Quality Limited Waters, or sections of surface waters that do not meet water quality PH standards, are listed in the appropriate appendix.

This section of the plan also discusses groundwater quality in the region, with a brief discussion of the problems. Problems identified with the Salt River Basin associated with ammonia and turbidity are those from Cherry Creek to Roosevelt Lake. Studies of Pinal Creek, Miami Wash and Bloody Tanks Wash have identified manganese, ammonia, Copper and TDS as concerns. Tonto Creek, located in this same basin, lists ammonia, mercury and turbidity as problems. The San Pedro River Basin has identified problems with Copper(t), Copper(d), Zinc, Ph, Chromium and Cadmium(t) at Copper Creek. The Upper Gila River Basin along the San Francisco River to San Carlos Lake identified problems with ammonia, turbidity, boron, mercury and nitrogen. A portion of the Verde River Basin and a portion of the East Verde River has identified a problem with turbidity, arsenic, lead, nickel, mercury, beryllium and T-Phos [ADEQ 305 (b) Draft Report, 1994]. This

section also discusses actions suggested and/or taken to alleviate the problems.

1.4 CHAPTER 5: POINT SOURCE MANAGEMENT

New state permit programs established by ADEQ mean that a large number of facilities, including wastewater treatment works, mining operations and industrial facilities must now acquire a permit for discharges from the facility or reuse of effluent. There are approximately 51 facilities within the CAAG region which require an individual permit. Of these, 84% have or will require Aquifer Protection Permits and NPDES permits also. This section of CAAG's plan reviews types of permits and includes a list of facilities. Recommendations are also made for ADEQ to address problems with technical review and permitting.

Projection of water waste treatment needs over the 20-year planning period focus on more densely populated areas, which are identified as incorporated places and census designated places with populations of 1,500 people or more. Areas which are projected to need new or expanded wastewater treatment facilities are listed. Recommendations are made for planning responsibilities in unincorporated areas and for special districts. The plan also makes a number of recommendations regarding what should be included in wastewater treatment facility plans for these areas in order to be consistent with the AWQMP.

A review of historical compliance data reported by ADEQ from 1989 through 1992 indicated that over half of the approximately 51 facilities requiring individual permits were in compliance with state and/or federal requirements. The major problem area of compliance for licensed facilities seemed to be in having a certified operator. Within the 25 non-permitted facilities, the major non-compliance issue was the operation and maintenance problems found during a facility inspection. Recommendations are made to address point source compliance problems, primarily through improved programs for technical assistance and enforcement of current programs.

A number of other issues are discussed and recommendations made relative to point source management, including disposal of sludge and non-hazardous liquid waste, household hazardous waste, pre-treatment requirements, onsite wastewater treatment and solid waste management. Included as an appendix to this section of the plan is a description of all currently permitted facilities within the CAAG region and renewal due dates by facility type and basin.

1.5 CHAPTER 6: NONPOINT SOURCE MANAGEMENT

This section of the plan reviews a number of federal and state programs to control nonpoint source pollution, including the NPDES permit program for storm water runoff, the Section 404 Dredge and Fill Permit Program, Arizona's Aquifer Protection Permit Program, Arizona's regulatory program for underground storage tanks, and Arizona's nonpoint source programs for certain categories of nonpoint source pollution. Existing NPDES permits within the CAAG region are noted in Appendix 5-1 and in a general trends analysis of these discharges within the NPS Management Chapter. Because some of these programs may not adequately protect sensitive resources and because control of nonpoint source pollution is largely a land use and land management decision best made at the local level, this section of the plan identifies areas where there is opportunity for local control and involvement. Public involvement is encouraged for permit decisions and for management of pollution on public lands through the NEPA/Environmental Assessment process and BMP Development Committees. Recommendations are made for management agency designations, for ADEQ, for other federal and state agencies including ADOT and for local governments.

1.6 CHAPTER 7: DRINKING WATER

There are approximately 300 active public drinking water systems in the CAAG region. Most drinking water systems in the region are small to very small systems with over 85% of the systems serving fewer than 500 persons; over half (52%) serving 100 persons or less. Less than 10% of the systems serve more than 1000 persons. The high percentage of small systems has a significant impact with respect to the cost of compliance with new regulations and increased monitoring requirements mandated by the 1986 amendments to the SDWA. All public systems using surface water supplies must provide filtration and disinfection, regardless of system size and additional treatment may be required to meet new standards. Sampling requirements and frequencies are based on the type of system and with one or two exceptions are the same regardless of the number of people served. This makes the per capita cost of compliance much higher for smaller systems. A review of ADEQ Water Quality and Waste Programs Annual Report for 1990, 1991, and 1992, indicates a steady improvement rate in the percentage of violations by systems within the CAAG region with the exception of having a certified operator in charge of the system.

The SDWA amendments have dramatically expanded the federal role in the regulation of public water systems in February, 1994. The SDWA required EPA to set national standards for contaminants in drinking water and oversee the implementation of state drinking water programs. State governments, through their health departments and environmental protection agencies, are expected to accept the major responsibility, called primary enforcement authority, for implementation and enforcement of the SDWA. Arizona expects adoption of this additional primary package through a State rule in November, 1994.

This section of the plan includes a number of recommendations with an emphasis on ways to ensure that water supplies are provided by systems with the financial, technical and managerial capability to operate and maintain those systems long-term. Regionalization and/or consolidations of small water systems, where feasible, is encouraged, consistent with forthcoming rules. Recommendations are also included for ADEQ and for improved technical assistance by other organizations to help facilities comply with regulations.

1.7 CHAPTER 8: REGIONAL CONTINUING PLANNING PROCESS

This plan must be consistent with federal and state laws and programs for water quality management and is directly influenced by other federal and state laws and programs. Therefore, it must be updated and amended as changes occur in those laws and programs. Local and sub-regional water quality management plans, facility plans and individual facilities and permits must be consistent with this plan as well as other local and sub-regional water quality plans. Every attempt has been made to reconcile existing facility and DMA planning efforts to date and those efforts which are anticipated in the immediate future. If local plans or facilities are not consistent with this plan, either they must be changed or this plan must be changed.

The regional continuing planning process defines how this plan will be kept up-to-date as changes occur; how consistency between local plans, facilities and permits and this plan will be determined; under what condition a plan amendment may be required and the process to be used for amending the plan and how the public will be involved in the continuing planning process.

Chapter 2 STATE AND FEDERAL LAWS, REGULATIONS AND PROGRAMS AFFECTING WATER QUALITY

There are four major Federal laws and resulting regulations and programs that have an impact on water quality planning: the 1972 Clean Water Act with major amendments in 1987, which focusses primarily on protection of surface water; the Safe Drinking Water Act as amended in 1986 with a focus on protection of public drinking water supplies; the 1980 Comprehensive Environmental Response, Compensation, and Liability Act which provides for response to releases of hazardous substances; and, the 1976 Resource Conservation and Recovery Act, along with the Hazardous and Solid Waste Amendments of 1984, which regulate hazardous and non-hazardous solid waste. Two Arizona laws, the Groundwater Management Act of 1980 and the Environmental Quality Act of 1986, along with the Federal laws, form the basis for State water quality management programs.

2.1 MAJOR FEDERAL WATER QUALITY MANAGEMENT LAWS

2.1.1 Clean Water Act (33 USCA § 1251)

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. It requires that States establish water quality standards as goals to be achieved for navigable waters. Standard setting involves two steps: designating uses to be protected and determining the water quality level (criteria) needed to support those uses.

In order to protect quality and designated uses of navigable waters, the Act makes discharge of pollutants unlawful unless it is permitted under the CWA. Provision is made for establishing effluent limitations based on (1) available technology and (2) water quality criteria for the waters into which the effluent is discharged.

The National Pollutant Discharge Elimination System (NPDES) program is established to issue permits which apply effluent limitations to ensure compliance with established navigable water quality standards. The CWA also prohibits disposal of sewage sludge except in accordance with a NPDES permit and requires the EPA to develop regulations and provide guidelines for sludge disposal. In Arizona, the NPDES program is administered by the EPA in cooperation with the State. Before a permit may be issued, the State must certify, under Section 401 of the CWA, that the discharge will not result in violation of Arizona's water quality standards or other requirements.

The NPDES program deals with discharge of wastewater, both point source and nonpoint source, into surface waters. To protect waters from pollution associated with discharge of other materials, the CWA established a permit program under Section 404 for discharge of dredged or fill material into navigable waters. This program is administered by the U.S. Army Corps of Engineers. As with the NPDES program, states must certify that permitted discharges will not result in violations of water quality standards.

Initial emphasis in implementation of the CWA was on the development of controls and wastewater treatment facilities necessary to prevent discharge of pollutants to surface water. It provided for planning and funding of construction for publicly owned treatment works in addition to regulatory programs. Amendments to the CWA in 1987 changed the focus of the act. Major changes included a high priority on control of toxic pollutants, provisions for regulating storm water runoff through the NPDES program, and programs to control nonpoint source pollution. In addition, the Federal grant program for funding construction of publicly owned wastewater treatment facilities was phased out, to be replaced by a revolving loan program at the State level.

The 1987 amendments to the CWA expanded the NPDES program to include municipal and industrial storm water discharge. Implementation of the storm water requirements is to begin with industrial activities and municipal systems serving populations greater than 100,000.

A new section (319) was added which requires states to develop nonpoint source management programs which identify waters which cannot be expected to meet water quality standards without additional action to control nonpoint source pollution, identify nonpoint source categories contributing to that pollution, and define processes for identifying control measures. This section also establishes a grant program for implementation of management programs.

The CWA as amended places increased emphasis on control of toxic pollutants, with requirements for development of water quality criteria for toxins. States are also required to identify waters which cannot reasonably be expected to meet water quality standards due to toxic pollutants, even after application of technology based controls. For each of these, states must identify responsible point sources and develop individual control strategies to reduce discharge of toxic pollutants within three years.

The CWA requires each state to prepare a biennial report which describes the quality of its navigable waters and analyzes the extent to which it protects wildlife and recreational use and the extent to which pollutant discharge limits have been achieved. This report is also to describe nonpoint sources of pollution and make recommendations for control of those sources. If point source discharges, with effluent limitations, interfere with attainment of water quality to assure protected uses, control strategies are to be established.

The CWA also provides for water quality management planning. Section 208 provides for development of areawide waste treatment management plans and for designation of waste treatment management agencies to implement portions of those plans. Plans developed under this section are also to include a process for identification of certain nonpoint sources of pollution. Section 303 requires states to have a continuing planning process for water quality management.

2.1.2 Safe Drinking Water Act (42 USC Ss 300f)

The purpose of the Safe Drinking Water Act (SDWA) is to ensure that drinking water supplied to the public is safe and wholesome. Federal regulations promulgated under the SDWA establish goals and standards for all drinking water supplied to the public: maximum contaminant level (MCL) goals, MCLs and secondary MCLs. The MCL goal is the level of contamination associated with no adverse health effects, and is a goal, not an enforceable standard. The MCL is an enforceable standard which is based on the MCL goal but which also takes costs and technologies into consideration. Secondary MCLs are guidelines only, related to the aesthetic quality of water (taste, odor, color). Primary standards may also include treatment technique requirements for contaminants which are difficult or costly to measure. Instead of setting MCLs, the EPA may require specific water treatment practices such as filtration or corrosion control to prevent health problems.

Amendments to the SDWA in 1986 increased EPA and State drinking water program responsibilities, requiring development of standards for additional contaminants including volatile organic compounds (VOCs), stringent filtration and disinfection requirements, and increased monitoring. The 1986 amendments also prohibit use of lead pipes, solder or flux in any public water system or plumbing in any facility connected to a public water system. The SDWA also provides for protection of underground sources of drinking water through state underground injection control programs, sole source aquifer designation, and wellhead protection program requirements.

As this document is being prepared, the U.S. Senate is taking action on a Safe Drinking Water Act reform bill. This bill has moved on to the House. When action is taken on a federal level, ADEQ will propose state rules for the contaminants addressed in the final regulations which are promulgated by EPA.

ADEQ is responsible for enforcing the SDWA in Arizona and is required to adopt and enforce drinking water standards and rules that are at least as stringent as those adopted by the EPA. Drinking water suppliers are responsible for implementing standards, and meeting monitoring and reporting requirements. Suppliers are also responsible for notifying the public in the event that standards are violated.

2.1.3 Resource Conservation and Recovery Act (42 USC Ss 6901)

The purpose of the Resource Conservation and Recovery Act of 1976 (RCRA) is to regulate hazardous and solid waste. Under Subtitle D, which deals with non-hazardous solid waste, the EPA developed solid waste management criteria which were the minimum criteria to be met by the States in their programs. New Federal regulations for solid waste disposal facility criteria were promulgated in 1991 which establish more stringent criteria for landfills, including water quality monitoring. However, solid waste management is primarily a state and local responsibility with little EPA regulation.

Hazardous waste management programs under Subtitle C of RCRA regulate entities that generate, transport, treat, store and dispose of hazardous waste. These programs include tracking of hazardous waste from its generation to its disposal through a system of manifests and permits.

Subtitle I of RCRA establishes a regulatory program for underground storage tanks (USTs). USTs are regulated through standards developed by EPA for tank design, installation, removal and monitoring.

The 1984 Hazardous and Solid Waste Amendments to RCRA provide additional standards for small quantity generators and underground storage tanks containing hazardous wastes or other regulated substances. RCRA was amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA) which established a mechanism for response to release of regulated substances from underground storage tanks and established a leaking UST (LUST) trust fund. SARA also strengthened programs under the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) which provides authorities to respond to releases of hazardous substances and establishes the Federal "Superfund."

2.1.4 Comprehensive Environmental Response, Compensation and Liability Act

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) provides authorities to respond to releases of hazardous substances and establishes the Federal "Superfund." Federal programs under this act were strengthened with the 1986 Superfund Amendments and Reauthorization Act (SARA). SARA also provides for stronger State involvement in the cleanup process.

2.2 MAJOR STATE WATER QUALITY MANAGEMENT LAWS

2.2.1 Environmental Quality Act (A.R.S. § Title 49)

The Environmental Quality Act of 1986 established the Arizona Department of Environmental Quality (ADEQ) as the responsible agency for all purposes of the Clean Water Act, the Safe Drinking Water Act, and RCRA. It also transferred responsibility for air quality to ADEQ from the Department of Health Services. The EQA addresses protection of both surface and groundwater, and requires the Director of ADEQ to adopt water quality standards by rule for both navigable waters and aquifers. It also requires that programs be adopted by rule to protect both surface and groundwater, and to control both point and nonpoint source pollution discharges.

The EQA requires any discharging facility to obtain an Aquifer Protection Permit (APP). An APP may be issued only to facilities designed, constructed and operated to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology (BADCT). The EQA also identifies conditions under which general permits may be issued and specifies criteria for developing best management practices (BMPs) which may be required by a general permit. General permits with BMPs for regulated agricultural activities (application of nitrogen fertilizer and concentrated animal feeding operations) are required to be adopted by rule.

EQA provisions include a water quality assurance revolving fund (WQARF) to cover costs of remedial action, with requirements for rules to be adopted for use of the fund and for determining priorities and selection of remedial actions to be undertaken. Arizona Department of Water Resources (ADWR) has joint authority with ADEQ for conducting feasibility studies and remedial investigations for groundwater.

The EQA also provides for regulation of pesticides and gives the Director of ADEQ responsibility for pesticide contamination prevention. The Act requires information to be submitted on pesticides registered for use in Arizona and requires establishment of a "groundwater protection list" of pesticides that have the potential to pollute groundwater. Use of listed pesticides must be regulated.

The Director of ADEQ is required by the EQA to conduct ongoing monitoring to determine compliance with applicable standards and effectiveness of BMPs and BADCT. The EQA provides for compliance orders, civil and criminal penalties for violation of water quality standards. It also allows for citizen suits to enforce the Act.

2.2.2 Groundwater Management Act

The purpose of the Groundwater Management Act of 1980 (GMA) was to control severe overdraft of groundwater supplies in some parts of the state and to provide a means for allocating limited groundwater resources. The GMA established the Arizona Department of Water Resources (ADWR) to manage groundwater resources and established four Active Management Areas (AMAs) in areas where groundwater supplies were most threatened. It required development of management plans and regulatory programs for these AMAs to achieve a long-term balance between the amount of groundwater used and the amount of recharge of aquifers ("safe yield"). In addition, two Irrigation Non-Expansion Areas (INAs) were established where groundwater supplies are insufficient to provide a reasonably safe supply of irrigation water. The GMA places emphasis on the quantity of groundwater available in critical areas, although water quality may be included as a consideration in AMA planning.

Management plans for each AMA must establish conservation requirements for agricultural, municipal and industrial users, as well as evaluate means of augmenting water supplies through such measures as groundwater recharge and reuse of effluent. The Second Management Plans for each area also include groundwater quality assessments and water quality management programs developed in coordination with ADEQ.

The GMA established grandfathered rights to groundwater, as well as procedures for selling those rights; methods to reduce withdrawals through conservation, augmentation of water supply and purchase and retirement of farmland; other management methods and rules for transportation of groundwater. Wells are regulated under the GMA, which requires licensing of well drillers, registration of existing wells and ADWR approval for new wells. Injection wells are regulated by ADEQ.

2.3 MAJOR PROGRAMS FOR WATER QUALITY MANAGEMENT IN ARIZONA

The Federal and State laws set out the basic requirements for water quality management programs which must be developed by appropriate designated agencies. Primary responsibility for meeting Federal water quality management requirements falls on the Environmental Protection Agency (EPA). The Arizona Department of Environmental Quality (ADEQ) has primary responsibility for State programs, although the Department of Water Resources shares responsibilities for some programs. Major program categories include program planning, designation of water uses and development of standards to protect those uses, water pollution control programs, monitoring and assessment, compliance and enforcement, and program evaluation.

2.3.1 Program Planning

The CWA provides for development of waste treatment management plans under Section 208, which are to identify treatment works necessary to meet anticipated municipal and industrial waste treatment needs over a 20-year period, and to include a process for identification of certain nonpoint sources of pollution. The 1987 amendments also provided for development of State nonpoint source management plans. States are also required to have a continuing planning process which includes effluent limitations and total maximum daily loads with schedules of compliance, priority rankings of waste treatment works needs, and elements from applicable areawide waste treatment plans. Each of these plans required by the CWA must be approved by the EPA.

Arizona has developed required State plans, including a Nonpoint Source Management Plan and Wellhead Protection Program, and recently revised the State Continuing Planning Process. In addition to required plans, the Arizona Department of Environmental Quality has developed a number of strategies, such as the Groundwater Protection Strategy and Groundwater and Surface Water Monitoring Strategies, which provide the framework to guide program implementation and evaluation.

2.3.2 Designated Uses/Water Quality Standards

Water quality standards are required by Federal law for surface waters and for public drinking water supplies. State law requires standards for surface waters, groundwater and drinking water. These standards are based on the uses for which waters are designated to be protected, and serve as the water quality goals for management programs.

2.3.2a Surface Water

Section 303 of the Clean Water Act requires States to establish use designations and water quality standards for navigable waters which must be reviewed every three years ("Triennial Review"). Arizona's Environmental Quality Act requires the Director of ADEQ to adopt surface water quality standards by rule, and also provides that the Director may adopt water quality standards for waters of the State not included under navigable waters. In 1992, the State adopted revised standards for navigable waters but did not include standards for other waters.

Establishing water quality standards requires the designation of uses for navigable waters and development of standards which will protect those uses. In Arizona, uses are designated by rule, with "fishable and swimmable" used as a baseline goal to meet CWA requirements. Designated uses may be revised, under specified conditions, if water quality improvements allow a use not currently designated.

Narrative water quality standards are defined which apply to all navigable waters. Numeric standards are established for each designated use and apply to listed waters and tributaries unless superseded or supplemented by standards prescribed specifically for unique waters or effluent-dominated waters. Changes adopted in 1992 include addition of numeric standards for priority (toxic) pollutants as required by the 1987 amendments to the CWA.

Water quality standards rules also define State antidegradation policy which prohibits degradation of water quality where the existing quality does not meet standards and provides that if existing water quality is better than standards, it shall be maintained except under specifically defined conditions. (Ref: A.A.C. § R18-11-104.)

Adopted State water quality standards for navigable waters must be approved by the EPA as the oversight agency for implementation of the Clean Water Act. If State standards are less stringent than Federal requirements, the EPA must establish water quality standards for the State.

2.3.2b Groundwater

Under the EQA, all aquifers in the State are classified to be protected for drinking water use, although the EQA also provides a process for reclassification of aquifers to non-drinking water status. (Ref: A.A.C. § R18-11-503) The EQA established primary drinking water MCLs as drinking water aquifer standards for the State and requires the Director of ADEQ to adopt additional MCLs as aquifer water quality standards within twelve months of their adoption by the EPA. It also allows the Director to adopt additional numeric standards if necessary to protect human health. To date, the State has adopted MCLs only as aquifer water quality standards.

2.3.3 Water Pollution Control Programs

A number of regulatory and voluntary programs have been established at the Federal and State level to control or prevent pollutants from impairing protected uses of surface and groundwater.

2.3.4 Technical Review/Operator Certification

State sewerage system rules (A.A.C. § R18-9-804) require ADEQ approval of plans prior to construction of sewage systems, including septic tank systems, and requires that these systems be in conformance with the Certified Water Quality Management Plan for that area. The rules also require final approval of construction, specify minimum requirements for sewage systems, and refer to Engineering Bulletins which provide minimum design guidelines for sewage systems. State

Drinking Water Rules (A.A.C. § R18-4-216) also require ADEQ review and approval of public and semi-public water supply system plans and construction and specifies minimum requirements.

The EQA (A.R.S. § Title 49) require's certificates of approval to construct water or wastewater treatment facilities (A.R.S. § 49-461) and certificates of approval of construction for sanitary facilities in residential subdivisions (A.R.S. § 49-104.B.11); public and semi-public swimming pools (A.R.S. § 49-104.B.12); solid waste disposal facilities, landfills and transfer stations (A.R.S. § 49-762); and sludge reuse (A.R.S. § 49-331-336).

State certification rules (A.A.C. § R18-4, Article I) require that public water systems and wastewater treatment plants be run by certified operators. Certification requirements are also established.

2.4 POINT SOURCE CONTROL PROGRAMS

2.4.1 National Pollutant Discharge Elimination System (NPDES) Program

In order to protect water quality and designated uses, the CWA (Section 301) prohibits discharges to surface waters except as permitted under the Act. Provision is made for establishing effluent limitations based on available technology and water quality criteria for the waters into which the effluent is discharged. The CWA (Section 402) also establishes the NPDES program to issue permits which apply and ensure compliance with established effluent limitations.

The NPDES program is administered by the EPA in cooperation with the States. States may, and are encouraged to, submit proposals to the EPA to administer their own NPDES programs. While the EQA requires the Director of ADEQ to adopt a permit program for point source discharges to navigable waters which would allow State administration of the NPDES program, Arizona is not actively pursuing NPDES primacy.

Before a NPDES permit may be issued, the State must certify under Section 401 of the CWA that the discharge will not result in violation of State navigable water quality standards or effluent limitations. The NPDES program also requires public notice and opportunity for comment.

2.4.2 Effluent Limitations

Effluent limitations for publicly-owned treatment works (POTWs) are based on secondary treatment. Effluent limitations for industrial discharges are generally technology-based and require application of "best available control technology economically achievable" for that class of industry. New sources are required to meet standards of performance reflecting the greatest degree of effluent reduction achievable at the time they begin discharge. In cases where application of technology-based effluent limitations does not allow attainment of water quality standards, more stringent controls may be required (i.e. water quality based effluent limitations).

2.4.3 Pretreatment

For industries discharging to publicly owned treatment works, effluent limitations may be different from those required for discharge directly to a receiving water. The CWA established a National Pretreatment Program to prevent the discharge of pollutants through treatment works and to prevent discharge of pollutants into POTWs which could interfere with operations or expose POTW workers to chemical hazards. The EPA has established federal standards which prohibit discharge of certain types of pollutants as well as categorical standards which apply to industrial users in specific industrial categories. POTWs may also set local discharge limits as needed to meet water quality standards or to comply with sludge management regulations.

All POTWs greater than 5 million gallons per day (mgd) are required to have pretreatment programs as a condition of their NPDES permits, and smaller plants may be required to have programs if types of discharges into the plant warrant pretreatment. Pretreatment programs must be approved by the EPA.

2.4.4 Sludge Management

The CWA prohibits disposal of sewage sludge except in accordance with a NPDES permit and requires the EPA to develop regulations and provide guidelines for disposal. Technical regulations have been adopted which limit pollutants allowed in sludge for certain uses. Arizona requires an Aquifer Protection Permit (APP) for agricultural application of wastewater sludge and has issued a general permit for sludge applications meeting specified conditions. (A.A.C. § R18-9-128)

2.4.5 Storm Water Discharge

The 1987 amendments to the CWA expand the NPDES program to include municipal and industrial storm water discharge. Currently, as this document is being printed, new proposals have been under the review and comment period which may amend the CWA in 1994. Permits for industrial storm water must meet technology-based effluent limitations, while municipal permits require controls to reduce the discharge of pollutants to the maximum extent practicable. Implementation is to begin with industrial activities and municipal storm sewer systems serving populations of 100,000 or more.

Regulations provide for individual, group and general permits for industrial discharge. The EPA has issued a general permit for industrial storm water discharge in areas where it retains NPDES primacy, including Arizona. This permit is intended as a baseline permit for all categories, requiring notification of the EPA by dischargers who must develop plans for controlling storm water runoff and pollution. The EPA strategy also provides for more stringent permits for facilities in watersheds shown to be threatened by storm water discharge and for industries which are shown to need more stringent controls.

Arizona includes urban runoff, and development of urban runoff best management practices in its nonpoint source program which is discussed below. Storm water NPDES permits are included in the nonpoint source management section of this plan.

2.4.6 Dredge and Fill (404) Permits (CWA Section 404)

Section 404 of the CWA established a permit program for discharge of dredged or fill material into navigable waters. This program is administered by the Army Corps of Engineers, although as with the NPDES program, States are encouraged to submit proposals to administer their own programs. Also, as with the NPDES program, States must certify under Section 401 of the CWA that permitted discharges will not result in violations of State navigable water quality standards. This program also is used to provide Federal protection of wetlands as defined in regulations adopted in 1989.

Several activities which may require Section 404 permits, such as construction and sand and gravel mining, are considered nonpoint sources of pollution in Arizona and are included in the nonpoint source discussion below and in the plan.

2.4.7 Aquifer Protection Permit Program (A.R.S. § Title 49, Chapter 2, Article 3)

The State Aquifer Protection Permit Program, established by the EQA, is designed to regulate facilities that may discharge to groundwater. It replaces the Groundwater Quality Protection Permit Program which was established in 1984. The APP program covers a wide range of facilities including injection wells, land treatment facilities, mine tailings piles and leaching operations, septic tank systems with a capacity greater than 2,000 gallons per day, and sewage or sludge ponds and wastewater treatment facilities.

Individual permits may be issued only to facilities designed, constructed and operated to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology (BADCT). BADCT guidance documents have been established for several types of facilities, including mining operations, landfills and municipal wastewater treatment facilities. These guidance documents outline ADEQ's review processes, available control technologies, site characteristics and other considerations which can influence selection of BADCT. BADCT for a particular facility is site- specific and is determined through negotiations with ADEQ.

General permits may also be issued under certain conditions and may require application of best management practices (BMPs). These may be required for a number of activities, including, urban runoff, silvicultural activities and septic tank systems with a capacity of less than 2,000 gpd. General permits are required by the EQA, and regulations have been adopted, for certain agricultural activities (application of nitrogen fertilizer and concentrated animal feeding operations).

2.4.8 Drywell Registration (A.R.S. § Title 49, Chapter 2, Article 8)

Drywells are injection wells constructed strictly for disposal of storm water and must be registered in Arizona. A license is required to drill drywells. Other injection wells are considered discharging facilities and are regulated under the APP Program.

2.4.9 Reuse Permits

Reuse of reclaimed wastewater for beneficial use requires a Reuse Permit (A.A.C. § R18-9, Article 7). Requirements are established for both the wastewater treatment facility that generates the reclaimed water and for the user of the reclaimed water. Allowable types of reuse are identified and specific numeric parameters are established for different types of reuse including pasture and crop irrigation, livestock watering, irrigation of landscaped areas with restricted and open access, and incidental or full body contact. There are additional requirements for application of reclaimed water for specific uses as well as requirements for restricting public access.

2.5 **NONPOINT SOURCE CONTROL PROGRAMS**

The CWA as amended in 1987 required States to develop management programs for nonpoint source pollution. Arizona's Nonpoint Source Management Program was completed in 1989. It identifies categories of nonpoint sources including agriculture, silviculture, construction, urban runoff, resource extraction, land disposal, hydraulic/habitat modification, and recreation. Regulatory and other programs for controlling nonpoint source pollution are outlined and responsible agencies are identified.

2.5.1 Aquifer Protection Permit Program

Some categories of nonpoint source pollution, including mining and land disposal, are covered under the APP Program. Individual permits are required for mine tailings piles and ponds and mine leaching operations. A general permit has been issued for wash water from sand and gravel operations and placer mining operations, as long as no hazardous substances are used, added or exposed in the process. General permits have also been issued for septic tank systems with flows of less than 2,000 gallons per day and for sewage disposal systems with flows of between 2,000 and 20,000 gallons per day, if they meet certain conditions.

2.5.2 Best Management Practices

Best management practices (BMPs) have been adopted by rule for some agricultural activities (application of nitrogen fertilizer and concentrated animal feeding operations). For other nonpoint source categories, such as silviculture and grazing, agreements with land managers (Memoranda of Understanding) are being developed for nonpoint source management. Advisory committees have been formed for development of best management practices for some categories, such as grazing.

2.5.3 Riparian Area Protection

Alteration of riparian areas falls under the hydrological/habitat modification category of nonpoint source pollution. Protection of riparian areas is also provided for in Arizona by Executive Order 91-6 which outlines State policy recognizing the critical nature of riparian areas and encouraging management practices which will result in maintenance of existing riparian areas and restoration of degraded riparian areas. It also establishes an Interagency Riparian Areas Coordinating Council and provides for development of a statewide riparian management plan and legislation mandating state riparian area protection.

2.5.4 Underground Storage Tanks

Underground storage tanks (USTs) are regulated under RCRA and the EQA. USTs must be registered with ADEQ and records kept. Release detection systems are required and immediate action must be taken in the event of a release to stop the leak and mitigate the impacts.

2.5.5 Wellhead Protection Program

The SDWA as amended in 1986 requires States to establish Wellhead Protection Programs to protect groundwater used to supply public water systems. Development of a program includes delineation of the area to be protected, identification of potential sources of contamination and development of management approaches to protect groundwater from pollution sources. It also requires contingency plans for alternative supplies in the event of contamination of water supplies.

Arizona's Wellhead Protection Program relies on existing, comprehensive programs for groundwater protection (also outlined in the State Groundwater Protection Strategy) with emphasis on educational measures. The EPA has also developed a strategy for groundwater protection and guidance documents for development of wellhead protection programs which focus more on local programs and solutions than does Arizona's State program. Demonstration programs have been funded in Pima and Yuma Counties in Arizona.

2.6 FACILITY FINANCING

Federal and Arizona environmental legislation have not generally included provision of funding for facility construction. Title II of the Clean Water Act is an exception, which provided for a grant program to fund construction of publicly-owned waste treatment works. In 1987, Title VI was added which provides for grants to the States for establishment of revolving funds for construction of treatment works and for implementation of nonpoint source management programs. State revolving fund programs, which require State matching funds, replace the Federal construction grant program.

In 1989, the State of Arizona established the Wastewater Management Authority of Arizona which may issue bonds to provide matching state funds for the program and has since issued rules for the loan program which establish eligibility criteria and a process for developing a priority list of eligible point source projects similar to that used in the construction grants program. A separate priority system is used for nonpoint source pollution demonstration projects under CWA § 319 and is consistent with the criteria defined in the State Nonpoint Source Management Plan.

Under Arizona's rules, the State is to publish an Intended Use Plan each year which will identify communities to receive assistance and to identify the types of financial assistance and interest rates. It is expected that interest rates will depend on the bond ratings of the communities receiving financing, since they must secure the bonds.

2.7 MONITORING AND ASSESSMENT

ADEQ has developed Surface and Groundwater Quality Monitoring Strategies to guide statewide monitoring efforts. These strategies include development of networks to monitor current water quality and to develop information for identification of water quality trends.

2.7.1 Ambient Water Quality Monitoring Networks

Monitoring of ambient surface and groundwater quality is done to determine whether water quality standards are met and to identify areas where water quality is threatened or standards violated. Fixed station monitoring consists of taking samples at representative sites along major rivers and areas of critical interest. Samples are collected at regular intervals for extended periods and are analyzed on a broad range of parameters. Surface water monitoring stations are maintained by the USGS as well as ADEQ. Water quality information from this network is kept in the Storage and Retrieval (STORET) database maintained by the EPA.

2.7.2 Facility Monitoring

Water and wastewater facilities must conduct monitoring as part of permit and system requirements and report results to ADEQ, which maintains a database for monitoring and compliance tracking. ADEQ conducts construction inspections to ensure that water and wastewater facilities are constructed in accordance with approved plans and specifications. Compliance assurance inspections are performed periodically to monitor the operation and maintenance of facilities. Priorities are developed annually to identify facilities to be inspected based on an evaluation of compliance history, date of last inspection and complaints received. Results of these inspections are published each year in ADEQ's Water Quality and Waste Programs Annual Report.

2.7.3 Special Investigations

The State also conducts intensive surveys and repeated sampling as complaints are received or problems occur.

2.7.4 State Water Quality Assessment (305(b) Report)

Section 305(b) of the CWA requires States to prepare a biennial report which describes the quality of its navigable waters and analyzes the extent to which it protects wildlife and recreational use and the extent to which pollutant discharges have been achieved. This 305(b) Report also describes nonpoint sources of pollution and makes recommendations for control of those sources. ADEQ includes an assessment of both surface water and groundwater quality in its 305(b) Reports.

The State Water Quality Assessment is based on monitoring data for the report period where available, with other waters evaluated based on previous assessments, older data and field reports. The Report identifies the principal water quality problems for the State as well as major sources of pollutants. The 305(b) Report is used by the State more as the basis for planning to address problem areas than as a basis for enforcement actions.

The 305(b) Report is updated in off years with a 205(j) Assessment Report, which highlights significant changes from the 305(b) Report.

2.7.5 Toxic Pollutants (304(l) List)

Section 304(l) of the CWA requires the State to identify waters which cannot reasonably be expected to meet water quality standards due to toxic pollutants, even after application of technology based controls.

2.7.6 NAWQA Program

In 1994, USGS began the National Water Quality Assessment Program (NAWQA) in Arizona. NAWQA is a nationwide program with sixty study units, one of which is located in Arizona labeled the Central Arizona Basins. This will be an on-going program repeating in 10 year cycles including planning, retrospective analysis and reconnaissance reviewing existing data, intensive data collection and interpretation including in field testing, reporting and low-intensity sampling. NAWQA's purpose is to ascertain and describe the current baseline status of water quality on a national basis and assess long term trends and compare and contrast study areas including interdisciplinary analysis. The goals of NAWQA are to provide long term monitoring, study and research, timely interpretation of information and better availability and use of information.

2.8 **COMPLIANCE AND ENFORCEMENT**

2.8.1 Water and Wastewater Facilities

If a wastewater facility is not in compliance with its NPDES permit conditions, ADEQ must report the noncomplying system to the EPA, who has enforcement responsibility. If a facility is in violation of conditions of a state APP, reuse or groundwater protection permit, ADEQ may take administrative action, usually via a cease and desist order. ADEQ may also seek injunctive relief and request a civil penalty through action filed in Superior Court.

If there is a violation of drinking water standards (MCLs), system owners must notify users of the violation. ADEQ may also initiate enforcement action in the form of notices of violations, administrative orders, or informal measures such as meetings and verbal notifications. In some cases, violations may be referred to the Attorney General's Office for legal action. The EPA may also require States to initiate enforcement actions if water systems are in violation under a strategy authorized by the 1986 Amendments to the SDWA.

2.8.2 Individual Control Strategies

For each of the waters identified under Section 304(l), States must identify responsible point sources and develop individual control strategies to reduce discharge of toxic pollutants within three years.

2.8.3 Administrative Orders

ADEQ may issue compliance orders against facilities which do not comply with State rules or permits. The agency may also enter into a consent order with a facility that has shown a willingness to comply with the requirements. The Environmental Protection Agency issue administrative orders and notices of violation for facilities which do not comply with Federal permits.

2.8.4 Legal Action

The Director of ADEQ may seek injunctive relief for facilities which are not in compliance with State rules or permits, and may ask that a civil penalty be assessed against the owner through an action filed in Superior Court. If a person violates a water quality standard or discharges without a permit knowingly or with criminal negligence, it is a criminal violation subject to action by the attorney general. The EQA also provides for citizen suits if state water quality standards or permit requirements are violated.

2.8.5 Remediation

The Federal superfund program, authorized by CERCLA, gives the EPA the responsibility to assure that all appropriate remedial response actions are taken in the event of a release, or threat of a release, of a hazardous substance into water, land or air. ADEQ is the lead agency for purposes of CERCLA in Arizona, and provides some support to Federal superfund activities which involve groundwater contamination. The Environmental Quality Act also established a Water Quality Assurance Revolving Fund (WQARF) and allows ADEQ to require development of a program to remedy pollution which endangers, or has already contaminated, waters of the state.

The Leaking Underground Storage Tank Trust Fund (LUST Trust) was established by SARA in 1986 to pay the costs of EPA or State- initiated corrective action, as well as for some enforcement and cost-recovery activities at sites of release from USTs containing petroleum. ADEQ is cooperating with the EPA to implement the LUST Trust program in Arizona, and is developing rules which will allow the State to administer its own UST/LUST program.

2.8.6 Program Evaluation

Assessment and monitoring may be used to determine whether water quality management programs are effective in protecting designated uses and maintaining or improving water quality. The primary tool for this in Arizona is the annual water quality assessment (305(b) or 205(j) report) which is also used to identify priority water quality problems. This may be used in conjunction with facility monitoring data in ADEQ's Annual Report to evaluate water quality management programs.

Plans and strategies may be revised as necessary to increase effectiveness of programs in maintaining and improving the quality of Arizona's waters.

2.9 WATER QUALITY MANAGEMENT PROGRAM IMPLEMENTATION DISCUSSION OF ISSUES AND IMPACTS

2.9.1 Program Planning

State and Areawide Water Quality Management Plans developed in the late 1970's as required by the Clean Water Act have become out of date as changes have occurred in laws, regulations and programs as well as in the regions. Limited availability of Federal funds for planning has also affected the ability of planning agencies to keep the plans update. Areawide plans have also, to some extent, been supplanted by a number of State plans and strategies developed to meet requirements of the EQA and 1987 amendments to the CWA. Outside of State public participation requirements, there is no clearly defined process for regional involvement in State water quality management planning except through the 208 planning process. The exception is for 208 Plan Amendments and participation of the Councils of Government in the State Water Quality Management Working Group.

Regional plans should define a process for maintaining areawide plans in the future. They should also make recommendations for regional involvement in development of State plans and programs. Plans should also consider integration of multiple programs and planning efforts as a means to facilitate understanding and coordination (e.g, through the Continuing Planning Process).

2.9.2 Designated Uses/Water Quality Standards

2.9.2a Surface Water

Arizona is required by the EQA to adopt numeric criteria for all priority (toxic) pollutants. The EPA has been slow in developing the necessary criteria documents for the 126 priority pollutants required by the CWA, and some of the documents which exist are out of date. ADEQ has derived its own numeric criteria designed to protect human health and aquatic and wildlife designated uses for all priority pollutants.

State water quality standards adopted in 1992 are generally based on national information because of a lack of data specific to the southwest or regions within the State. In the future, state standards may be developed which are designed to protect the ecological integrity of particular ecoregions. ADEQ has initiated the process of defining regions which are similar based on climatological data, geological surveys, soil surveys, chemical data and vegetation data and plans to begin biological and chemical data collection from selected reference sites in 1992. The process of collecting data, identifying appropriate ecoregion boundaries and developing biological criteria may take ten years.

2.9.2b Impacts of Revised Standards

Additional and/or more stringent water quality standards as adopted by ADEQ in 1992 are expected to result in additional needs for wastewater treatment. The cost of implementing surface water quality standards is a major concern.

The greatest impact of criteria for toxic pollutants is expected to be on wastewater treatment facilities which receive wastewater from industrial dischargers. These facilities may need to establish more stringent pretreatment requirements which would pass the impact on to industries which discharge into municipal wastewater treatment systems. Some industries which discharge

directly to navigable waters would also be affected. As required by Section 304(l) of the CWA, Arizona has identified some navigable waters which cannot be expected to attain water quality standards for toxic pollutants even after application of technology-based effluent limits. These data indicate that only ten (of 126) priority pollutants are of a concern in Arizona. Therefore, ADEQ concludes that impact of proposed numeric toxic pollutant criteria will be low and will not require upgrading of wastewater treatment facilities.

Compliance with standards for total ammonia and total residual chlorine will require nitrogen and chlorine removal by wastewater treatment facilities. In its Economic Impact Statement for the proposed rules, ADEQ estimated that implementation of nitrogen removal at approximately 130 wastewater treatment plants statewide could cost several hundred million dollars over the next 5-8 years. ADEQ's estimated cost for statewide implementation of ultraviolet irradiation or ozonation is over \$40 million. ADEQ does not consider these costs attributable to the revised standards but rather the results of implementation of the narrative standard "no toxins in toxic amounts." (Ref: ADEQ Economic Impact Statement submitted to the Governor's Regulatory Review Council in support of ADEQ's proposed water quality standards rules, March 1991.)

Adoption of drinking water maximum contaminant levels (MCLs) as surface water quality standards for radiochemicals is expected to have an impact in the Little Colorado River basin, where the adopted standards will provide a regulatory basis for implementation of nonpoint source controls.

2.9.2c Issues for Regional Planning

Implementation of navigable water quality standards will require facilities which discharge to surface waters to meet more stringent standards. Alternative measures to meet requirements will have to be evaluated, including upgrading of facilities and alternatives to surface water discharge. Costs of engineering studies and modifications to facilities could be significant. Regional plans should include identification of compliance requirements and schedules for discharging facilities. Financing alternatives should also be discussed.

Regional plans should also identify surface water segments where nonpoint source controls may be required to meet more stringent standards.

2.9.2d Groundwater

Adoption of MCLs as aquifer water quality standards may mean that standards are more stringent than natural background. However, impacts are primarily on users of groundwater or discharging facilities. These impacts are discussed under drinking water and the aquifer protection permit program.

2.9.3 Water Pollution Control Programs

2.9.3a Technical Review/Operator Certification

Plans should consider whether recommendations could be made to improve effectiveness at the regional level, including training.

2.9.3b Point Source Control Programs

1. NPDES Permit Programs

Amendments to the Clean Water Act in 1987 imposed new NPDES program requirements for effluent limitations for toxic pollutants, sludge management and storm water discharges.

2. Effluent Limitations

Effluent limitations are affected by revisions to surface water quality standards. Issues associated with these impacts are discussed under water quality standards. Technology-based effluent limitations for industrial dischargers may further be affected by guidelines developed by the EPA. Regional plans should consider whether there are appropriate guidelines for industries in the regions and make recommendations as necessary for additional or revised guidelines.

3. Pretreatment

Pretreatment programs are controlled by POTWs, who determine which of their industrial users should be regulated, issue permits with discharge limits, monitor compliance and take enforcement actions when necessary. Discharge limits may be based on EPA standards which prohibit discharge of certain types of pollutants and on standards which apply to specific categories of industrial users. Limits may also be set locally to meet water quality criteria or to comply with sludge management regulations. Pretreatment programs in Arizona, which does not have NPDES pretreatment primacy, must be approved by the EPA.

Regional plans should consider whether pretreatment programs are adequate and whether they are enforced. Lack of technical or financial resources may affect the ability of POTWs to set appropriate limits. POTWs may also be reluctant to fully enforce pretreatment programs or to publish the required list of significant violators for a number of reasons, including concern about potential liability if the limit violated was challenged and found not to be technically sound, or concern that users might become less cooperative.

4. Sludge Management

Disposal of sludge in landfills has been a common disposal method in the past, but will be limited in the future due to Federal regulations for municipal solid waste landfills (MSWLFs) which were adopted in October 1991 and prohibit disposal of liquids in MSLWFs. If sludge is to be disposed of in a MSLWF, it must pass the "paint filter test" (i.e. must contain at least 20% solids) which requires substantial dewatering.

Federal regulations adopted in February 1993 establish standards for other methods of sewage sludge disposal: application to agricultural and non-agricultural land, placement in or on surface disposal sites, and incineration. The rule includes specific numerical limits for several pollutants as well as management practices, monitoring and record keeping requirements. Reporting is required for facilities required to have approved pretreatment programs or publicly owned treatment works with design flows of one MGD or more.

Regional plans should identify current methods of sludge disposal for facilities and address possible need for changes as a result of new regulations for solid waste disposal. Alternative methods should be considered, including the possible need for more stringent pretreatment requirements to meet sludge quality standards.

5. Aquifer Protection Permit Program

Many facilities in Arizona have filed Notices of Disposal and will be required to obtain Aquifer Protection Permits. The permitting process requires substantial resources to implement and has moved slowly since the APP rules were adopted. However, in June of 1991, new legislation required that schedules of compliance be established for all facilities which have submitted Notices of Disposal, based on a list published on January 1, 1992 with deadlines for application submittal. Deadlines are based on the degree of risk posed by each facility and an ADEQ work plan to process all permit applications no later than January 1, 2001.

Regional plans should include a schedule for compliance with APP program requirements. Coordination with Federal NPDES permit schedules and State reuse permit programs should be considered. Resource issues should also be addressed.

2.9.3c Nonpoint Source Control Program

Arizona's Nonpoint Source Management Program identifies a number of nonpoint sources of pollution requiring best management practices or other control measures. Responsibilities for planning and implementation of control measures are also identified. The program also specifies criteria for establishing priorities for funding nonpoint source management projects.

Regional plans should address development and implementation of best management practices for activities which contribute to non-point source pollution in the region, and responsible management agencies should be identified at the regional and local level. Plans should identify existing or potential demonstration or watershed projects. BMP monitoring and evaluation should also be addressed.

Wellhead protection programs should also be considered in regional plans as a local means of implementing controls on potential sources of pollution. Plans should identify areas where groundwater supplies are threatened and wellhead protection programs may be appropriate.

1. Storm Water Discharge

EPA regulations for NPDES permits for storm water discharge from municipal and industrial facilities set an application deadline of November, 1991 for individual and group permits. In August, 1991, the EPA issued a proposed implementation strategy which relies primarily on general permits which would cover storm water discharges from most industrial activities. The EPA also issued a draft general permit for states, including Arizona, where it retains NPDES primacy. Under the general permit, facilities would have to submit notices of intent to the EPA, would be required to develop plans to prevent pollution from storm water discharge and to conduct some monitoring. Plans and monitoring reports would not necessarily have to be submitted to states or the EPA.

Issues for regional planning include identification of possible areas where general permit requirements may not adequately protect water quality and identification of industrial facilities which need individual permits. The need for best management practices (BMPs) should be addressed, including technical and financial resources required for BMP development and implementation.

2. Dredge and Fill (404) Permits

Federal regulations adopted in 1989 included a definition of wetlands which has become a very controversial issue as Congress addresses reauthorization of the Clean Water Act. Developers and business interests argue that current regulations "protect lands of marginal ecological value at a great economic cost" while environmental groups are looking for more stringent protection measures. Congress may address this issue through separate legislation.

Regional plans should address whether the Section 404 permit program in Arizona is implemented in a manner that adequately protects water quality, riparian areas and wetlands. The need for additional controls or best management practices for some activities, such as construction or sand and gravel mining, should be considered.

2.9.3d Construction Grant/State Revolving Fund Programs

The 1987 amendments to the Clean Water Act phased out the construction grant program and replaced it with Federal capitalization grants for state revolving fund (SRF) programs. The SRF programs require state matching funds of at least 20% to use the Federal funds. States could begin using at least a portion of Federal construction grant funds to capitalize state programs as early as Fiscal Year 1987 if a SRF program were developed by the state and approved by the EPA. Construction grant funds were authorized through FY 1990, and SRF capitalization grants were authorized through FY 1994.

Arizona did not pass enabling legislation for a SRF until 1989. In order to meet state matching fund requirements, Arizona established a bonding authority so that matching funds would be borrowed, and interest rates depend on the bond ratings of communities applying for funds. Because of the time taken to establish Arizona's program, funds that could have been loaned and repaid were awarded as grants, reducing the size of the state loan program. Congress has also appropriated less funds for SRF programs than authorized by the CWA, although reauthorization of the CWA may extend the authorization of Federal funding for state revolving loans.

Regional plans should consider whether the SRF program provides an effective funding mechanism and should identify a process for identifying alternative means of funding construction and nonpoint source projects in the region.

2.9.3e Monitoring and Enforcement

1. Drinking Water

As new standards and other regulations are established as required by the 1986 amendments to the Safe Drinking Water Act, program responsibilities will increase. Many systems may have to install new equipment to comply with new surface water filtration and disinfection requirements. Sampling requirements are also becoming increasingly technical and operators may not have the necessary training, especially in small systems. Some systems may have to hire skilled operators to take water samples and operate facilities and contract with certified laboratories to perform complicated analytical services. The EPA has estimated the annual cost of compliance with new regulations nationwide at about \$2.5 billion, assuming systems are in compliance with existing standards.

ADEQ's Annual Report Water and Wastewater for 1990 considered 70% of the 1,780 regulated water systems in Arizona to be in noncompliance with one or more applicable sampling requirements, and 59% of all systems were in violation of one or more

applicable drinking water quality standards. (This includes systems that did not provide samples.)

Regional plans should assess general compliance levels for drinking water systems in the region and identify major reasons for noncompliance. Needs for upgrades such as filtration systems should be identified and the need for technical and financial resources should be addressed. Recommendations should be made for improved compliance, which may include issues of resource utilization and viability of small systems.

2. Surface Water Quality Assessment/Control of Toxic Pollutants

In a July 1991 study, the General Accounting Office reported that efforts to control toxic pollution under Section 304(l) of the CWA are not as effective as they could be. (GAO/RCED-91-154) Water quality monitoring was found to be not comprehensive enough to accurately assess the extent of pollution problems. In many cases, assessments of water quality are based on an evaluation of descriptive information rather than analysis of water samples. [Arizona's 1990 Section 305(b) Report assessed about 30% of the stream miles in the State. Over 70% of the miles assessed were evaluated, and about 28% were monitored.] Monitoring often is done in areas where known problems exist, and states generally do little monitoring of nonpoint source toxic pollution. (In its 1991 Assessment (205(j) Report), ADEQ identifies this and a number of other problems with the current assessment.) The GAO report cited lack of resources as one reason monitoring is limited. Mandatory programs take priority over ambient monitoring, and point source programs come before nonpoint source because of the legal requirements and emphasis of the CWA.

CWA provisions also limit requirements for individual control strategies to clean up impaired waters to those where impairment is the result of point source discharge of one of the 126 toxic pollutants identified by the EPA. In Arizona, this means five ("short-list") of 165 impaired waters. No more stringent controls are required for the other 160 waters, even through the priority pollutant list may not include all of the most harmful toxic pollutants and nonpoint sources may contribute more pollution than point sources.

Regional plans should consider whether the monitoring program and level of emphasis on point versus nonpoint sources of pollution in the region is appropriate to regional needs and problems. Recommendations should be made for monitoring locations and emphasis as appropriate. Plans should also include recommendations for effective feedback on monitoring results to land and resource managers. Individual control strategies for facilities in the region should also be identified and processes for follow up monitoring and evaluation should be developed.

3. Resource Requirements/Constraints

Resources have been identified as a limiting factor in effective management of a number of water quality programs. Implementation of Federal laws requires development of EPA regulations and guidelines for implementation at the State and local levels. State programs also require adoption of standards and regulations, often by rule, to provide the basis for enforcement. With increased requirements, Federal and State agencies must look for sources of additional funds or reconsider agency roles in implementation of the CWA, SDWA and other laws.

Among funding sources under consideration as part of reauthorization of the Clean Water Act are charges for permits and fees to cover development of effluent limits. The EPA is also working to develop a fee system based on the toxicity of a facility's discharge. However, "the EPA predicts that financial responsibility to close the anticipated funding gaps will shift increasingly to the states." (GAO Toxic Water Pollution) Many states use some sort of alternative financing method such as fees, taxes or bonds to generate funds for their water quality management programs. Most of these are permit application, training or operator certification fees.

With limited resources, setting priorities is critical. The GAO has reported that Federal priorities may be guided more by public perceptions than on rankings of public risk. ("Meeting Public Expectations with Limited Resources," June, 1991.) The same report discusses the importance of measuring results to ensure the effectiveness of programs. However, because of limited data, the EPA generally monitors its performance based on activities it carries out rather than on environmental improvements which may or may not result from those activities.

Regional plans should include a process for evaluating how funds are spent and whether the emphasis is placed in areas of greatest concern. Processes should be defined for establishing regional priorities and evaluating program effectiveness. Alternative means of funding programs should be identified.

2.10 FRAMEWORK FOR REGIONAL PLANNING

Federal laws and regulations place demands on the States, local governments and other agencies for implementation. State laws, rules and programs also make demands on local agencies. There are a number of levels on which these demands may be evaluated and at which they can be addressed in regional water quality management plans.

2.10.1 Broad Policy Level (Federal/State)

Once Federal and State laws have been passed and rules and regulations have been adopted, they must be implemented by State and local agencies, industry and individuals. While implementation is largely a top-down process, there is opportunity for public participation in development of laws, rules and regulations. A regional continuing planning process for water quality management can provide for informed and effective local involvement.

2.10.2 Regional Planning and Policy Level

Planning for implementation of Federal and State water quality management laws and regulations must also take regional considerations into account.

(a) Geography, hydrology, population, land use and land ownership have an impact on which elements of laws and regulations are most salient in the region and where priorities lie.

(b) Other Federal and State laws and regulations may have an impact on water quality management at a regional level. These include requirements of the National Environmental Policy Act and the National Forest Management Act, which may have a major impact in areas with large areas of Federal land or National Forests.

(c) Regional standards and requirements for water quality management could be established based on shared regional values. Federal laws are generally minimum requirements, and State requirements are at least as stringent as national requirements. While regions must meet the State requirements at a minimum, regional plans could establish more stringent requirements.

2.10.3 Local Planning and Policy Level

Local plans, policies, zoning and ordinances have impacts associated with water quality issues and implementation of Federal and State laws and regulations. Depending on local values and conditions, some county or community plans may take a strong, proactive role toward protection of natural resources, while others do not. Local plans and ordinances can serve as tools for implementing regional water quality management plans. Some programs, such as the Wellhead Protection Program, offer opportunities for local implementation.

2.10.4 Management Agency Level

Agencies with designated responsibilities for water quality management must develop specific plans to meet Federal and State requirements. Regional plans can identify general requirements, but it is the designated management agency which must implement a plan designed to meet very specific conditions and requirements. (Management agency plans include facility plans for wastewater treatment works, pollution prevention plans for storm water runoff, and best management practices to be used for various types of activities which can cause nonpoint source pollution.) These plans must also identify the specific steps and resources needed to implement them. Areawide plans can define steps by which it can be ensured that these plans are consistent with applicable plans, laws, and regulations and meet applicable requirements. They can also recommend priorities and schedules for plan development.

2.10.5 Implementation

Once specific plans have been developed to meet the requirements of Federal and State laws and regulations, they must be implemented. However, resources for implementation (and perhaps for development of specific plans) may not be available or adequate to meet requirements for compliance with laws and regulations. While areawide water quality management plans cannot solve the problem of lack of resources, they can be used to define a process for providing information on funding sources. They can also address provision of technical assistance to local agencies for planning and implementation. In addition, they could be used to develop a process and/or guidelines for setting priorities.

2.10.6 Monitoring

Monitoring may serve a number of purposes for water quality management. Baseline monitoring can characterize existing conditions and provide a basis for planning and future evaluations. Monitoring can be used to assess whether implementation activities, such as use of best management practices, are carried out as planned, and may also be used to evaluate whether the activities had the desired effect. Monitoring may be used to show the impact of a project on water quality, or be used to measure whether water quality standards are being met. (Ref: Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska, EPA, May, 1991.)

Areawide water quality management plans can address monitoring requirements in the region as well as feedback loops necessary to get information on monitoring results to land managers and other responsible agencies so that appropriate action may be taken.

2.10.7 Compliance and Enforcement

While compliance and enforcement are primarily the responsibility of federal and state regulatory agencies, processes for facilitating compliance and ensuring appropriate enforcement could be addressed in the areawide plans, perhaps through design of effective monitoring and feedback systems.

2.10.8 Remediation

The areawide water quality management plans could address a process for identifying problem areas and setting priorities for remediation activities.

2.10.9 Program Evaluation and Planning

Areawide water quality management plans should include a process for monitoring plans and programs in the region to ensure that they are implemented and to evaluate their effectiveness in protecting designated uses and maintaining water quality. This is a broad monitoring and evaluation process, with feedback to Federal and State law makers and regulatory agencies as well as local planning and management agencies.

2.11 IMPACT OF LAWS, PLANS AND PROGRAMS ON WATER QUALITY PLANNING IN THE CAAG REGION

Federal and state laws and regulations for water quality management, discussed in the previous section on state and federal rules and regulations, place demands on local governments and other agencies for implementation. Other federal and state laws and programs also have impacts on water quality management in central Arizona. In addition, local conditions and local plans, policies and ordinances interact with federal and state programs to form a basis for regional and local plans for water quality management, and must be considered in the context of the regional plan and the implications they have on the plan update requirements. This section will briefly summarize other laws, plans and programs that have an impact on the region, water quality management and planning.

2.11.1 Tribal Lands

Almost 30% of the land in the CAAG Region is reservation lands where tribal governments have jurisdiction. Federal and tribal laws and regulations apply, whereas state laws generally do not. Tribes were not eligible to participate in most environmental programs until the amendments to the Safe Drinking Water Act in 1986 and the Clean Water Act in 1987. These amendments noted that tribes had been excluded from the environmental regulatory and management structure established for the nation and outlined a process through which tribes could be "treated as States." Tribes must apply to the EPA for "treatment as a state" (TAS) status under separate programs and statutes. After a tribe receives TAS status, it can apply for a number of programs under the CWA and SDWA. The EPA generally retains regulatory authority for implementing federal laws on tribal lands where the tribal government does not have authority. Tribes also have the authority to develop their own environmental laws and ordinances.

Several tribes in Arizona developed basic water quality management plans in the early 1980s, which they were not required to submit to the State. Because of the separate regulatory authority on Tribal lands, this Plan focuses on the non-reservation portions of the region. However, water quality issues transcend political boundaries. Development of improved communication and coordination between Tribes and local governments within the region for environmental planning, regulation and management will be addressed in the Regional Continuing Planning Process section of the plan.

2.11.2 Other Laws and Regulations

2.11.2a National Environmental Policy Act of 1969

The National Environmental Policy Act of 1969 (NEPA) establishes policy, sets goals and provides means for carrying out policies to ensure that federal actions protect the environment. It requires that environmental impact statements be prepared on major federal actions that will have a significant effect on the environment. This applies to actions on federal lands or which use federal funds, and includes provisions for public involvement as well as evaluation of alternatives and disclosure of environmental impacts of the proposed action.

2.11.2b Wild and Scenic Rivers Act (P.L. 90-542)

The National Wild and Scenic Rivers Act of 1968 provides federal protection for free-flowing rivers and streams. Rivers may be designated under one or more of three classifications: wild, scenic or recreational, based on the use of the river at the time of classification. Protection provided under the Act includes prohibition or severe limits on construction of dams and other projects which might affect the free flowing nature of the river as well as management standards or requirements, which vary depending on the classification.

A number of streams and rivers on land managed by the BLM or the U.S. Forest Service have been evaluated for suitability for designation under the Act.

2.11.3 Resource and Land Management Plans

2.11.3a Bureau of Land Management

The Bureau of Land Management (BLM) owns approximately 2% of the land in Gila County and 7% in Pinal County for a total of 11% of the land in the CAAG Region. The BLM develops Resource Management Plans (RMPs) for the use of their lands. The Safford District RMP (1991) covers portions of eastern Pinal County and the southeaster portion of Gila County. The Phoenix District RMP (1988) covers central Pinal County.

2.11.3b U.S. Forest Service

Management of U.S. Forest Service lands, which comprises approximately 30% of the CAAG region, is guided by the Multiple-Use Sustained Yield Act of 1960 (MUSYA) and the National Forest Management Act of 1976 (NFMA) to ensure that these lands are managed for a variety of uses on a sustained basis to ensure a continued supply of goods and services in perpetuity. The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by NFMA, specifies that land and resource management plans shall be developed for units of the National Forest System. Land Management Plans (LMPs) were developed for each of the National Forests (Apache-Sitgreaves, Tonto, and Coronado) in the 1980s. While individual plans differ, plans

generally identify planned land management activities over the next ten years, evaluate the expected environmental impacts of those activities as well as best management practices or other mitigation measures, and outline a monitoring program.

2.11.3c Other Federal Agencies

Other federal agencies have also develop resource and land management plans for use of their lands. The Department of Defense prepares land management plans for military installations under their jurisdiction. The Department of Defense operates a 7000+ acre installation in the north-central portion of Pinal County.

The Department of Interior, National Parks Service also develops management plans for parks, national monuments and recreation areas in the region. The U.S. Bureau of Reclamation has been involved in numerous projects in the region, most notably the construction of dams, irrigation projects and the Central Arizona Project (CAP) canal.

2.11.4 Other State Policies and Programs Affecting the CAAG Region

2.11.4a Groundwater Management Act (GMA)

The Groundwater Management Act (GMA) established the Pinal Active Management Area (AMA). New irrigated acreage is banned in this area and groundwater withdrawals and uses must be reported annually. The GMA also required development of a series of management plans for the primarily agricultural Pinal AMA. The management goal of the Pinal AMA is to allow non-irrigation development and to preserve the agricultural economy for as long as feasible while preserving water for future non-irrigation uses. With an overall goal to reduce the rate of groundwater depletion in the AMA, another short-term goal is to extend the life of the agricultural economy for as long as feasible, while considering the need to preserve water supplies for future non-irrigation uses.

The Second Management Plan for the AMA expanded on agricultural, municipal and industrial conservation programs and added programs to promote augmentation of water supplies and to manage groundwater quality. One objective from the Second Management Plan is to create incentives and regulations to encourage direct use and recharge of effluent.

2.11.4b Special Designations of Water Segments

One water segment, Bonita Creek, in the CAAG region has currently been designated as a unique water of special significance and has been provided special protection through more stringent water quality standards and non-degradation requirements.

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". Several lakes and stream segments in the CAAG region are currently classified as effluent dominated. Both the unique waters and effluent dominated waters designations are further discussed in the Water Resources section of the plan.

2.11.4c Delegation Agreements With Counties

ADEQ has entered into agreements with counties to delegate some of the State's authorities and responsibilities for review and approval of wastewater treatment facilities, primarily for small on-site systems. Delegation agreements may vary by county.

2.11.5 Regional Plans and Policies

2.11.5a Council of Governments

In 1970, Governor Williams established six planning districts in Arizona and directed that all planning functions undertaken on an areawide or regional basis conform to those boundaries. Councils of Governments for each of these districts have conducted planning activities in these areas, and in 1976 were designated water quality management planning agencies (DPAs) for development of areawide plans under Section 208 of the Clean Water Act. The Central Arizona Association of Governments (CAAG) is the planning agency for District V and conducts water quality management planning under guidance of its Regional Council and Environmental Review Committee.

2.11.5b Resource Conservation and Development Areas (RC&Ds)

The Resource Conservation and Development Program was created under the Food and Agricultural Act of 1962 (P.L. 87-703) and amended by the Agricultural Food Act of 1981 (P.L. 97-98). The program is administered by the U.S. Department of Agriculture through the Soil Conservation Service (SCS). RC&Ds are non-profit corporations designed to provide resource development and environmental protection in multi-county areas. Sponsoring organizations include cities and towns, counties, irrigation districts, NRCDs, tribal councils and others.

The Hohokam RC&D includes Maricopa, Gila and Pinal Counties and was authorized in 1972. The council and local sponsors have completed a number of projects aimed at improving economic opportunities and conserving resources in rural areas. One conservation tillage demonstration project was completed and shows significant benefits in air quality protection and reduced agricultural production costs. This project has been expanded by local NRCDs in Pinal County.

2.11.5c Natural Resource Conservation Districts (NRCDs)

National Resource Conservation districts are legal subdivision of the state of Arizona that are administered under the State Land Department. Technical assistance is provided by the Soil Conservation Service. The purpose of the NRCDs is to promote, coordinate and carry out activities that conserve soil, water and other natural resources. As subdivisions of the State, NRCDs provide a link that enables the SCS, a federal agency, provide technical assistance to private landowners.

There are several NRCDs in the region including: Florence-Coolidge NRCD, West Pinal NRCD, Eloy NRCD, Winkelman NRCD, Gila River NRCD, East Maricopa NRCD, Tonto NRCD and the San Carlos Apache NRCD. Each NRCD has been given authority to develop and implement comprehensive plans in their districts.

2.11.6 Local Plans and Policies

Local governments exercise control over land use and development through a number of methods, including land planning, zoning and subdivision ordinances and building codes. They also have the power to control nuisances and to adopt regulations concerning health, safety and public welfare (ADOC, pg. 9).

2.11.6a General Plans

Cities and towns are required under A.R.S. § 9-461 to develop general plans which must include a land use plan and circulation element. For cities with a population greater than 50,000, plans must also include additional elements such as conservation, recreation and public services and facilities. Communities with populations under 50,000 may also choose to include these other sections, and many cities and towns in the CAAG region have general plans which address water and wastewater facilities and protection of natural resources. More specific facility plans are generally developed for implementing wastewater treatment facilities.

Counties also have the mandate to develop comprehensive plans (A.R.S. § 11-821). Plan requirements are more general, but are to be developed to preserve natural resources and promote public health, safety and welfare. County plans are also to include recommendations for development and zoning regulations (ADOC, pg. 28).

2.11.6b Zoning Ordinances

A.R.S. § 9-462 gives cities and towns the power to enforce zoning regulations which may include special requirements for sensitive areas such as special grading or drainage requirements, or other requirements necessary for protection of public welfare. Zoning ordinances are to be prepared in accordance with general plans and are an important tool for implementing community policies. Counties also have zoning authority in unincorporated areas, but this authority is more limited than that of cities and towns.

2.11.6c Subdivision Authority

Both municipalities and counties may adopt ordinances controlling the design of subdivisions, which may include requirements for water and wastewater utilities. Subdivisions in unincorporated areas are regulated by the counties. Arizona's Department of Real Estate will not allow sale of subdivided lots until water supply sources and solid waste and wastewater disposal methods have been approved by ADEQ. NOTE: In Active Management Areas, including the Pinal AMA, a certificate of assured water supply from ADWR is required for subdivision approval, in addition to the ADEQ approvals.

2.11.6d Designated Management Agencies (DMAs)

Agencies with designated responsibilities for water quality management must develop and implement specific plans to meet Federal and State requirements. Cities, towns and sanitary districts meet legal requirements to be designated agencies for management of publicly owned waste treatment works under section 208(b) of the Clean Water Act. Designation is made by the Governor with approval by the Environmental Protection Agency, through the 208 Plan approval or amendment process. The existing Designated Management Agencies within the CAAG Region are listed on Table 2-1.

The majority of wastewater treatment facilities in the CAAG Region are managed by non-municipal agencies, including private investors and federal, state or other public agencies. These are not eligible for management agency designation according to Section 208(b) of the CWA. Further management agency designations and recommendations are discussed in the point source, nonpoint source, drinking water and continuing planning process sections of the plan.

Table 2-1

Designated Management Agencies within the CAAG Region	
City of Apache Junction	1990
Arizona City Sanitary District	1978
Cobra Valley Sanitary District	1985
City of Coolidge	1978
City of Eloy	1978
City of Globe	1978/1985
Town of Hayden	1978
Town of Mammoth	1978
City of Miami	1978
Northern Gila County (Payson) Sanitary District	1978
Oracle Sanitary District	1978
Pinal Sanitary District	1983
Town of Florence	1994

2.12 REFERENCES

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Chapter 3.0 PLANNING AREA DESCRIPTION

The CAAG region is comprised of both Gila and Pinal Counties, and is geographically situated in the south central interior region of the State of Arizona. Gila County contains 4,752 square miles of land, and is ranked 11th in total size out of the 15 counties within Arizona. Pinal County, the larger of the two county region, contains 5,344 square miles of land and is ranked 10th in comparison with the other counties within Arizona. Together, the two county CAAG region contains a total of 10,096 square miles (which comprises approximately 9% of Arizona's total land area), and is bordered by Coconino and Navajo Counties to the north; Maricopa and Yavapai Counties to the west; Graham County to the east; and Pima County to the south. (See Map 1, Arizona State Planning & Development Districts)

The planning area for the CAAG region contains almost 3,000 square miles or approximately 28% of the total land area, of several Indian reservations. These include the Ak-Chin, Gila River, San Carlos, Tonto Apache, Tohono O'odham and White Mountain Apache Indian Reservations. As noted in the "Impacts of Laws and Regulations on the CAAG Region", amendments to the Safe Drinking Water Act in 1986 and the Clean Water Act in 1987 established a process through which tribes can be treated as States and manage their own programs under these laws. In addition, while Federal laws apply to Indian reservation lands, State laws generally do not. For these reasons, the Indian reservations are not included as part of this plan update. However, reservation areas within the CAAG region are included in the planning area description. (See Maps 3 and 3a)

3.1 PHYSICAL CHARACTERISTICS AND NATURAL RESOURCES

3.1.1 Elevation and Topography

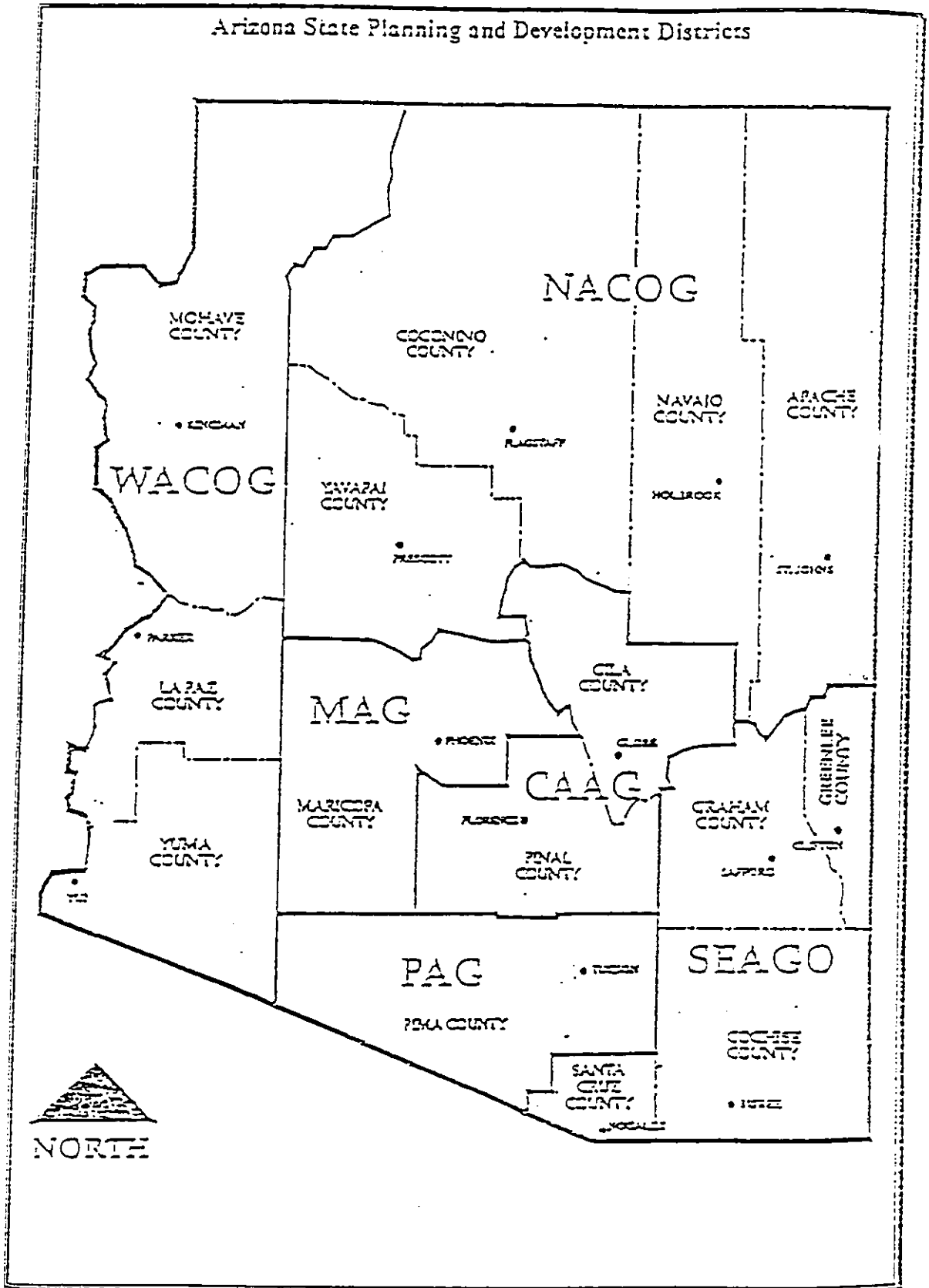
The physical landscape of the CAAG region is distinctively unique, ranging from the low lying desert terrain of southern Pinal County, to the steep hills and mountains which are characteristic of northern Gila County. As displayed on Map 2, the State of Arizona encompasses three geologic-physiographic provinces: the Colorado Plateau to the north, the Basin and Range Province to the south, and the intervening Central Highlands province which runs through the central interior region of the state.

3.1.1a Pinal County Topography

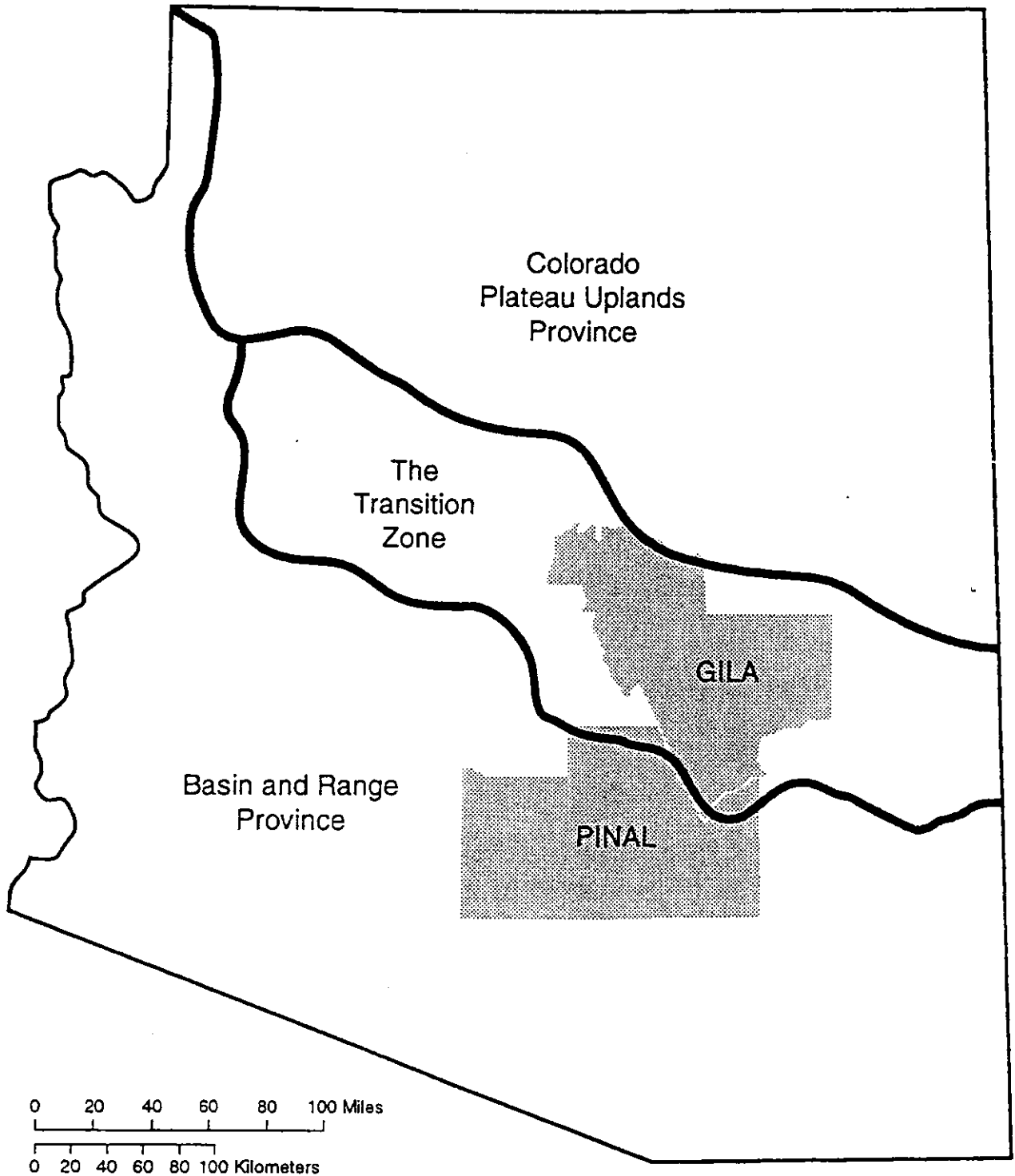
The topography of Pinal County located in the southern part of the CAAG region ranges from level and gently sloping foothills located on the valley slopes and floodplains, to more distinctively sloped hills and mountains which are located throughout the county. Elevations in Pinal County range from approximately 1,000 feet above mean sea level in the lower lying desert areas, to a high point of approximately 6,158 feet in the mountains located in the far eastern portion of the county, which are adjacent to Graham County. The map shows that all of Pinal County, with the exception of a small area in the extreme north central region of the county, is located within the Basin and Range Province and therefore reflects the physiographic features and characteristics which are indicative of that particular zone.

MAP 1

Arizona State Planning and Development Districts



Physiographic Provinces of Arizona



The Basin and Range Province is characterized by extremely dry desert lowlands with annual precipitation ranging from 4 to 12 inches. The Basin and Range Province is comprised of a series of north to northwest trending, fault-block mountain ranges that are flanked by broad gravel fans which slope from the foot of the mountains down into the basins. These regional mountain ranges incorporate a diversity of Proterozoic to Cenozoic rock formations which display very complex structural and metamorphic histories.

As is typical of the Basin and Range Province, the extensive mountain-bounded ranges within the zone are separated by broad alluvial valleys which are comprised of alluvial fill in heterogeneous layers. More specifically, these layers of fill contain unconsolidated deposits responsible for the formation of underground aquifers, which generally contain large quantities of water stored below the surface. Such water serves as an important element to the semi-arid, desert environment of Pinal County.

3.1.1b Gila County Topography

The topography of Gila County located in the northern part of the CAAG region ranges from moderately to intensely steep hills and mountains, interspersed with gently to strongly sloping valley plains and stream floodplains. Elevations in Gila County range from approximately 1,950 feet above mean sea level near the lower lying desert terrain regions located along the Gila River in the southern area of the county, to a height of 7,915 feet at Promontory Butte, located in the extremely mountainous, northern area of the county along the Mogollon Rim. In direct correlation with topographical elevation, Gila County contains heavily forested areas and numerous grassland meadows in the northern highlands, and mountainous desert regions in the southern part of the county that are covered with various desert cacti, flora and fauna.

As identified by Map 2, the southern part of Gila County contains desert terrain, and is located within the Basin and Range Province. However, the majority of Gila County is located within the Central Highlands zone, which is geographically situated in between the Colorado Plateau to the north, and the Basin and Range Province to the south.

The Central Highlands zone is characterized as being a region which is topographically diverse, and features deep canyons, high peaks, and contains a number of interspersed mesas, valleys, and small mountains. Interestingly, because this transition zone contains physiographic aspects which are relevant to both the Colorado Plateau and the Basin and Range Province, it basically conveys little resemblance to either geologic zone. The geological structure of this zone is extremely diversified, and the numerous types of rock formations have exerted a strong influence upon both the landforms located throughout Gila County, and the development of various soil types.

The Central Highlands Province, is also commonly known as the surface-water province of Arizona, due to the fact that the Mogollon Rim, which is located on the northern fringe of the CAAG region, stimulates precipitation by forcing prevailing northerly flows of warm, moist air to the higher and much cooler elevations of the region. Because this transitional zone is largely a geologic region of bedrock and steep stream gradients, it tends to promote surface water runoff in considerable volumes. Over 50% of the State of Arizona's developed surface water originates within the Central Highlands region, which serves as a water source for approximately 60% of the state's population.

3.2 CLIMATE

The climate of the CAAG region is extremely diverse, and contains various climatic zones ranging from the high altitude, coniferous forests of northern Gila County, to the warm and dry Sonoran Desert located in the southern part of Pinal County. The average annual precipitation ranges from approximately 4 to 9.5 inches in the lower desert regions, to a range of approximately 14 to 25 inches in the mountains and areas of higher elevation. The variability in climate results from vast differences in elevation, regional distribution of topographical features, and variations in rainfall. Such variabilities contribute to the noticeable differences in fauna and flora which are dispersed throughout both Gila and Pinal Counties.

The CAAG region is characterized by two distinctive rainy seasons. The winter rain season generally lasts from December to March, and results from precipitation that originates over the Pacific Ocean and Gulf of Alaska, and moves eastward across California into Arizona. Although this rainfall usually accounts for a large measure of the overall percentage of Pinal and southern Gila County's annual average precipitation. In the northern highlands of the CAAG region, this precipitation generally results in several inches of snowfall. The other rainy season is commonly referred to as the monsoon season, and occurs between the months of July and September. This particular rainfall is the result of relatively moist, warm air which results from a seasonal Bermuda high pressure system that is geographically situated over the Gulf of Mexico. This established, incoming northwestern air flow from the Gulf of Mexico causes the hot and unstable air located throughout the lower lying desert regions to rise by processes of convection, and typically generates severe thunderstorms and heavy rainfalls within a short duration of time.

The climate in southern Gila and Pinal Counties is characterized by mild winters and extremely warm summers. The climate within northern Gila County is considered to be relatively mild throughout both the summer and winter seasons. As displayed in Table 3-1, the average daily maximum and minimum temperature averages, along with the average annual precipitation amounts for the thirteen incorporated communities located throughout the CAAG region is considerably diverse. Average temperatures range from a January minimum of 23.7 degrees in Payson, to a July maximum of 107.0 degrees in Coolidge. Although the CAAG region is topographically and climatically diverse, most of the precipitation within the district occurs during the two rainy seasons of winter and summer, with dryer periods of weather occurring during the spring and fall.

**TABLE 3-1
 TEMPERATURE AND ANNUAL TOTAL PRECIPITATION**

LOCATION	AVERAGE DAILY TEMPERATURE				AVERAGE ANNUAL PRECIPITATION PER YEAR
	JANUARY		JULY		
	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
GILA COUNTY					
GLOBE	55.0	32.7	97.0	70.3	18.05
HAYDEN	65.3	29.4	103.1	69.4	12.89
MIAMI	55.0	32.7	97.0	70.3	18.05
PAYSON	53.1	23.7	92.5	58.5	20.77
WINKELMAN	65.3	29.4	103.1	69.4	12.89
PINAL COUNTY					
APACHE JUNCTION	64.9	35.6	104.3	74.1	7.52
CASA GRANDE	66.0	35.0	106.2	76.0	8.12
COOLIDGE	66.9	33.4	107.0	74.3	8.22
ELOY	67.0	35.7	105.0	75.1	8.45
FLORENCE	66.8	36.1	106.1	74.0	9.50
KEARNY	65.3	29.4	103.1	69.4	12.89
MAMMOTH	60.1	34.4	96.7	69.8	13.03
SUPERIOR	60.4	43.7	97.2	75.9	17.06

SOURCE: ARIZONA COMMUNITY PROFILES, ARIZONA DEPARTMENT OF COMMERCE, DECEMBER, 1992

3.3 HYDROLOGY

Water within the CAAG region is obtained from various sources, including existing groundwater supplies, effluent, Colorado River water which is transferred into the region as allotted by the Central Arizona Project, and attainable surface water from the region's river basins. Although many segments of these river beds within the various basins are intermittent, and only contain water during periods of heavy rains associated with the seasonal storm periods, some rivers do in fact maintain yearly flows and provide adequate water supplies for purposes of diversion.

3.3.1 Surface Water

As illustrated on Map 4, the CAAG region is comprised of six major surface river basins, which include: the Middle Gila, the Salt River, the Santa Cruz River; the San Pedro River; the Upper Gila River; and the Verde River. As a result of the higher average temperatures and minimal annual precipitation averages, there are only a few perennial bodies of water that can be found throughout

the southern region of the CAAG region.

3.3.1a Middle Gila Basin

The Middle Gila River Basin contains all but the southeastern and southwestern portions of Pinal County. It is separated by the Upper Gila on the east and the Santa Cruz basins on the west. Much of the surface water in the Middle Gila comes from the Upper Gila, down from the mountainous regions of Gila County, where the northerly flow of the Santa Cruz originates from the south.

3.3.1b Salt River Basin

The Central Highlands province area accounts for approximately 65% of the Salt/Verde Basin flow. The principal runoff producing areas for the Salt River are the White River and Black River, whose headwaters originate on the White Mountain Apache and San Carlos Indian Reservations, respectively. The White River drains the north and west sides of the White Mountains, while the Black River drains the east and south sides of the mountains. Their confluence with the Salt River produces 380,000 acre feet of water per year from an area of 1,864 square miles. Along with these two major sources, the Salt River is also sustained by numerous tributaries and flows along a relatively steep gradient in a western direction across the central part of Gila County and merges with Pinal Creek, which in turn flows to Roosevelt Lake. The San Carlos River flows in a southerly direction to the San Carlos Reservoir, and forms the southeastern boundary between Gila and Graham Counties.

3.3.1c San Pedro River Basin

The headwater of the San Pedro River Basin originates in the high mountainous regions of northern Mexico and flows in a northerly, northwesterly direction to its confluence with the Gila River near Winkelman where it becomes part of the Upper Gila River Basin. This watershed includes not only parts of Mexico, but also, the Mule, Huachuca, Santa Rita, Whetstone, Dagoon, Winchester, Santa Catalina, and the Galiuro Mountain ranges, all located in southeastern Arizona.

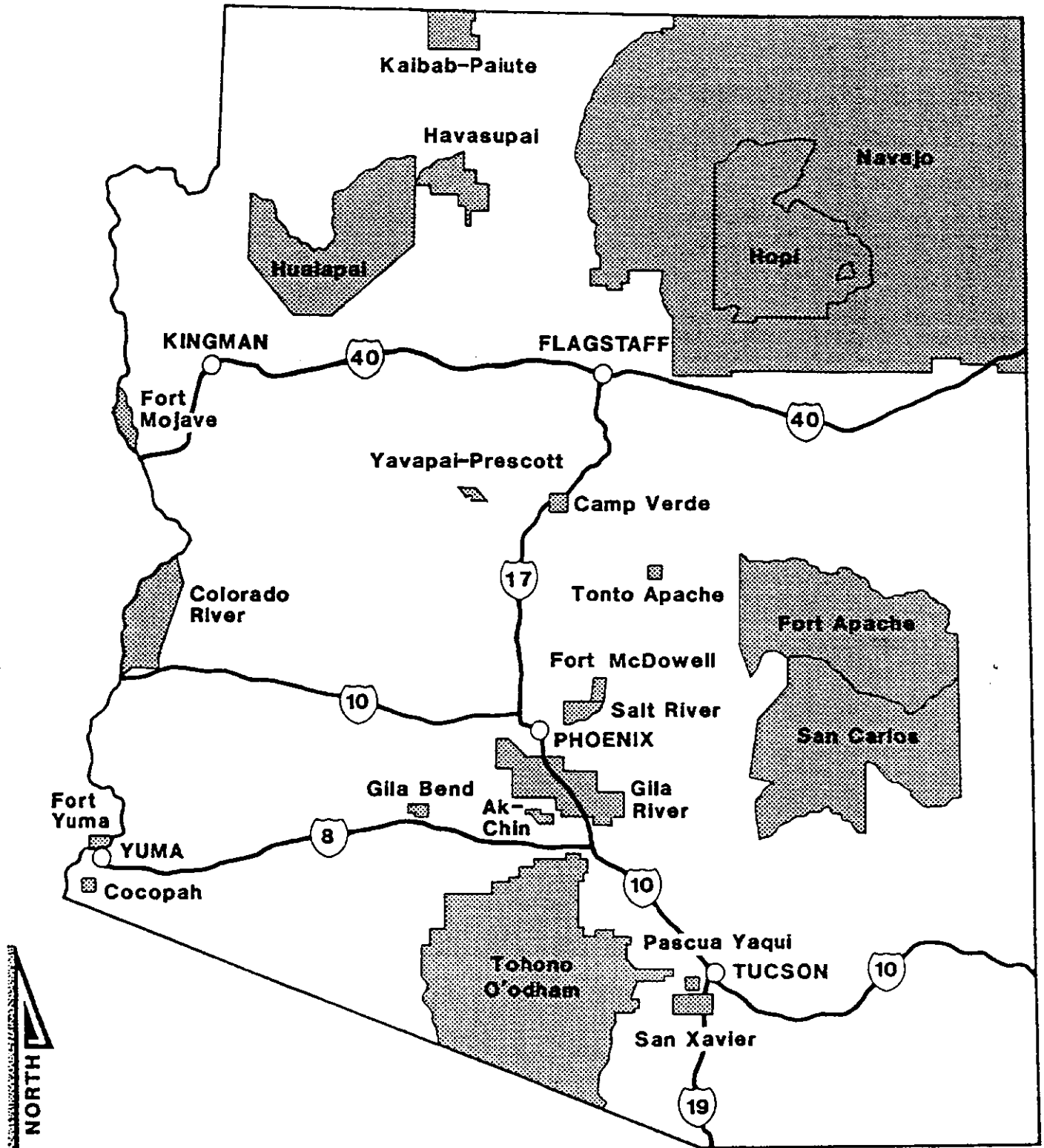
3.3.1d Santa Cruz River Basin

Like the San Pedro, the Santa Cruz River, which comprises the Santa Cruz River Basin, also has its headwaters in the mountainous regions of northern Mexico. Flowing in a northerly direction through the City of Tucson, the Santa Cruz River enters the south central part of Pinal County and dissipates onto an extremely large floodplain just west of Eloy and Casa Grande. The North Branch of the Santa Cruz flows in a northerly direction to the Gila River Indian Reservation adjacent to the City of Casa Grande. From there it turns due north to the Ak Chin Reservation to join with the Gila River.

3.3.1e Upper Gila River Basin

The Upper Gila River Basin, whose headwaters are located near Silver City, New Mexico, enters the region near San Carlos Lake in central eastern Arizona. The Gila River, then flows in a westerly direction past Hayden to Florence, where it enters the Gila River Indian Reservation. From there it continues northwesterly to metropolitan Phoenix.

MAP 3



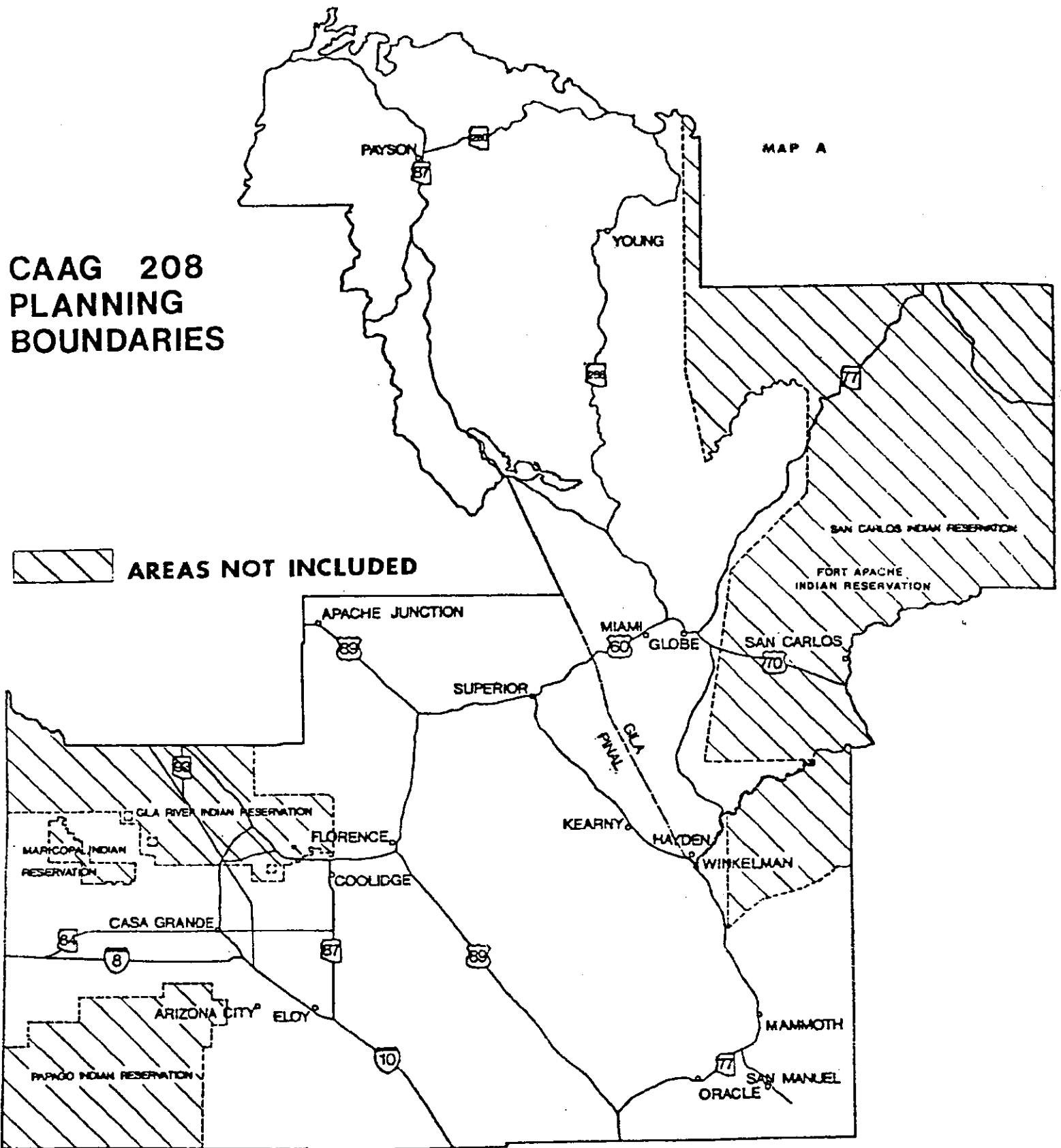
INDIAN RESERVATIONS IN ARIZONA

Prepared By



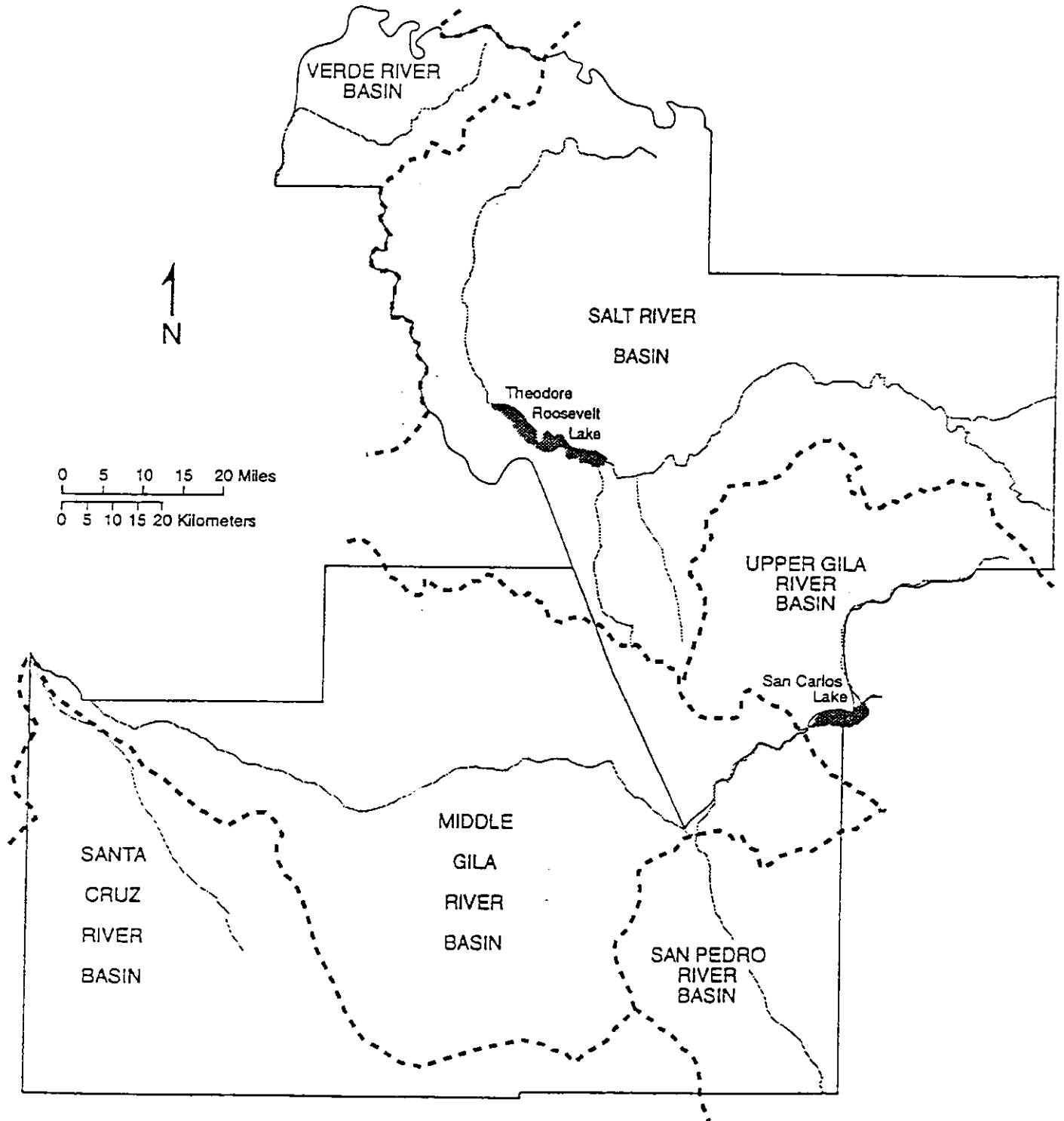
THE INDIAN DEVELOPMENT DISTRICT OF ARIZONA, INC.

CAAG 208 PLANNING BOUNDARIES



MAP 4

Surface Water Basins Within the CAAG District



3.3.1f Verde River Basin

The extreme northwestern areas of Gila County are drained by the East Verde River, which in turn flows into the Verde River, and forms a portion of the boundary between Gila and Yavapai Counties. Tonto Creek, which is also linked with numerous tributaries throughout the southern Verde Basin, flows southward from the north central area of Gila County down along the western region of the county until it flows into Theodore Roosevelt Lake.

3.3.2 Groundwater

Map 5 shows the location of the major groundwater basins in the region. Availability of groundwater in the CAAG region is generally governed by the local geology (i.e., structures found in the surface and sub-surface structure). The principal aquifers in Arizona are composed of unconsolidated alluvium (alluvial aquifers), consolidated sedimentary rocks (sandstone aquifers), and crystalline igneous and metamorphic rocks (bedrock aquifers). These aquifers fall within the three physiographic provinces of Arizona as follows:

The *Central Highlands Province* covers approximately 15% of the state's land area and provides a geologic and physiographic transition from the Basin and Range Lowlands to the Plateau Uplands. The province is characterized by rugged, sharply pinnacled mountains of volcanic origin, and intervening basins that are small, relatively shallow and not interconnected. The most prominent structural feature of the Mogollon Rim, which provides a groundwater divide between the Central Highlands and the Colorado Plateau. Much of the stream flow within Arizona originates in this province. These streams are often fed by groundwater.

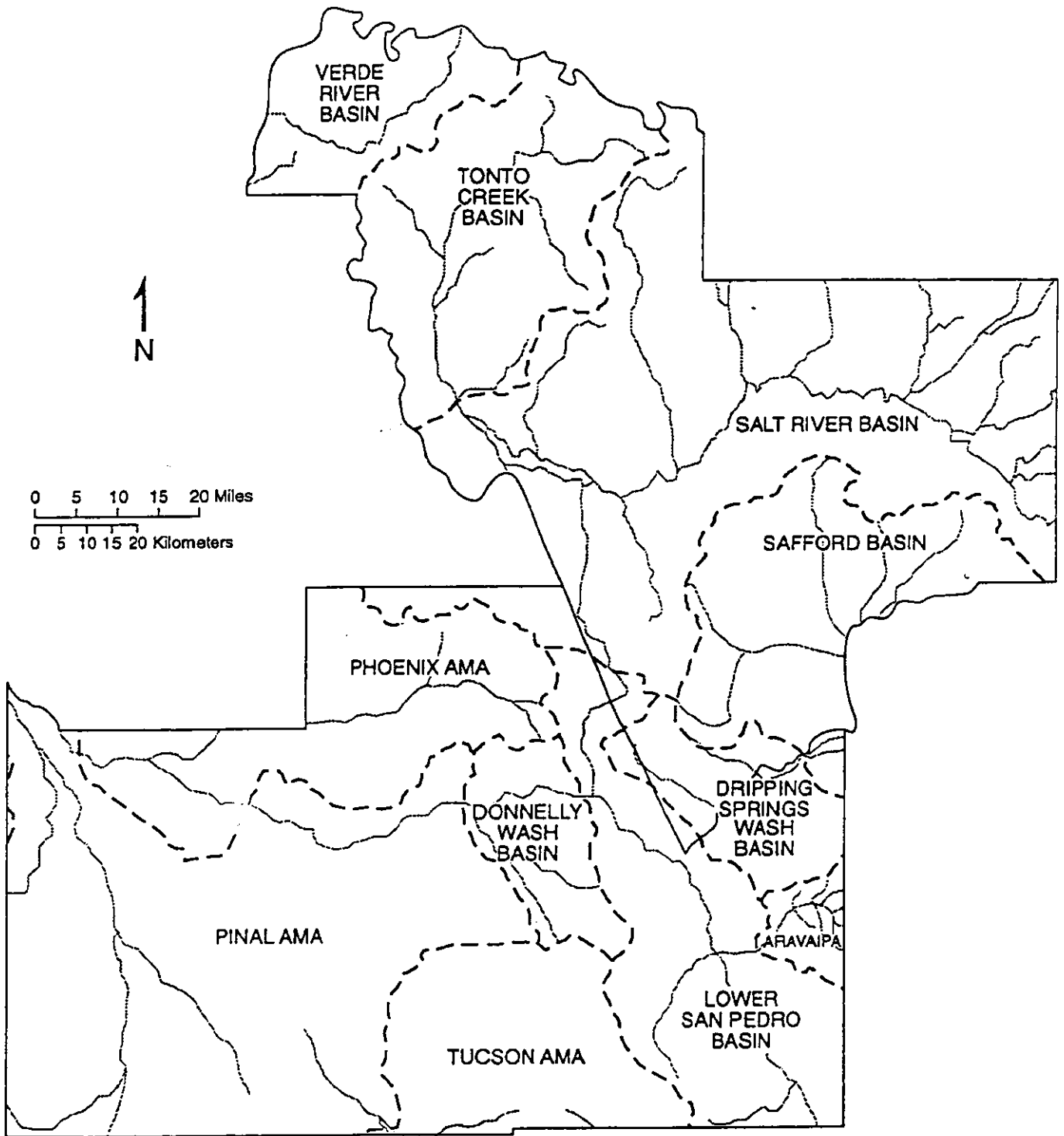
Groundwater occurrence and availability are primarily governed by the local structural attitude of the rocks, subsurface and surface material, degree of cementation and consolidation of sediments which fill the small valleys between the relatively impermeable volcanic mountain blocks, and the amount of recharge available from surface runoff. Occasional fractured volcanic rocks and solution cavities yield water to wells. Recharge in the province occurs along the mountain fronts adjacent to the valleys and along the streams, both perennial and intermittent, that run through the valleys.

The *Basin and Range Lowlands Province* constitutes 45% of the State's land area. This province is characterized by broad, flat alluvial basins from which isolated mountain ranges arise sharply. The mountains generally consist of resistant igneous and metamorphic rocks. Coarse-grained basin-fill sediments were derived from these mountains during episodes of regional crustal warping. Tectonics and block faulting provided periods of uplift, subsidence and associated volcanism that resulted in widespread lateral and vertical heterogeneities and unconfined aquifer conditions which occasional confined and perched zones. Intermittent tectonically inactive and highly evaporative periods are evidenced by fine-grained, gypsiferous playa deposits. The basin alluvium constitutes the most productive aquifers, from which about 98% of the groundwater utilized in Arizona is pumped. Water levels range from close to land surface to more than 800 feet below the surface.

3.3.3 Active Management Areas (AMAs)

The majority of Pinal County, located in the southern half of the CAAG region, is regulated by the Arizona Department of Water Resource's Active Management Areas (AMAs). The primary purpose of these divisions is to ensure adequate water supplies for urban growth and irrigation purposes. Three of the state's four AMAs are located within the CAAG region: the Phoenix AMA, the Pinal AMA, and the Tucson AMA.

Water Planning Areas Within the CAAG District



The primary goals of the Pinal Active Management Area are threefold: to allow for the physical development of areas within its district that are not dependent upon irrigation-oriented activities; to preserve the local agricultural economies for as long as feasibly possible; and to protect and preserve groundwater sources for non-irrigation utilization between a range of approximately 1,000 to 1,200 feet below land surface.

The primary planning goals of the Phoenix and Tucson Active Management Areas are to maintain water conservation standards for agricultural, municipal, and industrial users; to develop a program for water supply augmentation and reuse; and to continually assess and manage groundwater quality within the district. The East Salt River Valley Sub-Basin is the area of the Phoenix AMA which comprises the northern portion of Pinal County. Only a very small portion of the southern Pinal County is located within the Tucson AMA.

3.4 SOILS

A soil association is basically a group of defined and named soil units occurring together in a characteristic pattern over a specified geographic region. Not only does an association differ in terms of an identified region's temperature and precipitation levels, but each particular soil association also differs in terms of soil depth, texture, acidic levels, permeability, drainage, corrosivity, and overall suitability for development.

The primary types of soils within the CAAG region correlate directly with the physiographic features characteristic of both the Central Highlands and the Basin and Range geologic provinces.

As identified by the U.S. Department of Agriculture, Soil Conservation Service (SCS), Maps 6 and 7 display the geographical distribution of the various soil classifications in Gila and Pinal Counties. The SCS study for Gila County placed an emphasis upon the geographical setting of soil associations according to their perspective climatic categorizations; whereas the study for Pinal County placed an emphasis upon soils and their associations within a physiographic environment. Although detailed site investigations are usually required to determine whether or not a particular area is suitable for development, the purpose of these maps are to give a general description of the soil associations and their location within the CAAG region.

When analyzing the content of soils from the perspective of mean annual temperature and precipitation levels, the CAAG region contains five identifiable soil associations extending throughout both Gila and Pinal Counties. The major association of soils can be categorized as follows:

Hyperthermic Arid - Soils with mean annual soil temperatures of more than 72° degrees Fahrenheit, and averaging less than 10 inches of mean annual precipitation.

Thermic Semiarid - Soils with mean annual soil temperatures ranging from 59° to 72° degrees Fahrenheit, and averaging 10 to 16 inches of mean annual precipitation.

Mesic Semiarid - Soils with mean annual soil temperatures ranging from 47° to 59° degrees Fahrenheit, and averaging 10 to 16 inches of mean annual precipitation.

Mesic Subhumid - Soils with mean annual soil temperatures ranging from 47° to 59° degrees Fahrenheit, and averaging more than 16 inches of mean annual precipitation.

Frigid Subhumid - Soils with mean average soil temperatures of less than 47° degrees fahrenheit, and more than 16 inches of mean annual precipitation.

As shown on the maps, Gila County contains 14 identifiable soil associations which are spatially distributed throughout various elevations in the county. Eight of these are classified as warm semiarid soil associations: Glendale-Gila-Anthony; Rimrock-Bonita-Graham; Graham-House-Mountain-Rock Outcrop; Mabray-Lithic Torriorthents; Cellar-Lampshire-Rock Outcrop; Retriever-Calciorthids; White House-Caralampi-Hathaway; and the Continental-Eba-Nickel. In accordance with the climatic and temperature criteria listed above, all eight of these semiarid soil associations are classified as Thermic Semiarid. Elevations of the warm semiarid soil associations located throughout Gila County range from approximately 2,000 to 5,800 feet above mean sea level.

From a regional perspective, the majority of lands within these soil associations are primarily utilized for rangeland and recreational activities. With the exception of the White House-Caralampi-Hathaway and Continental-Eba-Nickel associations, most of the soils within these areas generally contain moderate to severe limitations for purposes of construction and extensive community development.

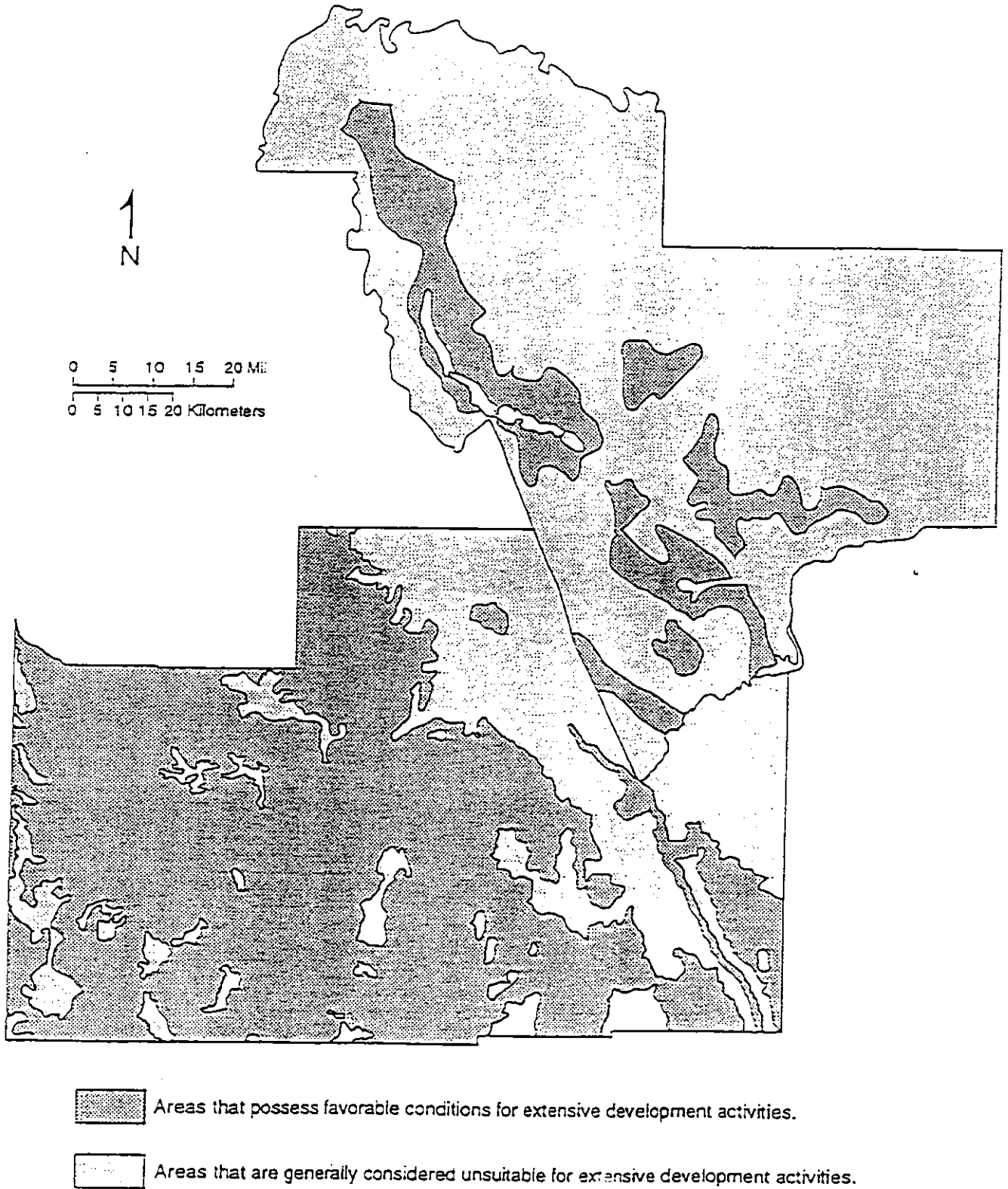
A moderate soil limitation basically implies that the soils within these associations contain properties that are moderately, or somewhat reasonably favorable for construction or community development purposes, and that most limitations due to inadequate soil features can be overcome by special planning that focuses upon methods of how to alleviate problematic areas. However, a severe soil limitation implies that the soil has many properties that are considered unfavorable for community development, such as steep slopes, potential flooding hazards, bedrock near the surface, seasonal high water tables, or high levels of susceptibility to volume and moisture changes.

The cool subhumid soils within Gila County range in elevation from 4,000 to 7,850 feet above mean sea level, and are comprised of the Jacks-Dye-Rock Outcrop; Roundtop-Tortugas; Barkerville-Moano-Faraway; Thunderbird-Cabazon; and Showlow-Cibeque soil associations. Soils within the Jacks-Dye-Rock Outcrop Association are classified as Thermic Semiarid; whereas the other soils listed above are considered Mesic Subhumid, due to their cooler mean annual soil temperatures. These soil associations are located upon slopes which generally range anywhere from 5 to 65 degrees in height, and are therefore considered unsuitable for any form of extensive, physical community development activities. The lands within these associations are primarily utilized for rangeland, timber production, and contain various recreational activities. However, within the Thunderbird-Cabazon association, which is geographically situated within the northwest region of Gila County, significant residential and industrial development has occurred upon several isolated site locations which contain favorable soil conditions.

The cold subhumid Overgaard-Elledge soil association, located in far north central Gila County, is the only Frigid Subhumid classification within the region. Elevations within this soil association range from approximately 6,500 to 7,500 feet above mean sea level. Like many other soil associations located throughout Gila County, this smaller region also possesses severe restrictions concerning activities related to construction and community development, due to its mountainous features and steep slope gradients. The lands within this particular association are utilized for rangeland, timber production, and also contain various recreational activities.

MAP 6

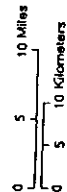
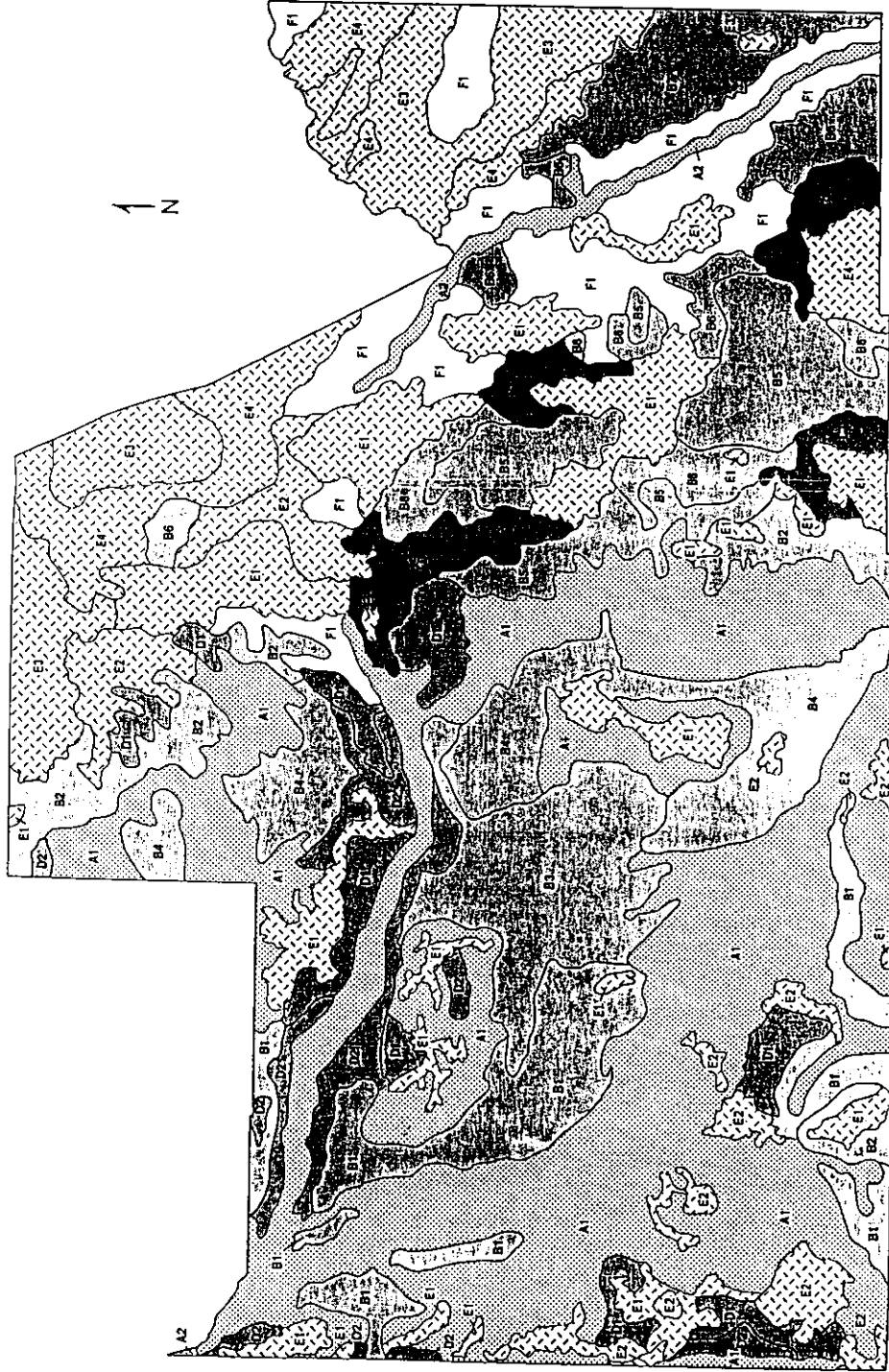
Soil Suitability for Development
Within the CAAG District



Source: U.S. Department of Agriculture Soil Conservation Service, 1971 and 1973

MAP 7

Soil Associations Within Pinal County



- Soils of the Flood Plains**
 - A1-1 Gilman-Antho-Pimer association
 - A2-1 Tomifluents association
- Soils of the Valley Slopes**
 - B1-1 Mohaf-Casa Grande association
 - B2-1 Mohaf-Pima association
 - B3-1 Casa Grande-Lapalma association
 - B4-1 Mohaf-Vecont association
 - B5-1 White House-Caralampi association
 - B6-1 Caralampi-White House association
 - B7-1 Caralampi association
- Shallow Soils Over Bedrock**
 - Chiricahua association
- Limy Soils on Valley Slopes and High Fans**
 - Gunsight-Cavett-Rillito association
 - Laveen-Rillito association
- Rock Land**
 - Granite and Schist Rock Land (arid and semiarid)
 - Andesite and Basalt Rock Land (arid and semiarid)
 - Andesite and Basalt Rock Land (subhumid)
 - Granite and Schist Rock Land (subhumid)
- Miscellaneous**
 - F1 Rough Broken Land

Source: U.S. Department of Agriculture Soil Conservation Service, 1971

As shown on Map 7, the SCS study prepared for Pinal County identified the spatial distribution of soil associations in accordance with their physiographic setting within the county. Descriptions of the soil associations are categorized as follows: Soils of the Floodplains; Soils of the Valley Slopes; Shallow Soils over Bedrock; Limy Soils on Valley Slopes and High Fans; Rockland; and Rough Broken Lands, which consist of areas of rock land which are extremely difficult to adequately delineate for visual display.

Soils of the Floodplains account for a large percentage of land area within Pinal County, and are classified as Hyperthermic Arid, due to the area's higher mean annual soil temperatures and limited annual precipitation levels. The lands within these associations are primarily utilized for irrigated crops and pastureland; the production of cotton; desert rangeland; and also contains various recreational activities. Although the prime rangeland within these areas is considered to be somewhat poor as a habitat for wildlife, the soils within these associations provide a favorable base for the erection of commercial, industrial, and residential structures, along with other various community development projects.

Seven soil associations comprise the Valley Slopes: Mohall-Casa Grande; Mohall-Pinamt; Casa Grande-La Palma; Mohall-Vecont; White House-Caralampi; Caralampi-White House; and Caralampi soil associations. Of these seven associations, the Mohall-Casa Grande, Mohall-Pinamt, Casa Grande-La Palma, and Mohall-Vecont have been classified as Hyperthermic Humid. As in the case of the Gilman-Anthro-Pimer and Torrifluvents floodplain soil associations mentioned above, these particular soils contain minimal slopes and are also utilized for irrigated crops and pastureland; the production of cotton; desert rangeland; various recreational activities; and are also considered exceptionally favorable for construction activities.

The White House-Caralampi, Caralampi-White House, and Caralampi soil associations are primarily situated within the eastern regions of Pinal County along moderately sloped alluvial fans. These particular soil associations are classified as Thermic Semiarid. Unlike the soil associations located in the lower-level elevations of the county, these particular associations are comprised of reddish gravel-like material, and are considered rather limited in terms of agricultural productivity. The principal sources of land utilization within these associations include rangeland and recreational activities, along with limited construction and community development.

The Chiricahua Association is a Shallow Soil Over Bedrock and can be classified as Thermic Semiarid, and is located upon low to moderately sloped granitic foothills in the central and southeastern parts of Pinal County. The slope gradients which range from 5 to 25 percent, and the gravel-like texture of the soil compositions within this soil association generally prohibit any viable form of farming, or extensive crop cultivation. The main uses of the soil association are predominately comprised of rangeland activities, and limited forms of construction.

The Limy Soils on Valley Slopes and High Fans are basically comprised of both the Gunsight-Cavelt-Rillito and Laveen-Rillito soil associations. These soil associations are classified as Hyperthermic Arid, and are located upon the lower elevations of central and western Pinal County. These associations are located in areas which contain relatively level slope gradients. The lands within these associations are primarily utilized for irrigated crop and pastureland, the production of cotton, and various community site developments.

The Rock Land physiographic regions within Pinal County are comprised of the following soil associations: Granite and Schist Rock Land (arid and semiarid); Andesite and Basalt Rock Land (arid and semiarid); Andesite and Basalt Rock Land (subhumid); and Granite and Schist Rock Land (subhumid). The arid and semi-arid classifications of these particular associations basically

indicate that they are Hyperthermic Arid; whereas the subhumid classifications are Mesic Subhumid.

The Granite and Schist Rock Land (arid and semiarid) Association consists of the mountains and buttes of granite and schist which are located throughout the southeastern, central, and western areas of Pinal County. Approximately 60 to 75 percent of this association is comprised of rock outcrop, which contains slopes ranging from 15 to 75 percent, and elevations ranging from 1,200 to 4,000 feet above mean sea level. The Andesite and Basalt Rock Land (arid and semiarid) association consists of the arid and semiarid mountains and buttes which are primarily located throughout the central and western areas of Pinal County. This association is comprised of andesite and basalt, and contains slopes ranging from 5 to 60 percent, and elevations ranging from 1,200 to 4,000 feet above mean sea level. Approximately 50 to 75 percent of the Andesite and Basalt Rock Land (arid and semiarid) association consists of rock outcrop. The lands within both of these associations are primarily utilized for desert rangeland and various recreational activities. Due to the area's steep slopes, and the shallow, rock and gravel-like textures of the soils which are characteristic of this region, any form of cultivation or construction for the purpose of community development activities would involve rather severe limitations.

The Andesite and Basalt Rock Land (subhumid) Association consists of the rough and mountainous areas of andesite, basalt, and tough agglomerate formations which are located in the northeastern and eastern areas of Pinal County. This association contains slopes ranging from 15 to 75 percent or more, and elevations ranging from approximately 3,000 to 5,500 feet above mean sea level. Approximately 40 to 50 percent of this association consists of rock outcrop in the form of ledges, pinnacles, and talus slopes.

The Granite and Schist Rock Land (subhumid) association consists of the rough mountainous areas of granite and schist which are also located in the northeastern and eastern areas of Pinal County. This association contains slopes ranging from 15 to 75 percent, and has elevations which also range from approximately 3,000 to 5,500 feet above mean sea level. Although these associations are categorized from a climatological perspective as being subhumid in nature, this particular classification would only be applicable to the mountainous uplands that are generally above 5,000 feet in elevation. The majority of lands within these soil associations which are below 5,000 feet in elevation are classified as Thermic Semiarid. As is the case with most of the mountainous areas within the Basin and Range Province, the lands within both of these associations are primarily utilized for desert rangeland, and contain various recreational activities. Due to the steep slopes, and the shallow, rock and gravel-like textures of the soils which are characteristic of this region, severe limitations exist for crop cultivation and community development activities.

The area identified on Map 7 as Miscellaneous, or the areas containing rough broken land, are rather mountainous areas that are predominately located in the eastern region of the county, and consist of soils which are undevelopable.

3.5 ECOREGIONS

In 1987, the EPA divided the United States into 76 ecoregions. An ecoregion is defined as an area of relative homogeneity based on land use, soils, topography, and potential natural vegetation. Ecoregions or ecosystems provide a means of grouping surface water and groundwater basins exhibiting similar characteristics such as physical habitat, hydrology, water chemistry, and biotic communities. There exists a homogeneity between water bodies located within the same ecoregion and heterogeneity between water bodies of different ecoregions. The Arizona

Department of Environmental Quality (ADEQ) anticipates using ecoregions to establish surface and groundwater quality standards and develop ecoregion specific biological criteria to prioritize water quality monitoring in the future.

The CAAG region is located in three distinct ecoregions: the Southern Basin and Range, the Arizona/New Mexico Mountains, and the Southern Desert. The majority of Gila County is located in the Arizona/New Mexico Mountain ecoregion which contains how to high mountains with grazed forests and woodlands. Small portions of southeastern Gila County and eastern Pinal County are in the Southern Desert ecoregion which supports desert shrubland on a desert plain, with abrupt high mountains providing "mountain islands" for higher elevation ecosystem fauna and flora communities. The balance of Pinal County is located in the Southern Basin and Range ecoregion and is characterized by desert valleys supporting desert shrubland separated by low mountains.

3.6 LAND OWNERSHIP

Table 3-2 show land ownership in the CAAG region. The Federal Government controls approximately 65% of the land in the region. The State Government controls another 19 percent while 15% of the land is privately held.

Approximately 28% of the land is Indian Reservation. The Clean Water Act, as amended in 1987 mandates that tribes be treated as States. CAAG's intent in this water quality plan update is to focus on non-reservation portions of the region, and to address Indian tribes under boundary coordination issues as part of the Regional Continuing Planning Process.

Most of the non-reservation lands in the region is publicly owned. The Forest Service is a major land owner with 30% of the land region-wide. Only 6.5% of the land in Pinal County is Forest Service while almost 56% of the land in Gila County is controlled by that agency. Other public lands are State Trust, Bureau of Land Management (BLM), military reservations, national parks and monuments and state or county parks.

The potential for land exchanges between federal agencies and private landowners exists within the region. While such exchanges do not usually have a significant impact on overall land ownership percentages, they do have local impacts with implications for water quality management planning.

Federal land management agencies such as the USFS, BLM and some of the USNPS, have developed plans which address water and wastewater issues. These will be incorporated into this plan through development of the Continuing Planning Process. Some specific water quality issues, particularly with respect to nonpoint source management, will be addressed on a region-wide basis which include State and Federal land.

**TABLE 3-2
 BREAKDOWN OF MAJOR LAND OWNERSHIP BY COUNTY**

COUNTY	LAND OWNERSHIP	ESTIMATED ACREAGE	OWNERSHIP %
GILA	PRIVATE	112,147.3	3.7
	STATE TRUST	31,180.6	1.0
	BUREAU OF LAND MANAGEMENT	57,520.8	1.9
	TONTO NATIONAL FOREST	1,702,409.6	55.5
	WHITE MOUNTAIN APACHE RESERVATION	528,138.8	17.2
	SAN CARLOS RESERVATION	633,994.9	20.7
	TONTO NATIONAL MONUMENT	1,107.1	0.0
	YAV-TONTO APACHE RESERVATION	81.7	0.0
	TOTAL	3,066,580.8	100.0
PINAL	PRIVATE	914,558.6	26.5
	STATE TRUST	1,222,932.1	35.4
	BUREAU OF LAND MANAGEMENT	383,578.1	11.1
	MILITARY RESERVATION	7,073.5	0.2
	PARKS & RECREATION	3,636.9	0.1
	TONTO NATIONAL FOREST	196,513.5	5.7
	CORONADO NATIONAL FOREST	28,872.4	0.8
	TOHONO O'ODHAM RESERVATION	266,344.3	7.7
	GILA RIVER RESERVATION	275,316.0	8.0
	SAN CARLOS RESERVATION	132,237.5	3.8
	AK-CHIN RESERVATION	21,014.3	0.6
	CASA GRANDE RUINS NATIONAL MONUMENT	469.4	0.0
	HOHOKAM PIMA NATIONAL MONUMENT	1,574.5	0.1
	TOTAL	3,454,121.1	100.0

SOURCE: ARIZONA STATE LAND DEPARTMENT

3.7 SOCIO-ECONOMIC DATA AND LAND USE

3.7.1 Population

The population of the CAAG region was 156,595 at the 1990 census. Of this total, Pinal County had 116,379 residents or 74% of the total district population; Gila County had 40,216 residents or 26% of the total. As indicated in Table 3, the growth in the CAAG region has far exceeded the overall increase in population within Arizona. Arizona increased its population by 3.6% from 1960 to 1970, 5.3% from 1970 to 1980, and 3.5% from 1980 to 1990. In these same time frames, the CAAG region has increased in population by 9.9%, 31.7% and 22.3%, respectively. Due to its proximity to both the Phoenix and Tucson metropolitan areas, Pinal County has grown at a faster rate than had been projected and will probably continue to do so in the future. See Tables 3-3 & 3-4 Historical and Project Population Growth for the CAAG region (1970-2020).

3.7.2 Planning Issues

Rapid population growth puts demands on counties and communities to develop the necessary infrastructure to support the increased population. For example, several communities are facing the need to construct new wastewater treatment facilities or plan for expansion of existing facilities. Others may need to do so in the near future. However, water and wastewater are only two aspects of necessary community infrastructure, which also includes transportation and community services. All of these needs compete for federal, state and local funding.

3.7.3 Population Distribution

While 28% of the land in the CAAG region is reservation land, only 11.5% of the population resides on reservations. Population on the Indian reservations is widely dispersed with few centers of concentration other than Sacaton and San Carlos which account for almost 35% of the total reservation population in the region. Average population density for the reservation portions of the region is 6.2 persons per square mile. See Table 3-5, Population in the CAAG region.

Approximately 56% of the population on the non-reservation portions of CAAG region reside in incorporated communities which include the communities of Globe, Hayden, Miami, Payson, and Winkelman within Gila County; and the communities of Apache Junction, Casa Grande, Coolidge, Eloy, Florence, Kearny, Mammoth, and Superior, all located within Pinal County. Population densities for the unincorporated, non-reservation areas are 6.0 and 8.9 persons per square mile, in Gila and Pinal Counties, respectively.

Arizona's overall population density is 32.2 persons per square mile compared with 15.5 for the CAAG region, or slightly less than have the state average. The City of Coolidge, the most densely populated city in the region with 2665 persons per square mile, is comparable to the density of Phoenix which is 2325.4 persons per square mile.

3.7.4 Planning Issues

The dispersed nature of the regions population has several implications for water quality management planning, particularly for drinking water and wastewater systems.

**TABLE 3-3
 HISTORIC POPULATION GROWTH 1960 TO 1990**

LOCATION	1960	% CHANGE	1970	% CHANGE	1980	% CHANGE	1990	% CHANGE
GILA COUNTY	25,745	--	29,255	13.6	37,080	26.8	40,216	8.5
GLOBE	6,217	--	7,333	18.0	6,886	-6.1	6,152	-10.7
HAYDEN	1,760	--	1,283	-27.1	1,205	-6.1	878	-27.1
MIAMI	3,350	--	3,394	1.3	2,716	-20.0	2,035	-25.1
PAYSON	(U)	--	1,490	--	5,068	240.1	8,377	65.3
WINKELMAN	1,123	--	974	-13.3	1,060	8.8	707	-33.3
PINAL COUNTY	62,673	--	67,916	8.4	90,918	33.9	116,379	28.0
APACHE JUNCTION	(U)	--	2,390	--	9,935	315.7	18,092	82.1
CASA GRANDE	8,311	--	10,536	26.8	14,971	42.1	19,076	27.4
COOLIDGE	4,990	--	4,651	-6.8	6,851	47.3	6,934	1.2
ELOY	4,899	--	5,381	9.8	6,240	16.0	7,201	15.4
FLORENCE	2,143	--	2,173	1.4	3,391	56.1	7,510	121.5
KEARNY	902	--	2,829	213.6	2,646	-6.5	2,262	-14.5
MAMMOTH	1,913	--	1,953	2.1	1,906	-2.4	1,845	-3.2
SUPERIOR	4,875	--	4,975	2.1	4,600	-7.5	3,376	-26.6
CAAG REGION	88,418	--	97,171	9.9	127,998	31.7	156,595	22.3
ARIZONA	1,302,161	--	1,775,399	3.6	2,716,546	5.3	3,665,228	3.5

SOURCE: UNITED STATES CENSUS BUREAU

**TABLE 3-4
 POPULATION PROJECTIONS WITHIN THE CAAG REGION 2000 TO 2040**

LOCATION	1990	2000	% CHANGE	2010	% CHANGE	2020	% CHANGE	2030	% CHANGE	2040	% CHANGE
GILA COUNTY	40,216	44,642	11.0	48,113	7.8	51,441	6.9	54,836	6.6	57,402	4.7
GLOBE	6,152	6,682	8.6	7,202	7.8	7,700	6.9	8,208	6.6	8,592	4.7
HAYDEN	878	1,013	15.4	1,091	7.7	1,167	7.0	1,244	6.6	1,302	4.7
MIAMI	2,035	2,165	6.4	2,333	7.8	2,494	6.9	2,659	6.6	2,783	4.7
PAYSON	8,377	9,778	16.7	10,538	7.8	11,267	6.9	12,011	6.6	12,573	4.7
WINKELMAN	707	720	1.8	776	7.8	829	6.8	884	6.6	925	4.6
PINAL COUNTY	116,379	138,766	19.2	158,059	13.9	177,227	12.1	195,324	10.2	212,690	8.9
APACHE JUNCTION	18,092	21,024	16.2	23,947	13.9	26,851	12.1	29,593	10.2	32,224	8.9
CASA GRANDE	19,076	22,250	16.6	25,343	13.9	28,416	12.1	31,318	10.2	34,103	8.9
COOLIDGE	6,934	7,889	13.8	8,986	13.9	10,076	12.1	11,105	10.2	12,092	8.9
ELOY	7,201	8,395	16.6	9,562	13.9	10,722	12.1	11,817	10.2	12,867	8.9
FLORENCE	7,510	8,831	17.6	10,058	13.9	11,278	12.1	12,430	10.2	13,535	8.9
KEARNY	2,262	2,694	19.1	3,069	13.9	3,441	12.1	3,793	10.2	4,130	8.9
MAMMOTH	1,845	2,154	16.7	2,454	13.9	2,751	12.1	3,032	10.2	3,302	8.9
SUPERIOR	3,376	3,896	15.4	4,438	13.9	4,976	12.1	5,484	10.2	5,971	8.9
CAAG REGION	156,595	183,408	17.1	206,172	12.4	228,668	10.9	250,160	9.4	270,092	8.0
ARIZONA	3,665,228	4,632,875	26.4	5,652,525	22.0	6,811,900	20.5	8,069,500	18.5	9,334,375	15.7

SOURCE: ARIZONA DEPARTMENT OF ECONOMIC SECURITY RESEARCH ADMINISTRATION, POPULATION STATISTICS UNIT, MAY 1993

**TABLE 3-5
 1990 REGION POPULATION FIGURES**

LOCATION	COUNTY	COMMUNITY	COUNTY AS A % OF REGION
GILA COUNTY	40,216		25.7
GLOBE		6,152	
HAYDEN		878	
MIAMI		2,035	
PAYSON		8,377	
WINKELMAN		707	
PINAL COUNTY		116,379	
APACHE JUNCTION	18,092		
CASA GRANDE	19,076		
COOLIDGE	6,934		
ELOY	7,201		
FLORENCE	7,510		
KEARNY	2,262		
MAMMOTH	1,845		
SUPERIOR	3,376		
REGION TOTAL	156,595		

SOURCE: UNITED STATES CENSUS BUREAU

- 1) With a widely dispersed population, there is a greater reliance on individual systems or very small systems where there are subdivisions of homes. However, these systems may be relatively expensive to install if climate, geology or hydrology of the areas make traditional septic systems inappropriate. In some areas, subdivisions were approved many years ago under old standards that are not appropriate today.

- 2) In unincorporated areas where there are greater numbers of people, development may be of a density to warrant a cluster or centralized system. However, there is generally no entity with the legal authorities to operate a water or wastewater system. Special districts, facility districts and/or sanitary districts must have priority as a management alternative to individual or private systems.

Similar problems may occur in unincorporated suburbs of larger communities, such as in the Apache Junction urban area. Often urban service boundaries are established to encourage in-fill development, but these in turn have an impact on outlying areas outside those boundaries. In some cases, there may be geographic reasons for limiting service

areas but in others the boundaries may be based primarily on political jurisdiction. Where communities or sanitary districts may want to expand their boundaries, they may allow existing small facilities to deteriorate, and possibly oppose further facility funding, so that the cost to take them over is lower.

- 3) Where incorporated areas or places of concentrated population have still relatively low population densities, the question arises as to when centralized systems become appropriate and/or cost effective or necessary because of impacts of existing systems in recent years.

3.7.5 Seasonal Population

Seasonal population has a significant impact on water quality management planning needs in central Arizona. There are three major components of seasonal population in the region: people with second homes in the area; people who spend one or more nights staying in hotels, motels or campgrounds; and visitors/tourists who pass through without stopping for the night.

The number of second homes in both Gila and Pinal County has increased significantly between 1980 and 1990, so that each county now has over 5,000 second homes. The 1990 census shows Gila County with 5,289 second homes and Pinal County with 6,375 second homes.

The CAAG region experiences the impact from seasonal population year round. The Payson/Pine/Strawberry area as well as the lakes in Gila County experience a summer fluctuation of valley residents wanting to escape the heat. Pinal County experiences a winter population increase from out-of-state visitors.

3.7.6 Planning Issues

- 1) Systems must be designed to handle relatively high peak flows and to operate at lower levels rather than being designed for steady flows year-round.
- 2) Some individual systems may be appropriate for seasonal use in areas with second homes but may not be appropriate for year-round use (e.g., ET (evapo-transpiration) beds in areas with low winter temperatures).
- 3) Part-time users may have different perceptions of the need for wastewater system improvements or be less willing to bear the cost than year-round residents.
- 4) In areas where second homes and year-round homes are mixed (such as Apache Junction or Payson), income differences between second home owners and year-round owners or renters may affect eligibility for some grants or loans for system improvements.
- 5) There are federal and state requirements for the use of approved population estimates and projections in planning for wastewater treatment facilities. However, the approved numbers are only for permanent residents. There is currently no approval process for estimates or projections of seasonal population, nor are there any approved methodologies for developing these estimates and projections.

3.7.7 Land Use and Economic Activity

The State of Arizona's economy has perennially been influenced by the four "C's": cotton, copper,

commerce and climate. The CAAG region's economy has all four in slightly different forms: copper, farming (which includes cotton, alfalfa, and cattle), commerce (including government related jobs) and climate which manifests itself in tourism.

In 1990, 17.5% of the non-agricultural labor force in the CAAG region was employed in the service industry and 20% was in retail trade, both of which to some extent serve the tourism industry. Construction made up almost 4% and manufacturing accounted for almost 12% of the jobs. Mining and quarrying accounted for 11.5% of employment while public administration and government related jobs were over 30% of the employment opportunities. This information, taken from the 1990 Census of Population and Housing Summary Tape File 3A, goes on to report that agricultural jobs, which include forestry and fisheries, accounted for 6.5% of the total labor force in the CAAG region.

Travel, tourism and winter visitors are a significant factor in the economy of central Arizona. The cities of Apache Junction and Casa Grande benefit more from the winter visitors than any other communities in the CAAG region. Apache Junction more than doubles in size during the winter months while Casa Grande increases in size by 30% to 40%. The region has several major visitor attractions: the Boyce Thompson Arboretum near the Town of Superior which attracts 72,000 visitors annually; Biosphere II near Oracle with attracts over 500,000 visitors; and the Casa Grande Ruins National Monument which brings in up to 180,000 visitors annually. In addition, the region has several state parks and a variety of recreational opportunities in the National Forests.

While many visitors to the region recreate on Forest Service or BLM lands, these lands are also used for a variety of other uses. Each is managed for "multiple use" including timber harvest, grazing, wildlife, recreation and mining. Each as developed land management plans for the highest and best use of its lands.

Approximately 3% of the land in Gila County and 8% in Pinal County is used for farming and agriculture. Pinal County is one of Arizona's five major agricultural areas and has approximately 390,000 acres that are irrigated agricultural lands, with the balance used for rangeland, recreation and wildlife habitats.

The Casa Grande Valley is the region's largest farming district which is shared by the communities of Casa Grande, Coolidge, Eloy and Florence. The farming industry provides the majority of jobs for this valley and directly employs over 4,000 workers. Cotton is still the largest cash crop, although crops such as alfalfa, winter wheat and citrus are also grown. Concentrated animal feeding operations (CAFOs) such as feedlots and dairies are found throughout the Casa Grande Valley.

Another major employment sector is in government-related jobs which accounts for over 25% of non-farm employment in each county and 30% of the jobs region-wide. Government employment includes law enforcement and justice system, public works, highway and public health departments.

Mining activity has been concentrated within the areas of southern Gila and eastern Pinal County. These areas are highly mineralized and have been subject to intensive mining activities over the past one hundred and twenty years. The most frequently mined commodities are in the district are copper, manganese, silver, gold, molybdenum and sand & gravel.

Mineral extraction has traditionally represented a large percentage of the region's overall economic base, however, a global downturn in the copper industry during the 1980's led to several mine closures and the loss of over 4,000 mining related jobs. Despite recent closures and layoffs,

copper mining still dominates the economies of Superior, Globe-Miami, Kearny, Hayden, Winkelman, Mammoth and San Manuel, which together form the State's "Copper Belt". Mining still accounts for an important part of the region's nonfarm, high-wage employment: 11.5% in Gila County and 11% in Pinal County.

The losses in mining-related employment, which were experienced over the past 10 to 12 years, have been accompanied by a rather significant shift in employment toward the service sector. This process has had adverse economic repercussions throughout the district.

While the mining industry has stabilized over the past several years, the potential for the industry to remain a major source of employment over the long term is questionable as communities pursue a course in well balanced, economic diversification. The Town of Kearny supports a sizable retirement community, although other towns such as Hayden, Winkelman and Superior have been unable to attract retirees or other employment opportunities.

Manufacturing facilities are found primarily near the larger communities of Casa Grande, Eloy, Florence and Apache Junction. State correctional facilities are located at Florence and Picacho. The Arizona Training Center is south of Coolidge.

3.7.8 Planning Issues

- 1) Mining and agriculture are major land uses with potential impacts on nonpoint source pollution. Grazing, timber harvest and recreation are also activities, in the CAAG region, that can generate nonpoint source pollution and should be addressed in the planning process.
- 2) Industrial and manufacturing activity is largely confined to more urban areas with municipal wastewater treatment facilities and approved pretreatment programs (Casa Grande and Payson). However, as smaller communities develop stronger industrial bases, impacts of those industries will have to be addressed. Similarly, development of major, isolated industrial facilities will need to be addressed.
- 3) The number of National Forests and wilderness areas and the associated tourism have impacts on air quality and solid waste as well as water quality. Tourists generate waste at parks, campgrounds and highway rest areas that must be disposed of locally. Runoff from roads used by tourists and residents has an impact on sedimentation and other pollutants in washes and streams.

REFERENCES

1990 Census of Population and Housing Summary Tape File 3A

Chapter 4.0 WATER QUALITY ISSUES

This chapter is intended to provide an overview of existing and potential water quality problems within the designated areawide planning area, including an identification of the types and degree of problems and the sources of pollutants contributing to the problems. The focus of this assessment is on surface and groundwater basins on non-Tribal lands in the region.

While surface and groundwater are addressed separately, it should be recognized that there is a very close connection in many areas between surface and groundwater, i.e., quality problems in one area 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. These discharges may be identified based on the 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.

This section of the plan also briefly addresses reclaimed water, which is becoming increasingly important in areas with limited water resources as wastewater treatment technologies improve.

4.1 SURFACE WATER

Surface water is generally considered to be water which flows or is stored on the surface of the land. The State of Arizona has eleven surface water basins with boundaries defined following the USGS Hydrologic Unit Code system.

The CAAG region contains parts of five major river basins: the Salt River Basin (about 75 percent in Gila County), the Gila River Basin (about 15 percent in Pinal County and 15 percent in Gila County), the Santa Cruz River Basin (about 20 percent in Pinal County), the San Pedro River Basin (about 15 percent in Pinal County), and the Verde River Basin in Gila County. Three of these basins (Salt, Gila, Verde, and San Pedro) are generally considered to be the major surface water producers.

4.1.1. Surface Water Basins

The occurrence of surface water in the CAAG area is widely varied. In Pinal County ephemeral, intermittent, and perennial flow can be found in the Upper Gila-San Pedro River Basins (eastern Pinal County and San Carlos Reservation), while only ephemeral flow can be expected in the Santa Cruz River Basin of western Pinal County.

The Santa Cruz River Basin of western Pinal County is a mixture of surface water runoff, irrigation tailwater, and effluent released from sewage treatment plants in the Tucson metropolitan area, and is diverted at several locations near Red Rock for agricultural irrigation.

There are also three major surface water basins in Gila County, the Upper Gila, Salt River, and the Verde River. Gila County has a number of intermittent and perennial streams in the Salt River Basin, which drain most of the county.

The Salt River is the major stream in Gila County and is formed by the confluence of the White and Black Rivers in the eastern portion of the county. Most of Gila County lies in the Salt River Basin. The Salt River flows westerly across the county to Roosevelt. Carrizo, Cibecue, Canyon, and Cherry Creeks feed the Salt River between the confluence of the White and Black Rivers and the

Roosevelt area. Tonto Creek, one of the Salt's major tributaries, joins the Salt River at Roosevelt.

4.1.2. Designated Uses

Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity. (33 C.F.R. § 329).

The State of Arizona has designated uses for all navigable waters in the State, with "fishable and swimmable" used as the baseline to meet requirements of the Clean Water Act. Designated Uses definitions in Arizona are as follows (Excerpts from A.A.C. § R18-11-104 and 101, certified February 18, 1992).

Domestic Water Source (DWS): Designated use of a navigable water as a potable water supply. Treatment by coagulation, sedimentation, filtration, disinfection or other treatments may be required to yield a finished water suitable for human consumption.

Full Body Contact (FBC): Designated use of a navigable water for an activity which causes the human body to come into direct contact with the water to the point of complete submergence. The activity is such that ingestion of the water is likely to occur and certain sensitive body organs, such as eyes, ears or nose may be exposed to direct contact with the water.

Partial Body Contact (PBC): Designated use of navigable water for an activity which may cause the human body to come into direct contact with the water but normally not to the point of complete submergence. The activity is such that ingestion of the water is not likely to occur, nor will sensitive body organs such as the eyes, ears or nose normally be exposed to the water.

Aquatic and Wildlife, Cold Water Fishery (A&Wc): Designated use of a navigable water by animals, plants or other organisms, including salmonids, for habitation, growth or propagation.

Aquatic and Wildlife, Warm Water Fishery (A&Ww): Designated use of a navigable water by animals, plants or other organisms, excluding salmonids, for habitation, growth or propagation.

Aquatic and Wildlife, Ephemeral (A&We): Designated use of a navigable water by animals, plants or other organisms, excluding fish, for habitation, growth or propagation.

Aquatic and Wildlife, Effluent Dominated (A&Wedw): Designated use of effluent dominated water by animals, plants or other organisms for habitation, growth or propagation.

Agricultural Irrigation (AgI): Designated use of a navigable water for irrigation farming.

Agricultural Livestock Watering (AgL): Designated use of a navigable water for consumption by livestock.

Fish Consumption (FC): The use of a navigable water by humans for harvesting aquatic organisms for consumption. Harvestable aquatic organisms include, but are not limited to, fish, clams, turtles, crayfish and frogs.

The navigable waters in the CAAG region with their designated uses are listed in Appendix 4-1.

The State of Arizona has adopted water quality standards to protect the designated uses of its navigable waters. Standard types include antidegradation, narrative and 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 (A.R.S. § Title 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 navigable water quality standards are listed in Appendix 4-2.

4.1.3. Special Classifications

4.1.3a. Unique Waters

A navigable water may be classified as an unique water by the director of ADEQ upon a finding that the navigable water is an outstanding state resource based upon one of the following criteria (Excerpt from A.A.C. § R-18-11-12):

1. The navigable water is of exceptional recreational or ecological significance because of its unique attributes, including but not limited to, attributes related to the geology, flora, fauna, water quality, aesthetic values or the wilderness characteristics of the navigable water.
2. Threatened or endangered species are known to be associated with the navigable water and the existing water quality is essential to maintenance and propagation of a threatened or endangered species or the navigable water provides critical habitat for a threatened or endangered species.

Special standards are adopted, by rule, for each designated "unique water". Bonita Creek, a tributary to the Upper Gila River is within the CAAG region, is classified as a unique water under the antidegradation standard (A.C.C. § R-18-11-107D). The 1992 designated uses for Bonita Creek are as follows: A&Ww, FBC, DWS, FC, AgL based on the 1987 assessment which did not include Tribal lands. (BLM/Safford, Watershed Monitoring 1990-1991).

4.1.3b. EDWs (Effluent Dominated Waters)

In cases where flow in a stream segment consists primarily of discharges of treated wastewater, that surface water may be classified as an "effluent dominated water". Refer to Appendix 4-2 for EDW standards. The navigable waters classified as effluent dominated waters within the CAAG region are listed in Appendix 4-2.

4.1.3c. Priority Lakes

Theodore Roosevelt Lake, a 17,000 acre reservoir on the Salt River drainage in central Arizona, is the only listed priority lake within the CAAG region. Theodore Roosevelt Dam was constructed in 1911, and created the reservoir which served initially for conservation storage and hydroelectric power generation. The dam is currently undergoing reconstruction which is due to be completed in 1995. The changes will add flood control to the purpose of the reservoir and will increase the lake's capacity to 19,200 acres. Designated uses for Roosevelt Lake include DWS, FBC, FC, A&Ww, Agl and AgL. Roosevelt Lake is a major source of agricultural and drinking water for the Phoenix metropolitan area. It also provides recreational activities including fishing, camping, swimming, waterskiing and boating. Current dam expansion will flood some of the existing recreational

facilities and the USFS has scheduled approximately \$50 million in improvements and redevelopment of recreational facilities by 1996.

The Theodore Roosevelt Lake, Arizona Phase I Diagnostic/Feasibility Study Final Draft was completed by ADEQ Water Assessment Section under the Clean Lakes Program in November 1993. This limnological study was performed to provide a water quality and sediment contaminant baseline for Roosevelt Lake which was compared to other historic water quality data and information to determine if the lake is presently affected by contaminant metals.

The study noted that the water quality of Roosevelt Lake is potentially threatened from an acid mine drainage plume in the Pinal Creek watershed, a tributary of the Salt River. The Pinal Creek Group, a consortium of mining companies is currently performing interim remedial action to prevent or preclude the migration of the acidic plume to the surface waters of Pinal Creek. Pinal Creek's surface waters presently exceed water quality standards for manganese, nickel, beryllium and pH at the beginning of perennial waters. The Salt River above Roosevelt Lake exceeds water quality standards for beryllium and arsenic.

With present information it is not possible to specifically attribute metals contamination, toxic contaminants or other pollutants emanating from manmade sources. More extensive and comprehensive examination of potential pollution sources in the watershed and lake's tributaries are recommended.

4.1.3d. Water Quality Limited Waters

Waterbodies that are not fully supporting all of their designated uses or if existing controls are not sufficient to achieve water quality standards are now classified as Water Quality Limited Waters. All Water Quality Limited Waters were prioritized for Total Maximum Daily Load (TMDL) analysis, pursuant to CWA Section 303(d). A TMDL represents the sum of the existing or future individual "wasteload allocations" (water quality based effluent limitations) for point sources of pollution, and "load allocations" for nonpoint and natural background sources. TMDLs are required when technology-based effluent limitations (i.e., existing sewage treatment) are not stringent enough to achieve water quality standards for such waters.

The ADEQ's 1994 Draft Water Quality Assessment Report included assessment of use support and impairment based on monitoring data and information primarily collected in a 5-year period, from October 2, 1988 through September 30, 1993. The assessment process and the "water quality limited" listing process are linked together; however they use different criteria due to different purposes. The purpose of the designated use support assessment is to determine a statewide water quality status report that is used to help set priorities and evaluate management activities. The assessment sets no regulatory requirements and is used primarily for planning and prioritization purposes. The water quality limited list, however, is very resource intensive and includes potential regulator actions. Listing water quality limited waters is limited to waterbodies with compelling evidence that additional water quality based controls are needed.

The 1994 Draft Water Quality Assessment Report list indicates the priority ranking of these listed waters for TMDLs, the primary cause of impairment, and which uses were assessed as in non-support. The listed waterbodies are prioritized for Total Maximum Daily Loan analysis as high, medium and low. Based on the priority rankings, ADEQ will develop TMDL strategies which will be incorporated into several programs such as water quality management planning, Nonpoint Source Management Zones, permit actions, facility inspections, monitoring and assessments and data modeling and management. Following development of TMDLs for a waterbody or watershed,

control actions may be implemented by updating Water Quality Management Plans, providing additional stipulations in permits, establishing specific BMPs to control nonpoint source contributions, required improvements to wastewater treatment facilities and establishment of other local restrictions. TMDLs will be evaluated and control actions adjusted in order to achieve water quality objectives within an identified waterbody.

A listing of Water Quality Limited Waters in the CAAG region is included in Appendix 4-4.

4.1.3e. Riparian Areas

In 1990, the U.S. 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 wetland areas within the conservation area.

Riparian area was defined by A.R.S. § 45-101-7 as a geographically delineated area with distinct resource values, that is characterized by deep-rooted plant species that depend on having roots in the water table or its capillary zone, and that occurs within or adjacent to a natural perennial or intermittent stream channel or within or adjacent to a lake, pond, or marsh bed maintained primarily by natural water sources. Riparian area does not include areas in or adjacent to ephemeral stream channels, artificially created stockponds, man-made storage reservoirs constructed primarily for conservation or regulatory storage, municipal and industrial ponds, or man-made water transportation, distribution, or off-stream storage and collection systems.

Wetlands, as defined in surface water rules (A.A.C. § R18-11-101), consists of those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, cienegas, tinajas, and similar areas.

Riparian areas can act as natural filters to remove suspended solids and other contaminants. Vegetation in these areas can slow runoff water's velocity, thereby reducing the erosion action and increasing valuable groundwater recharge. Current Nonpoint Source Program demonstration projects are being conducted in riparian areas to demonstrate some of these actions. In the past, riparian vegetation along many of Arizona's stream channels has been systematically removed to increase runoff to support irrigation and urbanization.

While riparian areas are not specifically classified or protected by rule in Arizona at this time, Executive Order #91-6 recognizes the importance of protecting and restoring riparian areas and establishes an Interagency Riparian Areas Coordinating Council to consider and recommend a state wide riparian management plan. Development of this plan is to be coordinated by the Arizona Game and Fish Department. The Executive Order also requires ADEQ to coordinate with other state agencies, such as ADWR, to develop legislation mandating state riparian area protection.

To date there is no official state wetland inventory and the USFS mapping of Arizona's wetlands are quickly becoming outdated due to rapid land development. The USFWS is currently adding riparian area features to existing National Wetlands Inventory maps. AGFD, as a result of 1992 legislation, is conducting a statewide inventory of riparian areas. The initial phase of this inventory of riparian vegetation communities associated with perennial waters has been completed. The inventory along intermittent streams is to begin in June 1994. When completed, this inventory will be utilized to develop riparian protection programs based on a classification system to determine

functions and values of riparian areas which will identify priorities for preservation and mitigation.

Wetlands are included in Arizona by definition as "waters of the United States" and are therefore protected by surface water standards at the levels specified for adjacent stream or lake designated uses but designated uses have not been established for isolated wetlands or cienegas. Wetlands are currently protected by surface water rules in narrative, numeric and antidegradation standards; however, as the criteria for protection of wetland and riparian areas differ from human health and aquatic life criteria, specific narrative and numeric standards need to be developed.

Some riparian areas and wetlands are eligible for protection under Arizona's Surface Water Quality Standards as "Unique Waters". In addition, section 404 of the CWA, authorizes the U.S. Army Corp of Engineers to issue Dredge and Fill Permits, which limit discharges materials into waters of the U.S. through stipulation of acreage and location of wetlands subject to removal. Additionally ADEQ issues 401 Water Quality Certifications prior to approval of 404 permits. The program directly affects riparian/wetland areas because the removal of these materials often takes place within stream beds. Due to a lack of auditing for implementation of 404 nor 401 permits, the effectiveness of the permits for protection of riparian or wetlands has not been documented.

The majority of riparian areas located in the CAAG region are either associated with the free flowing unmodified stream segments in the more mountainous regions or with the ephemeral and intermittent streams in the lower elevations. These riparian communities are arrayed along stream channels and can only exist in response to surface and subsurface conditions where water and moisture are abundant. The communities are characterized by the cottonwood-willow and mesquite series, and are commonly transitional zones between perennial and ephemeral stream channels and xeric desert upland. Many riparian areas in Arizona include historic and archaeological sites.

Within Gila County, important riparian areas have been identified along the East Verde River and its tributaries; Tonto Creek; the San Carlos River; the Upper Salt River and several of its tributaries, which is inclusive of Cherry Creek; and areas along the White and Black Rivers. Within Pinal County important riparian areas have been identified along the Gila River, extending from San Carlos Lake to the central region of Pinal County; the San Pedro River; and along Aravaipa and Queen Creeks.

4.1.3f. Wild and Scenic Rivers

A wild and scenic river is a free flowing river or river segment with outstanding scenic, recreational, geologic, fish and wildlife, historic, archeological, or other values which had been designated by act of Congress or the Secretary of the Interior as a part of the National Wild and Scenic Rivers System (Public Law 90-542).

There are three general bases for including rivers in the Wild and Scenic Rivers System.

1. Some of the more prominent rivers can be included as a way of providing national recognition, a "hall of fame" for great rivers that are a part of our nation's history and a legacy to future generations.
2. Other rivers may be included in the system because their values are seriously threatened by water developments, mining, residential developments, etc. The Wild and Scenic Rivers Act then becomes the legal mechanism for protective action.
3. The third category of rivers is becoming the biggest list, those with unique values which require special management protection so they can be preserved for the future. These requirements are documented in a management plan for each river, as required by the Wild And Scenic Rivers Act.

Within the Gila Box Riparian National Conservation Area, 23 miles of the Gila River, and 15 miles of Bonita Creek are on a list of potential wild for inclusion in the Wild and Scenic River System. See Appendix 4-5 for the listing of potential Wild and Scenic Rivers located in the CAAG region.

4.1.4. Surface Water Quality Monitoring and Assessment

Designated use support is assessed by comparing surface water standards to recent monitoring data where it is 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 complaints investigations, site investigation reports, land use management studies, or other resources which may be used for professional field evaluations.

Water Quality Assessments Reports (305(b)) prepared by ADEQ are primarily based on monitoring data and information collected in a 5 year period. For the 1994 Draft 305(b) Report, the data collection period extends from October 1, 1988 through September 30, 1993. Surface water data utilized for the 305(b) assessment is provided by ADEQ's monitoring program and data and information provided by the USFS, BLM, USNPS, USGS, EPA and AGFD. One difficulty in comparing historical data with current data are the constant changing qualifications and scientific assumptions used from one assessment year to the next. Changes in federal and state standards and methods also make it difficult to compare prior and current assessments.

Data collection activities have increased in the past ten years. ADEQ and 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.

The 1994 Draft 305(b) Water Quality Assessment included approximately 5,600 stream miles, which is only 5% of the estimated 108,000 stream miles in Arizona which includes streams, washes and canals. By combining miles partially and not supporting uses, 3,725 stream miles are assessed as impaired. The comparison of monitored versus evaluated assessments indicates a slightly higher rate of impairment among monitored streams. Additionally lakes and streams on Indian Lands were not subject to this assessment. Both monitoring and evaluated data are too limited to provide a sound statistical basis for assessment of water quality, and information for identifying sources of water quality problems are often limited or unavailable. Other weaknesses identified in the current assessment and monitoring process include sampling based on a perceived problem with may result in finding more exceedances of standards than if random sampling were conducted, a lack of data on natural background levels, chemical analysis may not be appropriate for assessing the impact of water quality on biological communities.

In 1994, USGS began the National Water Quality Assessment Program (NAWQA) in Arizona. NAWQA is a nationwide program with sixty study units, one of which is located in Arizona labeled the Central Arizona Basins. This will be an on-going program repeating in 10 year cycles including planning, retrospective analysis and reconnaissance reviewing existing data, intensive data collection and interpretation including in field testing, reporting and low-intensity sampling. NAWQA's purpose is to ascertain and describe the current baseline status of water quality on a national basis and assess long term trends and compare and contrast study areas including interdisciplinary analysis. The goals of NAWQA are to provide long term monitoring, study and research, timely interpretation of information and better availability and use of information.

4.1.4a. Fixed Station Network

The Fixed Station Network (FSN) is the principal source of data to assess the chemical, physical, and biological characteristics of surface waters on a long-term basis. USGS operates the nationwide stream quality network known as NASQAN, and cooperates with ADEQ in monitoring 15-18 sites in Arizona. ADEQ operates a complimentary network of monitoring sites.

FSN monitoring of surface water is performed on a regular basis at selected sites throughout the state for a pre-determined period of time. For Water Year 1994, ADEQ plans to monitor a total of 23 sites: 16 sites bimonthly (6 times), one site quarterly, 5 sites once, and one site whenever it flows (ephemeral). USGS will conduct water quality monitoring at an additional 14 sites. For more information on monitoring sites and agencies, refer to Appendix 4-6, Surface Water Data for CAAG Region.

4.1.4b. Microbiological Monitoring

On June 29, 1989, EPA promulgated a final rule regulating the microbiological quality of drinking water. The federal regulation established maximum contaminant levels for total coliform and for fecal coliform organisms in drinking water for all public water systems. It established monitoring requirements, sample invalidation criteria, reporting and public notification requirements. The National Primary Drinking Water Regulations for total coliform were adopted by Arizona in the last revision of the state's drinking water rules effective August 8, 1991. The total coliform rule is found in the proposed rules at § R18-4-202, scheduled for state rule adoption in November, 1994.

A cooperative agreement between ADEQ and ADHS provides for monitoring atypical microbiological parameters, such as viruses and parasites. During Water Year 1991, known polluted waters in the Santa Cruz Basin were sampled and compared to ambient levels elsewhere in the basin. In Water Year 1992, the San Pedro Basin was monitored and evaluated. Samples are to be used to determine if there are any correlations between these microgeological parameters and chemical/physical parameters. These data will also be available for developing future parasite and virus surface water standards.

Microbiological monitoring was carried out along a segment of the Salt River, since this area is heavily used during the summer months by "tubers". Through a cooperative agreement, water samples were collected in the National Forest recreational area by Maricopa County sanitarians during heavy use periods. The Arizona Department of Health Services laboratory completed the analyses using Arizona Department of Environment Quality funding.

4.1.4c. Toxics Testing

Routine surface water monitoring by ADEQ and USGS include analyses for a limited number of priority pollutants that are typically found in water or sediment. The Arizona Priority Pollutant Program is a multi-agency effort to screen waterbodies and to monitor water, sediment, and fish tissue for the presence of priority pollutants. Toxic chemicals included in the monitoring include ammonia, arsenic, silver, beryllium, cadmium, chromium, copper, mercury, nickel, lead, selenium, antimony and thallium. Surface waters used for public drinking water supplies are also being tested at the point of use for the toxic chemicals listed in Arizona's Public Drinking Water Rules A.A.C. § R18-4-201 through R18-4-290.

4.1.4d Public Health and Aquatic Life Impacts

Statewide there were no restrictions on bathing areas nor were waterborne diseases of man reported. However, the State does not have an adequate reporting system in place for such incidence.

The Arizona Department of Health Services completed a public health risk assessment for recreation usage of the Painted Rock Borrow Pit Lake on the Gila River in September 1991 (ADHS, 1991). As a result of the study, a fish consumption advisory was issued on October 3, 1991, warning people not to eat fish turtles, crayfish and other aquatic organisms from portions of the Salt and Gila Rivers.

Aquatic life impacts include threatened, endangered, and extirpated native fish species. Five of the 32 native fishes found in Arizona at the turn of the century no longer occur here and 21 of the remaining 27 are listed by the State as endangered or threatened, or are under study for listing. The negative effects of hydro/habitat modification also extend to other native aquatic-dependent species. Currently there are no appropriate interagency mechanisms within the State to prevent further declines.

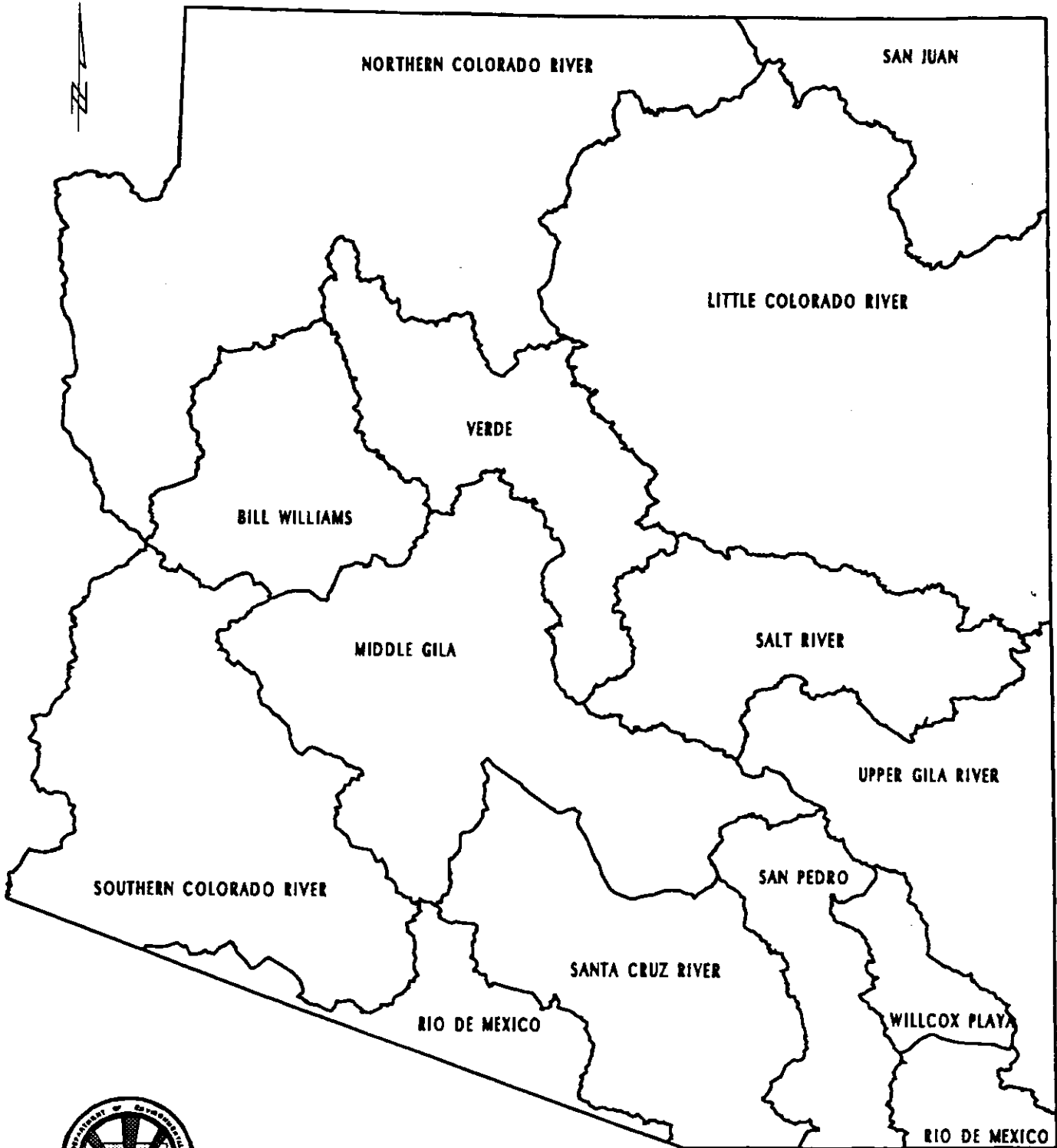
According to biologists with the USFWS, long-term deliveries of CAP water may jeopardize rare native fish in the Gila River System. The water may carry non-native fish to the Gila River and its tributaries from the Colorado River. State and federal officials indicated that solving the problem by adding more fish barriers to the CAP project would cost millions of dollars. State and local officials are concerned about the CAP's potential to spread aggressive, predatory non-native fish, particularly the striped bass. (Staff, The Associated Press, Arizona Republic, June 1, 1993).

4.2. SURFACE WATER QUALITY ASSESSMENT

The water quality assessment of this plan is intended to provide an overview of water quality of the surface water basins (refer to Chapter 3, Map 4, Page 42 for CAAG surface water basins) in the region and to identify major problem areas. The assessment does not include areas on Indian Lands. Information included is based primarily on ADEQ's 1991, 1992 and 1994 Water Quality Assessment. Supporting data on surface water quality from the 1994 ADEQ assessment is contained in Appendix 4-6 "Surface Water Data for CAAG Region". Beginning on page 69, maps of the surface water basins within the state are included for reference including: Map 1 of the State of Arizona Surface Water Basins; Map 2 of the Middle Gila Basin; Map 3 of the Upper Gila River Basin; Map 4 of the Salt River Basin; Map 5 of the San Pedro River Basin, Map 6 of the Santa Cruz Basin and Map 7 of the Verde Basin. Please note that the maps were prepared by ADEQ for the 1992 water assessment while some of the text in this plan incorporates information from the 1993 water quality assessment. While maps for the 1993 assessment were not available during preparation of this plan, this information does not change drastically over short time periods.

It should be noted that testing of surface water is often a result of complaints or known problems. Therefore, the data presented may not necessarily be representative of the untested reaches or lakes. Also, continuing changes in the criteria and methods makes comparisons with previous assessment difficult.

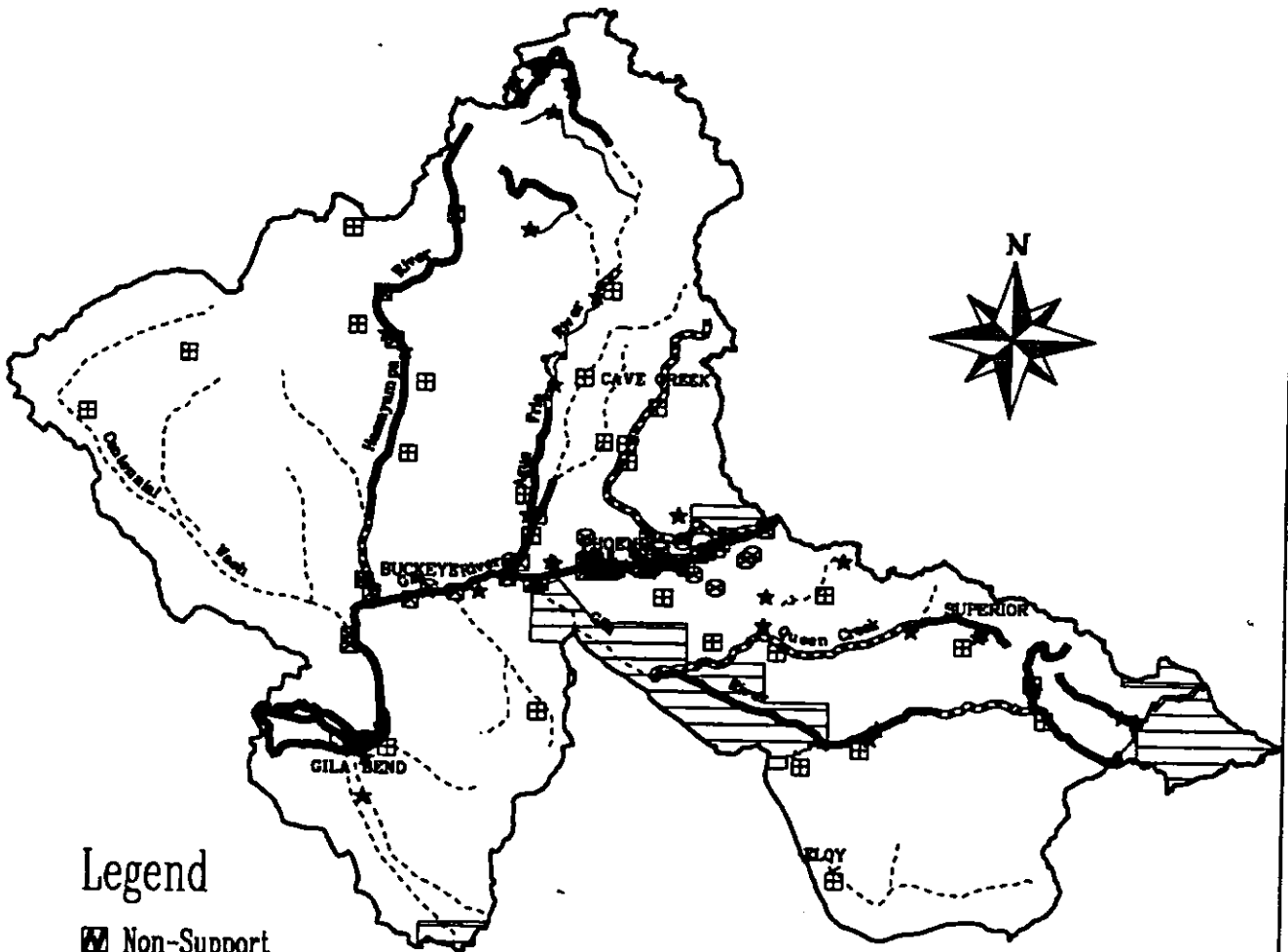
MAP 1
Surface Water Basins













Source: ADEQ, 1993

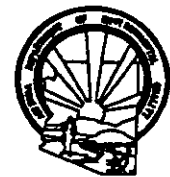
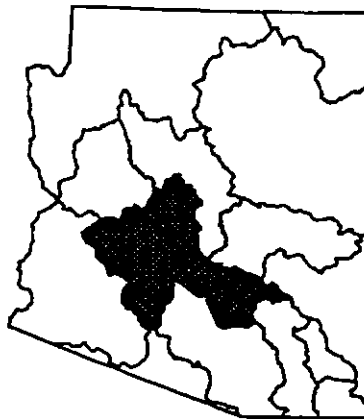
SCALE
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1992 Middle Gila Basin Assessment Map



Legend

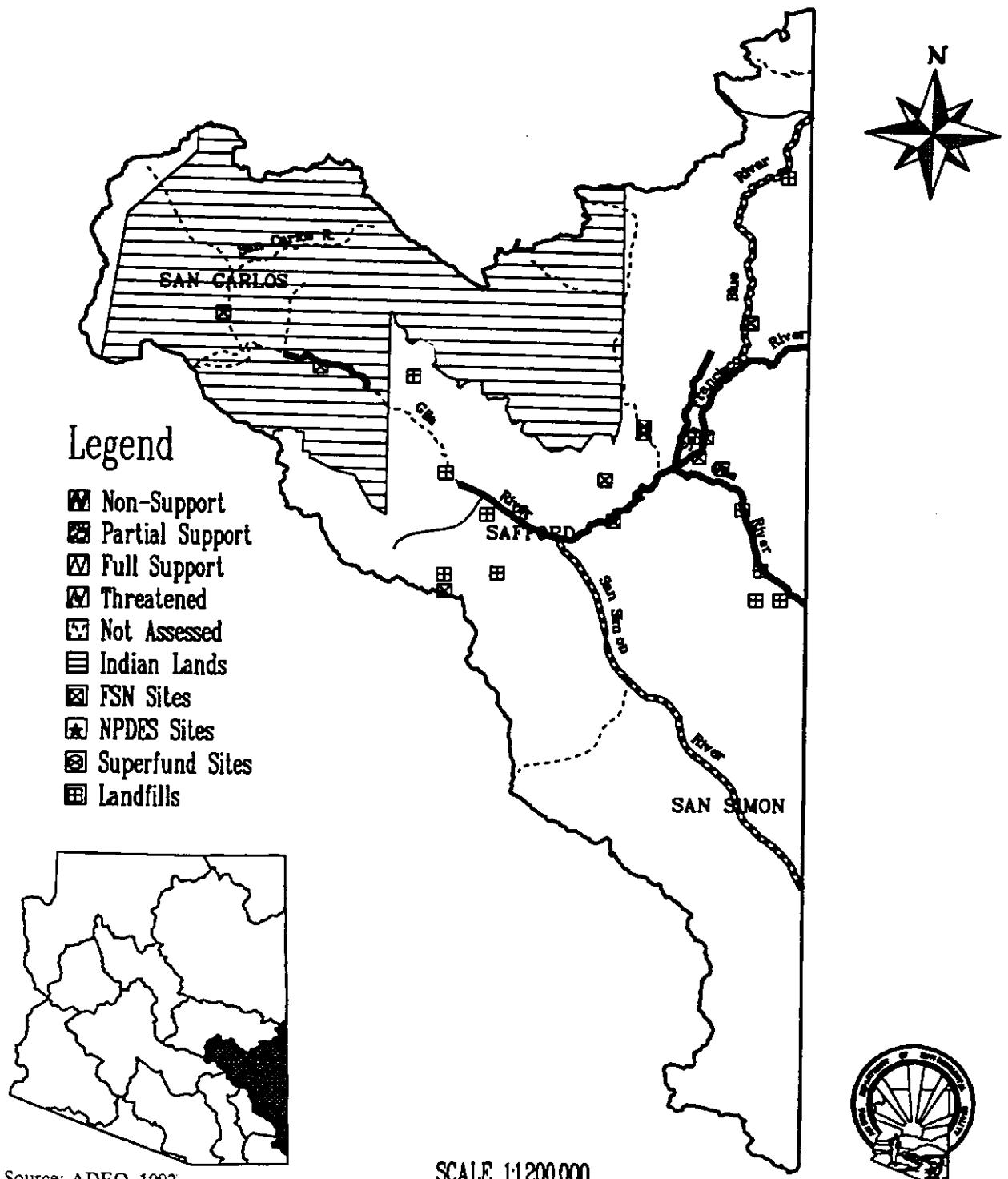
-  Non-Support
-  Partial Support
-  Full Support
-  Threatened
-  Not Assessed
-  Indian Lands
-  FSN Sites
-  NPDES Sites
-  Superfund Sites
-  Landfills



Source: ADEQ, 1993

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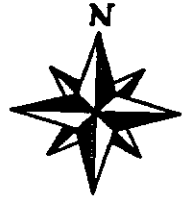
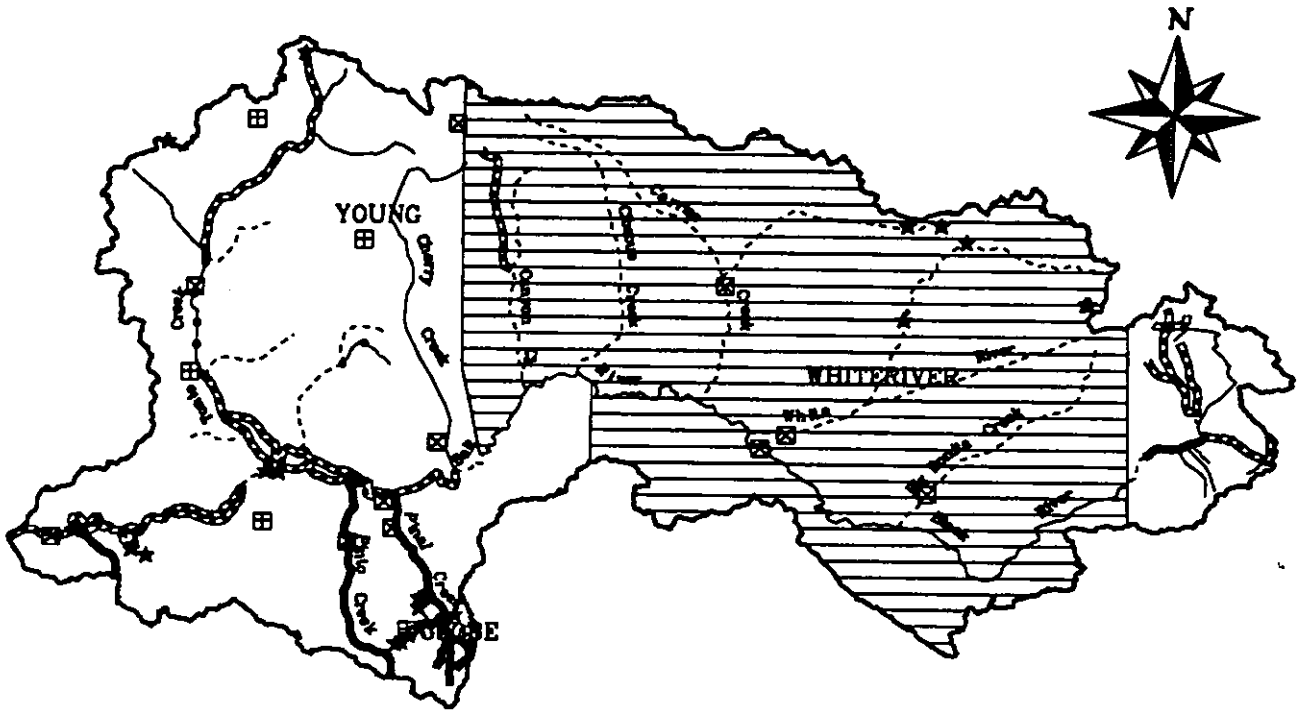
1992 Upper Gila River Basin Assessment Map













Source: ADEQ, 1993

SCALE 1:1,200,000

1992 Salt River Basin Assessment Map



Legend

-  Non-Support
-  Partial Support
-  Full Support
-  Threatened
-  Not Assessed
-  Indian Lands
-  FSN Sites
-  NPDES Sites
-  Superfund Sites
-  Landfills













Source: ADEQ, 1993

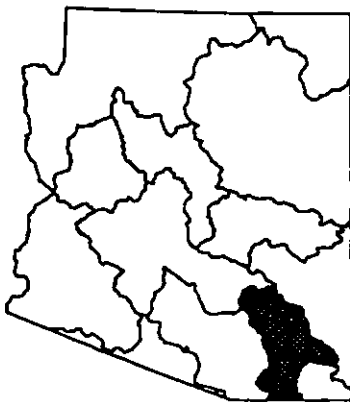
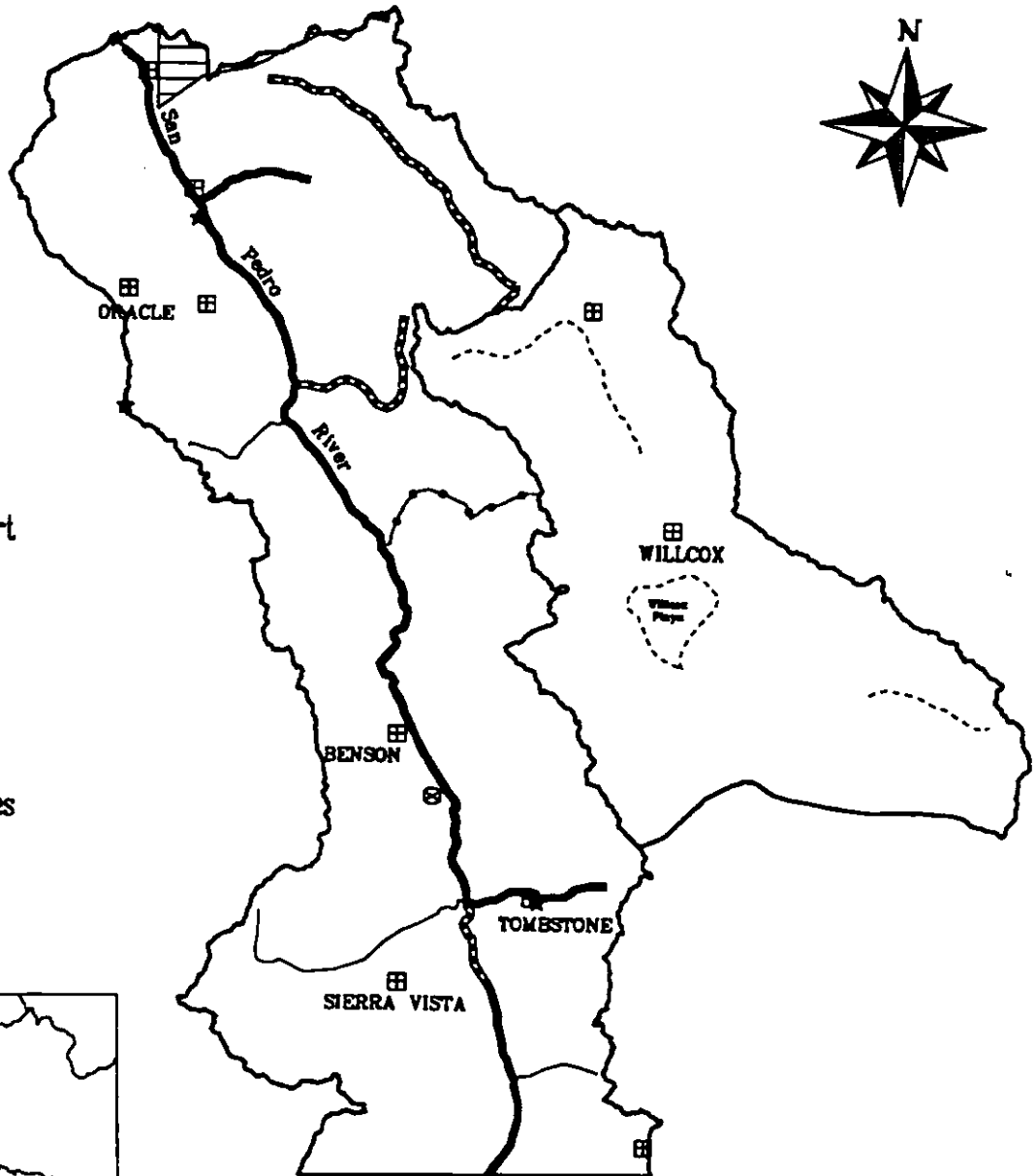
SCALE 1:1,200,000



1992 San Pedro River/Willcox Basin Assessment Map

Legend

-  Non-Support
-  Partial Support
-  Full Support
-  Threatened
-  Not Assessed
-  Indian Lands
-  FSN Sites
-  NPDES Sites
-  Superfund Sites
-  Landfills

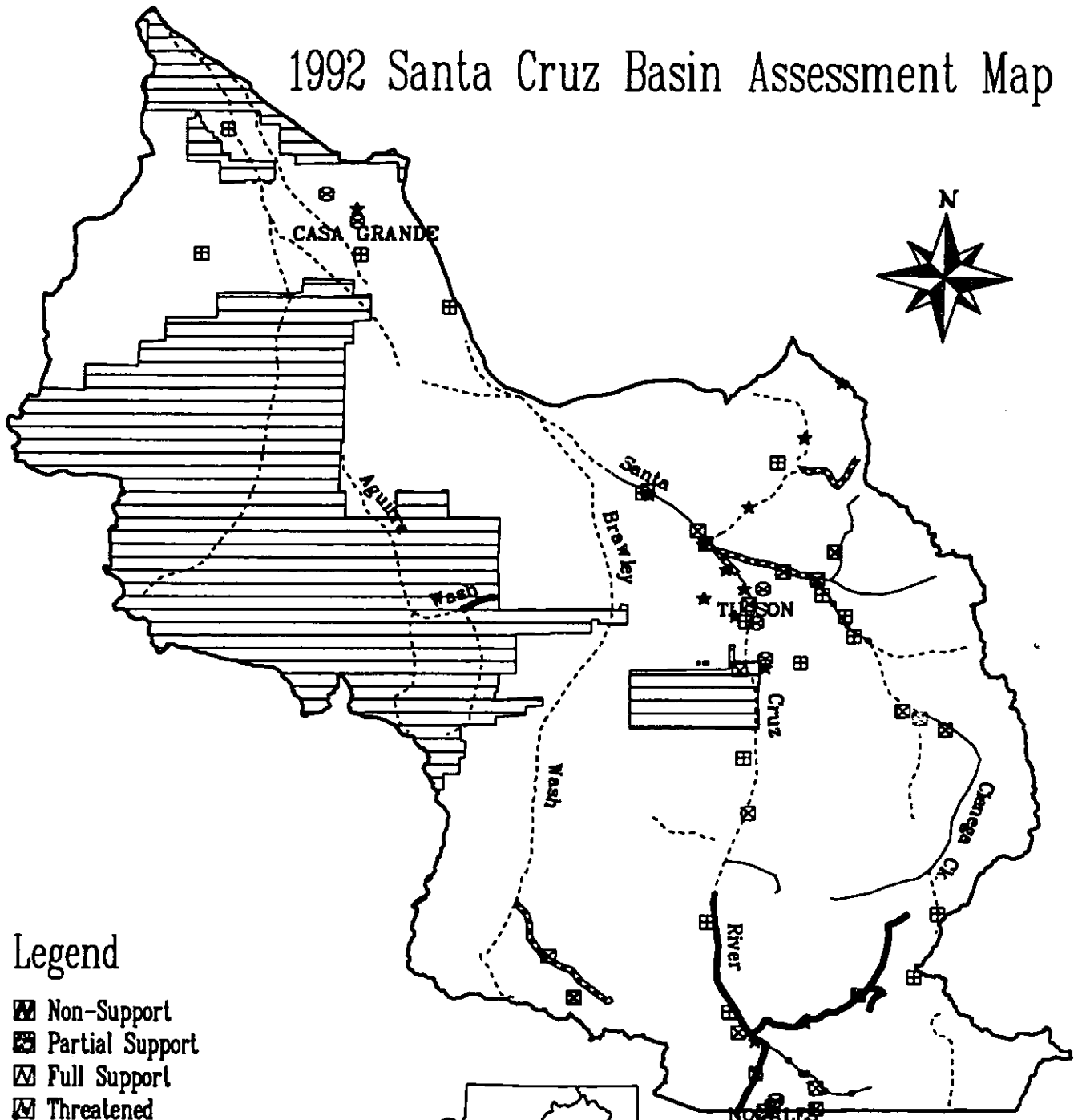


Source: ADEQ, 1993

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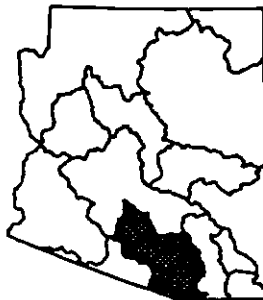


1992 Santa Cruz Basin Assessment Map



Legend

- ☒ Non-Support
- ☒ Partial Support
- ☒ Full Support
- ☒ Threatened
- ☒ Not Assessed
- ▨ Indian Lands
- ☒ PSN Sites
- ★ NPDES Sites
- ⊙ Superfund Sites
- ☒ Landfills



Source: ADEQ, 1993

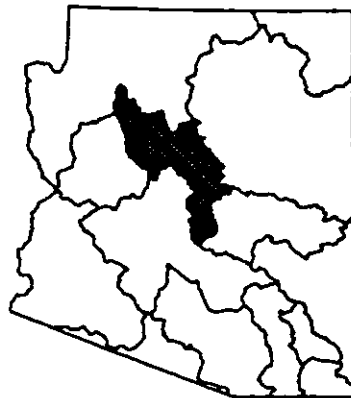
SCALE 1:1,000,000

1992 Verde Basin Assessment Map



Legend

- Non-Support
- Partial Support
- Full Support
- Threatened
- Not Assessed
- Indian Lands
- FSN Sites
- NPDES Sites
- Superfund Sites
- Landfills

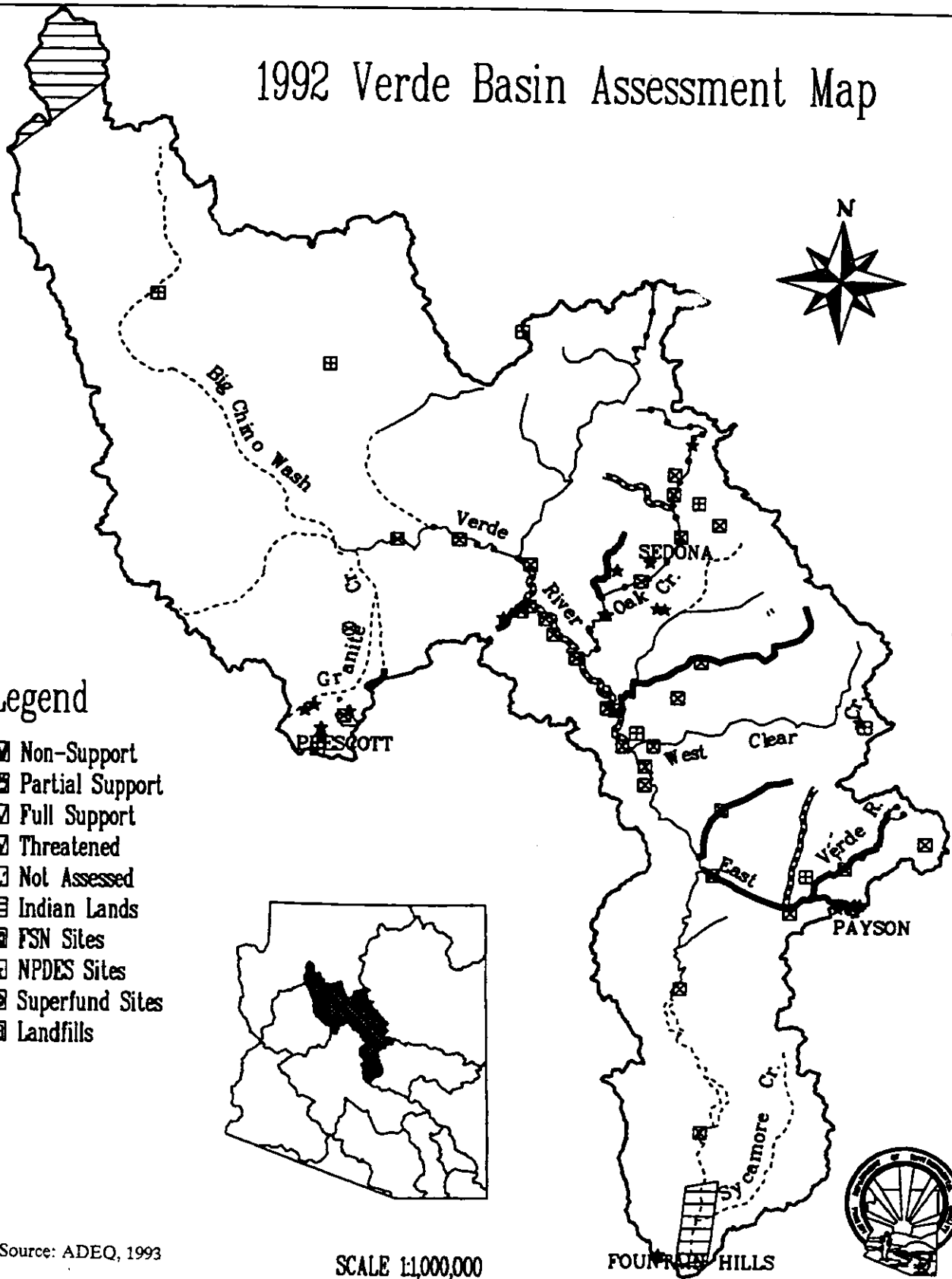


Source: ADEQ, 1993

SCALE 1:1,000,000



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4.2.1. Middle Gila River Basin

The Middle Gila River Basin encompasses an area of approximately 12,150 square miles, and includes the Phoenix metropolitan area. Almost two-thirds of the State's population resides in this basin. The basin receives limited rainfall. Surface water flow in this basin is attributable to releases from upstream impoundments, effluent from wastewater treatment plants, and/or agricultural return flows.

Of the 14,164 total stream miles in the Middle Gila River Basin, approximately 13,253 stream miles are on non-Indian lands. The 1994 Draft assessment statistics by ADEQ demonstrate that of the 1,006 stream miles assessed, 17% are in full support, 19% are threatened, 30% provides partial support and 34% are in non-support. The top stressors/causes are salinity/TDS, turbidity, metals and suspended solids. Top sources are agricultural activities, natural and hydromodification.

Approximately 63,253 total lake acres are located in the basin with 62,528 on non-Indian lands. According to ADEQ 1994 Draft statistics, of the 7 lakes, 1,932 acres were assessed, .07% were in full support, 3% were threatened, 86% provided partial support and 10% were in non-support. The top stressors are metals which impact 80% of the total lake acres. Agricultural activities, as a source, impacted 90% of the lake acres yet pesticides and salinity/TDS impacted only 10% of the total lake acres assessed.

In the Queen Creek and Eloy areas (New Magma and Central Arizona Irrigation and Drainage Districts), the SCS is providing accelerated technical and financial assistance to improve on-farm chemical handling facilities and irrigation systems which reduce deep percolation and runoff. The SCS is cooperating on this project with Natural Resource Conservation Districts, local Irrigation and Drainage Districts, and ADWR in implementing land treatment projects to address water quality and quantity concerns. A similar land treatment project is in the planning stage for the Hohokham Irrigation District.

The Arizona Department of Health Services released a human health risk report in 1991 (Risk Assessment for Recreation Usage of the Painted Rocks Borrow Pit Lake at Gila Bend, Arizona) indicating that a greater than acceptable lifetime cancer risk could result from long-term consumption of fish from this impoundment and upstream along the Gila River. A fish consumption advisory was issued on October 3, 1991, warning people not to eat fish, turtles, crayfish or other aquatic organisms from portions of the Salt and Gila Rivers.

Total dissolved solids exceed 1000 mg/l on the Gila River below the San Carlos Reservoir. At a downstream monitoring station, near the Gila River Indian Community, TDS ranged between 7160-9090 mg/l in 1990. Elevated salts and high boron are attributed to the agricultural return flows from Broadacres Farm on the Gila Indian Reservation near St. Johns. Broadacres Farm utilizes City of Chandler effluent and shallow saline groundwater to irrigate saline soils. The high levels of TDS did not affect the assessment of this reach, because it is not protected for Agricultural Irrigation or Domestic Water source uses. However, this contamination may contribute to downstream irrigation limitations.

The Gibson Mine is located on a ridge near Globe dividing the Salt River and Middle Gila River drainages. The Gibson Mine produced high grade copper ore between 1906-1918, until the underground workings apparently ended in 1918. Since then, the mine has been operated sporadically to produce copper from the ore dumps. In response to a complaint in 1990, investigations by ADEQ revealed that mining operations are contaminating streams in both watersheds. Samples taken along a tributary of Mineral Creek (Middle Gila River Basin) revealed

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contamination by cadmium, copper, zinc, manganese, and low pH at levels which would impair all designated uses. In 1993, the Attorney General entered into a consent decree with the chief lessee, requiring engineering studies in preparation for remediation actions. The engineering studies have been completed, reviewed and approved; however, subsequently the operation was discontinued and there have been insufficient funds to initiate remediation actions as approved. Negotiations are in progress with the owners who were found to be responsible for certain discharges.

Also along Mineral Creek, an August 1990 follow-up investigation was conducted by ADEQ of the ASARCO Ray Mine tailings pond spill of approximately 324,000 gallons, containing 5,706 pounds of copper. This spill resulted from heavy rains, causing three separate ponds with leachate solution to overflow. All ponds were set up to pump excess solution to a back-up holding pond; however, the back-up system itself overflowed and the pumps in the three leachate ponds could not keep pace with the rapidly rising waters. The overflow resulted in an 18 mile long plume of river water heavily contaminated with copper, phosphorus, sulfates, and suspended solids. The U. S. Department of Justice is currently reviewing an enforcement order by EPA.

Perlite tailings have been discharging into two unnamed tributaries to Queen Creek. Although a non-toxic mineral, the milky-white discharge of perlite fines caused turbidity measured at 1,450 nephelometric turbidity units (NTU). ADEQ investigations have identified two sources of the perlite fines: the Harborlite Corporation and Nord Perlite Company. The Harborlite Corporation has completed construction of earthen berms around their waste dumps. High flows in August 1993 scoured the channels and mixed the bottom deposits so completely that the perlite fines were no longer identifiable. As a result, further cleanup action in the washes has been discontinued.

Investigation into complaints of a green stream in Queen Creek revealed that a culvert had become plugged, backing water up into some copper ore along a railroad embankment. Magma Copper resolved the problem upon notification, investigated further, and corrected similar situations at other locations along the creek.

There have been reports of railroad acid spills in the area of Kelvin, located near Kearny, which have caused some concern regarding possible contamination to the middle Gila River.

During the January 1993 record flooding, ASARCO Hayden Tailings discharged approximately 220,000 cubic yards of tailing material into the Gila River. Tailings deposits along the bank were documented, and voluntary actions to remediate were initiated; however, the tailings have now spread to such an extent that remediation, as originally proposed, may not be possible.

The possibility of a new mine opening near Solomon by ASARCO may impact the Middle Gila River Basin.

4.2.2. Upper Gila River Basin

The Upper Gila River Basin, located in southeastern Arizona, encompasses approximately 7,400 square miles. Almost one-third of the Upper Gila River Basin is Tribal Land (primarily on the San Carlos Indian Reservation) and not included in this assessment. The 1994 Draft Assessment by ADEQ estimated approximately 12,325 stream miles in the basin with approximately 8,415 miles not on Indian lands. Of the 458 stream miles assessed, approximately 45% were in full support, 0% were threatened, 34% provided partial support and 21% were in non-support. Top stressors/causes included turbidity and metals with natural, agricultural activities and resource extraction identified as being the top sources.

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Of the 22,187 total lake acres in the basin, 1,739 acres are not on Indian lands. Three lakes totaling 117 acres were assessed and all 117 acres provided partial support. Noxious aquatic plants were the top stressor/cause impacting approximately 73% of the acres assessed, while both pH and dissolved oxygen impacted 27% of the acres.

That portion of the Upper Gila River Basin located in the CAAG region is impacted by upstream activities such as irrigated agriculture and resource extraction. Monitoring in the basin indicates that turbidity, copper and mercury exceed standards at several locations and that TDS increases significantly as the Gila passes through the Safford Valley. Additionally, parasites, Giardia and Cryptosporidium, have been found in the San Francisco River, near the headwater in Alpine. Human enteric viruses were detected once in the San Francisco River in the vicinity of the Alpine WWTP and further monitoring is being conducted to determine the source of the viruses.

The possibility of a new mine opening by ASARCO near Solomon may impact the Upper Gila River Basin.

Samples taken at a USGS station near Redrock, New Mexico, on the Gila River as it enters Arizona, indicated turbidity and mercury exceedances of Arizona standards.

4.2.3. Salt River Basin

The Salt River Basin encompass approximately 6,300 square miles with 8,731 total stream miles, 4,397 of which are not located on Tribal Lands. Less than one percent of the land in the basin is classified as private land while almost one-half of the basin is located in National Forest lands. Except for the Miami-Globe mining district, the basin is lightly populated. The principal land uses on National Forest lands are recreation, grazing, and some silviculture.

The 1994 Draft Assessment statistics compiled by ADEQ indicated that of the 462 stream miles assessed, 46% were in full support, only .06% were threatened, 33% were in partial support and 21% were in non-support. Top stressors for stream miles assessed included nutrients, turbidity, metals, suspended solids and pH. Top sources impacting stream miles were agricultural activities, hydromodification, natural, resource extraction and major industrial NPDES discharges. The possibility of a new mine opening at Carlotta near Miami may impact the Salt River Basin.

The Salt River Basin includes approximately 27,544 total lake acres, 24,365 of which are not on Indian lands. The 1994 ADEQ assessment covered 3 lakes for a total of 14,353 lake acres, of which none were in full support or threatened, 14,303 acres were in partial support and 50 acres were in non-support. The top stressor/cause was salinity/TDS impacting all of the 14,353 acres assess. Top sources for the basin include natural sources, impacting 14,253 acres and agricultural activities affecting 13,158 lake acres.

Habitat degradation attributed to recreation and grazing impacts have been noted by the USFS and AGFD, as well as, aquatic habitation being rated in fair condition through monitoring of many of the headwater streams. Results indicated that surface water standards were generally met, except for high copper in a few tributaries to the West Fork of the Black River.

The worst wildfire in Arizona's history (Dude Creek Fire) started on June 25, 1990 on the Mogollon Rim, along tributaries to Tonto Creek and the East Verde River (i.e. Webber Creek, Dude Creek, Bonita Creek, Ellison Creek, Horton Creek, and Tonto Creek). Before the fire was extinguished it had burned over 28,000 acres in the Salt River and the Verde River Basins. Impacts on Arizona

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surface water quality have occurred, and will continue to occur until long-term rehabilitation efforts by USFS and for natural regeneration occurs. For example, since the fire, samples analyzed by the USFS for suspended solids have been as high as 700,000 ppm, and normal rainfall events have caused water levels in creeks to rise as high as 10-15 feet above normal levels along Forest Road #430. Initially, the USFS proposed four timber harvest sales on about one-third of the burnt areas to assist in breaking-up of the baked soil crust to increase sprouting and re-vegetation of the severely burned areas. Only two of the four areas were initially bid upon, and then these two bids were rescinded after the bidder defaulted before any cutting occurred. Cattle grazing has been limited in the affected area. ADEQ has established a monitoring station on Ellison Creek in the burn area to observe effects on stream water quality.

In the Tonto Creek watershed, sand and gravel operations, as well as rangeland practices are believed to be the sources of turbidity, phosphorus, and ammonia exceeding standards and dissolved oxygen below standards.

The lower Salt River Basin, including the Salt River and the 4 lakes located in the river, is a primary source of drinking water for the Phoenix Metropolitan Area, and has a high level of salts due to the saline springs located on Indian Lands above Roosevelt Lake. Total dissolved solids and sulfate exceed the secondary drinking water standards and create objectionable tastes in the finished water. Although the Salt River is naturally high in salts, mining and other activities in the watershed may also be contributing to this problem.

A WQARF Superfund project was established in 1988 in the Globe/Miami copper mining area along Pinal Creek and its tributaries. The Remedial Action Plan, developed by the Cyprus Miami Mining Company to address and remediate contamination in the surface and groundwater of Pinal Creek, consists of a three phase study: Phase I - completed May, 1990; Phase II - completed June, 1994; with Phase III to be prepared between 1994 and 1996. Phase I, Interim Remediation Plan, consists of a multi-year groundwater pumping and industrial reuse plan designed to reduce the acidic and metal contamination levels and prevent the plume from breaking through to the surface water.

Phase II studies, completed by the Pinal Creek Group, include a human health and ecological assessment of the potential impact on human, aquatic and non-biotic flora and fauna. The Human Health Risk Assessment determined that no carcinogenic health effects from use of Pinal Creek would occur; however, potential secondary effects may occur by ingestion of neutralized groundwater containing manganese or by consumption of beef from locally raised cattle watered exclusively with acidic groundwater containing copper. The Ecological Risk Assessment determined that acute toxicity to aquatic biota due to manganese occurs. Also, chronic toxicity to aquatic species occurs in Pinal Creek due to aluminum, cobalt and manganese, and in Roosevelt Lake due to zinc. Acute or chronic toxicity effects by metals were not demonstrated for the Salt River. It should be noted that the study did not include impacts on the most contaminated stream segment. Phase III, Feasibility Report, is expected to evaluate alternative clean-up approaches, set clean-up goals and select a final remediation plan for the Pinal Creek watershed.

During the 1993 floods, contaminated groundwater rose in the Pinal Creek-Miami Wash area and began discharging into the creek through a seep. Cyprus Miami Mining Company documented the problem and immediately initiated remediation by pumping groundwater back into existing leaching circuits. Additionally, the Pinal Creek Group installed a temporary dam south of the seep across from Miami Wash to control local surface flow. The Pinal Creek Group replaced the seven wells in the plume area.

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Magma Mine in Pinto Valley reported a 1993 breach of a tailings dam on Pinto Creek, which had also occurred in 1989 and 1992, resulting in a massive contamination of surface water. In response to the discharge, the U. S. Department of Justice negotiated a Consent Decree requiring Magma to institute BMPs for solution containment; make engineering improvements on tailings dams; conduct ambient in-stream water monitoring, including biomonitoring; establish a seepage program at the tailing ponds; and pay penalties to EPA and Arizona. More stringent discharge limitations have been added to the NPDES permit stipulations. Additionally, following the 1993 tailings spill, Magma cleaned up the bank deposits along Pinto Creek, removing nearly 10,000 cubic yards of deposits.

An investigation, conducted by ADEQ, of two facilities located near Claypool, along tributaries of Pinal Creek following a referral from the State Fire Marshall's Office, described heavy soil contamination and a possible illegal wastewater discharge. One facility mixed corrosive and flammable chemicals for use by mines and the other facility processed copper being made into rods and copper wire. (The day before the investigation the chemical company burned down.) Water samples taken near each facility indicated that the pH was lower than standards, and boron, cadmium, chromium, copper, lead, and zinc exceeded surface water standards. Sulfate, TDS, and fluoride values also greatly exceeded ambient conditions. These new sources of contamination simply added a broader basis for assessment of impairment on Pinal Creek and its tributaries.

4.2.4. San Pedro River Basin

The San Pedro River Basin, in southeastern Arizona, encompass approximately 3,740 square miles. and 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 1994 Draft ADEQ assessment statistics indicate that of the 5,557 total stream miles, 5,507 are not on Indian Lands, and 367 miles were assessed. Full support was demonstrated in 24% of the miles assessed, with 33% threatened, 15% in partial support and 28% in non-support. Top stressors included metals and turbidity. Of the 699 total lake acres in the basin, none were assessed.

The San Pedro River flows north into the United States from Mexico in southeastern Arizona to the Gila River. At the border, ADEQ monitoring in 1990-1991 indicated mercury, selenium, lead, copper, and turbidity exceeded surface water standards. There has been concern that pollutants from Mexico may flow north during flooding, thus creating problems in the CAAG region. At various monitoring points along the San Pedro in southeastern Arizona (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 in that area, are believed to be the sources of pollutants in this watershed although currently there have been no instances of accelerated erosion observed in the portion of the basin located in southeastern Arizona.

High flows in the San Pedro River appear to be mobilizing metals which were deposited by upstream mining and accelerated soil erosion. This is substantiated by sample results during high flows which exhibited copper, mercury, lead, fecal coliform, and turbidity at levels which exceeded standards. (Arsenic, barium, beryllium, chromium, iron, manganese, and zinc were also elevated during these events, but did not exceed standards.)

ADEQ investigated a reported mill tailing pond overflow, which discharged into the San Pedro River

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near San Manuel. Surface water samples taken in the San Pedro River at the time of the investigation revealed no exceedances of surface water standards.

Shallow subsurface water is contaminated at Klondike tailings along Aravaipa Creek. Contamination exceeds aquifer standards, surface water standards, and health based guidance levels for soil ingestion. Aravaipa Creek provides habitat to several Threatened and Endangered species within its perennial flow. BLM is seeking funds to initiate mitigation efforts here.

4.2.5. Santa Cruz River Basin

The Santa Cruz River Basin, located in south central Arizona, encompasses approximately 8,200 square miles including Casa Grande and Eloy. Most of the population in the Santa Cruz River Basin is clustered around the metropolitan area of Tucson. Currently, agriculture is the dominant land use in the basin. Grazing is a widespread land use. Mining activities vary with the current market price. Because of extensive groundwater use throughout the basin, most of 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 results only from wastewater discharges and rainstorms.

Of the 9,720 stream miles, 7,138 are on non-Indian Lands, and 381 miles were included in the 1994 Draft Assessment. Of the assessed miles, 32% were in full support, 6% were threatened, 37% were in partial support and 25% were non-support. Top stressors/causes include turbidity and metals, with resource extraction and hydromodification as top sources. The possibility of Cyprus mining expansion near Casa Grande may impact the Santa Cruz River Basin.

In 1992-1993, 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 U.S. (1988-1989) indicated that metals and turbidity exceeded standards and low dissolved oxygen occurred. Both operating and abandoned mines in Arizona and Mexico along the Santa Cruz continue to threaten water quality.

A serious public health concern has been the contamination of Nogales Wash with raw sewage from Mexico. Human enteric viruses were detected once in the Nogales Wash during a special parasite and virus monitoring program that was enacted in the Santa Cruz River Basin in 1991. As a temporary solution, chlorine was added to the channelized wash by the International Boundary and Water Commission. No additional viruses were detected in the three samples collected after the chlorination began. For a short time thereafter, the water in Nogales Wash was diverted to the Nogales International Wastewater Treatment Plant in Arizona for treatment. Recently, the International Boundary and Water Commission expanded the wastewater treatment plant and provided a chlorination station in Nogales, Sonora Mexico. The sewer collection system in Mexico is being rehabilitated, and industrial pretreatment is to be provided in Mexico and the United States (EPA and SEDUE, 1992).

Total lake acres in the Santa Cruz River Basin are approximately 5,138 with 4,656 not on Indian Lands. Of the 442 acres assessed in the 1994 Draft Assessment, none were in full support, 260 acres were threatened, 170 acres were in partial support and 12 acres were non-support.

ADEQ monitoring detected the presence of the parasites Giardia and Cryptosporidium in the Santa Cruz River mainstem and numerous tributaries. The presence of Giardia appears to be linked to the presence of treated or untreated municipal wastewater in the stream. Cryptosporidium

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appears to be linked to cattle grazing activities in the river bottom. Both of these parasites are widespread in their distribution and occurrence, and have been found in other Arizona watersheds to date.

4.2.6. Verde River Basin

The Verde River Basin encompasses approximately 6,650 square miles located in central Arizona. The Verde River supplies high quality water, low in TDS, for agricultural water and potable purposes. Because of the desirable attributes of this watershed, a high level of protection and priority is essential. The Verde River Basin has a substantial area of its watershed under management by the USFS, with parts of four national forests within the basin. Primary land uses are silviculture, grazing, irrigated agriculture, recreation, and some mining.

In ADEQ's 1994 Draft Assessment statistics, of the 8,755 total stream miles, 8,499 were not on Indian Lands. Of the 702 miles assessed, 28% were in full support, 13% were threatened, 44% were in partial support and 15% were non-supporting. Top stressors/causes were metals, turbidity and suspended solids. Top sources were natural, hydromodification and agricultural activities. Of the 8,310 lake acres, 8,304 were not on Indian Lands and 2,067 were assessed. The assessment demonstrated that all 2,067 were in partial support with 2,015 acres impacted by metals which occurred naturally.

A forest fire occurred in June 1990 on the Mogollon Rim, along tributaries to East Verde River (Verde River Basin) and Tonto Creek (Salt River Basin). Impacts to this basin are currently being monitored (discussed in the Salt River Basin section). Monitoring results throughout this basin demonstrated that turbidity, associated with accelerated erosion in the watershed and land disturbing activities in the streambed, is a serious concern. Arsenic also exceeded Fish Consumption standards throughout this basin, with ambient levels slightly higher than other surface water basins.

In 1990, the USGS completed a water quality trend analysis of 8 constituents at 6 study sites in the Verde River Basin. The trend analysis was based on monitoring conducted between October 1976 to March 1987. There was an increasing trend in dissolved solids and dissolved sulfate concentrations at Verde River near Camp Verde, which may indicate the emergence of inorganic water quality problems on a local basis. Analysis of data collected downstream on the Verde River above Horseshoe Dam (between 1980 to 1987) indicated a reduction in concentrations of these two constituents of almost equal amounts. Observed trends in the other selected constituents did not indicate the emergence of water quality problems in the Verde River Basin. Further trend analysis using additional data sources is necessary to properly evaluate the watershed status and deploy water quality program resources.

4.3. GROUNDWATER

Groundwater is usually considered to be water which is transmitted and stored within the pore space of rocks or unconsolidated material, referred to as an aquifer. An aquiclude refers to the area which stores water but does not transmit significant amounts. Aquifers can be further classified as confined or unconfined. A confined or artesian aquifer is one which is overlaid by an impermeable or confining layer of material which may place the aquifer under pressure. An unconfined aquifer refers to the typical "water table" condition in which the water has direct vertical contact with the surface through overlying permeable material.

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Groundwater is extremely important in Arizona where approximately 60 percent of the total water withdrawal in Arizona is from groundwater resources. In 1985, groundwater was 48% of the State's total withdrawal of 7.221 million acre feet with approximately 74% of the groundwater pumped for agriculture and the remainder for public uses. In the CAAG area the occurrence and characteristics of the groundwater resources are very diverse.

4.3.1 Groundwater Basins

Aquifer boundaries are identified as the hydrologic basins designated by the Department of Water Resources (Ref: Department of Environmental Quality, Water Quality Boundaries and Standards, Title 18, Chapter 11, Article 5). Each basin was designated based on its physiography, surface drainage patterns, subsurface geology and aquifer characteristics. Similarities of water supply, water use, and other factors relevant to water resource management were used to determine the boundary of the groundwater basins. Refer to Chapter 3, Map 5, Page 44 for water planning areas in the CAAG region.

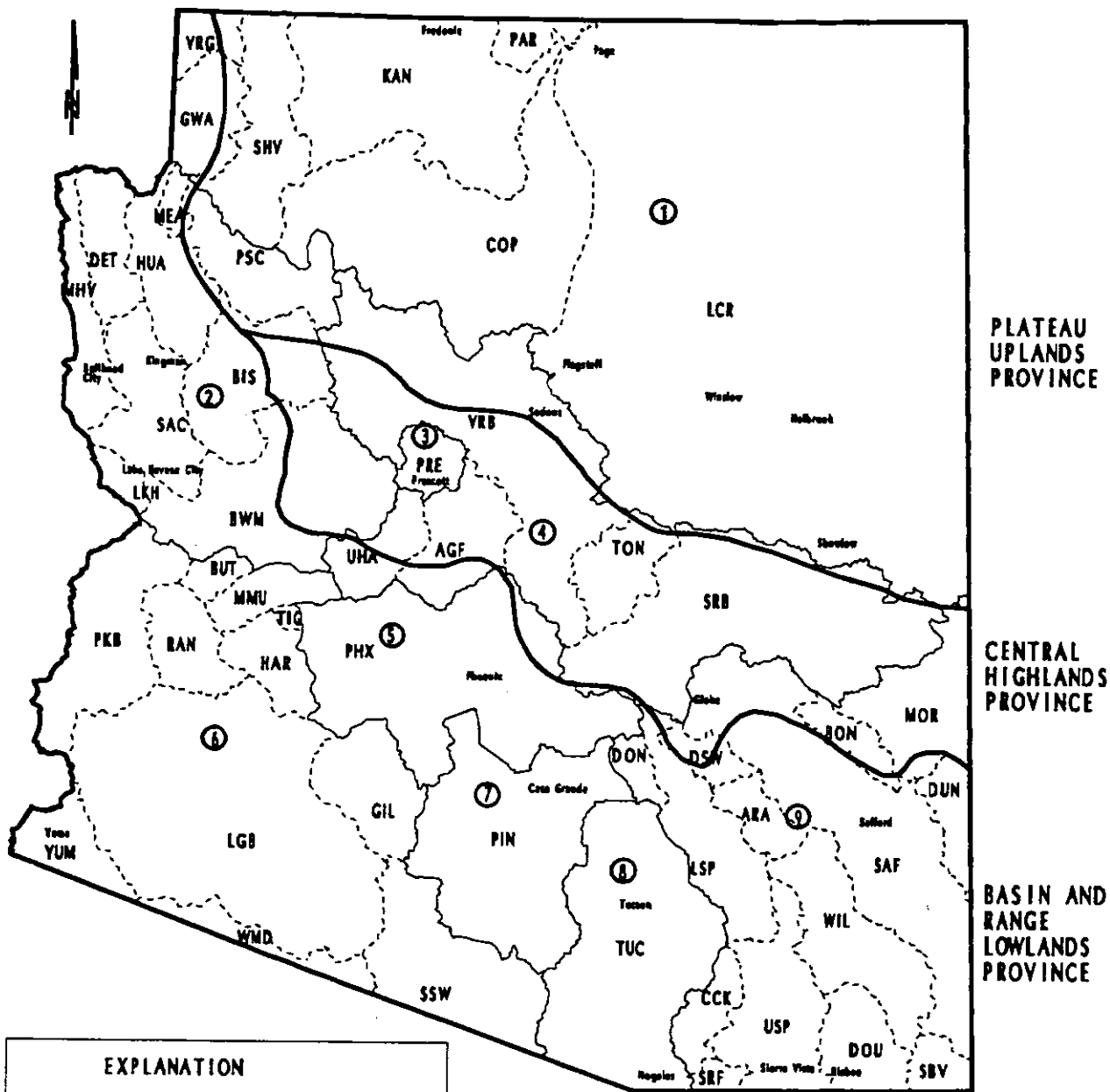
As a result of the Groundwater Management Act in 1980, four Active Management Areas (AMAs) were designated, the Phoenix AMA, Pinal AMA, Prescott AMA and Tucson AMA. In 1994, Santa Cruz AMA, previously a part of the Tucson AMA, was also designated. The bulk of the State's population and areas of intensive agricultural land use are concentrated within the AMAs. Most of the other groundwater basins in Arizona are sparsely populated with fewer wells and minimal water quality analyses on which to assess groundwater conditions. The 50 groundwater basins including the AMAs, have been grouped into nine planning regions. The Phoenix AMA (5), Pinal AMA (7), Tucson AMA (8), Southeast Arizona Region (9) and Central Highlands Region (4) are located in the CAAG planning area. Page 84, Map 8 identifies the groundwater basins and planning regions within the state.

4.3.2 Groundwater Protection

All aquifers in Arizona are currently protected for drinking water use, and Federal drinking water standards, known as Maximum Contaminant Levels (MCL) have been adopted by rule as aquifer water quality standards. Numeric standards have been established for several organic and inorganic chemicals as well as radionuclides, microbiological pollutants and turbidity A.A.C. § R18-11-406. 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 A.A.C. § R18-11-405. Both the numeric and narrative water quality standards are listed in Appendix 4-2.

In addition to these enforceable 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. The Groundwater Protection Strategy (ADEQ, 1989) outlines both the statutory authorities for groundwater protection and program activities and serves as a guide for implementation of groundwater protection programs. Many federal and state and local agencies provide the framework for groundwater protection policies as demonstrated in Table 4-1.

ARIZONA GROUNDWATER BASINS AND PLANNING REGIONS



EXPLANATION	
	PROVINCE BOUNDARY
	BASIN BOUNDARY
	PLANNING REGION BOUNDARY
	PLANNING REGION NAME

Source: ADEQ, 1993

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**TABLE 4-1
GROUNDWATER PROTECTION PROGRAMS IN ARIZONA**

PROGRAM	AGENCY	SOURCES/CONTAMINANTS CONTROLLED
Aquifer Protection Permit	ADEQ	Landfills, lagoons, storage ponds, mine tailings piles and ponds, injection wells, mine leaching operations, septic tanks, effluent recharge projects, point sources to navigable waters, wastewater, agricultural contaminants, recharge, underground storage and recovery projects.
Underground Storage & Recovery Project Permits	ADWR	Underground storage of water, with recovery. Coordination with ADEQ on water quality issues.
Poor Quality Groundwater Withdrawal Permit	ADWR	Poor quality groundwater.
Underground Storage Tank (UST)	EPA/ADEQ	USTs, petroleum, BTEX, fuels.
Underground Injection Control (UIC)	EPA/ADEQ	Storage or disposal of wastewater or other contaminants.
Drywell Registration	ADEQ	Urban and storm water runoff.
Hazardous Waste Management (HWM)/RCRA	ADEQ	Hazardous wastes.
Solid Waste Management (SWM)	ADEQ	Landfills, non-hazardous wastes, petroleum-contaminated soils.
Nonpoint Source Pollution Control (NPS)	ADEQ	Mineral extraction and processing, on-site wastewater disposal, recreation activities, range agriculture, CAFOs, cropland agriculture, construction activities, silviculture activities, urban storm water runoff, drywells, and hydrologic modifications.
Sludge Management (SM)	ADEQ	Sludge producing and disposing facilities
Construction Grant/State Revolving Fund (SRF)	EPA/ADEQ	Wastewater and nonpoint source pollution prevention activities.
National Pollutant Discharge Elimination System (NPDES)	EPA/ADEQ	Wastewater treatment plants, storm water, and all point source discharges to surface water.
Water Quality Assurance Revolving Fund (WQARF)	ADEQ	Hazardous and non-hazardous substances.
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	EPA/ADEQ/A DWR	Hazardous waste.
Pesticide Contamination Prevention	ADEQ	Pesticides
Safe Drinking Water (SDW)	ADEQ	Public water supply systems.
Well Permits	ADWR	Well registration, construction, abandonment and capping.
Wastewater Reuse Permit	ADEQ	Wastewater.
Wellhead Protection	ADEQ	Public water supply system.

Source: 1994 Water Quality Assessment (Draft) ADEQ 4/94

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4.3.3 Threats to Groundwater

Groundwater pollution is closely related to land use with a minority of groundwater contamination cases due to naturally occurring constituents. Contamination may occur as relatively well-defined plumes emanating from specific sources or it may exist as a general deterioration of water quality over a wide area due to a more diffuse sources. Because groundwater quality degradation from many nonpoint sources often affects large areas, it may be difficult to definitively pinpoint specific sources.

4.3.3a. Volatile Organic Compounds (VOCs)

VOCs are present in, or are used for, the manufacturing of many substances, including degreasers, solvents, plastics, paint, varnish, finish removers, detergent, medicine and gasoline. When found in groundwater, VOCs are usually association with industrial waste disposal, landfills, and other sites improperly used for disposal of chemicals. VOCs most commonly detected in Arizona's groundwaters include acetone, trichlorethylene (TCE), vinyl chloride, dichloroethane, benzene dichlorethylene, dichloroethane, chloroform, toluene, methylene chloride, and tetrachloroethylene (PCE). Documented cases of VOC sources include gasoline leaks; industrial waste disposal practices such as injection into dry wells and disposal into surface impounds, leach fields, dry washes and unregulated landfills; disposal or leaks at dry cleaning facilities; and, less commonly, surface spills.

4.3.3b. Nitrate

Nitrate is one of the most common pollutants in Arizona's groundwater and is associated with both human activities and natural nitrogen sources such as organic acids. Higher nitrate concentrations are usually linked to industrial sources, wastewater treatment plants, concentrated feed lots, septic tanks/leach fields, or agricultural fertilizers.

4.3.3c. Major Cations and Anions (Dissolved Mineral Content)

Dissolved mineral content is one measure of ambient water quality and is expressed as the total dissolved solids (TDS) content. In Arizona, the TDS content, which can be used to gage potability, generally falls within the range of suitability for human consumption although higher concentrations are relatively common. In certain basins, groundwater naturally contains moderate to high concentrations of fluoride and trace metals. TDS include inorganic compounds such as calcium, magnesium, sodium, sulfate, bicarbonate, chloride and silica.

Mining activities have been responsible for high levels of dissolved cations and anions and sulfate, TDS and hardness are frequently elevated in the groundwater downgradient from such operations. Excessive amounts of sulfate and TDS in groundwater may also result from discharge of treated wastewater effluent and deep percolation of salts leached by irrigated agriculture.

4.3.3d. Metals

Heavy metals occur naturally in groundwater and elevated levels are often associated with mineralized areas. Metals may also reach groundwater from human caused sources and are often associated with landfills and industrial wastes. The EPA has assigned Pri-MCLs for eight metals occurring in drinking water including arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver.

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Metals such as manganese, copper, iron, chromium and others have been found in groundwater downgradient from mining operations, particularly where acid drainage has developed. Groundwater downgradient from landfills commonly contains elevated concentrations of iron, manganese and barium.

4.3.3e. Pesticides

Pesticides are most often detected in groundwater underlying agricultural areas. Pesticides may refer collectively to a myriad of chemicals used as insecticides, rodenticides and herbicides. To date, only two pesticides have been confirmed in groundwater in Arizona, dibromochloropropane (DBCP) and ethylene dibromide (EDB). DBCP and EDB were used as fumigants for citrus and cotton from the 1950s through the 1970s. EDB is also used as an anti-knock component in gasoline and may contaminate groundwater through LUST sites.

Pesticides can be leached by percolation of irrigation water downward to the aquifer or may contaminate groundwater as a result of improper disposal of pesticides in landfills or elsewhere.

4.3.3f. Petroleum Hydrocarbons

LUST sites, primarily those containing petroleum fuels, are a significant source of groundwater contamination. Over half of the reported LUSTs were located at service stations but also include utility, transportation and shipping companies; municipal facilities; pipelines and mining, food, lodging, high technology and paint companies. Benzene, toluene, ethylbenzene and xylene (BTEX) are the most commonly detected chemicals in groundwater at LUST sites although total petroleum hydrocarbons (TPHC) and EDB have also been detected.

4.3.3g. Radionuclides

Radioactive elements such as uranium, radon, and radium occur naturally in the soil and water throughout Arizona. Contamination of groundwater, mainly in the Plateau Uplands Province, has resulted from uranium mining activities, waste dumps and mine tailing and mine dewatering.

4.3.3h. Bacteria

Effluent from septic tanks may contaminate groundwater with bacteria and nitrate. Contamination of groundwater by microorganisms may result when the tanks are installed in areas with inadequate soils or shallow depth groundwater, especially where limestone or fractured bedrock aquifers are present.

4.3.4. Threats to Groundwater in the CAAG Region

Although threats to groundwater are not a major problem throughout the CAAG region, fertilizer and pesticide applications are the two areas most readily identified as having potential to impact groundwater quality. The other activities/uses which threaten groundwater quality include:

- Septic systems.
- Confined livestock and poultry operations that create animal wastes to dispose of.
- Storage and loading areas of fertilizer and pesticide.
- Application equipment wash areas.
- Run-off from farmyards and septic systems which may slowly seep into groundwater or quickly enter aquifers by draining through poorly constructed wells.

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- Chemigation with fertilizers and pesticides which can cause direct contamination if, for example, back-siphon elements of the system are not working properly (Anthony, et. al., 1992).

Other groundwater problem areas include:

- LUSTs
- Mining, sand and gravel operations, and construction activities which can contribute to increases in the turbidity/siltation of a water body.
- Land surface subsidence in areas of intensive groundwater development, causing substantial economic consequences.
- Agricultural clearing, poor range land and forestry practices, have caused vegetation removal that resulted in increased turbidity and sedimentation downstream.
- Riparian area vegetation removal to increase runoff for irrigation and domestic uses, decrease the filtrating (fine sediment and other contaminants), or trapping, capacity of the watershed.
- Land subsidence and the resulting earth fissures can result in considerable damage to sewage systems, well casings, and building foundations.
- Reversal of drainage patterns and removal of land from irrigation may result from erosion along fissures.
- Municipalities within the CAAG region can also contribute to waterbody pollution through discharges from wastewater treatment plants, urban runoff, natural background levels, and other unknown sources.

4.3.4a. LUST's (Leaking Underground Storage Tanks)

The Underground Storage Tank Program mandates registration of underground storage tanks, and establishes requirements for new and existing tanks, including spill and overflow prevention devices and leak detection. Owners and operators must also make guarantees of financial responsibility, to provide for clean-up in the event of a release from their tanks. To minimize financial hardship caused by the new regulations, ADEQ worked with the Legislature to develop a State Assurance Fund and a loan program to provide financial assistance to smaller businesses.

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 are 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.

ADEQ also developed a data base 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 which may potentially leak. According to EPA information, USTs over 15 years old and constructed of bare steel pose a high risk for release. The location of LUST sites are included in Chapter 6 of this document in Table 6-3 on page 190 and a map of open UST sites for the State of Arizona is included in Chapter 6, as Map 2, page 191.

4.3.4b. Mining

Active and inactive mines are known to contaminate groundwater. Metals contamination of groundwater and/or surface water is known to occur at the Gibson Mine on Mineral Creek and Pinto Creek.

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The 1994 Draft ADEQ Water Quality Assessment noted major groundwater contamination in the Pinal Creek area including low pH and MCLS for fluoride and cadmium due to acid mine drainage. SMCLs for iron, manganese and copper were exceeded.

4.3.4c. Septic

In the unincorporated areas within the CAAG region, the primary method of wastewater treatment is septic tank systems. These systems often do not function adequately because of improper construction and unsuitable ground conditions for septic tank systems. Areas that have elevated levels of nitrates which may be associated with septic tanks have been identified as follows:

Pinal County - Colonia del Sol, Dudleyville, Maricopa, Picacho, Riverside/Kelvin, Stanfield

Gila County - Central Heights, Claypool, East Verde, Ice House Canyon, Lower Miami, pine-Strawberry, Six Shooter Canyon.

Apache Junction is an urbanized area addressing the issue of septic tank systems by organizing a community facilities district.

4.3.4d. Agriculture

Agriculture continues to be the leading source of impairment to groundwater in Arizona. Agriculture is also the major land use in Arizona, and includes rangeland activities, the application of nitrogen fertilizers, concentrated animal feeding operations, and crop irrigation. Feedlots within the CAAG region include: Red Rock, Casa Grande, and John Wayne at Red River. Contamination of groundwater and surface water attributed to agriculture activities includes: nitrates, nutrients, TDS, agriculture chemicals, and turbidity contamination.

To minimize nitrogen impacts from agriculture practices on water quality, the Nonpoint Source Management Program has established a Best Management Practices Program in rule. These practices are aimed at reducing and preventing nutrient contamination of lakes and streams as well as protecting of aquifers from nitrates.

High levels of nitrates have been detected in Arizola, Casa Grande, Florence, Friendly Corners, Komatke and La Palma which may be associated with agricultural activities.

4.3.4e. VOCs

A site in Payson has been identified for a WQARF feasibility study. Aquifer pump tests indicate associated with a VOC contamination of PCE due to dry cleaning chemical disposal. Although not detected in the CAAG region to date, in other areas of the State, VOC contamination has been found in conjunction with landfills.

4.3.4f. Landfills

Within the CAAG region, and throughout the State, there are a significant of number of landfills which have been constructed, utilized and closed prior to implementation of regulations to protect groundwater at the sites. Additionally, there are a significant number of unregulated landfills associated with mining and agricultural activities which may affect groundwater quality. Illegal or "wildcat" dumping appears to be an increasing problem. As more regulated landfills refuse to accept sludge, the dumping of sludge at unauthorized sites may create additional problems.

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4.3.5 Monitoring and Assessment

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 focussed monitoring for compliance, source investigations and regulatory cleanup actions. Accuracy and completeness of data in the ADEQ data base depends on the existence of monitoring wells and the level of agencies' compliance with State reporting requirements. A majority of the sampling efforts for 1990-1993 occurred in the original four AMAs.

The 1994 Draft 305(b) Water Quality Assessment Report by ADEQ reported on statewide groundwater conditions by groundwater basin. Petroleum data was not listed because little of this data had been entered into the database. Additionally, semi-volatile organic chemicals were not reported as they are rarely found in Arizona's groundwater. Most samples were analyzed for inorganic constituents, metals and physical parameters and a significant number of samples were analyzed for VOCs. Fewer samples were analyzed for pesticides and/or radiochemicals. Groundwater quality sampling results for 1980-1991 are compiled from ADEQ's Groundwater Quality Database. Results are organized by major water quality parameter groups, and by groundwater basins and planning regions. Petroleum is not listed because there is little data available. Also semi-volatile organic chemicals are not reported as they are rarely found in Arizona's groundwater.

Again, it should be noted that often testing of groundwater is based on complaints or known problems; therefore, the data presented may not necessarily be representative of the groundwater basin. Since the data is being generated by multiple agencies, there may be several problems associated with its use: a lack of quality control information; inconsistencies in sampling, preservation and laboratory analytical techniques; water quality problems associated with well construction rather than aquifer contamination; and lack of information on sampling locations, well depths, well construction and aquifer characteristics.

ADEQ's Draft 1994 groundwater assessment included testing data on 1,267 wells sampled statewide from 1990-1993. Of the total number of samples, ions were detected in 87% of the samples but there was only 21 samples out of 4,558 that exceeded the MCL. Of the 5,452 samples examined for metals, 35% of the samples demonstrated metals and there was only 1 exceedence of the MCL. A total of 69% of the 975 samples tested for nutrients reflected detectable levels and 8 samples exceeded the MCL. The percentage of pesticides detected in the 9,301 samples tested at less than .01%. No samples exceeded the MCL. VOC's were tested for in 15,113 samples with slightly more than 3% at detectable levels and 42 total exceedances. This data demonstrated few MCL exceedances and generally supports the belief that groundwater in the state meets drinking water standards. Table 4-2 is a summary of the groundwater testing conducted between 1990-1993 with percentages of detections and exceedances noted. Table 4-2 demonstrates the number of wells tested in the planning regions located in CAAG, the percentages of detections and the number of tests that exceeded the MCL.

**TABLE 4-2
GROUNDWATER MONITORING DATA 1990-1993 FOR THE CAAG REGION**

GROUNDWATER BASIN	# OF WELLS SAMPLED	CONSTITUENTS ANALYZED														
		IONS			METALS			NUTRIENTS			PESTICIDES			VOCs		
		Total	Det	Exc	Total	Det	Exc	Total	Det	Exc	Total	Det	Exc	Total	Det	Exc
Phoenix AMA	662	2557	91%	12	2626	50%	1	266	93%	0	2372	.3%	0	7405	3%	21
Pinal AMA	166	270	81%	2	419	25%	0	269	59%	8	4670	0%	0	1230	.3%	0
Tucson AMA	76	233	88%	1	368	24%	0	48	85%	0	274	0%	0	2782	2%	0
Southeast Arizona Region	58	282	85%	1	244	20%	0	73	55%	0	19	0%	0	832	1%	0
Donnelly Wash Basin	0															
Dripping Spring Wash Basin	0															
Lower San Pedro Basin	1	2	100%	0												
Safford Basin	13	13	100%	1										212	2%	0
Central Highlands Region	96	311	84%	1	491	26%	0	39	51%	0	48	0%	0	162	?	17
Tonto Creek Basin	0															
Verde River Basin	18	97	70%	0	131	35%	0	24	58%	0						

Source: ADEQ, 1993 Draft Water Quality Assessment

Notes: Empty spaces indicate that no data is available in ADEQ's groundwater database.

Total is the total number of samples analyzed

Det is the percentage of detections determined by the # of samples in which the a parameter was identified divided by the total number of samples.

Exc is the # of samples determined to exceed the MCL (Maximum Contaminant Level) have been a composite of many sources, including surface water during peak use seasons.

4.4 GROUNDWATER QUALITY ASSESSMENT

A full assessment and identification of trends of groundwater quality in the CAAG region is not possible due to limited data. To date, monitoring and assessment of groundwater has concentrated on identification of contaminated sites, rather than on overall quality. Well testing in the region has been concentrated primarily in the AMAs with minimal testing in the Central Highlands or Southeast Arizona Planning Regions as indicated in Table 4-2. Major groundwater contamination sites by planning region are listed in Appendix 4-7.

4.4.1 Tucson AMA

Most of the groundwater reserves in the Tucson AMA meet all applicable EPA and state drinking water standards and are, generally, of very good quality; however, in some areas near Tucson and Nogales, groundwater fails to meet primary drinking water standards due to TEPs. Groundwater withdrawals from public supply wells located within these areas have been discontinued in order to protect public health. Chromium has been found in groundwater in several location in the Tucson metropolitan area due to industrial discharges. Some drinking water wells in the Yuma area have been closed due to contamination by DBCP and EDB pesticides.

The Tucson AMA Second Management Plan for 1990-2000, adopted in 1989, identified an area south of Red Rock near Interstate Highway 10 with TDS and nitrate concentrations which exceeded the MCL.

4.4.2 Phoenix AMA

The majority of the groundwater in the Phoenix AMA meets federal and state drinking water standards. Large portions of aquifers within the Salt River Valley, including areas within Glendale, Mesa, Chandler and Phoenix contain groundwater with nitrate concentrations high enough to render the water unfit for potable use. Along portions of the Gila River, high TDS concentrations render the groundwater unsuitable for drinking and other uses. Several locations in Phoenix have demonstrated elevated levels of chromium due to industrial discharges from electronics, aviation and plating firms. Pesticides DBCP and EDB have contaminated numerous drinking water wells in the Salt River Valley.

Maricopa County public water systems have demonstrated drinking water problems due to nitrates and inorganics. A total of 27 systems in the county exceeded MCLs in 1992.

The Phoenix AMA Second Management Plan for 1990-2000, adopted in 1989, identified areas in the East Salt River Valley extending from north of Florence to north of Casa Grande on either side of the San Tan Mountains as having TDS in excess of the MCL. Sulfate concentrations were identified north of Casa Grande and nitrate concentrations northwest of Florence.

4.4.3 Pinal AMA

The Pinal AMA Second Management Plan for 1990-2000, adopted in 1989, identified areas, in the northern portion of the AMA, where federal drinking water standards for some parameters are exceeded. Most elevated concentrations of TDS, nitrate and sulfate which have been detected in the AMA are in the northern portion and underlie current and former agricultural areas. TDS concentrations exceed MCLs throughout most of the Eloy and Maricopa-Stanfield sub-basins. Nitrate concentrations exceed MCL in parts of the Eloy, Maricopa-Stanfield sub-basins and are

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highest in the central and northern parts of the Eloy sub-basin and in the north-central part of the Maricopa-Stanfield sub-basin. Metal concentration exceeded MCL in some areas including high selenium concentration in an area in the central part of the Eloy sub-basin. High arsenic concentrations occur in an area west of Casa Grande. VOCs have been detected near the Casa Grande landfill and in a well six miles east of Casa Grande. Pesticides have been detected only at a few locations including a well along the Gila River and several wells 15 miles southeast of Casa Grande and in a well several miles west of Maricopa. Pesticide concentrations in these wells were all below allowable limits.

Some Pinal County drinking public water systems appear to have water quality problems primarily relating to nitrates and inorganics. In 1992, of the 202 regulated wells, which 106 public water supplies, there were 19 systems which exceeded MCLs. Exceedances included 1 arsenic, 1 barium, 1 cadmium, 3 fluoride, 11 nitrate and 2 gross alpha radiochemicals.

The USDA is coordinating a project in the Casa Grande-Coolidge area to evaluate the impact of agriculture practices on groundwater quality and to assist local agricultural clientele with implementation of Best Management Practices to minimize potential for groundwater degradation. These projects are a cooperative effort between the Soil Conservation Service, Agricultural Stabilization and Conservation Service, Cooperative Extension Service, ADWR, Natural Resource Conservation Districts and local producers.

4.4.4 Central Highlands Planning Region

The 1990-1993 monitoring data by ADEQ indicates that of the 1,267 wells sampled, less than 7.5% were located in the Central Highlands Region with the majority of the wells located in the Salt River Basin. Data concerning overall quality of the groundwater basins is minimal. Pinal Creek in the Globe-Miami area has been identified as a WQARF site and has been found to exceed MCLs for heavy metals and a low pH level. PCE, a VOC, has been identified in groundwater in Payson.

Of the 105 public water supplies monitored by ADEQ between 1990-1993, there were no MCL exceedances in 1993 and three in 1992.

4.4.5 Southeast Arizona Region

Between 1990 and 1993, a total of 58 wells were monitored for groundwater analysis by ADEQ. Of the 25 wells monitored in basins located within the CAAG region, 52% of those wells were located in the Safford Basin. Data concerning overall quality of the groundwater in this region is minimal. North of Globe, TDS and sulfate levels were elevated and both groundwater and surface water is contaminated with copper, manganese and excessive pH. Elevated fluoride levels were identified in Mammoth, sulfate exceeded standards in San Manuel, and Winkelman testing demonstrated major cations and anions with significant TDS.

4.5 RECLAIMED WATER (REUSE)

"Reclaimed wastewater" is defined in the existing rules as "effluent which meets the standards for the specific reuses contained in A.A.C. § R18-9-707".

ADEQ is proposing a major revision of the existing rules related to the reuse of reclaimed water. The existing rules are found in Title 18, Chapter 9, Article 7 of the Arizona Administrative Code. ADEQ proposes to repeal these rules and to integrate the reuse permit program and the Aquifer Protection Permit program. Specifically ADEQ has proposed retaining the basic concept that

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"reclaimed water" means wastewater that has completed its passage through a wastewater treatment plant. ADEQ further proposes to define "reclaimed water" as treated wastewater from a domestic, municipal or industrial wastewater treatment plant (excerpt from "Rules for the Reuse of Reclaimed Water Concept Paper", p. 8, ADEQ, Oct. 23, 1992).

ADEQ also proposes to regulate wastewater treatment plants that supply reclaimed water for reuse applications under the APP program. The new rules propose to prescribe reclaimed water quality criteria and treatment requirements for wastewater treatment plants in revised APP rules. Concurrently ADEQ also will propose revisions to the BADCT guidance document for municipal and domestic wastewater treatment plants to specifically address reclamation. A list of current reuse permits issued for Pinal and Gila Counties are included as in Chapter 5, Table 5-2 of this plan.

There are seasonal fluctuations in the demand for reclaimed water. Most reclaimed water is reused for agricultural irrigation or landscape irrigation. The seasonal demand for reclaimed water (high irrigation demand in the summer and the low irrigation demand in the winter), in combination with a relatively constant annual supply of reclaimed water, results in a surplus of reclaimed water during the winter months. In most cases, the available options for disposal or seasonal storage of the surplus reclaimed water (ground water recharge, USR or discharge to a navigable water) require an individual APP, as well as other permits.

ADEQ believes that waste water treatment plants should be required to implement best available demonstrated control technology (BADCT). BADCT implementation requires that wastewater treatment plants be designed, constructed and operated to ensure the greatest degree of discharge reduction achievable through the application of BADCT technology, processes, operating methods or other alternatives, including, where practicable, a technology permitting no discharge of pollutants (See A.R.S. § 49-243.B.1).

While beneficial reuse of effluent should be encouraged in areas where water availability is a problem, the impacts of reuse should also be considered. Modifying a discharging system for reuse may have as adverse impact on riparian areas in effluent dominated waters. Different types of reuse may have different values, for instance, use of effluent to irrigate areas currently irrigated with potable water versus use of effluent to irrigate newly created areas such as golf courses.

Effluent is the only source of water in Arizona which is expected to increase in the foreseeable future once the CAP is fully utilized. As the population increases, so does the supply of effluent, even in communities with successful water conservation programs. If water quality can be maintained and basic water demands satisfied, effluent offers an increasing supply of water with the potential for riparian areas, human use or recharge. Further research is necessary to determine the value of such reuse and whether some discharge contaminants can be allowed without damage to human health or to wildlife.

Since the majority of wastewater treatment plants are required to obtain individual APPs, it makes sense to consolidate the reuse permit and APP programs. This consolidation would be one example of ADEQ's intent to implement the statutory mandate (A.R.S. § 49-203.C) to integrate water quality protection programs and to avoid duplication and dual permitting to the maximum extent practicable.

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**APPENDIX 4-1
 LIST OF NAVIGABLE WATERS AND USES IN THE CAAG REGION**

NAVIGABLE WATER	DESIGNATED USES
Middle Gila River Basin	
Ash Creek	A&Ww, FBC, FC, AgI, AgL
Gila River (Ashurst-Hayden Dam to Florence WWTP)	A&Ww, FBC, FC, AgL
Gila River ¹ (Florence WWTP to Felix Road)	A&Wedw, PBC
Gila River (Felix Road to the Salt River)	A&Ww, PBC, AgL
Picacho Reservoir	A&Ww, FBC, FC, AgI, AgL
Queen Creek (Headwaters to the Superior WWTP)	A&Ww, PBC, DWS, AgL
Queen Creek ¹ (Superior WWTP to Potts Canyon, 8 kilometers downstream from the outfall)	A&Wedw, PBC
Queen Creek (Below Potts Canyon)	A&Ww, PBC, AgL
Unnamed Wash ¹ (Queen Vally WWTP outfall to 3 kilometers downstream from the confluence with Queen Creek)	A&Wedw, PBC
Salt River Basin	
Apache Lake	A&Wc, FBC, DWS, FC, AgI, AgL
Black River	A&Wc, FBC, AgI, AgL
Canyon Creek	A&Wc, FBC, DWS, FC, AgI, AgL
Carrizo Creek	A&Wc, FBC, FC, AgI, AgL
Cedar Creek	A&Ww, FBC, AgI, AgL
Cherry Creek	A&Wc, FBC, FC, AgI, AgL
Cibecue Creek	A&Wc, FBC, FC, AgI, AgL
Coon Creek	A&Ww, FBC
Devil's Chasm Creek	A&Wc, FBC, FC
Pinal Creek (Headwater to Globe WWTP)	A&We, PBC, AgI, AgL
Pinal Creek ¹ (Globe WWTP outfall to 5 kilometers downstream from the outfall - Radium)	A&We, PBC, AgI, AgL
Pinal Creek (Radium to Setka Ranch)	A&We, PBC, FC, AgI, AgL
Pinal Creek (Setka Ranch to the Salt River)	A&Ww, FBC, FC, AgI, AgL
Pinto Creek	A&Ww, FBC, FC, AgI, AgL
Roosevelt Lake	A&Ww, FBC, DWS
Rye Creek	FC, AgI, AgL

**APPENDIX 4-1
 LIST OF NAVIGABLE WATERS AND USES IN THE CAAG REGION**

Salt River Basin (Continued)	
Salome Creek	A&Ww, FBC, FC, AgL
Salt River (above Roosevelt Lake)	A&Ww, FBC, FC, Agl, AgL
Slate Creek	A&Ww, PBC, FC, AgL
Spring Creek	A&Ww, FBC, FC, AgL
Tonto Creek	A&Wc, FBC, FC, Agl, AgL
White River	A&Wc, FBC, FC, Agl, AgL
White River, East Fork	A&Wc, FBC, FC, Agl, AgL
White River, North Fork	A&Wc, FBC, DWS, FC, Agl, AgL
Workman Creek	A&Wc, FBC, DWS, FC, Agl, AgL
San Peder River Basin	
Aravaipa Creek	A&Ww, FBC, DWS, FC, AgL
Copper Creek	A&Ww, PBC, Agl, AgL
San Pedro River (Redington to the Gila River)	A&Ww, FBC, AgL
Unnamed Wash ¹ (Oracle WWTP outfall to confluence with Big Wash)	A&Wedw, PBC
Santa Cruz River Basin	
North Branch of the Santa Cruz Wash ¹ (Casa Grande WWTP outfall to confluence with the Santa Cruz River)	A&We, PBC, AgL
Santa Cruz River (Wash) (Baumgartner Road to the Gila River Reservation)	A&We, PBC, AgL
Upper Gila River Basin	
Apache Creek	A&Ww, FBC, AgL
Blood Basin Tank	A&Ww, FBC, FC, AgL
Blue River	A&Wc, FBC, FC, Agl, AgL
Bonita Creek ²	A&Ww, FBC, DWS, FC, AgL
Cammerman Wash ¹ (Arizona Department of Correction-Globe WWTP to 3 km downstream from the outfall)	A&Wedw, PBC
Cave Creek & Ponds	A&Wc, FBC, FC, Agl, AgL
Gibson Creek	A&Wc, FBC, FC, Agl, AgL
Gila River (New Mexico border to San Carlos Lake)	A&Ww, FBC, FC, Agl, AgL
Gila River (San Carlos Lake to the San Pedro River)	A&Ww, FBC, FC, AgL

**APPENDIX 4-1
 LIST OF NAVIGABLE WATERS AND USES IN THE CAAG REGION**

Upper Gila River Basin (Continued)	
Gila River (San Pedro River to Mineral Creek)	A&Ww, FBC, FC, Agl, AgL
Gila River (Mineral Creek to Ashurst-Hayden Dam)	A&Ww, FBC, FC, Agl, AgL
Mineral Creek	A&Ww, FBC, FC, AgL
Pigeon Creek	A&Ww, FBC, AgL
San Carlos Lake	A&Ww, FBC, FC, Agl, AgL
Verde River Basin	
American Gulch (Headwaters to Payson WWTP)	A&Ww, FBC, FC, Agl, AgL
American Gulch ¹ (Payson WWTP outfall to the East Verde River)	A&Wedw, PBC
Bonita Creek	A&Wc, FBC, DWS, FC
Chase Creek	A&Wc, FBC, DWS, FC
Dude Creek	A&Wc, FBC, FC, Agl, AgL
East Verde River	A&Wc, FBC, DWS, FC, Agl, AgL
Pine Creek	A&Wc, FBC, DWS, FC, Agl, AgL
Sycamore Creek (Coconino National Forest)	A&Wc, FBC, FC, Agl, AgL
Sycamore Creek (Tonto National Forest)	A&Ww, FBC, FC, Agl, AgL
Verde River (upstream from Bartlett Dam)	A&Ww, FBC, FC, Agl, AgL

Source: A.A.C. § R18-11-112, 12/31/92.

Abbreviations:

- A&Wc..... Aquatic and Wildlife (cold water fishery)
- A&We..... Aquatic and Wildlife (ephemeral)
- A&Wedw Aquatic and Wildlife (effluent dominated water)
- A&Ww Aquatic and Wildlife (warm water fishery)
- AgL..... Agricultural Livestock Watering
- Agl..... Agricultural Irrigation
- DWS..... Domestic Water Source
- FBC..... Full Body Contact
- PBC..... Partial Body Contact
- FC Fish Consumption
- WTP Water Treatment Plant
- WWTP Wastewater Treatment Plant

Notes:

- 1 An effluent dominated water
- 2 A unique water: Limits developed on a site-specific basis for each stream, segment or lake. See A.A.C. § R18-11-112 for applicable criteria

**APPENDIX 4-2
NAVIGABLE WATER QUALITY STANDARDS**

ANTIDEGRADATION	
a.	The determination of whether there is any degradation of water quality in a navigable water shall be on a pollutant-by pollutant basis.
b.	The level of water quality necessary to protect existing uses shall be maintained and protected. No degradation of existing water quality is permitted in a navigable water where the existing water quality does not meet applicable water quality standards.
c.	<p>Where existing water quality in navigable water is better than applicable water quality standards, the existing water quality shall be maintained and protected. The Director may allow limited degradation of existing water quality in such navigable waters, except unique waters, provided the Department has held a public hearing on whether degradation should be allowed pursuant to the general public hearing procedures prescribed at A.A.C. § R18-1-401 and R18-1-402 and the Director makes all of the following findings:</p> <ol style="list-style-type: none">1. The level of water quality necessary to protect existing uses is fully protected.2. The highest statutory and regulatory requirements for all new and existing point sources as set forth in the Clean Water Act are achieved.3. All cost-effective and reasonable best management practices for nonpoint source control are implemented.4. Allowing lower water quality is necessary to accommodate important economic or social development in the area in which the navigable water is located.
d.	Existing water quality shall be maintained and protected in a navigable water that is classified as a unique water or that the Director has proposed for classification as a unique water pursuant to A.A.C. § R18-11-112. The Director shall not allow limited degradation of a unique water pursuant to subsection (c) of this Section.
e.	Nothing in this Section or in the implementation of this Section shall be inconsistent with Section 316 of the Clean Water Act where a potential water quality impairment associated with a thermal discharge is involved.

Ref: A.A.C. § R18-11-107

**APPENDIX 4-2
NAVIGABLE WATER QUALITY STANDARDS**

NARRATIVE WATER QUALITY STANDARDS	
<p>Navigable waters shall be free from pollutants in amounts or combinations that:</p>	<ol style="list-style-type: none">1. settle to form bottom deposits that inhibit or prohibit the habitation, growth or propagation of aquatic life or that impair recreational uses;2. cause objectionable in the area which the navigable water is located;3. cause off-taste or odor in drinking water;4. cause off-flavor in aquatic organisms of waterfowl;5. are toxic to humans, animals, plants or other organisms;6. cause the growth of algae or aquatic plants that inhibit or prohibit the habitation, growth or propagation of other aquatic life or that impair recreational uses;7. cause or contribute to a violation of an aquifer water quality standard; or,8. change the color of the navigable water from the natural background levels of color.
<p>Navigable waters shall be free from oil, grease and other pollutants that float as debris, foam, or scum; or that cause a film of iridescent appearance on the surface of the water; or that cause a deposit on a shoreline, bank or aquatic vegetation. The discharge of lubricating oil or gasoline associated with the normal operation of a recreational watercraft shall not be considered a violation of this narrative standard.</p>	
<p>In all navigable waters, the concentration of radiochemicals shall not exceed the limits established by the Arizona Radiation regulatory Agency in A.A.C. § 12R-1-4, Appendix A, Table II, Column 2.</p>	
<p>In navigable waters that are designated as domestic water sources, the following water quality standards for radiochemicals shall not exceed:</p>	<ol style="list-style-type: none">1. The concentration of gross alpha particle activity, including radium-226 but excluding radon and uranium, shall not exceed 15 picocuries per liter of water.2. The concentration of combined radium-226 and radium-228 shall not exceed 5 picocuries per liter of water.3. The concentration of strontium-90 shall not exceed 8 picocuries per liter of water.4. The concentration of tritium shall not exceed 20,000 picocuries per liter of water.5. The average annual concentration of beta particle activity and photon emitters from man-made radionuclides shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 milligrams per year.

Reference A.A.C. § R18-11-108

APPENDIX 4-2 NAVIGABLE WATER QUALITY STANDARDS

NUMERIC WATER QUALITY STANDARDS				
a. The water quality standards prescribed in this section and in Appendix 4-1 apply to listed navigable waters and their tributaries. Additional standards are prescribed for unique waters and effluent dominated waters.				
b1. The following standards for fecal coliform , expressed in colony forming units per 100 milliliters of water (cfu/100 ml), shall not be exceeded:				
	FBC	DWS/PBC/A&W ¹ /Agl/AgL		
* 30-day geometric mean (5 sample minimum)	200	1000		
*10% of samples for a 30 day period	400	2000		
*Single sample maximum	800	4000		
b2. The following standards for fecal coliform in effluent dominated waters.				
	All designated uses			
30-day geometric mean (5 sample minimum)	200			
10% of samples for a 30-day period	400			
Single sample minimum	800			
c. The following water quality standards for pH , expressed in standard units, shall not be violated:				
	DWS	FBC/PBC/A&W ²	Agl	AgL
Maximum	9.0	9.0	9.0	9.0
Minimum	5.0	6.5	4.5	6.5
Maximum change due to discharge	NNS	0.5	NNS	NNS
d. The following maximum allowable increase in ambient water temperature ³ , expressed in degrees Celsius, shall not be exceeded:				
	A&Ww, A&Wedw		A&Wc	
Maximum increase due to discharge ^{4,5}	3.0		1.0	
e. The following water quality standards for turbidity , expressed as a maximum concentration in nephelometric turbidity units (NTU), shall not be exceeded:				
	FBC, PBC, A&Ww, A&Wedw		A&Wc	
Rivers, streams and other flowing waters	50		10	
Lakes, reservoirs, tanks and ponds	25		10	

**APPENDIX 4-2
 NAVIGABLE WATER QUALITY STANDARDS**

NUMERIC WATER QUALITY STANDARDS (CONTINUED)			
f. The dissolved oxygen concentration ⁶ in a navigable water shall not fall below the following minimum concentrations, expressed in milligrams per liter (mg/L):			
	A&Ww	A&Wc	A&Wedw
Single sample minimum ^{7,8}	6.0	7.0	1.0
g. The following water quality standards for total phosphorus and total nitrogen , expressed in milligrams per liter (mg/L), shall not be exceeded:			
	Annual Mean	90th Percentile	Single Sample Maximum
Verde River and its tributaries from headwaters to Bartlett Lake.			
Total phosphorus	0.10	0.30	1.00
Total nitrogen	1.00	1.50	3.00
White River, Black River, Tonto Creek and their tributaries.			
Total phosphorus	0.10	0.20	0.80
Total nitrogen	0.50	1.00	2.00
Salt River and its tributaries, except Pinal Creek from the confluence of the White and Black Rivers to Theodore Roosevelt Lake.			
Total phosphorus	0.12	0.30	1.00
Total nitrogen	0.60	1.20	2.00
Theodore Roosevelt, Apache, Canyon and Saguaro Lakes.			
Total phosphorus	0.03 ^a	NNS	0.60 ^b
Total nitrogen	0.30 ^a	NNS	1.00 ^b
Salt River below Stewart Mountain Dam to confluence with the Verde River			
Total phosphorus	0.05	NNS	0.20
Total nitrogen	0.60	NNS	3.00
Little Colorado River and its tributaries above River Reservoir in Greer; South Fork of Little Colorado River above South Fork Campground; Water Canyon Creek above Apache-Sitgreaves National Forest boundary			
Total phosphorus	0.08	0.10	0.75
Total nitrogen	0.60	0.75	1.10
Little Colorado River at crossing of Apache County Road No. 124			
Total phosphorus	NNS	NNS	0.75
Total nitrogen	NNS	NNS	1.80
Little Colorado River above Lyman Lake to above Amity Ditch diversion near crossing of Arizona Highway			

**APPENDIX 4-2
 NAVIGABLE WATER QUALITY STANDARDS**

273 (applies only when in-stream turbidity is less than 50 NTU)			
Total phosphorus	0.20	0.30	0.75
Total nitrogen	0.70	1.20	1.50
Colorado River, at Northern International Boundary near Morelos Dam			
Total phosphorus	NNS	0.33	NNS
Total nitrogen	NNS	2.50	NNS
San Pedro River, from Curtiss to Benson			
Total phosphorus	NNS	NNS	NNS
Total nitrate as N	NNS	NNS	10.0

Reference A.A.C. § R18-11-109

Footnotes and Abbreviations

1Includes A&Wc, A&Ww, and A&We

2Includes A&Wc, A&Ww, A&Wedw, and A&We

3There is no water quality standard for the temperature for the A&We designated use.

4Does not apply to Cholla Lake.

5Does not apply to a wastewater treatment plant discharge to a dry watercourse that creates an effluent dominated water.

6There is no dissolved oxygen standard for the A&We designated use.

7Or 90% saturation, whichever is less.

8The dissolved oxygen water quality standard for a lake shall apply below the surface but not at a depth >1 meter.

NNSNo Numeric Standard.

Department of Environmental Quality - Water Quality Boundaries and Standards

Appendix A. Numerical water quality criteria

PARAMETERS	DWS1 (µg/L)	FC1 (µg/L)	FBC1 (µg/L)	FBC2 (µg/L)	AAWc Acute1 (µg/L)	AAWc Chronic3 (µg/L)	AAWc Acute2 (µg/L)	AAWc Chronic1 (µg/L)	AAWc Acute3 (µg/L)	AAWc Chronic2 (µg/L)	AAWc Acute4 (µg/L)	AAWc Chronic5 (µg/L)	Ag1 (µg/L)	Ag2 (µg/L)
Acenaphthene	470	2600	8400	8400	830	530	830	530	830	530	830	530	NNS	NNS
Acenaphthylene	0.003	0.002	0.12	0.12	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Acetamin	110	750	1300	1300	34	30	34	30	34	30	34	30	NNS	NNS
Acrylonitrile	0.06	0.64	1400	2.6	3800	250	3800	250	3800	250	3800	250	NNS	NNS
Aldrin	0.002	0.0003	0.08	0.08	2.0	NNS	2.0	NNS	2.0	NNS	2.0	NNS	NNS	NNS
Aroclor	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Atrazine	2100	6300	42000	42000	b	b	b	b	b	b	b	b	4.5	19
Atrazine (as S)	2.8 T	140 T	56 T	56 T	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Atrazine (as A)	30 T	3.1 T	30 T	30 T	88 D	30 D	88 D	30 D	88 D	30 D	88 D	30 D	NNS	NNS
Atrazine (as B)	3	NNS	NNS	NNS	360 D	190 D	360 D	190 D	360 D	190 D	360 D	190 D	NNS	NNS
Atrazine (as C)	4	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Atrazine (as D)	1000 D	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Benzene	0.0002	0.0007	0.006	0.006	120	180	120	180	120	180	120	180	NNS	NNS
Benzidine	0.003	0.00008	0.12	0.12	1300	89	1300	89	1300	89	1300	89	NNS	NNS
Benz(a)anthracene	0.003	0.002	0.12	0.12	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Benz(b)fluoranthene	0.003	0.00001	0.12	0.12	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
3,4-Benzofluoranthene	0.003	0.00004	0.12	0.12	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Beryllium (as Be)	0.008 T	0.21 T	700 T	700 T	63 D	5.3 D	63 D	5.3 D	63 D	5.3 D	63 D	5.3 D	NNS	NNS
BHC-alpha	0.006	0.03	0.33 T	0.33 T	1600	130	1600	130	1600	130	1600	130	NNS	NNS
BHC-beta	0.02	0.02	0.78	0.78	1600	130	1600	130	1600	130	1600	130	NNS	NNS
BHC-gamma (lindane)	0.20	0.02	1	1	1600	130	1600	130	1600	130	1600	130	NNS	NNS
Blk(2-chlorobenzyl) methane	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Blk(2-chlorobenzyl) ether	0.03	1.4	1.3	1.3	120000	6700	120000	6700	120000	6700	120000	6700	NNS	NNS
Blk(2-chloropropyl) ether	280	15000	5600	5600	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Blk(2-ethylhexyl) phthalate	2.5	7.4	100	100	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Bromoform	NNS	NNS	NNS	NNS	400	360	400	360	400	360	400	360	NNS	NNS
4-Bromophenyl phenyl ether	NNS	80	180	180	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Butyl benzyl phthalate	NNS	NNS	NNS	NNS	15000	10000	15000	10000	15000	10000	15000	10000	NNS	NNS
Cadmate (as Cd)	1400	5000	28000	28000	180	14	180	14	180	14	180	14	NNS	NNS
Carbon tetrachloride	3 T	81 T	70 T	70 T	1700	130	1700	130	1700	130	1700	130	NNS	NNS
Chlordane	40	NNS	NNS	NNS	4 D	4 D	4 D	4 D	4 D	4 D	4 D	4 D	NNS	NNS
Chlorine (Total residual)	5	5.5	11	11	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Chlorobenzene	2	0.001	2	2	18000	1100	18000	1100	18000	1100	18000	1100	NNS	NNS
Chlorodibromomethane	100	500	2800	2800	2.4	0.21	2.4	0.21	2.4	0.21	2.4	0.21	NNS	NNS
Chloroethane	TTM	12	17	17	11	5.0	11	5.0	11	5.0	11	5.0	NNS	NNS
2-Chloroethyl vinyl ether	NNS	NNS	NNS	NNS	9800	620	9800	620	9800	620	9800	620	NNS	NNS
Chloroform	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
2-Chloronaphthalene	TTM	590	210	210	180000	9800	180000	9800	180000	9800	180000	9800	NNS	NNS
2-Chlorophenol	13000	13000	11000	11000	14000	900	14000	900	14000	900	14000	900	NNS	NNS
	13000	13000	700	700	2700	130	2700	130	2700	130	2700	130	NNS	NNS

PARAMETERS	DWS ¹ (µg/L)	FC ¹ (µg/L)	PBC ¹ (µg/L)	PBC ¹ (µg/L)	A&Wc Acute ² (µg/L)	A&Wc Chronic ³ (µg/L)	A&Ww Acute ² (µg/L)	A&Ww Chronic ³ (µg/L)	A&Wdw Acute ² (µg/L)	A&Wdw Chronic ³ (µg/L)	A&Ww Acute ² (µg/L)	A&Ww Chronic ³ (µg/L)	A&Wc Acute ² (µg/L)	A&Wc Chronic ³ (µg/L)	Ag ¹ (µg/L)	Ag ¹ (µg/L)
3-methyl-4-Chlorophenol	NNS	NNS	NNS	NNS	15	4.7	15	4.7	15	4.7	NNS	NNS	15000	NNS	NNS	NNS
4-Chlorophenyl phenyl ether	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Chromium (as Cr)	100 T	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Chromium (as Cr III)	NNS	67000 T	140000 T	140000 T	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Chromium (as Cr VI)	NNS	3400 T	700 T	700 T	16 D	11 D	16 D	11 D	16 D	11 D	16 D	11 D	16 D	11 D	16 D	11 D
Chrysoene	0.001	0.0001	0.12	0.12	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Copper (as Cu)	1000 D	NNS	5700 D	5700 D	FD	FD	FD	FD	FD	FD	FD	FD	FD	FD	FD	FD
Cyanide	140 T	210000 T	3100 T	3100 T	22 T	5.2 T	41 T	9.7 T	41 T	9.7 T	41 T	9.7 T	41 T	9.7 T	41 T	9.7 T
DDD	0.15	0.0009	5.8	5.8	1.1	0.001	1.1	0.02	1.1	0.02	1.1	0.02	1.1	0.02	1.1	0.02
DDT	0.1	0.0006	4.1	4.1	1.1	0.001	1.1	0.02	1.1	0.02	1.1	0.02	1.1	0.02	1.1	0.02
DE ¹	0.1	0.0005	4.1	4.1	1.1	0.001	1.1	0.02	1.1	0.02	1.1	0.02	1.1	0.02	1.1	0.02
Dibenz(a,h) anthracene	0.003	0.00003	0.12	0.12	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dichlorobenzene	600	2800	13000	13000	790	300	1200	470	1200	470	1200	470	1200	470	1200	470
1,3-Dichlorobenzene	94	1200	13000	13000	2500	970	2500	970	2500	970	2500	970	2500	970	2500	970
1,4-Dichlorobenzene	75	1200	13000	13000	360	210	2000	740	2000	740	2000	740	2000	740	2000	740
3,3-Dichlorobenzidine	0.08	0.09	3.1	3.1	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Dichlorobromomethane	10	10	11	11	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800
Dichlorobromopropane	0.2	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,1-Dichloroethane	NNS	NNS	14000	14000	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dichloroethane	3	170	13	13	10000	10000	39000	41000	39000	41000	39000	41000	39000	41000	39000	41000
1,1-Dichloroethylene	7	4.5	7	7	1500	930	1500	930	1500	930	1500	930	1500	930	1500	930
1,2- <i>cis</i> -Dichloroethylene	70	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2- <i>trans</i> -Dichloroethylene	100	13000	2800	2800	68000	3900	68000	3900	68000	3900	68000	3900	68000	3900	68000	3900
2,4-Dichlorophenol	21	810	470	470	1000	88	1000	88	1000	88	1000	88	1000	88	1000	88
Dichlorophenoxyacetic acid	70	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dichloropropane	5	NNS	200	200	26000	9200	26000	9200	26000	9200	26000	9200	26000	9200	26000	9200
1,3-Dichloropropane	2.1	360	60	60	3000	1100	3000	1100	3000	1100	3000	1100	3000	1100	3000	1100
Diethyl c	0.002	0.0002	0.09	0.09	2.5	0.002	2.3	0.002	2.3	0.002	2.3	0.002	2.3	0.002	2.3	0.002
Diethyl phthalate	5600	110000	110000	110000	26000	1600	26000	1600	26000	1600	26000	1600	26000	1600	26000	1600
Dimethyl phthalate	70000	2800000	1400000	1400000	17000	1000	17000	1000	17000	1000	17000	1000	17000	1000	17000	1000
2,4-Dimethylphenol	140	2200	28000	28000	1000	310	1000	310	1000	310	1000	310	1000	310	1000	310
2,4-Dinitrophenol	14	5400	280	280	110	9.2	110	9.2	110	9.2	110	9.2	110	9.2	110	9.2
2-methyl-4,6-Dinitrophenol	2.7	170	550	550	310	24	310	24	310	24	310	24	310	24	310	24
2,6-Dinitrotoluene	0.009	0.02	0.38	0.38	15000	970	15000	970	15000	970	15000	970	15000	970	15000	970
2,6-Dinitrotoluene	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
2,3,7,8-TCDD (Dioxin)	0.0000002	0.000000004	0.0000009	0.0000009	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005
1,2-Diphenylhydrazine	0.04	0.25	1.8	1.8	150	11	150	11	150	11	150	11	150	11	150	11
Di-n-butyl phthalate	700	2300	14000	14000	470	35	470	35	470	35	470	35	470	35	470	35
Di-n-octyl phthalate	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Endosulfan sulfate	0.35	0.78	70	70	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Endosulfan-alpha	0.35	0.92	70	70	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Endosulfan-beta	0.35	0.92	70	70	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Endrin	0.2	1.1	40	40	0.18	0.002	0.2	0.08	0.2	0.08	0.2	0.08	0.2	0.08	0.2	0.08
Endrin aldehyde	2.1	0.81	430	430	0.18	0.002	0.2	0.08	0.2	0.08	0.2	0.08	0.2	0.08	0.2	0.08
Ethylbenzene	700	110000	64000	64000	21000	1400	21000	1400	21000	1400	21000	1400	21000	1400	21000	1400
Ethylene dibromide	0.05	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Fluorethene	280	130	5600	5600	2000	1600	2000	1600	2000	1600	2000	1600	2000	1600	2000	1600

PARAMETERS	DW9 ¹ (µg/L)	FC ¹ (µg/L)	PBC ¹ (µg/L)	PBC ¹ (µg/L)	A&Wc Acute ² (µg/L)	A&Wc Chronic ³ (µg/L)	A&Ww Acute ² (µg/L)	A&Ww Chronic ³ (µg/L)	A&Ww Acute ² (µg/L)	A&Ww Chronic ³ (µg/L)	A&Wc Acute ² (µg/L)	A&Wc Chronic ³ (µg/L)	Ag ¹ (µg/L)	Ag ¹ (µg/L)
Fluorene	260	580	5600	5600	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Fluoride	4000	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Heptachlor	0.400	0.0002	0.31	20	0.52	0.004	0.32	0.004	0.52	0.004	0.32	0.004	0.52	0.004
Heptachlor epoxide	0.200	0.0001	0.15	10	0.52	0.004	0.32	0.004	0.52	0.004	0.32	0.004	0.52	0.004
Hexachlorobenzene	0.02	0.002	0.83	100	6.0	3.7	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Hexachlorobutadiene	0.45	0.52	18	280	45	8.2	45	8.2	45	8.2	45	8.2	45	8.2
Hexachlorocyclopentadiene	49	550	1000	1000	3.5	0.3	3.5	0.3	3.5	0.3	3.5	0.3	3.5	0.3
Hexachloroethane	2.5	4.8	100	140	490	350	490	350	490	350	490	350	490	350
Indeno (1,2,3-cd) pyrene	0.003	0.000003	0.12	340	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Isophorone	5.5	520	28000	28000	59000	43000	59000	43000	59000	43000	59000	43000	59000	43000
Lead (as Pb)	50 T	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Manganese (as Mn)	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Mercury (as Hg)	2.1 T	0.6 T	42 T	42 T	2.4 D	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Methoxychlor	40	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Methyl bromide	9.8	7500	200	200	5500	360	5500	360	5500	360	5500	360	5500	360
Methyl chloride	3.7	1800	230	2800	270000	15000	270000	15000	270000	15000	270000	15000	270000	15000
Methylene chloride	4.7	480	190	27000	97000	5500	97000	5500	97000	5500	97000	5500	97000	5500
Naphthalene	NNS	NNS	560	560	1100	710	3300	600	3300	600	3300	600	3300	600
Nickel (as Ni)	140 T	400 T	2800 T	2800 T	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Nitrate (as N)	10000	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Nitrite (as N)	10000	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Nitrate/nitrite (Total as N)	10000	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Nitrobenzene	3.5	600	70	70	13000	850	13000	850	13000	850	13000	850	13000	850
2-Nitrophenol	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
4-Nitrophenol	NNS	NNS	NNS	NNS	4100	3000	4100	3000	4100	3000	4100	3000	4100	3000
N-nitrosodimethylamine	0.0007	2.1	0.03	0.03	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
N-nitrosodiphenylamine	7.1	12	290	NNS	2900	200	2900	200	2900	200	2900	200	2900	200
N-nitrosodi-n-propylamine	0.003	0.51	0.2	0.2	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
PCBs	0.5	0.00099	0.18	0.18	2.0	0.01	2.0	0.01	2.0	0.01	2.0	0.01	2.0	0.01
Pentachlorophenol	210	29000	2000	2000	1	1	1	1	1	1	1	1	1	1
Phenanthrene	0.003	0.0005	0.12	0.12	30	6.3	30	6.3	30	6.3	30	6.3	30	6.3
Phenol	4200	6500000	84000	84000	5100	730	7000	1000	7000	1000	7000	1000	7000	1000
Pyrene	210	1100	4200	4200	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Selenium (as Se)	50 T	9000	470	470	20 T	2.0 T	20 T	2.0 T	20 T	2.0 T	20 T	2.0 T	20 T	2.0 T
Styrene	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Sulfides	100	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,1,2,2-Tetrachloroethane	0.17	11	7	7	4700	3200	4700	3200	4700	3200	4700	3200	4700	3200
Tetrachloroethylene	5.00	11	35	35	2600	280	2600	280	2600	280	2600	280	2600	280
Thallium (as Tl)	0.63 T	44 T	3700 T	3700 T	700 D	150 D	700 D	150 D	700 D	150 D	700 D	150 D	700 D	150 D
Toluene	1000	90000	42000	42000	8700	180	8700	180	8700	180	8700	180	8700	180
Toxaphene	3.0	0.0008	3.0	3.0	0.73	0.0022	0.73	0.0022	0.73	0.0022	0.73	0.0022	0.73	0.0022
2,4,5-TP (m)	50	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2,4-Trichlorobenzene	NNS	NNS	2800	2800	750	130	1700	300	1700	300	1700	300	1700	300
1,1,1-Trichloroethane	200	13000	13000	13000	2600	1600	2600	1600	2600	1600	2600	1600	2600	1600
1,1,2-Trichloroethane	0.61	31	25	25	18000	12000	18000	12000	18000	12000	18000	12000	18000	12000
1,1,1,2-Tetrachloroethane	3.0	70	110	110	20000	1300	20000	1300	20000	1300	20000	1300	20000	1300

PARAMETERS	DWS ¹ (µg/L)	FC ² (µg/L)	FBC ³ (µg/L)	PBC ⁴ (µg/L)	A&Wc Acute ⁵ (µg/L)	A&Wc Chronic ³ (µg/L)	A&Ww Acute ¹ (µg/L)	A&Ww Chronic ³ (µg/L)	A&Wdw Acute ¹ (µg/L)	A&Wdw Chronic ³ (µg/L)	A&Ww Acute ² (µg/L)	A&Ww Chronic ³ (µg/L)	Ag ¹ (µg/L)	Ag ¹ (µg/L)
2,4,6-Trichlorophenol	3.2	4.9	130	NNS	160	25	160	25	160	25	3000	460	NNS	NNS
Trifluoromethane, Total	100	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Uranium (as Ur)	35 D	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Vinyl chloride	2.0	670	80	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Xylenes (Total)	10000	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Zinc (as Zn)	5000 T	NNS	28000	28000	L.D	L.D	L.D	L.D	L.D	L.D	L.D	L.D	L.D	10000 T

µg/L - micrograms per liter

b - The standard to protect this use is 7 million fibers (longer than 10 micrometers) per liter.
 c - Values for ammonia are contained in separate tables located at the end of Appendix A.
 d - Indicates that the parameter is a known, probable or possible human carcinogen and that the standards to protect DWS, FC and PBC are based on carcinogenicity. A "c" by itself indicates that the excess cancer risk level for the DWS designated use is 1 x 10⁻⁶. A "c" followed by a number indicates that the excess cancer risk level for the DWS designated use only is greater than 1 x 10⁻⁶. These excess cancer risk levels, multiplied by 10⁻⁶ are: c1=3; c2=17; c3=67; c4=13; c5=117; c6=10; c7=125; c8=50; c9=100; c10=7; c11=8; c12=2; and c13=133. The excess cancer risk level for the FC and PBC designated uses is 1 x 10⁻⁶.

- d - Cadmium - A&Wc acute standard: e(1.128 [ln(Hardness)] - 3.828)
 A&Wc chronic standard: e(0.7852 [ln(Hardness)] - 3.490)
 A&Ww acute standard: e(1.178 [ln(Hardness)] - 3.0146)
 A&Ww chronic standard: e(0.7832 [ln(Hardness)] - 3.490)
 A&Wdw acute standard: e(1.128 [ln(Hardness)] - 3.0149)
 A&Wdw chronic standard: e(0.7832 [ln(Hardness)] - 3.490)
 A&Ww acute standard: e(1.128 [ln(Hardness)] - 0.9091)
 A&Ww chronic standard: e(0.7852 [ln(Hardness)] - 3.490)
 (See Footnote 4)
- e - Chromium III - A&Wc acute standard: e(0.8190 [ln(Hardness)] + 3.688)
 A&Wc chronic standard: e(0.8190 [ln(Hardness)] + 1.561)
 A&Ww acute standard: e(0.8190 [ln(Hardness)] + 3.688)
 A&Ww chronic standard: e(0.8190 [ln(Hardness)] + 1.561)
 A&Wdw acute standard: e(0.8190 [ln(Hardness)] + 4.9361)
 A&Wdw chronic standard: e(0.8190 [ln(Hardness)] + 1.561)
 A&Ww acute standard: e(0.8190 [ln(Hardness)] + 3.688)
 A&Ww chronic standard: e(0.8190 [ln(Hardness)] + 1.561)
 (See Footnote 4)

- f - Copper - A&Wc acute standard: e(0.9422 [ln(Hardness)] - 1.464)
 A&Wc chronic standard: e(0.9345 [ln(Hardness)] - 1.465)
 A&Ww acute standard: e(0.9422 [ln(Hardness)] - 1.464)
 A&Ww chronic standard: e(0.9345 [ln(Hardness)] - 1.465)
 A&Wdw acute standard: e(0.9422 [ln(Hardness)] - 1.464)
 A&Wdw chronic standard: e(0.9345 [ln(Hardness)] - 1.465)
 A&Ww acute standard: e(0.9422 [ln(Hardness)] - 1.514)
 A&Ww chronic standard: e(0.9345 [ln(Hardness)] - 1.448)
 (See Footnote 4)

- g - Lead -
 - A&Wc acute standard: $e^{(1.2730 \ln(\text{Hardness})) - 1.460}$
 - A&Wc chronic standard: $e^{(1.2730 \ln(\text{Hardness})) - 4.705}$
 - A&Ww acute standard: $e^{(1.2730 \ln(\text{Hardness})) - 1.460}$
 - A&Ww chronic standard: $e^{(1.2730 \ln(\text{Hardness})) - 4.705}$
 - A&Wedw acute standard: $e^{(1.2730 \ln(\text{Hardness})) - 1.460}$
 - A&Wedw chronic standard: $e^{(1.2730 \ln(\text{Hardness})) - 4.705}$
 - A&We acute standard: $e^{(1.2730 \ln(\text{Hardness})) - 0.7131}$
 - A&We chronic standard: $e^{(1.2730 \ln(\text{Hardness})) - 3.9518}$
 - (See Footnote 4)

- h - Nickel -
 - A&Wc acute standard: $e^{(0.8460 \ln(\text{Hardness})) + 3.3611}$
 - A&Wc chronic standard: $e^{(0.8460 \ln(\text{Hardness})) + 1.1644}$
 - A&Ww acute standard: $e^{(0.8460 \ln(\text{Hardness})) + 3.3611}$
 - A&Ww chronic standard: $e^{(0.8460 \ln(\text{Hardness})) + 1.1644}$
 - A&Wedw acute standard: $e^{(0.8460 \ln(\text{Hardness})) + 3.3611}$
 - A&Wedw chronic standard: $e^{(0.8460 \ln(\text{Hardness})) + 1.1644}$
 - A&We acute standard: $e^{(0.8460 \ln(\text{Hardness})) + 4.4389}$
 - A&We chronic standard: $e^{(0.8460 \ln(\text{Hardness})) + 2.2417}$
 - (See Footnote 4)

- i - Pentachlorophenol - A&Wc acute standard: $e^{(1.005 \text{ pH}) - 4.830}$
 - A&Wc chronic standard: $e^{(1.005 \text{ pH}) - 5.290}$
 - A&Ww acute standard: $e^{(1.005 \text{ pH}) - 4.830}$
 - A&Ww chronic standard: $e^{(1.005 \text{ pH}) - 5.290}$
 - A&Wedw acute standard: $e^{(1.005 \text{ pH}) - 4.830}$
 - A&Wedw chronic standard: $e^{(1.005 \text{ pH}) - 5.290}$
 - A&We acute standard: $e^{(1.005 \text{ pH}) - 3.4306}$
 - A&We chronic standard: $e^{(1.005 \text{ pH}) - 3.9006}$
 - (See Footnote 5)

- j - Silver -
 - A&Wc acute standard: $e^{(1.72 \ln(\text{Hardness})) - 6.52}$
 - A&Ww acute standard: $e^{(1.72 \ln(\text{Hardness})) - 6.52}$
 - A&Wedw acute standard: $e^{(1.72 \ln(\text{Hardness})) - 6.52}$
 - A&We acute standard: $e^{(1.72 \ln(\text{Hardness})) - 6.52}$
 - (See Footnote 4)

- k - Zinc -
 - A&Wc acute standard: $e^{(0.8473 \ln(\text{Hardness})) + 0.860}$
 - A&Wc chronic standard: $e^{(0.8473 \ln(\text{Hardness})) + 0.761}$
 - A&Ww acute standard: $e^{(0.8473 \ln(\text{Hardness})) + 0.860}$
 - A&Ww chronic standard: $e^{(0.8473 \ln(\text{Hardness})) + 0.761}$
 - A&Wedw acute standard: $e^{(0.8473 \ln(\text{Hardness})) + 0.860}$
 - A&Wedw chronic standard: $e^{(0.8473 \ln(\text{Hardness})) + 0.761}$
 - A&We acute standard: $e^{(0.8473 \ln(\text{Hardness})) + 3.1342}$
 - A&We chronic standard: $e^{(0.8473 \ln(\text{Hardness})) + 3.0484}$

- 1 - The standard to protect this use is 0.003 µg/l aldrin/dieldrin.
- m - 2,4,5-Trichlorophenoxyacetic acid
- 1 - The numeric standards to protect this use shall not be exceeded.
- 2 - Determination of compliance with acute standards shall be as prescribed in R 18-11-120(C).
- 3 - Determination of compliance with chronic standards shall be as prescribed in R 18-11-120(C).
- 4 - Hardness is determined pursuant to the methods specified for the definition of hardness Section 101. Hardness is determined from a sample taken at the same time and place that the sample for the next is taken. Hardness, expressed as mg/l CaCO₃, is then inserted into the equation where it says "Hardness".
- 5 - The pH at the time and location that the sample for pentachlorophenol was taken is inserted into the equation where it says "pH".

NNS - No numeric standard.

D - Dissolved

T - Total recoverable

TTHM - Indicates that the chemical is a trihalomethane. See trihalomethane for DWS standard.

A&Wc - ACUTE

pH	Temperature in Degrees Celsius																			30 and above	pH				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			19	20	25	
6.5	79	28	28	27	27	27	27	26	26	26	25	25	25	25	25	24	24	24	24	24	24	24	16.6	11.8	6.5
6.6	28	27	27	26	26	26	25	25	25	24	24	24	24	24	24	24	24	24	23	23	23	23	16.2	11.4	6.6
6.7	27	26	26	26	25	25	25	24	24	24	24	24	23	23	23	23	23	23	23	22	22	22	15.6	11.1	6.7
6.8	26	25	25	24	24	24	24	23	23	23	23	22	22	22	22	22	22	22	22	22	21	21	15.0	10.6	6.8
6.9	25	24	24	24	23	23	23	22	22	22	22	21	21	21	21	21	21	21	21	21	21	20	14.4	10.1	6.9
7.0	23	23	22	22	22	22	21	21	21	21	20	20	20	20	19.9	19.7	19.6	19.5	19.4	19.3	19.2	19.2	13.3	9.3	7.0
7.1	22	21	21	21	20	20	20	19.9	19.6	19.5	19.3	18.9	18.8	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.5	11.6	7.1	7.1
7.2	19.8	19.6	19.2	19.0	18.8	18.5	18.4	18.1	17.9	17.8	17.6	17.3	17.2	17.0	16.9	16.8	16.7	16.7	16.6	16.5	16.5	16.6	11.6	7.1	7.2
7.3	18.0	17.8	17.5	17.3	17.1	16.9	16.7	16.5	16.3	16.2	16.0	15.9	15.8	15.6	15.5	15.4	15.3	15.2	15.2	15.1	15.0	15.0	10.6	7.5	7.3
7.4	16.2	16.0	15.7	15.5	15.3	15.1	15.0	14.8	14.6	14.5	14.4	14.3	14.1	14.0	13.9	13.8	13.7	13.6	13.6	13.5	13.5	9.5	6.7	7.4	
7.5	14.3	14.1	13.9	13.7	13.6	13.4	13.3	13.1	13.0	12.8	12.7	12.6	12.5	12.4	12.4	12.3	12.2	12.1	12.1	12.1	12.0	8.4	6.0	7.5	
7.6	12.5	12.3	12.2	12.0	11.9	11.7	11.6	11.5	11.4	11.2	11.2	11.1	11.0	10.9	10.8	10.8	10.7	10.6	10.6	10.5	10.5	7.4	5.3	7.6	
7.7	10.8	10.7	10.5	10.4	10.3	10.1	10.0	9.9	9.8	9.7	9.6	9.5	9.5	9.3	9.3	9.2	9.2	9.2	9.1	9.1	9.1	6.4	4.6	7.7	
7.8	9.2	9.1	9.0	8.9	8.8	8.7	8.6	8.5	8.4	8.3	8.2	8.1	8.1	8.0	8.0	7.9	7.9	7.9	7.8	7.8	7.8	5.5	4.0	7.8	
7.9	7.8	7.7	7.6	7.5	7.4	7.3	7.2	7.2	7.1	7.0	7.0	6.9	6.8	6.8	6.7	6.7	6.7	6.6	6.6	6.6	6.6	4.7	3.4	7.9	
8.0	6.5	6.4	6.4	6.3	6.2	6.1	6.1	6.0	5.9	5.9	5.8	5.8	5.7	5.7	5.7	5.6	5.6	5.6	5.6	5.6	5.6	4.0	2.9	8.0	
8.1	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.8	4.7	4.7	4.6	4.6	4.6	4.5	4.5	4.5	4.5	4.5	4.5	4.5	3.2	2.3	8.1	
8.2	4.2	4.1	4.0	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	2.6	1.89	8.2	
8.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.1	1.53	8.3	
8.4	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.4	2.4	2.4	1.71	1.27	8.4	
8.5	2.1	2.1	2.1	2.0	2.0	2.0	1.98	1.96	1.95	1.94	1.93	1.92	1.91	1.90	1.90	1.90	1.90	1.90	1.90	1.91	1.92	1.41	1.05	8.5	
8.6	1.68	1.66	1.63	1.61	1.60	1.59	1.58	1.58	1.57	1.56	1.55	1.54	1.54	1.54	1.54	1.54	1.54	1.55	1.55	1.56	1.57	1.15	0.88	8.6	
8.7	1.35	1.33	1.32	1.31	1.30	1.29	1.28	1.27	1.26	1.26	1.25	1.25	1.25	1.25	1.25	1.25	1.26	1.26	1.27	1.28	1.29	0.96	0.74	8.7	
8.8	1.08	1.07	1.06	1.05	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.03	1.03	1.04	1.05	1.06	0.81	0.61	8.8	
8.9	0.87	0.86	0.86	0.85	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83	0.84	0.84	0.84	0.85	0.85	0.86	0.87	0.88	0.69	0.51	8.9	
9.0	0.70	0.70	0.69	0.69	0.69	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.70	0.70	0.71	0.71	0.72	0.73	0.74	0.59	0.48	9.0	

NOTES:

1. pH and temperature are field measurements taken at the same time and location as the water samples destined for the laboratory analysis of ammonia.
2. If field measured pH and/or temperature values fall between the A&Wc Acute Total Ammonia tabular values, round field measured values according to standard rounding procedures to nearest tabular value to determine ammonia standard.

**APPENDIX 4-3
 EFFLUENT DOMINATED WATERS IN THE CAAG REGION**

STREAM SEGMENT	DESIGNATED USES
MIDDLE GILA RIVER BASIN	
Gila River from Florence WWTP outfall to 5 kilometers downstream from the outfall	A&Wedw, PBC
Queen Creek from Superior WWTP to 8 kilometers downstream from the outfall	A&Wedw, PBC
Unnamed Wash from Queen Valley WWTP outfall to 3 kilometers downstream from the confluence with Queen Creek	A&Wedw, PBC
SALT RIVER BASIN	
Pinal Creek from Globe WWTP outfall to 5 kilometers downstream from the outfall	A&We, PBC, AgI, AgL
SAN PEDRO RIVER BASIN	
Unnamed Wash from Oracle WWTP outfall to confluence with Big Wash	A&Wedw, PBC
SANTA CRUZ RIVER BASIN	
North branch of the Santa Cruz Wash from Casa Grande WWTP outfall to confluence with the Santa Cruz River	A&We, PBC, AgL
UPPER GILA RIVER BASIN	
Cammerman Wash from Arizona Department of Correction - Globe WWTP outfall to 3 kilometers downstream from the outfall	A&Wedw, PBC
VERDE RIVER BASIN	
American Gulch from Payson WWTP outfall to the East Verde River	A&Wedw, PBC

Ref: A.A.C. § R18-11-113

**APPENDIX 4-4
 WATER QUALITY LIMITED WATERBODIES PRIORITY RANKING IN THE CAAG REGION 1994**

WATERBODY ID, NAME, SEGMENT DESCRIPTION	MILES OR ACRES	CAUSE OR STRESSOR	USE NON-SUPPORT	SPECIAL STATUS	BAN OR ADVISORY	NPS MANAGEMENT ZONE	TOTAL SCORE	RANK
MIDDLE GILA RIVER BASIN								
AZ15050100-007 Gila River Mineral Creek-Donnelly	14	3 arsenic, copper, turbidity	3 A&Ww,FBC, AgL				6	MEDIUM
AZ15050100-008 Gila River San Pedro-Mineral Creek	18	3 arsenic, copper, turbidity	2 A&Ww, FBC				5	MEDIUM
AZ15050100-012 Mineral Creek, hdwt-Gila River	17	6 arsenic, beryllium, copper, nickel, pH (low), sulfide, zinc	3 A&Ww, FBC, AgL				10	HIGH
AZ15070101-005 Gila River, B* Sand Tank	14	6 chlordan, DDT, dieldrin, mercury, toxaphene, narrative standards	5 A&Ww, FC, FBC, Agl, AgL		2 fish advisory		13	HIGH
SALT RIVER BASIN								
AZ15060103-004 Salt River, Pinal Cr-Roosevelt Lake	3	3 arsenic, nutrients, turbidity	0			(proposed Salt/Verde/Phoenix Zone)	3	MEDIUM
AZ15060103-005 Pinal Creek, hdwt-Salt River	18	7 beryllium, copper, low DO, manganese, nickel, pH, turbidity	4 A&Ww, FBC, Agl, AgL			(proposed Salt/Verde/Phoenix Zone)	11	HIGH

APPENDIX 4-4
WATER QUALITY LIMITED WATERBODIES PRIORITY RANKING IN THE CAAG REGION 1994

WATERBODY ID, NAME, SEGMENT DESCRIPTION	MILES OR ACRES	CAUSE OR STRESSOR	USE NON-SUPPORT	SPECIAL STATUS	BAN OR ADVISORY	NPS MANAGEMENT ZONE	TOTAL SCORE	RANK
AZ15060103-014 Canyon Creek hdwt-Oak Creek	19	1 turbidity	0	1 W&S-1		(proposed Salt/Verde/Phoenix Zone)	2	LOW
AZ15060103-018 Pinto Creek, hdwt-Spring Creek	25	2 copper, pH	2 A&Ww, AgL	1 W&S-1		(proposed Salt/Verde/Phoenix Zone)	5	MEDIUM
VERDE RIVER BASIN								
AZ15060203-022 East Verde, hdwt-Verde River	42	4 arsenic, low DO, mercury, turbidity	0	W&S-1		(proposed Salt/Verde/Phoenix Zone)	5	MEDIUM

Ref: ADEQ, Arizona's Water Quality Assessment Report - 1994, Draft, 4/1/94

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**APPENDIX 4-5
 STEAMS AND RIVERS DETERMINED ELIGIBLE FOR WILD, SCENIC OR RECREATIONAL RIVER DESIGNATION
 IN THE CAAG REGION**

RIVER SEGMENT	TYPE OF DESIGNATION	SUITABILITY
<p>The U. S. Forest Service and the Bureau of Land Management evaluated potential eligibility of a number of rivers and streams in Arizona for Special designation under the Wild and Scenic Rivers Act. Following is a listing of rivers found eligible, type of designation and suitability for designation. As of January 1994, suitability of most rivers and streams had not yet been determined.</p>		
SALT RIVER BASIN		
Cherry Creek (1) Forest Road #329 to Billy Lawrence Creek (2) Bill Lawrence Creek to Ellison Ranch	Wild Scenic	TBD TBD
Parker Creek from Rock Spring to confluence with Cottonwood Creek	Scenic	TBD
Pinto Creek from Layton Ranch to lower end of Pinto Box		
Salome Creek from confluence with Turkey Creek to Forest Road #60	Wild	TBD
Spring Creek (1) Forest Road #416 to wilderness boundary (2) Wilderness boundary to confluence with Tonto Creek	Recreational Wild	TBD TBD
Tonto Creek from Hell's Gate Wilderness -- north boundary to south boundary	Wild	TBD
Tonto Creek from mouth of Cocomunga Creek to mouth of Gun Creek	Scenic	TBD
Upper Salt River (1) San Carlos Indian Reservation to east boundary of Salt Wilderness (2) East boundary of Salt Wilderness to Fort Apache Reservation (3) Fort Apache Reservation to Salt Wilderness (4) Salt Wilderness to highway 288 bridge Workman Creek	Scenic Wild Wild Scenic	TBD TBD Yes Yes

**APPENDIX 4-5
 STEAMS AND RIVERS DETERMINED ELIGIBLE FOR WILD, SCENIC OR RECREATIONAL RIVER DESIGNATION
 IN THE CAAG REGION**

RIVER SEGMENT	TYPE OF DESIGNATION	SUITABILITY
SANTA CRUZ RIVER BASIN		
Workman Creek (1) Workman Falls to Salome Wilderness (2) Salome Wilderness to confluence with Salome Creek	Recreational Wild	TBD TBD
Campaign Creek	Not Eligible	---
Coon Creek	Not Eligible	---
Canada Del Oro (1) Headwaters to 1/4 mi. south of Road #736 (2) 1/4/ mi. south of Road #736 to Forest Boundary	Wild Recreational	Not Determined Not Determined
Romero Canyon from headwaters to wilderness boundary	Wild	Not Determined
SAN PEDRO RIVER BASIN		
Aravaipa Creek from confluence of Turkey Creek to Hell's Half Acre Canyon	Wild	Scheduled 94
Turkey Creek from T6S, R19E, S.32 to Aravaipa Creek confluence	Recreational	Scheduled 94
Redfield Canyon from headwaters to San Pedro River confluence	Not Eligible	---
UPPER GILA RIVER BASIN		
Arnett Creek from Forest Road #4 to mid-section 7	Scenic	TBD
Gila River (Middle) (1) Coolidge Dam to Hook & Line Ranch (2) Hook & Lline Ranch to T4S, R16E, R.14 (3) T4S,16E, S.14 to east edge of Hayden-Winkleman Tailings Ponds	Recreational Wild Recreational	Scheduled 94 Scheduled 94 Scheduled 94
Telegraph Creek from Forest Road #4 to Arnett Creek	Scenic	TBD

**APPENDIX 4-5
 STEAMS AND RIVERS DETERMINED ELIGIBLE FOR WILD, SCENIC OR RECREATIONAL RIVER DESIGNATION
 IN THE CAAG REGION**

RIVER SEGMENT	TYPE OF DESIGNATION	SUITABILITY
VERDE RIVER BASIN		
East Verde River (1) West edge of "East Verde Park" to west edge of L.F. Ranch (2) West edge of L.F. Ranch to Verde Wild River Area boundary	Recreational Scenic	TBD TBD
Fossil Creek (1) Below APS dam to Mazatzal Wilderness Boundary (2) Mazatzal Wilderness boundary to Verde Wild River Area Boundary	Recreational Wild	TBD TBD
NOTES: TBD:to be evaluated and determined Not eligible:not eligible for designation Schedule 94:scheduled for designation in 1994		

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SURFACE WATER DATA FOR CAAG REGION

ID Number	Reach/Lake Name, Segment Description Site Description	Designated Uses in Waterbody	Agency Study Site ID Number	Samples: Year-Number (Misc. info)	SAMPLES EXCEEDING STANDARDS								
					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support		
MIDDLE GILA RIVER BASIN													
15050100-009	Gila River, Drip Sprgs-San Pedro, above San Pedro	A&Ww, FBC, FC, AgL	ADEQ Ray Mine	1990-1 Background	ok						Full		
15050100-008	Gila River, San Pedro-Mineral Cr @ Kelvin	A&Ww, FBC, FC, Agl, AgL	USGS Fixed Station 09474000	1989-1 1990-1992 sediments only	TDS	1,000	1,140	mg/l	1		Partial Agl		
	Gila River, San Pedro-Mineral Cr above Mineral Creek				ADEQ Ray Mine	1990-3 Background	Arsenic t	3.1	10-14	ug/l	2	66%	Partial FC
							TDS	1,000	mean 1070	mg/l	2	66%	Partial Agl
							Turbidity	50	110	NTU	1	33%	Non A&Ww, FBC
	Gila River, San Pedro-Mineral Cr below Hayden Az				ADEQ Ray Mine	1990-1	Copper d	0.05	0.38	mg/l	1	100%	Non A&W
	Gila River, San Pedro-Mineral Cr @ Hayden tailings				EPA/ASARCO Copper Mine Init NPDES monitoring	1993-1	(Turbidity	50	200	NTU			During flood event)
Gila River, San Pedro-Mineral Cr below San Pedro R	ADEQ Ray Mine	1990-1 Background	TDS	1,000	1,050	mg/l	1	100%	Partial Agl				
15050100-007	Gila River, Mineral Cr-Donnelly below Mineral Creek	A&Ww, FBC, FC, Agl, AgL	ADEQ Ray Mine	1990-4	Arsenic t	3.1	10-21	ug/l	3	75%	Partial FC		
					Copper t	0.5	4.16-4.27	mg/l	2	40%	Non AgL		
					Copper d	varies	0.35	mg/l	1	25%	Partial A&Ww		
					TDS	1,000	mean 1073	mg/l			Partial Agl		
					Turbidity	50	1270-1330	NTU	2	40%	Non A&Ww, FBC		
15050100-001	Gila River, Santa Cruz-Salt R above Salt R	A&Ww, PBC, AgL	ADEQ Fixed Station MGR2	1990-9 1991-3	DO	6.0	4.0-5.2	mg/l	5	38%	Non A&Ww		
					Selenium t	20	28-32	mg/l	2	25%	Non A&Ww		
					Turbidity	50	58-194	NTU	3	17%	Partial A&Ww, PBC		

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					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support
15050100-012	Mineral Cr, hdwt-Gila	A&Ww, FBC, FC, AgL	ADEQ Gibson Mine	1990-set of 3	Copper d	varies	3.01-184	mg/l	8	100%	Non A&Ww
				1991-set of 6	Copper t	0.5	0.61-218	mg/l	15	100%	Non AgL
				1992-2sets of 3	Nickel t	0.4	0.44-0.58	mg/l	4	25%	Partial FC
					pH	6.5-9	5.1-6.4	SU	7	50%	Non A&Ww, FBC
					Zinc d	varies	1.8-3.13	mg/l	3	37%	Non A&Ww
	Mineral Creek, hdwt-Gila River		ADEQ/EPA Copper Mine tour WQMS 210.154	1992-2 sites (abv & blw Ray mine)	Copper d	varies (69)	145	ug/l	only below mine		Non A&Ww
			ADEQ/EPA Copper Mine tour WQMS 210.154	1992-1 (below all mines)	pH	6.5-9.0	6.4	SU	1	100%	Non A&Ww, FBC, AgL
					Copper t	0.5	72.5	mg/l	1	100%	Non AgL
			ADEQ Ray Mine above mine	1990-4	Arsenic t	3.1	11	ug/l	1	17%	Partial FC
				1992-2 Abv Ray Mine	Copper d	varies	0.018-0.272	mg/l	2	40%	Non A&Ww
			ADEQ Ray Mine below mine	1990-3	Arsenic t	3.1	19-21	ug/l	2	50%	Partial FC
					1991-1	Copper d	varies	0.19-1.91	mg/l	6	66%
				1992-1	Copper t	0.5	0.21-5.36	mg/l	2	22%	Partial AgL
					1992-5 sites Blw Ray Mine	Turbidity	50	850	NTU	1	25%
			ADEQ Fixed Station MIN1	1993-11	Beryllium t	0.21	0.6-1.31	ug/l	6	55%	Partial FC, Non FBC
					Copper d	varies	160-1140	ug/l	9	90%	Non A&Ww
					Copper t	500	510-2700	ug/l	10	91%	Non AgL
Turbidity	50	70-200			NTU	5	45%	Non FBC, A&Ww			
ADEQ ASARCO, Ray Mine WQMS 212.251	1992-7 sites	Copper d	varies	0.19-9.24	mg/l	4 sites		Non A&Ww			
ADEQ Priority Pollutant	1992 fish & sediment	Arsenic	0.76 HBGL	3.1	mg/kg	1	100%	Sediment contam.			
		Beryllium	0.32 HBGL	2.2	mg/kg	1	100%	Sediment contam.			
15050100-0500	Freestone Lake	(unlisted)	AGFD Fish stocking	1990-2	pH	6.5-9	9.7	SU	1	50%	Partial A&Ww

SAN PEDRO RIVER BASIN

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					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support
SAN PEDRO RIVER BASIN											
15050203-001	San Pedro, Arivaipa-Gila R. @ Aravaipa Road	A&Ww, FBC, AgL	ADEQ Ray Mine WQMS 212.	1990-1 Background	ok						Full
			ADEQ Fixed Station SP15 @ Aravaipa Rd	1993-2	ok						Full
			USGS Sediment study	1990- suspended solids	Flows over 30 cfs resulted in suspended solids greater than 27,400 mg/l						
15050203-004	Aravaipa, Rattlesnake-San Pedro	A&Ww, FBC, DWS, FC, AgL	ADEQ Klondike Mine Inv WQMS-212.303	1993-2 (3 sediments) (10 tailings)	ok						Threat A&Ww, DWS, FC, FBC (copper, lead, nickel, and silver)
	Aravaipa, Rattlesnake-San Pedro		USGS Fixed Station 09473000	1989-1992 sediment samples only	ok						Too few parameters to assess
	Aravaipa, Rattlesnake-San Pedro		ADEQ Priority Pollutant	1993-Fish and sediment	ok						Full
	Aravaipa, Rattlesnake-San Pedro @ Parsons Canyon		ADEQ Biocriteria dev.	1992-1	ok						Full
	Aravaipa, hdwt-Rattlesnake @ Hells Half Acre		ADEQ Biocriteria dev.	1992-1 1993-1	ok						Full
	Aravaipa, Rattlesnake-San Pedro @ W. Wilderness bdry		BLM/Safford Monitoring	1990-3 1991-1 1993-2	Zinc d	varies	0.361	ug/l	1		Non A&Ww
	Aravaipa, hdwt-Rattlesnake @ Woods Ranch		ADEQ Fixed Station AVP1	1993-3	Turbidity	50	95.2	NTU	1	33%	Non A&Ww, FBC

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					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%

SAN PEDRO RIVER BASIN											
15050203-004 off	Oak Grove Cyn, hdwt-Aravaipa	A&Ww, FBC, DWS, FC, AgL	BLM/Safford Monitoring	1991-1 1993-1	ok						Full
15050203-004 off	Javalina Cyn, hdwt-Aravaipa	A&Ww, FBC, DWS, FC, AgL	BLM/Safford Monitoring	1991-1	ok						Full

SALT RIVER BASIN												
15060103-004	Salt River Pinal Cr-Roosevelt above Roosevelt Lake	A&Ww, FBC, FC, Agl, AgL	USGS Fixed Station 09498500	1989-12	Arsenic t	3.1	5-9	ug/l	median 5		Partial FC	
				1990-12	Fecal coli	800	1,100-3,100	CFU	4	7%	Threat FBC, A&Ww	
				1991-12	T-nitrogen	single sample 2	0.69-5.0		mg/l	Exceedance in 1993 primarily related to flood event.		Partial A&Ww, FBC
				1992-12		mean 0.6	mean 0.49 (1993)		mg/l			
				1993-12	T-phosporus	single sample 1	0.4-4		mg/l	1190 mean		Partial Agl
						mean 0.12	mean 0.49					
								TDS	1,000	1010-3120	mg/l	
				During Jan 1993 floods lead exceeded standard (no total managanese sample taken)								
				Turbidity	50	54-1300	NTU	9	15%	Partial A&Ww, FBC		
415060104-018	Corduroy Cr, hdwt-Carrizo Cr	A&Wc, FBC, FC, Agl, AgL	AGFD Stocking Program	1990-2 few parameters							(too few parameters to assess)	
15060103-015	Cherry Creek, hdwt-Salt River abv USFS Rd #203	A&Wc, FBC, FC, Agl, AgL	ADEQ Fixed Station CC2	1991-4 1992-6	ok						Full	
			ADEQ Biocriteria dev.	1992-2 sites 1994-2 sites	ok						Full	
15060103-014	Canyon Creek, hdwt-Oak Creek	A&Wc, FBC, FC, DWS, Agl, AgL	ADEQ Fixed Station CAN1 blw OW Ranch Rd	1990-5 1991-6 1992-6 1993-5	Arsenic t	3.1	18	ug/l	1	4%	Full	
					Mercury t	0.6	0.7	ug/l	1	4%	Full	
					Turbidity	10	10.5-18	NTU	4	20%	Partial A&Wc	
			ADEQ Biocriteria dev.	1992-1 1993-1	ok						Full	
			AGFD Stocking program	1992-2 sets 2 sites	ok (few parameters)						Too few parameters to assess	

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ID Number	Reach/Lake Name, Segment Description Site Description	Designated Uses in Waterbody	Agency Study Site ID Number	Samples: Year-Number (Misc. info)	SAMPLES EXCEEDING STANDARDS								
					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support		
15060103-005	Pinal Cr, hdwt-Salt River @ Inspiration	A&Ww, FBC, FC, Agl, AgL	USGS Globe/Miami Mining	1987to1989-17	Manganese t	10	40-58	mg/l	17	100%	Non Agl		
					TDS	1,000	2,800-3,480	mg/l	17	100%	Non Agl		
	Pinal Cr, hdwt-Salt River @ Setka Rch (Globe)		USGS Miami/Globe Inv.	1988to1989-9	DO	> 6	5.9	mg/l	1	11%	Partial A&Ww		
					Manganese t	10	61-84	mg/l	9	100%	Non Agl		
					TDS	1,000	3,460-3,690	mg/l	9	100%	Non Agl		
	Pinal Creek, hdwt-Salt R. @ Inspiration Dam		USGS Fixed Station 09498400	1989-6 1990-6 1991-6 1992-6 1993-6	Manganese t	10	14-52	mg/l	28	93%	Non Agl		
					TDS	1,000	2,780-3,490	mg/l	2958 mean	Non Agl			
					During Jan 1993 floods (1200 cfs instead of max 100 cfs), Copper (t & d), Lead (t), & Arsenic (t) exceeded standards. Several other heavy metals (t) dramatically increased, but dissolved fraction of many metals noticeably decreased during the event.							Threats to all uses and downstream Roosevelt Lake.	
					Turbidity	50	71-3000	NTU	5	17%	Partial A&Ww, FBC		
					Pinal Creek hdwt-Salt River								
	Pinal Creek, hdwt-Salt River		ADEQ Complaint Inv. WQMS 212.328	1993 4 sites	Beryllium t	0.21	0.81	ug/l	1 site		Partial FC, FBC		
					Copper t	0.5	1.7-16.2	mg/l	2 sites		Non AgL, partial Agl		
					Manganese t	10	25.4-42.8	mg/l	2 sites		Non Agl		
					pH	6.5-9.0	4.3	mg/l	1 site		Partial A&We,PBC,Agl, AgL		
					TDS	1000 EPA criteria	3100	mg/l	4 sites		Non Agl		
	Pinal Creek, hdwt-Salt River		Cyprus Miami Mi EPA required WQMS-210.051	1989-6 sites	Copper t	0.5	2.0-23.2	mg/l	6	100%	Non AgL		
					Manganese t	10	48.2-101	mg/l	5	83%	Non Agl		
pH		6.5-9.0			4.25-5.5	SU	5	83%	Non A&Ww, FBC, AgL				
TDS		1,000			3,728-4,996	mg/l	6	100%	Non Agl				
Pinal Creek, hdwt-Salt River	ADEQ Investigation WQMS-	1991-5 sites	Manganese t	10	30.3-70.8	mg/l	100%		Non Agl				
			Nickel t	0.4	0.65-0.76	mg/l	2	50%	Partial FC				
			pH	6.5-9.0	5.90		3	33%	Partial A&Ww,FBC,AgL				
			TDS	1000 (EPA criteria)	3180-3308	mg/l	4	100%	Non Agl				

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ID Number	Reach/Lake Name, Segment Description Site Description	Designated Uses in Waterbody	Agency Study Site ID Number	Samples: Year-Number (Misc. info)	SAMPLES EXCEEDING STANDARDS						
					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support
15060103-005 off13off	Bloody Tanks Wash hdwt-Miami	A&We, PBC, AgL	ADEQ-Haz. Mat Complaint Inv Pacific St Chem	1990 set of 3 (only total metals)	Ammonia	varies	37.1-69.4	mg/l	3	100%	Non A&Ww
					Boron t	1	3.17-10.6	mg/l	3	100%	Non Agl
					Chromium t	1	5.23-24.8	mg/l	3	100%	Non Agl, AgL
					Copper t	0.5	16.6-53.8	mg/l	3	100%	Non Agl, AgL
					Lead t	0.1	0.34-0.92	mg/l	3	100%	Non Agl
					pH	6.5-9.0	4.1-4.5	SU	3	100%	Non A&Ww,PBC,Agl,AgL
					TDS	1000	3660-7880	mg/l	3	100%	Non Agl
					Zinc t	10	33.3-142	mg/l	3	100%	Non Agl, AgL
		A&We, PBC, AgL	EPA/Cyprus NPDES monitoring @ Oxhide	1993-1	Copper d	varies (17)	89.7	ug/l	1	100%	Non A&Ww
		A&We, PBC, AgL	EPA/Cyprus NPDES monitoring blw Cyprus Miami	1993-1	Copper d	varies (17)	103	ug/l	1	100%	Non A&Ww
A&We, PBC, AgL	EPA/Cyprus NPDES monitoring @ Triple Nickel	1993-1	Copper d	varies (17)	125	ug/l	1	100%	Non A&Ww		
A&We, PBC	EPA/Cyprus NPDES monitoring above Miami W	1993-1	Copper d	varies (17)	89.7	ug/l	1	100%	Non A&Ww		
15060103-018	Pinto Creek, hdwt-Spring Creek	A&Ww, FBC, FC, Agl, AgL	Hargis + Assoc. Tailings Spills WQMS 212.276	1993-12 sites	Copper d	varies	18-53	ug/l	10	80%	Non A&Ww (at time - heavy runoff and major tailings spills)
	Pinto Cr, hdwt-Spring Cr @ Magma Cu. Tailings Dam #3		ADEQ Magma Copper	1991-0 Tailings Spill	narrative						Non A&W,FBC,Agl,AgL, partial FC
	Pinto Creek, hdwt-Spring Cr above Gibson trib		ADEQ Gibson Mine Inv	1990 set of 2	ok						Full

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					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support	
	Pinto Cr, hdwt-Spring Cr. @ Gibson Mine trib		ADEQ Gibson Mine Inv	1990-2	Copper d	varies	0.048-7.9	mg/l	5	100%	Non A&Ww	
				1991-1	Copper t	0.5	1.65-10.3	mg/l	3	50%	Non AgL, Partial AgL	
				1992-2	pH	6.5-9	6.39	SU	1	20%	Partial A&Ww, FBC	
	Pinto Creek hdwt-Spring Creek above Gibson Mine trib		ADEQ/EPA Copper Mine Init NPDES	1992-1	ok							
			ADEQ/EPA Copper Mine Init NPDES	1992-1	Copper d	varies	0.080	mg/l	1	100%	Non A&Ww	
				1992-1	ok							
Pinto Creek hdwt-Spring Creek below Carlotta	ADEQ/EPA Copper Mine Init NPDES	1992-1	ok (Copper t twice concentration found above Carlotta)									
15060103-017	Pinto Cr, Spring-Roosevelt Lake abv Henderson Rch	A&Ww, FBC, FC, Agl, AgL	ADEQ Fixed Station PC1	1990-5	Arsenic t	3.1	10	ug/l	1	5%	Threat FC	
				1991-4	Beryllium t	0.21	0.5	ug/l	1	5%	Threat FC	
				1992-6 1993-6	Selenium t	20	100	ug/l	1	5%	Threat FC, FBC	
	Pinto Creek, Spring-Roosevelt Lake		Hargis + Assoc. Tailings Spills WQMS 212.276	1993-2 sites (2 soils also)	ok						Full (during heavy runoff)	
15060103-018 off	Unnamed trib, hdwt-Pinto Cr Gibson Mine Tributary	A&Ww, FBC, FC, Agl, AgL	ADEQ Gibson Mine Inv.	1990-3	Copper d	varies	3.3-236	mg/l	7	100%	Non A&Ww	
				1991-1	Copper t	0.5	2.92-252	mg/l	9	100%	Non Agl, AgL	
				1992-5	Manganese t	10	21.3-48.8	mg/l	3	45%	Non Agl	
					pH	6.5-9.0	3.63-6.40	SU	9	100%	Non A&Ww, FBC, Agl, AgL	
					Zinc d	varies	0.19-3.30	mg/l	4	65%	Non A&Ww	

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Appendix 4-6
SURFACE WATER DATA FOR CAAG REGION

ID Number	Reach/Lake Name, Segment Description Site Description	Designated Uses in Waterbody	Agency Study Site ID Number	Samples: Year-Number (Misc. info)	SAMPLES EXCEEDING STANDARDS						
					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support
			ADEQ/EPA Copper Mine Init NPDES monitoring	1992-1	Copper d	varies (0.033)	3.34	mg/l	1	100%	Non A&Ww
					Copper t	0.5	2.92	mg/l	1	100%	Non AgL
					pH	6.5-9.0	5.5	SU	1	100%	Partial A&Ww, FBC, AgL
15060103-022	Salome Creek hdwt-Roosevelt Lake blw Little Turkey	A&Wc, FBC, FC, Agl, AgL	ADEQ Biocriteria dev.	1992-1 1993-1	ok						Full
15060105-006	Tonto Cr, Gun Creek-Greenback @ Pumpkin Center	A&Wc, FBC, FC, Agl, AgL	SRP Monitoring	1990-4 few parameters	ok						Full
	Tonto Cr, Gun Creek-Greenback near Punkin Center	A&Wc, FBC, FC, Agl, AgL	ADEQ Payson Const. & Matl	1990-0	narrative						Violation & COE= C&Desist
	Tonto Creek, Gun Creek-Greenback	A&Wc, FBC, FC, Agl, AgL	USFS Tonto NF	1991-3							Full
15060105-014	Rye Creek, hdwt-Tonto Creek	A&Ww, FBC, FC, AgL	USFS Tonto NF	1991-3	ok						Full
15060105-013 off8	Christopher Cr, hdwt-Tonto	A&Wc, FBC, FC, Agl, AgL	USFS Tonto NF	1991-3	ok						Full
			ADEQ Mnt Meadows R WQMS 212.357	1993-4 sites (illegal discharge)	TDS	1000	1050	mg/l	1		Partial AgL
					T-phos	1.00	2.95	mg/l	1		Partial A&Wc
					T-nitrogen	2.00	21.98	mg/l	1		Partial A&Wc
15060105-012	Haigler Cr., hdwt-Tonto	A&Wc, FBC, FC, Agl, AgL	ADEQ Fixed Station HAG1	1992-6 1993-6	ok						Full
			ADEQ Biocriteria dev.	1992-1 1993-1	ok						Full
			USFS Tonto NF	1991-3	ok						Full

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SURFACE WATER DATA FOR CAAG REGION

ID Number	Reach/Lake Name, Segment Description Site Description	Designated Uses in Waterbody	Agency Study Site ID Number	Samples: Year-Number (Misc. info)	SAMPLES EXCEEDING STANDARDS						
					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support
15060103-0040	Roosevelt Lake	A&Ww, FBC, DWS, FC, Agl, Agl	ADEQ/USGS Clean Lakes Prog.	1991-92 45 samples	Arsenic t	3.1	4-6	ug/l	mean < 10		Threat FC
					Beryllium t	0.21	0.5-0.7	ug/l	5	11%	Partial FBC, Threat FC, DWS
									median < 0.5		
					Chloride	250 EPA	280-450	mg/l	230 mean		Partial DWS
				TDS	500 EPA	526-1100	mg/l	557 mean		Partial DWS	

VERDE RIVER BASIN											
15060203-021	Verde R, E Verde-Wet Bottom @ Childs	A&Ww, FBC, FC, Agl, AgL	FWS Priority Pol.	1989-1	Arsenic t	3.1	14.2	ug/l	1	100%	Partial FC
15060203-024	Fossil Cr, hdwt-Verde R near Strawberry	A&Ww, FBC, FC, Agl, AgL	ADEQ Fixed Station FOS1	1990-6	Lead t	100	190	ug/l	1	9%	Full
				1991-6	Nickel t	400	660	ug/l	1	9%	Threat FC
15060203-022	East Verde River, hdwt-Verde near Childs	A&Wc, FBC, FC, Agl, AgL	SRP Monitoring	1990-4 Few parameters	ok						Full
	East Verde River, hdwt-Verde R. @ Childs		USGS Fixed Station 09507980	1991-6	Arsenic t	3.1	4-150	ug/l	median 19		Partial FC, FBC
				1992-6	Mercury t	0.6	1.6	ug/l	1	6%	Threat FC
				1993-5	Turbidity	10	50-73	NTU	2	12%	Partial A&Wc, FBC
	East Verde River hdwt-Verde River @ 2nd Xing Campgr		ADEQ Biocriteria dev.	1992-1	ok						Full
	East Verde River hdwt-Verde River @ Brushy Canyon		ADEQ Biocriteria dev.	1992-1 1993-1	ok						Full
East Verde River, hdwt-Verde abv H-89	ADEQ Fixed Station EVR2	1990-6	Arsenic t	3.1	12	ug/l	median < 10		Full		
		1991-6	DO	7	6.2-6.8	mg/l	4	25%	Partial A&Wc		
					Turbidity	10	10.9-73	NTU	4	25%	Partial A&Cc, FBC

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ID Number	Reach/Lake Name, Segment Description Site Description	Designated Uses in Waterbody	Agency Study Site ID Number	Samples: Year-Number (Misc. info)	SAMPLES EXCEEDING STANDARDS							
					Parameter	Standard Or Criteria	Level Exceeding	Units	No.	%	Use Support	
15060203-022 offa	Bonita Creek, hdwt-East Verde River Upper Bonita Creek	A&Wc, FBC, DWS, FC	USFS Tonto NF	1991-3	ok							Full
	Bonita Creek, hdwt-East Verde River Lower Bonita Creek		USFS Tonto NF	1991-3	ok							Full
15060203-022 offd	Dude Creek, hdwt-East Verde River	A&Wc, FBC, FC, Agl, AgL	USFS Tonto NF	1991-3	ok							Full
15060203-022 offe	Ellison Creek, hdwt-East Verde River	A&Wc, FBC, FC, AgL	ADEQ Spec inv.	1991-5 sites	ok							Full
			ADEQ Fixed Station	1992-6	Beryllium t	0.21	4.8	ug/l	1	17%	Partial FC, FBC	
			ELC1		Turbidity	10	12.5-200	NTU	2	40%	Non A&Wc, partial FBC	
			USFS Tonto NF	1991-3	ok						Full	
15060203-022 offi	Pearly Creek, hdwt-East Verde	A&Wc, FBC, FC, Agl, AgL	USFS Tonto NF	1991-1	ok							Full
15060203-022 offf	Pine Cr, hdwt-East Verde R.	A&Wc, FBC, FC, DWS, Agl, AgL	USFS Tonto NF	1991-3	Turbidity	10	13.2	NTU	1	33%	Partial A&Wc	
			ADEQ Biocriteria dev.	1992-1 1993-1	ok						Full	

Parameter: DO = Dissolved oxygen, TDS = Total Dissolved Oxygen. SU = Standard Unit, NTU = Nephelometric Turbidity Unit, CFU = Colony Forming Unit per 100 ml. HBGL = Health Based Guidance Level (ADHS, 1992).

Agency: ADEQ = Arizona Department of Environmental Quality, SRP = Salt River Project, USFS = US Forest Service, USGS = US Geological Service, AGFD = Arizona Game and Fish Department, BLM = US Bureau of Land Management, FWS = Fish and Wildlife Service, IBWC = International Boundary Water Commission.

Use Support: A&W = Aquatic and Wildlife (w = warmwater, c = coldwater, e = ephemeral, edw = effluent dominated water) FBC = Full Body Contact, PBC = Partial Body Contact, FC = Fish Consumption, DWS = Drinking Water Source, Agl = Agriculture Irrigation, AgL = Agriculture Livestock Watering, UNIQUE = Unique Water.

HBGL: Human Health Based Guidance Level for soil ingestion, established by Arizona Department of Health Services (1990).

SOURCE: ADEQ, Arizona's Water Quality Assessment Report - 1994, Draft, 4/1/94

APPENDIX 4-7
AQUIFER WATER QUALITY STANDARDS

NARRATIVE WATER QUALITY STANDARDS	
a.	A discharge shall not cause a pollutant to be present in an aquifer classified for a drinking water protected use in a concentration which endangers human health.
b.	A discharge shall not cause or contribute to a violation of a water quality standard established for a navigable water of the state.
c.	A discharge shall not cause a pollutant to be present in an aquifer which impairs existing or reasonably foreseeable uses of water in an aquifer.

Historical Note: Adopted effective January 4, 1990 (Supp. 90-1). Amended effective August 14, 1992 (Supp.92-3)

Ref: A.A.C. § R18-11-405

APPENDIX 4-7 AQUIFER WATER QUALITY STANDARDS

NUMERIC WATER QUALITY STANDARDS: Drinking Water Protected Use	
a.	The aquifer water quality standards in this Section apply to aquifers that are classified for drinking water protected use.
b.	The following are the aquifer water quality standards for inorganic chemicals:
POLLUTANT	(mg/L)
Arsenic	0.05
Asbestos	7 million fibers/liter <small>(longer than 10 um)</small>
Barium	1.0
Cadmium	0.005
Chromium	0.1
Fluoride	4.0
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.0
Nitrite (as N)	1.0
Total nitrate and nitrite (as N)	10.0
Selenium	0.05
c.	The following are the aquifer water quality standards for organic chemicals:
POLLUTANT	(mg/L)
Benzene	0.005
Carbon Tetrachloride	0.005
o-Dichlorobenzene	0.6
para-Dichlorobenzene	0.075
1,2,-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
cis-1,2-Dichloroethylene	0.07
trans-1,2,-Dichloroethylene	0.1
1,2-Dichloropropane	0.005

APPENDIX 4-7 AQUIFER WATER QUALITY STANDARDS

Ethylbenzene	0.7
Monochlorobenzene	0.1
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1.0
Trihalomethanes (Total)	0.10
1,1,1-Trichloroethylene	0.20
Trichloroethylene	0.005
Vinyl Chloride	0.002
Xylenes (Total)	10.0
d. The following are the aquifer water quality standards for pesticides and polychlorinated biphenyls (PCBs):	
POLLUTANT	(mg/L)
Alachlor	0.002
Atrazine	0.003
Carbofuran	0.04
Chlordane	0.002
1,2-Dibromo-3-Chloropropane (DBCP)	0.0002
Ethylene Dibromide (EDB)	0.00005
Heptachlor	0.0004
Heptachlor Epoxide	0.0002
Endrin	0.0002
Lindane	0.0002
Methoxychlor	0.04
Polychlorinated Biphenols (PCBs)	0.0005
Toxaphene	0.003
2,4,-Dichlorophenoxyacetic Acid (2,4-D)	0.07
2,4,5-Trichlorophenoxypropionic	0.05

APPENDIX 4-7 AQUIFER WATER QUALITY STANDARDS

e.	The following are the aquifer water quality standards for radionuclides:		
1.	The maximum concentration for gross alpha particle activity, including Radium-226 but excluding radon and uranium, shall not exceed 15 pCi/l.		
2.	The maximum concentration for combined Radium-226 and Radium-228 shall not exceed 5pCi/l.		
3.	The average annual concentration of beta particle and photon radioactivity from man-made radionuclides shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.		
4.	Except for the radionuclides listed in this subsection, the concentration of man made radionuclides causing 4 millirem total body or organ dose equivalents shall be calculated on the basis of a 2-liter-per-day drinking water intake using the 168-hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," National Bureau of Standards Handbook 69, National Bureau of Commerce, as amended August 1963 (and no future editions), incorporated herein by reference and on file with the Office of the Secretary of State and with the Department. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year. The following average annual concentrations are assumed to produce a total body or organ dose of 4 millirem/year:		
	RADIONUCLIDE	CRITICAL ORGAN	pCi/l
	Tritium	Total body	20,000
	Strontium-90	Bone Marrow	8
f.	The aquifer water quality standard for microbiological contaminants is based upon the presence or absence of total coliforms in a 100-milliliter sample. If a sample is total coliform-positive, a 400-milliliter repeat sample shall be taken within two weeks of the time the sample results are reported. Any total coliform-positive repeat sample following a total coliform-positive sample constitutes a violation of the aquifer water quality standard for microbiological contaminants.		
g.	The following are the aquifer water quality standards for turbidity:		
1.	One nephelometric turbidity unit as determined by a monthly average except that five or fewer nephelometric turbidity units may be allowed if it can be determined that the higher turbidity does not interfere with disinfection, prevent maintenance of effective disinfectant agents in water supply distribution systems, or interfere with microbiological determinations.		
2.	Five nephelometric turbidity units based on an average of two consecutive days.		

Historical Note: Adopted effective January 4, 1990 (Supp. 90-1). Amended effective August 14, 1992 (Supp.92-3)

Reference A.A.C. § R18-11-406

**APPENDIX 4-8
 MAJOR GROUNDWATER CONTAMINATED SITES WITHIN THE CAAG REGION**

SITE LOCATION AND NAME	CONTAMINATION PROBLEM	STATUS
CENTRAL HIGHLANDS PLANNING REGION		
Payson	PCE (VOC) in groundwater due to dry cleaning chemical disposal (542-13, 600 ug/l).	WQARF - Feasibility study and aquifer pump tests ongoing.
Miami/Globe (Pinal Creek) Area	Low pH due to acid mine drainage (down to 3.4 SU)	WQARF - Remediation initiated.
Miami/Globe (Pinal Creek) Area	MCS for lead (10-65 ug/l), fluoride (7-39 ug/l, and cadmium (5-384 mg/l) exceed MCLs due to acid mine drainage. SMCLS for iron, manganese, and copper also exceeded.	WQARF - Remediation initiated.
PHOENIX AMA		
Komatke	Sulfate levels up to 500 mg/l.	
PINAL AMA		
Anizola	Nitrate (up to 28 mg/l), most likely due to agriculture.	
Casa Grande	(TCE (up to 11.0 ug/l) in groundwater from landfill.	
Casa Grande	Sulfate level up to 800 mg/l.	
Casa Grande	Major cations and anions with TDS 3,000-5,000 mg/l.	
Casa Grande	Nitrate (up to 28 mg/l) most likely due to agriculture.	
Casa Grande (North)	Major cations and anions, with TDS 3,000 - 10,000 mg/l.	
Casa Grande & Stanfield	Arsenic exceeded standard.	
Coolidge	Major cations and anions, with TDS 3,000 - 10,000 mg/l.	
Coolidge	Sulfate levels up to 800 mg/l.	
Eloy (North)	Selenium over 0.01 (at or near standard).	
Florence	Nitrate (10-90 mg/l) most likely due to agriculture.	

**APPENDIX 4-8
 MAJOR GROUNDWATER CONTAMINATED SITES WITHIN THE CAAG REGION**

SITE LOCATION AND NAME	CONTAMINATION PROBLEM	STATUS
PINAL AMA (cont.)		
Friendly Corners	Nitrate (up to 28 mg/l), most likely due to agriculture.	
Komatke (East of)	Major cations and anions with TDS 3,000 to 10,000 mg/l.	
La Palma	Nitrate (up to 90 mg/l), most likely due to agriculture.	
Maricopa	Sulfate level up to 500 mg/l.	
Maricopa	Major cations and anions, with TDS over 10,000 mg/l.	
Randolph	Selenium over 0.01 mg/l (near or over standard).	
SOUTHEAST ARIZONA PLANNING REGION		
Globe-Miami	TDS and sulfate elevated due to mining. Sulfate up to 4,600 mg/l.	
Globe-Miami	Groundwater and surface water contaminated with copper, manganese, and excessive pH due to acid mine wastes and tailing.	WQARF - Remediation initiated.
Mammoth	Fluoride levels (>30 mg/l).	
San Manuel	Sulfate up to 1500 mg/l.	
Winkelman	Major cations and anions with TDS up to 10,000 mg/l.	

Source: Arizona's Water Quality Assessment Report - 1994, ADEQ, (Draft 4/1/94)

MCL = Maximum Contaminant Level, SMCL = Secondary MCL,

Fluoride = 4.0 mg/l MCL

Nitrate = 10.0 mg/l MCL

Sulfate = 250 mg/l SMCL

TDS = 500 mg/l SMCL

Chapter 5.0 POINT SOURCE MANAGEMENT

5.1 POINT SOURCE CONTROL PROGRAM

Section 208 of the Clean Water Act requires that both point and nonpoint sources of pollution must be addressed in the Areawide Water Quality Management Plan. A "point source" is defined as any discernible, confined and discrete conveyance from which pollutants are or may be discharged. Historically, point source management has referred to wastewater treatment plants and other facilities that discharged to navigable waters from the end of a pipe. Amendments to both federal and state laws have broadened the scope of point source management to other activities including mining and waste disposal. This section will focus primarily on facilities that require permits under a federal or state point source control program.

The purpose of this section of the plan is to establish planning priorities and guidelines for wastewater management. It will include: permit requirements, on-site disposal systems, centralized wastewater treatment systems, industrial and manufacturing dischargers, point source control programs, compliance issues and, lastly, solid waste.

This section of the plan will be used by ADEQ for the "consistency review process". Both federal and state laws have requirements that certain permits and other activities must be found consistent with the areawide water quality management plan. If the proposed activity is "inconsistent", a plan amendment may be required. This continuing planning and plan amendment processes are discussed further in the Continuing Planning Process section of the update.

5.1.1 Categories of Facilities

There are approximately 51 facilities within the CAAG region that require individual permits. These facilities can be further classified as municipal, industrial, landfill, or mining operations.

Of the 51 facilities, 62% are wastewater treatment, 20% are industrial, 2% are landfills, and 14% are mining. Of the types of permits required, 18% have NPDES permits, 14% have reuse permits, and 84% have or will require APPs.

Landfills, as potential point source dischargers, will be covered under the solid waste portion of this element. Mining operations are also considered potential point source dischargers and require permits under the Aquifer Protection Program. Some mining operations also require NPDES permits if they discharge to surface waters. Active mining operations and abandoned mines and tailings are considered under the nonpoint source section (Chapter 6) of this plan. Industrial facilities are operations that generate, treat and dispose of their own wastewater. Industrial facilities that discharge to municipal wastewater treatment systems are generally required to have pretreatment programs in place. Other industrial facilities are located in unincorporated areas and must address the entire waste disposal process for their individual facility. Industrial facilities are covered under this point source element.

5.1.2 Permit Programs for Point Source Management

NPDES

Section 402 of the Clean Water Act requires that any facility that discharges effluent to surface waters of the United States obtain a permit under the NPDES program. NPDES permits contain effluent limitations for specific pollutants based on the receiving water body and its designated

uses. These standards may be technologically based or water quality based if the receiving water is a specially designated water (e.g., unique water, effluent dominated water, TMDL-targeted). NPDES permits are drafted by ADEQ and must undergo Section 401 certification that the discharge will not violate state water quality standards. NPDES permits are issued by the EPA. The agency being granted the permit is required to monitor the discharge and report results to EPA and ADEQ. A listing of the current NPDES permit holders in the region are listed in Appendix 5-1, organized by the surface water basin of the receiving water.

Reuse

Facilities that treat effluent for irrigation or other purposes are required to obtain a reuse permit from ADEQ. Users of the reclaimed water are also required to obtain reuse permits. These state permits have quality limitations as well as monitoring requirements. Standards are specific to the intended end use. Facilities that discharge in addition to reusing effluent must obtain both a NPDES and a reuse permit. A listing, by surface water basin, of reuse permits currently issued for the CAAG region are located in Appendix 5-2.

Aquifer Protection Permit

The Aquifer Protection Permit Program came into being in October 1989 with the major purpose to protect groundwater and ensure that aquifer water quality standards are maintained. The APP replaced the existing Groundwater Protection Permits Program. ADEQ's Aquifer Protection Permit (APP) program is the principal management program for both point and non-point source pollution. APPs are required for all discharging facilities that do not have either a NPDES or a reuse permit. Any entity or individual responsible for a release or potential release of a pollutant which may impact on groundwater quality must obtain an APP. New facilities must obtain an APP prior to operation. A listing of the current APP permits in the CAAG region are listed in Appendix 5-3, organized by ground water basin. Please note that Aquifer Protection Permit Program replaced the Groundwater Quality Protection Permit Program in 1984. Therefore, both APPs and GMPPs are listed.

The APP program has two types of permits: individual and general. Individual permits require the use of best available demonstrated control technology (BADCT) and include monitoring requirement. General permits have been issued for a limited range of facilities including: sewage disposal systems with flows greater than or equal to 2000 gpd and less than 20,000 gpd (which meet certain conditions); recharge and underground storage and recovery pilot projects; and for agricultural application of wastewater sludge. If a facility does not comply with the requirements of a general APP permit, ADEQ may revoke the general permit and require the facility to obtain an individual APP.

Technical Review

All wastewater treatment facilities, including those covered under general permits, must have an approval from ADEQ prior to construction. Facilities must also be consistent with certified water quality management plans, facility plans and/or general plans.

5.1.3 Designated Management Agencies (DMAs)

Section 208(c)(1) of the Clean Water Act requires designation of water quality management agencies to carry out provisions of the areawide water quality management plan. Designated management agencies (DMA) must have adequate authority, resources and the desire to implement and enforce portions of this plan. The only agencies eligible for this designation in the CAAG region are incorporated places, sanitary districts and some improvement districts.

The ADEQ's "Continuing Planning Process for Water Quality Management", April, 1993, recognizes that DMAs will vary in their specific characteristics and capabilities, but all should share the following attributes:

- Appropriate legal authority to carry out designated responsibility.
- Financial solvency including, if appropriate, the ability to raise revenue through taxes or fee collection, the ability to accept grants or funds from other sources for water pollution management purposes, and the ability to incur short and/or long-term indebtedness for water quality management.
- Administrative competence with the organizational resources, personnel resources, equipment and facilities necessary to provide administrative and management support required for effective water quality management programs.
- Technical competence with the personnel resources, equipment and facilities needed to carry out the required technical water quality management activities.
- Public acceptability so that the designated management agency will be recognized and accepted as the legitimate entity with the appropriate water quality management mission, within its management area.
- Political accountability so that the leadership of the management agency is accountable to the public served within the agency's management area.

CAAG's 1978 WQM Plan identified and granted DMA status to ten entities responsible for wastewater treatment known as publicly owned treatment works. Each of these met the criteria listed in Section 208(c)(2). Since 1978, three entities have been granted DMA status. This Plan recommends the designation of additional management agencies to carry out areawide wastewater management.

The existing Designated Management Agencies within the CAAG Region (and the year of designation) are shown in Table 5-1.

5.2 CENTRALIZED WASTEWATER TREATMENT FACILITIES

There are approximately 83 centralized wastewater treatment facilities that require individual permits in the CAAG region. This includes both publicly and privately owned facilities. The majority of these facilities (82%) are owned and managed by non-municipal entities.

Table 5-1 Designated Management Agencies within the CAAG Region	
Municipalities	Sanitary Districts
City of Apache Junction1990	Arizona City1978
City of Coolidge1978	Cobre Valley1985
City of Eloy1978	
Town of Florence1994	Northern Gila County1978
City of Globe1978/1985	Oracle1978
Town of Miami1978	Payson*1978
Town of Hayden1978	Pinal1983
Town of Mammoth1978	*incorporated within NGCSD

Source: ADEQ, 1994

Most of the treatment facilities in the CAAG region are either wastewater lagoons or extended aeration package plants. Lagoons are large ponds 2 to 5 feet deep where raw wastewater enters at one edge or at the center. Sunlight, wind, algae, and oxygen interact to restore water quality. In the package plants, raw wastewater is generally aerated for 24 hours. Sludge loaded with bacteria, termed activated sludge, mixes with the air and wastewater and breaks down the organic matter.

5.2.1 Public Wastewater Treatment Facilities (POTW)

There are 15 systems in CAAG that can be classified as "publicly owned treatment works" or POTWs. POTWs refer to facilities that belong to an incorporated entity or a special taxation district such as a sanitary or improvement district. These centralized systems serve approximately 55% of the region's population. These facilities are generally small with the majority having design capacities less than 2.0 MGD. (See Table 5-2.)

Growth in unincorporated and other areas not served by POTWs or other large centralized wastewater treatment systems indicates a need for new facilities in areas of concentrated growth. Larger unincorporated areas with populations over 1500 were identified as "census designated places" (CDPs) in the 1990 Census.

Appendix 5-4 describes the current wastewater treatment facilities for each POTW in the region. This information was obtained by interview with local, county and state personnel and in visits to the facilities in the region. The information includes the status of the facility, current problems with the system and future plans for expansion. Table 5-2 shows 1990 population figures, population projections through the year 2010, estimated populations served and design capacities of the existing POTWs in the region. These population projections are for resident population only and do not account for seasonal population fluctuations. Areas that experience significant non-resident population changes are identified in the table by an asterisk (*).

**Table 5-2
 CAAG Public Wastewater Treatment Facilities
 Projected Permanent Population Served by Plant Capacity**

City/Town	Capacity (MGD)	<u>1990 Population</u> Capacity per Person/day(GPD)	<u>1993 Pop. Served</u> Capacity per Person/Day(GPD)	<u>1995 Population</u> Capacity per Person/Day(GPD)	<u>2000 Population</u> Capacity per Person/Day(GPD)	<u>2005 Population</u> Capacity per Person/Day(GPD)	<u>2010 Population</u> Capacity per Person/Day(GPD)
GILA COUNTY							
Globe	1.20	<u>6,062</u> 197.95	<u>6,299</u> 190.51	<u>6,413</u> 187.11	<u>6,682</u> 179.59	<u>6,950</u> 172.66	<u>7,202</u> 166.62
Hayden ¹	n/a	<u>909</u> n/a	<u>955</u> n/a	<u>972</u> n/a	<u>1,013</u> n/a	<u>1,053</u> n/a	<u>1091</u>
Miami	0.30	<u>2,018</u> 148.66	<u>2,041</u> 146.99	<u>2,077</u> 144.44	<u>2,165</u> 138.57	<u>2,251</u> 133.27	<u>2,333</u> 128.59
Northern Gila Co. Sanitary District*	1.70	<u>8,377</u> 202.94	<u>9,218</u> 184.42	<u>9,385</u> 181.14	<u>9,778</u> 173.86	<u>10,170</u> 167.16	<u>10,538</u> 161.32
Winkelman	0.12	<u>676</u> 177.51	<u>678</u> 176.99	<u>691</u> 173.66	<u>720</u> 166.67	<u>748</u> 160.43	<u>776</u> 154.64
SERVED BY CURRENT WWTP		18,042	19,191	19,538	20,358	21,172	21,940
SERVED BY SEPTIC OR OTHER IF NO ADDITIONAL FACILITIES		22,174	22,893	23,307	24,284	25,260	26,173

Source: 1990 Census Data; DES POPTAC, 1993; Interviews with WWTP operators.

Notes: 1 The Hayden WWTP is owned and operated by ASARCO, a mining facility. Due to the potential impact of increased or decreased industrial flows, insufficient data was available to complete a capacity analysis.

Table 5-2
CAAG Public Wastewater Treatment Facilities
Projected Permanent Population Served by Plant Capacity

City/Town	Capacity (MGD)	1990 Population Capacity per Person/day(GPD)	1993 Pop. Served Capacity per Person/Day(GPD)	1995 Population Capacity per Person/Day(GPD)	2000 Population Capacity per Person/Day(GPD)	2005 Population Capacity per Person/Day(GPD)	2010 Population Capacity per Person/Day(GPD)
PINAL COUNTY							
Apache Junction ^{1*}	1.5 (Pending)	<u>17,931</u> n/a	<u>18,892</u>	<u>19,517</u>	<u>21,024</u>	<u>22,488</u>	<u>23,947</u>
Casa Grande ^{2*}	4.0 (Proposed Upgrade)	<u>19,082</u> 209.62	<u>19,994</u> 200.06	<u>20,655</u> 193.66	<u>22,250</u> 193.66	<u>23,800</u> 168.07	<u>25,343</u> 157.83
Coolidge	0.80	<u>6,927</u> 115.49	<u>7,089</u> 112.85	<u>7,324</u> 109.23	<u>7,889</u> 101.41	<u>8,439</u> 94.80	<u>8,986</u> 89.03
Eloy	1.00	<u>7,211</u> 138.68	<u>7,544</u> 132.56	<u>7,793</u> 128.32	<u>8,395</u> 119.12	<u>8,980</u> 111.36	<u>9,562</u> 104.58
Florence	1.50	<u>7,510</u> 199.73	<u>7,935</u> 189.04	<u>8,198</u> 182.97	<u>8,831</u> 169.86	<u>9,446</u> 158.80	<u>10,058</u> 149.14
Kearny	0.25 (Proposed Upgrade)	<u>2,262</u> 110.52	<u>2,421</u> 103.26	<u>2,501</u> 99.96	<u>2,694</u> 92.80	<u>2,882</u> 86.75	<u>3,069</u> 81.46
Mammoth	0.30	<u>1,845</u> 162.60	<u>1,936</u> 154.96	<u>2,000</u> 150.00	<u>2,154</u> 139.28	<u>2,304</u> 130.21	<u>2,454</u> 122.25
Superior	0.75	<u>3,468</u> 216.26	<u>3,501</u> 214.22	<u>3,617</u> 207.35	<u>3,896</u> 192.51	<u>4,167</u> 180.00	<u>4,438</u> 169.00
Arizona City ²	0.5 (Proposed Upgrade)	<u>1,950</u> 256.64	<u>2,097</u> 238.44	<u>2,166</u> 230.08	<u>2,334</u> 214.22	<u>2,496</u> 200.32	<u>2,658</u> 188.11

(Table continued on next page)

Table 5-2
CAAG Public Wastewater Treatment Facilities
Projected Permanent Population Served by Plant Capacity

City/Town	Capacity (MGD)	<u>1990 Population</u> Capacity per Person/day(GPD)	<u>1993 Pop. Served</u> Capacity per Person/Day(GPD)	<u>1995 Population</u> Capacity per Person/Day(GPD)	<u>2000 Population</u> Capacity per Person/Day(GPD)	<u>2005 Population</u> Capacity per Person/Day(GPD)	<u>2010 Population</u> Capacity per Person/Day(GPD)
Oracle ³	0.03	<u>2,988</u> n/a	<u>3,282</u> n/a	<u>3,391</u> n/a	<u>3,653</u> n/a	<u>3,907</u> n/a	<u>4,161</u> n/a
San Manuel ⁴	0.67	<u>4,009</u> n/a	<u>4,264</u> n/a	<u>4,405</u> n/a	<u>4,746</u> n/a	<u>5,076</u> n/a	<u>5,405</u> n/a
Queen Valley ⁵	.040	n/a	n/a	n/a	n/a	n/a	n/a
SERVED BY CURRENT WWTP		75,183	78,955	81,567	87,866	94,985	100,081
SERVED BY SEPTIC OR OTHER IF NO ADDITIONAL FACILITIES		41,196	45,740	47,303	50,900	54,447	57,978

Source: 1990 Census Data; DES POPTAC, 1993; Interviews with operators

- Notes:
- 1 Capacity for the new Superstition Mountain Community Facilities District was not designed to serve the entire population of Apache Junction located within Pinal County; therefore, no capacity calculations were possible.
 - 2 MGD is demonstrated for the proposed capacity upgrade for facility expansion which has been approved.
 - 3 Only a portion of Oracle is served by the Oracle Sanitary District and the remainder of the area is served by septic; therefore, capacity calculation based on total population are not applicable.
 - 4 San Manuel's WWTP is owned and operated by Magma, a mining facility. Due to the potential impact of increased or decreased industrial flows, insufficient data was available to complete a capacity analysis.
 - 5 Queen Valley is not a CCD; therefore, no census data or projections are available.

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Currently, Arizona City, Kearny, and Casa Grande are expanding wastewater treatment facilities to increase capacity. The newly formed Superstition Mountain Community Facilities District is approved and will begin construction in late 1994, resulting in the establishment of regional wastewater treatment for the urbanized Apache Junction area.

Wastewater treatment needs were projected based on a rough estimate of need of 100 gallons per person per day (gpcd). Once a facility begins operating at 80% of the design capacity, it is recommended that the facility begin planning for expansion. Using this 80% figure as the base, the maximum design capacity of the plant was compared to the projected population growth of the entity; facilities at or below 115 gpcd were projected to be need for facility expansion.

5.2.2 Package Wastewater Treatment Plants

In addition to the POTWs in the region, there are approximately 68 private and/or institutional wastewater systems that require individual permits. These facilities come under the jurisdiction of either the county health department, through a delegation agreement with the state or ADEQ. These facilities vary from schools, hospitals and shopping centers to large master-planned communities. The capacities of most of these facilities is generally less than 0.5 MGD.

These private facilities are particularly prevalent in areas experiencing growth but which do not have centralized wastewater treatment. For example: nine package treatment plants are presently located within the City of Apache Junction planning area, serving the following entities: Superstition Grand Hotel; the Mining Camp; Roadhaven RV Resort; Sunrise RV Resort; Pueblo RV Resort; Rock Shadows and Denali Mobile Home Parks; Apache Junction Unified School District high school; and the Sierra Entrada subdivision. In addition, several miles east of Apache Junction are several large, master planned developments with package treatment systems: Gold Canyon Resort and the Gold Canyon RVP. A brief summary of some of the larger private facilities is provided in Appendix 5-5.

The Links at Ocotillo and Vineyard Roads, a planned manufactured housing community south of Apache Junction, is scheduled to begin construction of a package WWTP in December 1994 with a .75 MGD capacity with the first anticipated phase capacity increase of .75 MGD in February of 1996. Pinal County is in the preliminary planning and engineering stages for expansion.

5.3 **INDUSTRIAL WASTEWATER TREATMENT SYSTEMS**

As stated earlier, about 22% of the facilities in CAAG that require permits, can be classified as industrial systems. Wastewater treatment systems in this range of activities require permits if they treat and dispose of their own wastewater.

Many of these facilities are located outside incorporated communities. Those located within municipalities and discharging to the municipal system may be required to implement a pretreatment program to meet the facility requirements for effluent.

The key concerns in dealing with industrial and/or facilities is to address potential problems from discharge of hazardous materials and other pollutants to surface or groundwater. If the operation is tied to a centralized wastewater treatment system, the concern is to prevent discharges to the system that could upset the treatment process.

5.4 ON-SITE WASTEWATER TREATMENT

A major method of sewage disposal throughout rural Arizona and in the CAAG region is on-site septic tank leach field systems. These systems, when installed, operated and maintained properly, provide effective treatment. When malfunctioning, they present a health hazard and water quality problem through surfacing effluent and groundwater contamination from percolation of poorly treated effluent.

On a region-wide basis, on-site wastewater treatment systems serve approximately 35-40% of the population. On-site systems are prevalent throughout the unincorporated areas of both counties and in older areas of incorporated communities. Claypool, Central Heights-Midland City, Six Shooter Canyon, Ice House Canyon, Country Club Manor, and the Strawberry/ Pine areas of Gila County are largely dependent on-site systems. In Pinal County, Apache Junction, Maricopa/Stanfield, Dudleyville and parts of Oracle are also largely dependent on septic systems. In Apache Junction, prior to establishment of the Superstition Mountains Community Facility District, septic tanks may have provided as much as 90% of the wastewater treatment within the planning area.

The problems most often observed with on-site disposal systems (septic tank systems) are the result of three major conditions: (1) poorly located systems; (2) improperly designed and installed systems; and (3) poorly maintained systems.

Nitrates seem to be the biggest problem in terms of groundwater contamination. In most areas of the region this can be attributed to agricultural practices. There are areas, for example, around Apache Junction, where there is no agricultural activity, yet nitrate levels in groundwater have been increasing, which may have been attributed to septic tank systems.

The Pinal County Health Department reports areas that have experienced problems due to on-site wastewater treatment systems which include: the northern and eastern sections of the Apache Junction planning area, where the soils tend to have relatively high percentages of gravel, cobbles and clay which make them less suitable for percolation than the sandy loam found in the southern and western sections of the area.

Another example in Pinal County would be new subdivisions in the Star Valley area which are being approved with conditions that all lots are approved for the use of individual disposal systems with low flow showerheads and low flush toilets. Such systems shall be designed on an individual basis and shall be approved by ADEQ prior to issuance of a building permit. The buyer should be made aware that the cost of the disposal system may be in excess of \$10,000.

There are a few other areas within Pinal County where there are problems with existing on-site septic tank systems. Apache Junction has a large concentration of septic tank systems which were installed during the early to mid 1970's. There have been failures with many of these systems. Many of the older mobile home/RV parks are served by septic tank systems in the Apache Junction area and have experienced problems with these systems. Colonia del Sol is a subdivision located next to the City of Casa Grande. Portions of this subdivision have experienced problems with the failure of septic systems installed in the late 1950's. It is recommended by CAAG that both of these areas be sewerred. Portions of Queen Valley Subdivision, especially Unit Two, while approved for septic tank systems, lack appropriate and suitable soils for the installation of such. There have also been problems in the Kelvin-Riverside area with on-site systems.

5.5 COMPLIANCE DATA

ADEQ compliance data was reviewed for the years 1989-1992. Violations are reported in four different categories: quality violations for effluent, failure to submit monitoring or sampling data; lack of a certified operator; and operation/ maintenance/inspection violations. Of the approximately 135 facilities in the region requiring individual permits, over half were reported as out of compliance with federal and/or state regulations at least once during that period.

During the period reviewed, of the 38 facilities possessing NPDES permits, 21% had no violations; the remaining 79% had one or more violations. The most common violation for NPDES permit holders was failure to submit required monitoring information. The next most common violation was for discharge quality violations. Inspection problems and lack of certified operators or operator of the correct grade were third and fourth in number of occurrences.

Of the 17 facilities possessing reuse permits, 23% had no violations during the period from 1989-1992. The remaining 77% had one or more problems. Submittal of required monitoring information and reporting violations was again the most common violation for this group of facilities. Quality and inspection problems were nearly tied at 14% and 13%, respectively.

For the facilities requiring individual permits, 36% had no violations over the four year period, while 64% had one or more violations. The number one violation for this group of facilities was not having a certified operator or one of the correct grade. Submittal of data and inspection problems ranked second and third with discharge quality violations a distant fourth.

Of the facilities which currently do not require permits, 63% had no violations during the review period. The most common violation category was for inspection problems. Lack of certified operators was a distant second with submittal and quality violations rarely reported. It should be noted that because these facilities do not have permits, they do not sample for effluent quality nor submit monitoring reports to ADEQ. All facilities, regardless of permitting status, are inspected by ADEQ or the local health department, through a delegation agreement. The frequency of inspections depends on the size of the facility and compliance history.

Lastly, for the POTW facilities in the region, 19% had no violations and the remaining 81% had one or more during the period. Lack of proper submittals and quality were the two top violations.

A breakdown of the compliance data is provided in Table 5-3.

5.6 OTHER ISSUES FOR WASTEWATER TREATMENT FACILITIES

5.6.1 Non-hazardous Liquid Waste Disposal

Heavy reliance on on-site wastewater treatment systems in the CAAG region makes non-hazardous liquid waste disposal, commonly known as septage, an issue. Non-hazardous liquid waste is a regulated component which, by its composition, is more difficult to break down during treatment process. Examples of non-hazardous liquid waste include materials caught in grease traps and the compounds which accumulate in septic tanks that are not eliminated through the leaching process. The difference between non-hazardous liquid waste and sludge is the percentage of liquid content.

For efficient operation of septic tank systems, non-hazardous liquid waste must be pumped periodically. Failure to pump septic tanks may cause surfacing of effluent due to plugging of the

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leach fields. Improperly managed septic systems or improper disposal of this type of waste can create water quality problems.

Table 5-3 Compliance History 1989-92 Point Source Violations (By Type)					
Type of Violation	Facilities Requiring Individual Permits	NPDES Facilities	Reuse Facilities	PTOW Facilities	Non Permitted Facilities
Quality	8%	31%	26%	31%	4%
Submittal	22%	38%	43%	35%	12%
Inspection	21%	16%	25%	18%	56%
Operator	49%	6%	6%	15%	28%

Source: ADEQ, 1993

Note: Percentages were determined by dividing the total number of violations by type by the total number of facilities.

In areas largely dependent on septic systems, large amounts of non-hazardous liquid waste must be disposed of, yet disposal sites are limited. Non-hazardous liquid waste disposal was previously regulated and generally addressed under solid waste management rules and programs. New regulations under RCRA, subtitle D are designed to minimize leachate from landfills which will be done, in part, by restricting the placement of liquids in landfills. Non-hazardous liquid waste may be disposed of in sludge monofills or by land application according to new federal sludge regulations.

Currently some of the municipal wastewater treatment systems in the region accept non-hazardous liquid waste from septic system maintenance companies on a reimbursable basis. There are certain limitations on the amount that a facility can accept without disrupting the treatment process. There are some indications that when disposal facilities are not available, illegal dumping of non-hazardous liquid waste tends to occur. This is an issue in many of the unincorporated or remote areas.

As the region grows and more centralized wastewater treatment facilities are constructed, there will be less reliance on septic systems, reducing the amount of non-hazardous liquid waste produced. On-site systems will still be the preferred method of disposal in remote or low density areas. Therefore, provisions still need to be made for non-hazardous liquid waste disposal in unsewered areas.

5.6.2 Sludge Management

The treatment of wastewater results in the production and accumulation of residual byproducts which have to be treated or disposed of in a safe manner. Sludge is a highly concentrated source of organic pollutants. Poorly managed disposal of sludge can result in a water quality problem.

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Sludge generation is largely dependent on the treatment system being used. At non-lagoon treatment facilities, sludge management must be a regular part of the operation and maintenance program. Mechanical systems require the regular removal and disposal of sludge. Oxidation and settling pond systems also require sludge management, but removal is less frequent, depending on the size of the facility.

New federal regulations for landfills and for sludge management limit sludge disposal options. 40 CFR 503 covers land application, surface disposal, and incineration of municipal and domestic sewage sludge. It contains numerical limits for metals and hydrocarbons, pathogen and vector requirements, and management practices. It also contains monitoring, recordkeeping, and reporting requirements. The rule was designed to be self-implementing so that facilities must perform the required monitoring, recordkeeping, and reporting whether or not they have received a permit. Facilities have one year to achieve compliance with the rule, or two years if construction is required.

Sludge that is sent to municipal solid waste landfills is regulated under another Rule, 40 CFR 258, published October 9, 1991. (The rules require dewatering of sludge so that it can pass the "paint filter" test (at least 20% solids). Disposal to a sludge disposal facility or "monofill" or land application requires that the sludge meet limits on certain pollutants.

Due to increased regulations, many landfills no longer accept sludge for disposal. This creates limited opportunities for disposal, which, in turn may increase illegal dumping of sludge.

5.6.3 Household Hazardous Waste

Congress decided that certain types of solid waste should not be considered hazardous waste under Subtitle C of RCRA (40 CFR 261). An astounding array of toxic and hazardous chemicals are found in and around the typical home, not only as ingredients in pesticides and industrial chemicals, but also as components of common, everyday household products. The EPA defines a substance as hazardous if it is flammable, can react or explode when mixed with other substances, is corrosive or toxic. A substance is toxic if it harms people when enough enters their bodies. Toxic wastes poured down the drain may corrode plumbing; collect in the trap and release fumes through the drains; cause septic-system; leak out of pipelines, including sewers, and contaminate soil and groundwater; and/or interfere with the proper operation of municipal sewage treatment facilities.

Items which should never be disposed of by washing down the drain include, acids, pesticides, flammable, paint, paint remover, used motor oil or wood preservatives. Table 5-4 lists common household items which are considered hazardous.

Table 5-4 Hazardous Common Household Products			
Air fresheners and deodorizers	Drain cleaner	Furniture polish	Spot removers
Bleach	Flea Powder	Paint thinner	Toilet bowl cleaner
Antifreeze	Car wax, polish	Motor oil, gasoline	Herbicides and pesticides
Disinfectants	Floor Cleaner/Wax	Paints	Wood stains/varnish

Source: University of Tennessee, Agricultural Extension Service

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5.6.4 Pretreatment

Industrial discharges into municipal wastewater treatment systems can affect system operation as well as the quality of effluent and sludge produced.

The National Pretreatment Program was established by the CWA to prevent: (1) interference with POTW operations resulting from discharge of pollutants the system cannot treat; (2) pass-through or untreated pollutants into receiving waters; (3) contamination of sewage sludge to the extent that various disposal options are either ruled out or become more expensive, and (4) exposure of POTW workers to chemical hazards. The current emphasis of this program is on controlling toxic priority pollutants listed by the EPA.

All treatment plants larger than 5 MGD are required to have pretreatment programs as a condition of their NPDES permits. Smaller plants may also be required to have pretreatment programs if non-domestic waste causes any of the problems mentioned above. The National Pretreatment Program also allows POTWs to set local discharge limits as needed to meet water quality standards or to comply with sludge management regulations.

The pretreatment programs are generally controlled by the POTW, which determines which of its industrial users should be regulated, monitors compliance and takes enforcement actions when necessary. In Arizona, pretreatment programs must be approved by the EPA.

Pretreatment programs may be affected by programs to control toxic pollutants and requirements for individual control strategies where waters are not expected to meet water quality standards because of point source discharge of toxic pollutants. Once federal standards are approved for allowable levels of toxins in sludge, pretreatment programs may have to be revised as well.

The EPA has recently tightened its standards on regulations for toxic dumping into city sewers. Instead of meeting standards for 15 pollutants, the EPA now requires meeting standards on 27 pollutants for treatment plants to keep their National Pollution Discharge Elimination System NPDES permits (Bland, 1993).

In May, 1994 EPA announced the agencies proposed plans for developing new and revised effluent guidelines, which regulate industrial discharges to surface waters and to publicly owned treatment works. Section 304(m) of the CWA requires EPA to publish a biennial Effluent Guidelines Plan. The comment period regarding the proposal closed during the summer of 1994 and a final plan was expected to be published a short time later.

5.7 FUNDING SOURCES

Tables 5-5 and 5-6 provides an overview of the grant/loan programs and financing options which may be used for the construction of water or wastewater treatment facilities.

5.8 SOLID WASTE MANAGEMENT

Solid waste disposal practices can contribute to both point and nonpoint source pollution and water quality problems. Solid waste includes sludge, non-hazardous liquid waste, municipal solid waste as well as special and hazardous wastes. Sludge and non-hazardous liquid waste have been addressed under the wastewater management section and with the exception of household hazardous wastes, special and hazardous wastes will not be addressed. The focus of this section

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will be on the municipal component of solid waste.

New regulations as specified under Subtitle D of RCRA are much more stringent regarding landfills and disposal of solid waste. RCRA emphasizes planning and regulation as the major elements in dealing with a mounting national solid waste problem. It gives highest priority to reducing the use of toxins, followed by recycling, waste treatment and finally landfilling and incineration. RCRA sets goals of not less than 10% reduction in municipal solid waste generation by the year 2000. It also set goals of not less than 25% recycled by the year 1995 and 50% recycled by the year 2000.

In Arizona, the responsibility for solid waste management is vested with the Waste Programs Division at ADEQ. ADEQ has the legal authority to enforce prescribed standards relative to the storage, collection, transportation, treatment, handling, disposal and reclamation of solid and hazardous waste. State statutes also require that each county, city or town provide or contract for public facilities for the safe and sanitary disposal of solid waste generated within its jurisdiction.

Solid waste disposal facilities require solid waste disposal permits from ADEQ. Appendix 5-5 lists landfills in the region and the APP application deadline.

Solid waste is currently managed by the counties in the CAAG region. Both Pinal and Gila Counties have intergovernmental agreements with some of its member cities to manage county landfill sites near their jurisdictions. Some of the cities and towns also own and operate their own landfills.

Both the counties and the communities that operate landfills will need to evaluate whether it is more cost-effective to upgrade facilities and get permits under the new regulations or whether they should close their landfills and construct transfer stations to take municipal waste a regional landfills. Both the new federal and State regulations will mean significant upgrades to existing facilities. New facilities will be built to a much stricter set of design standards.

In addition, to the RCRA regulations, the state is requiring Aquifer Protection Permits for all new and existing landfills. Appendix 5-6 lists the landfills in Gila and Pinal Counties.

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**TABLE 5-5
 FUNDING SOURCES FOR WATER AND WASTEWATER FACILITIES**

FUNDING SOURCE	FUNDING	ELIGIBLE ENTITIES	ELIGIBILITY CRITERIA	ADVANTAGES	DISADVANTAGES	APPLICABILITY
State Revolving Fund (SRF)	Below market-rate loans interest rate depends in part on credit rating of applicant(s).	Designated management agencies (incorporated places, sanitary dists. and Indian Tribes). At least 50% of residents must be full time residents of area.	Requires master planning, and compliance with federal and state laws and regulations. Subject to prioritization by Wastewater Management Authority.	Significant savings in financial costs due to low interest rates vs conventional sources.	Lengthy process. More formal facility planning. Federal reporting requirements. Requires Davis-Bacon wage rate. Requires public vote.	Best for large projects.
Community Development Block Grant (CDBG) Regional Account	Grants awarded to counties and cities/towns on a competitive basis.	Incorporated places and counties	Benefit primarily low-mod income persons (specific, detailed income requirements) or to address urgent need.	Planning grants available for low income areas.	Requires Davis-Bacon wage rates. Grant amounts are limited to \$130,000. Urgent need funding limited. Must address current need, not projected need.	Relatively small projects so grant not offset by higher labor costs than if project were done without grant.
Community Development Block Grant(CDBG) State Special Projects Account (SSP)	Competitive statewide for rural counties. Available annually.	Incorporated places and counties.	Benefit primarily low-mod income persons (specific, detailed income requirements or to address urgent need.	Grant funding limit is \$500,000.	Requires Davis-Bacon wage rates. Point awarded for leverage (match). Must address current need, not projected need. Competitive process which may limit funding amount.	Relatively small projects so grant not offset by higher labor costs than if project were done without grant.
Farmers' Home Admin (FmHA) Rural Development Admin Rural Water & Sewer Grants And Loans	Grants for up to 75% of project costs. Low interest loans to fund full costs.	Incorporated places and county govts; non-profit org'ns; Indian Tribes.	Projects tied to job creation (one job per \$10,000 in project). Basic improvements on raw land owned by political entity.	Does not require Davis-Bacon wages . On-going application cycle.	Funding limited to existing needs.	Can be used for small to very large projects.
Economic Development Admin (EDA) Public Works Grant	Grants to help attract new industry, encourage business expansion. EDA participation usually 50-60% of project cost.	Political subdivision, Indian Tribe, special-purpose district, or nonprofit org'n. Project must be in an EDA designated Redevelopment Area or Growth Center		Can be used for facilities serving primarily industry and commercial areas. Tied to growth rather than existing need	Local match required . Requires Davis-Bacon wage rates.	Typical funding levels \$300,000-\$1 million.

Source:Program information handouts.

**TABLE 5-6
 FINANCING SOURCES FOR WATER AND WASTEWATER FACILITIES**

FINANCING	DESCRIPTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY
Financing from current revenues	Property tax, user fees, service charges--paying cash instead of borrowing.	Saves interest cost. Protects borrowing capacity. Avoids inconvenience/cost of mktg bond issues.	Requires available, uncommitted cash. Puts heavy burden on project year/current users vs newcomers.	Smaller projects.
Capital reserve funds	Form of pay-as-you acquire/u/funds accumulated in advance for future projects.	Saves bond interest and marketing cost. Funds can earn interest protects borrowing capacity.	May require tax increase. Not always equitable in spreading costs between current residents & newcomers.	Small and medium sized projects.
Financing with a debit instrument	Borrowing w/a debt instrument (bonds & loans).	Allows costs to be synchronized w/benefits.	Interest rate costs. Usually requires a financial consultant.	Revenue producing projects.
Revenue bonds	Bonds issued w/o backing of full faith & credit of city/town. Usually retired from project revenues.	Usually no debt limit. Default does not burden local taxpayers. User pays.	Higher interest rate. Use limited to revenue-producing projects. Requires careful estimate of expected revenue.	Revenue producing projects.
Special assessment bonds	Bonds issued to pay for public improvements where specific private benefits exists. Payments on bonds made by property owners based on benefits received.	Interest rate lower than prime. Only beneficiaries pay. Election not required. Upfront cash collection is offered.	District formation process.	Projects serving specific area of larger governmental jurisdiction.
Lease-purchase agreements	Facility is constructed by private firm or non-profit corporation. At end of lease period, title to facility can be conveyed to city of county.	Facilities may be acquired sooner without debit financing. May not affect debt limitations. Does not require public vote.	Interest rates usually high. May be unacceptable to voters who see it as a way to avoid an election.	Privatization to achieve desired goals.

Source:NACOG 208 Water Quality Management Plan Update 1993

5.8.1 Illegal Dumping

As discussed earlier, illegal dumping of non-hazardous liquid waste has occurred in remote and unincorporated areas without adequate or convenient non-hazardous liquid waste disposal sites. Illegal dumping of solid waste is also a problem in remote areas where the nearest landfill or transfer station is many miles away. An increase in wildcat dumping may occur as facilities begin charging fees to cover regulatory and operational costs.

5.8.2 Recycling

Under state regulations, counties must provide opportunities for recycling to their residents. Recycling is also a means to reduce the amount of waste disposed of in landfills thereby increasing the life of landfills. A key to the economic success of recycling programs is to induce participation and reduce transportation costs. If a community undertakes a recycling drive it should tailor the program to the community and coordinate with other local communities to economize. Demand markets for recyclables is also a deterrent.

5.8.3 Household Hazardous Waste

The issue of household hazardous waste (HHW) was discussed earlier in this section (See 5.6.3) under wastewater treatment. It is also an issue for solid waste management. Although it is exempt from current regulations, HHW can pose a serious threat to groundwater by leaching through the soil in the landfill where it is deposited.

Public education is a first step towards better HHW management. Cities, primarily in urban centers, hold hazardous waste collection days to remove toxic chemicals such as paints, solvents, pesticides, herbicides, and other potentially harmful substances from the waste stream. Even empty containers which previously held toxic substances can present a hazard. There are both transportation costs and safety concerns that make HHW collection projects problematic but there may also be opportunities for regional cooperative efforts with the metropolitan areas. Pinal County, in particular, benefits from close proximity to both the Phoenix and Tucson metropolitan markets.

5.9 RECOMMENDATIONS

5.9.1 **Permit Programs for Point Source Management**

- (1) It is strongly recommended that **ADEQ** develop a data base to track NPDES, reuse and APP permits issued by basin. Such a data base may provide new insight into potential point source pollution trends and overall surface water and groundwater quality and could prove to be an invaluable tool in regional water quality management planning.
- (2) **ADEQ** should consolidate the reuse permit and APP programs. This consolidation would implement the statutory mandate of A.R.S. § 49-203.C to integrate water quality protection programs and to avoid duplication and dual permitting to the maximum extent practicable.

5.9.2 Onsite Wastewater Treatment Systems

- (1) The **Health Departments of both Gila County and Pinal County** should identify on-site disposal problem areas and conduct on-site surveys to determine the extent and nature of the problem in each identified area. In those areas with documented problems with conventional systems:
 - (a) **ADEQ and Gila and Pinal County Health** should work with owners and developers to alleviate or solve the problems.
 - (b) **ADEQ and Gila and Pinal County Health** should encourage use of regional wastewater systems where feasible.
- (2) An educational program should be established and utilized in the **communities** that are experiencing a high rate of on-site disposal system failures. A program of this scope would inform the communities of the nature of the problems and the possible alternative solutions.
- (3) In those areas where conventional systems are not suitable:
 - (a) **ADEQ and Gila and Pinal County Health** should provide technical assistance.
 - (b) **ADEQ and Gila and Pinal County Health** should develop and maintain consumer-oriented informational materials regarding advantages, disadvantages and costs of alternative systems, including limitations as to where these systems are appropriate.
 - (c) **ADEQ and Gila and Pinal County Health** should encourage use of centralized systems where feasible.
 - (d) **ADEQ and Gila and Pinal County Health** should develop standardized and preapproved systems rather than custom ones.
- (4) **Municipalities and counties** should enforce minimum lot size requirements for installation of on-site wastewater disposal systems.
- (5) If there are problem areas, **municipalities and counties** should place a moratorium on installation while seeking alternative solutions.
- (6) **Pinal and Gila County Planning and Zoning/Building Departments** should require health department approval of on-site system installation prior to issuing permits.
- (7) **Municipalities and counties** should enforce sewer hookup ordinances. Those entities without such ordinances should consider their adoption.
- (8) **ADEQ and Pinal and Gila Counties** should provide for the formation of special districts for development and maintenance of on-site systems.

5.9.3 Centralized Treatment Systems

From analysis arrived at in reviewing Table 5-2, several entities may need to look at expanding their facilities immediately, and population projections further indicate that several facilities will need to begin planning for expansion in the near future.

- (1))**CAAG** will support reconciliation of the Apache Junction wastewater planning effort through the Superstition Mountain Community Facilities District to ensure consistency with this water quality management plan. [Refer to recommendation 5.9.4 (6)]
- (2) **CAAG** will support reconciliation of the Pinal County wastewater planning effort for Links to ensure consistency with this water quality management plan.
- (3) Facilities that may be in need of expansion to meet current needs:
 - (a) **City of Coolidge**
 - (b) **Oracle Sanitary District**
 - (c) **Queen Valley Sanitary District**
- (4) Facilities that may be in need of expansion to meet projected needs (through 2010):
 - (a) **City of Eloy** (by year 2000)
 - (b) **Town of Kearny** (by year 2010)
- (5) Areas without centralized wastewater treatment facilities which may need facilities to meet existing or projected needs during the planning period:
 - (a) **Central Heights-Midland City CDP**
 - (b) **Dudleyville CDP**
 - (c) **Star Valley**
 - (d) **Colonia de Sol**
 - (e) **Maricopa**
- (6) Analysis of the San Manuel facility and the Hayden facility, owned and operated by mining companies, were not possible during preparation of this plan due to limited information. It is recommended that additional study be conducted to determine future capacity.

5.9.4 Specific Recommendations for Certain Areas:

- (1) It is recommended that all existing **incorporated municipalities and sanitary districts** become designated the wastewater management authority for the wastewater producers within their boundaries, except where boundaries of incorporated municipalities and sanitary districts overlap. NOTE: **Winkelman, Casa Grande, Kearny, Superior S.D., and Queen Valley S.D.** need to process resolutions if they wish to become DMAs.
 - (a) For the **Town of Payson**, where the Northern Gila County Sanitary District covers a larger area than the incorporated town, the Plan recommends that the sanitary district retain its management agency designation. (Map forthcoming)
 - (b) For the **Town of Superior**, where the Superior Sanitary District covers a larger area than the incorporated town, the Plan recommends that the sanitary district be given the management agency designation. (Map forthcoming)

- (2) **Pinal and Gila Counties** should encourage regionalization of wastewater treatment in areas where there are needs adjacent to but outside of the boundaries of incorporated municipalities or sanitary districts.
- (3) **Pinal and Gila Counties** are encouraged to take planning responsibility for wastewater treatment needs in the unincorporated areas.
- (4) **Local planning agencies** should develop feasibility studies or facility plans prior to formation of a special district.
- (5) **ADEQ through CAAG** should assist in developing a regional, long-term solution to wastewater treatment problems in this area. A comprehensive wastewater management plan encompassing the Apache Junction area has been completed by Interwest Management Group for the Superstition Mountain Community Facilities District. Construction will begin late in 1994.
- (6) The **City of Apache Junction** having adopted Resolution 92-15 and 94-14 which created and supports the Superstition Mountain Community Facilities District (SMCFD) and to carry out the provisions of the Areawide Water Quality Management Plan, may delegate to the SMCFD its Designated Management Agency (DMA) responsibilities for the proposed service area by mutual agreement.
- (7) To prevent potential problems when plants reach capacity, this Plan recommends that when facilities reach 80% of design capacity, **facility owners** should develop plans for expansion.
- (8) Recommendations for planning and implementing wastewater treatment in the region:
 - (a) A point source inventory should be updated at least twice each year for wastewater treatment facilities. **CAAG** should maintain current inventories by updating the information at least biannually. The new or amended sections of the inventory should be distributed to participating members of CAAG. An inventory program would keep all participants informed of the status of treatment facilities and critical septic tank systems.
 - (b) A close working relationship should be developed between the **county health departments and the planning and zoning departments** in both counties. Such a relationship would assure that all new housing construction has adequate, approved sewage disposal systems and prevent installation of disposal systems which have not been inspected by the **county health departments**.
 - (c) **ADEQ, in cooperation with local governments**, should stress the formation of special taxation districts in order to ensure that adequate wastewater treatment facilities are available to serve the public.
 - (d) Where economic conditions are such that a system's viability is in question, **ADEQ and local government** officials should push for regionalization and/or consolidation of water supply systems in order to ensure adequate sanitary conditions for the public.

(e) **Local government** officials must maintain continuous coordination and information exchange with **ADEQ, Pinal and Gila County Health Department officials and municipal operators** if the area WQMP is to be a meaningful report.

- (9) **ADEQ** should restrict the future requests for NPDES permits which would allow any further discharge into Roosevelt Lake. Instead, ADEQ should require issuance of reuse permits.

5.9.5 Private Package Systems

- (1) **ADEQ** should encourage regionalization of WWTF, where feasible.
- (2) **Private developers and state and federal agencies** that run private systems should be made accountable and responsible for them.

5.9.6 Industrial Dischargers

- (1) The use of technical assistance from ADEQ should be encouraged for all **industrial dischargers**. **ADEQ** should provide a program of continuous monitoring of industrial dischargers.
- (2) **ADEQ** should provide technical assistance to communities and the counties for establishing pretreatment programs and effluent limits for industrial dischargers.
- (3) **Communities or DMAs** should adopt and enforce pretreatment programs.
- (4) **Industrial dischargers** should be accountable and responsible for management of their systems. **Industrial dischargers** should also frequently monitor for effluent limitations and be responsible for compliance issues in this area.
- (5) **Communities** should adopt and enforce pollution prevention programs where required.

5.9.7 Compliance Issues

- (1) Operation and Maintenance recommendations:
 - (a) **ADEQ through ASUA** should establish circuit riders who will monitor and sample smaller providers. A "circuit rider" system should be set up in order to reduce transportation costs. A system is currently in effect with some of the operators, but it should be expanded.
 - (b) A wastewater treatment equipment inventory and a mutual-aid agreement should be developed between all **publicly owned facilities**. The inventory would provide a listing of all available wastewater treatment operation, maintenance and emergency equipment in the region. The mutual-aid agreement would establish procedures and conditions whereby operators exchange needed equipment. This mutual-aid agreement should also be expanded to include information exchange and networking.
 - (c) **ADEQ** should continue to provide technical assistance to WWTFs.

- (d) **ADEQ** must perform annual inspections of private and municipal wastewater treatment facilities (even if additional staff requirements are needed). If problems are identified during inspection, more frequent monitoring will be required to maintain compliance. Additionally, a follow-up inspection must be performed to address the problems and to correct them. This follow-up will improve the operation and maintenance of each problem facility.
- **ADEQ** should focus on effluent requirements and not on plant operations.
 - **ADEQ** should update procedures which will acknowledge and incorporate proven methods which are presently in use.
 - **ADEQ** should improve communications by properly notifying entities of compliance problems and provide technical assistance.
- (2) Monitoring and Sampling recommendations:
- (a) **ADEQ** should develop a database with detailed compliance information and make this information available to local and regional government personnel.
 - (b) **ADEQ** should set-up a notification and tracking system for monitoring and sampling requirements.
 - (c) **ADEQ** should encourage the establishment of regional labs to reduce the cost of analyzing samples and associated transportation costs.
 - (d) Within limitations, **ADEQ** may want to establish effluent limits and sampling requirements based on the particular area or effluent treated by the facility.
- (3) **ADEQ** should continue to provide technical assistance to all WWTFs. This assistance should be provided upon request, as well as in the form of routine inspections to ensure compliance.
- (4) **ADEQ** should be available to provide emergency assistance to small operators on a 24-hour a day basis.
- (5) **ADEQ** should examine its policies and practices when providing emergency assistance to smaller systems. A fine should be the last resort when a system has requested assistance to resolve a problem for which they may not have the technical expertise to correct on their own.
- (6) **ADEQ** should look at establishing a contingency fund to provide assistance to smaller systems for emergency repairs. These smaller systems usually do not have funds on hand to pay for repairs to their systems and using other sources such as CDBG and FmHA would add months to the process. **ADEQ** could provide these funds on an interim basis for needed, immediate repairs and work out the details of reimbursement after the emergency situation has been resolved.

- (7) **ADEQ** should develop and maintain a database with detailed compliance information and make this information available to local and regional government planning personnel through scheduled mailings or a database accessible via modem.

5.9.8 Non-hazardous Liquid Waste Disposal

- (1) Public education is necessary. **County and city managers** must address increased public awareness and education in order to facilitate early identification of water quality problems in their jurisdictions.
- (2) **County and city** general plans should address non-hazardous liquid waste disposal in unsewered areas and provide information and locations of sites accepting non-hazardous liquid waste to non-hazardous liquid waste haulers.
- (3) **County and city** government should consider stricter controls and licensing procedures for non-hazardous liquid waste haulers which include monitoring provisions.
- (4) All **landfill operators and associated governmental entities** should look at controlling access to dumping facilities in order to reduce the amount of uncontrolled, indiscriminate dumping of non-hazardous liquid waste.

5.9.9 Sludge Disposal

- Methods of sludge disposal should be addressed in facility plans.

5.9.10 Household Hazardous Waste

- (1) Public education on the issue of HHW is necessary. **County and city managers** must address increased public awareness and education in order to facilitate early identification of water quality problems in their jurisdictions.
- (2) **Community and/or county** programs should be developed for the safe disposal of household hazardous waste and provide opportunities for such activities.

5.9.11 Pretreatment Issues

- (1) **ADEQ** should provide technical assistance to communities for establishing pretreatment programs and effluent limits for industrial dischargers.
- (2) **Industrial dischargers** should be accountable and responsible for the quality of their effluent.
- (3) **Designated Management Areas (DMAs)** should enforce pretreatment ordinances.
- (4) **Businesses** should be monitored by **counties/municipalities and/or DMAs** (possibly by survey) to determine what materials they use and how to dispose of them properly to meet new EPA standards.
- (5) **ADEQ** should develop an education program for business owners regarding dumping requirements and alternatives, such as hauling pollutants off as hazardous waste.

5.9.12 Funding Options

- **ADEQ** should set up a grant support program to assist in the COG's efforts for sustained water quality management planning. This may be as simple as informing the COGs as to which federal, state and/or private agencies have monies available for water quality issues.

5.9.13 Solid Waste

- (1) **Pinal and Gila Counties** should take a lead in regional solid waste management planning and implementation. Such planning may include waste reduction, recycling, energy generation and landfilling.
- (2) **County and city** comprehensive plans should include public education and outreach with support for local recycling operations and household hazardous waste drives.
- (3) **Pinal and Gila County** governments should strictly enforce dumping ordinances to reduce illegal or "wildcat" dumping.
- (4) **Pinal and Gila Counties** should take the lead in regional solid waste management planning and implementation, possibly forming special districts.
- (5) **ADEQ's Waste Programs Division** should provide funding for planning activities.
- (6) **ADEQ** should evaluate and all levels of governments support alternative technologies, such as sludge composting, packaging reduction, and more important, funds for start-up costs.
- (7) **ADEQ** should make funding available for areawide solid waste management planning efforts, similar to the areawide water quality management planning program. Such plans could project needs, develop regional alternatives, identify management agencies and funding sources for implementation. This would require amendment to solid waste legislation at the state government level.

5.9.14 Waste Reduction and Recycling

- (1) **Counties and cities** should provide public education materials on waste reduction and recycling.
- (2) **Counties and cities** should encourage and support existing recycling efforts and cooperate on regional opportunities for recycling.
- (3) **Counties and cities** should appoint recycling coordinators. The sharing of this position between several communities could make the position economically feasible.
- (4) **Counties and cities** should encourage recycling and set minimum graduated recycling goals for the years 2000 and 2010.
- (5) **Counties and cities** are encouraged to give preference to buying recycled products through their procurement processes.

5.9.15 Landfills

- (1) **Counties and cities** should begin data collection to monitor the volume of wastes received and the rate at which landfills are being filled.
- (2) **Pinal and Gila Counties** should explore formation of sanitary districts to manage solid waste if the counties are not able or unwilling to provide these services. This may be accomplished through combination with other special districts to reduce the number of governmental entities.
- (3) **Pinal and Gila Counties** should enforce illegal dumping ordinances and require offenders to pay for site cleanup.
- (4) **Pinal and Gila Counties** should encourage regionalization of solid waste disposal with cities and towns throughout the CAAG region.

5.10 REFERENCES

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On-site inspections and interviews with wastewater treatment plant operators.

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APPENDIX 5-1
NPDES Authorization in the CAAG Region by Surface Water Basins

Name	NPDES #	EXP YR	TOWN-SHIP	RANGE	SECTION	CITY	TRIBUTARY NAME/ RECEIVING WATER	LATITUDE	LONGITUDE	TYPE DISCHARGE
MIDDLE GILA RIVER BASIN										
Town of Florence	AZ0022594	96				Florence	Gila River	33°02'30"N	111°24'16"W	Effluent from WWTP
AZ Dept of Corrections	AZ0023485	96				Unincorporated	Gila River	33°04'07"N	111°21'08"W	Outfall from WWTP
Town of Winkelman	AZ0020176		5S	15E	24	Winkelman	Gila River	32°58'54"N	110°46'30"W	
Town of Kearny	AZ0021827		4S	14E	34	Kearny	Gila River	33°02'47"N	110°54'33"W	
Town of Florence	AZ0022691	98				Florence	Unnamed wash/ tributary to the Gila River/	33°03'50"N	111°22'12"W	
ASARCO Ray Unit		98					Mineral Creek	33°9'29"N	110°58'40"W	
Superior Sanitary District	AZ0021199	96	2S	12E	4	Superior	Queen Creek	33°16'45"N	111°17'25"W	Effluent from WWTP
Roadhaven RV Resort	AZ0023515	97	1N	8E	29	Apache Jct	Unnamed wash/ tributary to Queen Creek	33°24'19"N	111°33'38"W	Treated domestic wastewater
Queen Valley Sanitary District	AZ0022071	96	2S	10E	34	Queen Valley	Unnamed wash/ tributary to Queen Creek	33°17'38"N	111°18'31"W	Treated municipal wastewater
Mining Camp Restaurant	AZ0021825	97	1N	8E	12	Apache Jct	Siphon Draw/ tributary to Gila River	33°26'59"N	111°29'00"W	Effluent
Magma Copper Co	AZ0020389	98	2S	12E	3	San Manuel	Unnamed wash/ tributary to Queen Creek	33°17'15"N	111°06'54"W	

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Name	NPDES #	EXP YR	TOWN-SHIP	RANGE	SECTION	CITY	TRIBUTARY NAME/ RECEIVING WATER	LATITUDE	LONGITUDE	TYPE DISCHARGE
UPPER GILA RIVER BASIN										
US Bureau of Reclamation	AZ0023671	97				Coolidge Dam	San Carlos Reservoir	33°11'15"N	110°31'15"W	Construction wastewater
							Gila River	33°11'00"N	110°31'15"W	
							Gila River	33°10'15"N	110°31'30"W	
							San Carlos Reservoir	33°10'15"N	110°26'15"W	
AZ Dept of Corrections	AZ0022721	98	1N	16W	19	Globe	Ramboz Wash/ tributary to San Carlos Reservoir	33°24'55"N	110°42'35"W	

SALT RIVER BASIN										
Cobre Valley Plaza	AZ0020745	97	1N	15E	21	Claypool	Tributary to Miami Wash/ Russell Gulch	33°24'56"N	110°49'43"W	Treated wastewater from WWTP
Cyprus Miami Mining Company	AZ0020516	94				Christmas	Tributary to Gila River/Dripping Springs	33°05'24"N 33°05'55"N	110°42'36"W 110°44'52"W	Storm water runoff(2 discharge points)
Magma Copper Company	AZ0020401	98	1N	14E	0	Miami	Pinto Creek	33°23'29"N	110°59'05"W	
Magma Copper Company	AZ0020419	98	1N	15E	5	Miami	Pinal Creek	33°27'35"N	110°51'10"W	
Roosevelt Lakeview Park	AZ0021796	98	4N	12E	21	Roosevelt	Roosevelt Lake	33°40'12"N	110°08'15"W	Effluent from WWTP
Bureau of Reclamation	AZ0022632	97	4N	12E	20	Roosevelt	Salt River	33°40'16"N	111°09'41"W	Effluent from construction projects
							Roosevelt Lake	33°40'30"N	111°09'28"W	
							Salt River	33°37'13"N	110°57'15"W	
Tonto National Forest	AZ0023787	98	4N	12E	21	Roosevelt	Roosevelt Lake	33°40'25"N	111°07'03"W	
City of Globe	AZ0020249	95	1N	15E	14	Globe	Pinal Creek	33°25'46"N	110°47'28"W	Treated municipal wastewater

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Name	NPDES #	EXP YR	TOWN-SHIP	RANGE	SECTION	CITY	TRIBUTARY NAME/ RECEIVING WATER	LATITUDE	LONGITUDE	TYPE DISCHARGE
City of Globe	AZ0021787	96	1N	15E	15	Globe	Unnamed dry wash tributary to Pinal Creek	33°25'33"N	110°48'35"W	Treated municipal wastewater
Cyprus Miami Mining Corporation	AZ0020508	97	1N	14E	0	Claypool	Bloody Tanks wash	33°23'40"N 33°24'20"N 33°24'50"N 33°22'57"N 33°22'51"N 33°22'51"N	110°52'49"W 110°51'39"W 110°50'48"W 110°53'38"W 110°54'23"W 110°54'51"W	Storm water runoff & mine dewatering well water
AZ Game & Fish Dept	AZ0021211	95			0	Payson	Tonto Creek	34°22'59"N	111°05'47"W	
AZ Game & Fish Dept	AZ0021229	95	11N	14E	36	Phoenix	Canyon Creek	34°17'25"N	110°48'26"W	Trout rearing raceway effluent

SANTA CRUZ RIVER BASIN										
AZ Newsprint Industries Corp	AZ0023850		10S	9E	9		Santa Cruz River	32°33'18"N	111°19'36"W	
AZ Newsprint Industries Corp (Fletcher Challenge)			10S	10E	14	Redrock	Santa Cruz River	32°33'15"N	111°17'30"W	
City of Casa Grande	AZ0021873	99	6S	5E	12	Casa Grande	Santa Cruz Wash/ tributary to Santa Cruz River	32°55'00"N	111°47'15"W	Treated municipal wastewater
Oracle Sanitary District	AZ0020681	96			28	Oracle	Unnamed wash/ tributary to Big Wash tributary to Canada del Oro	32°36'54"N	110°48'02"W	Treated municipal wastewater
Saddlebrooke WW Plant	AZ0022853		10S	14E	27	Sun Lakes	Unnamed wash/ tributary to Canada del Oro	32°32'00"N	110°53'00"W	
Casa Grande WWTP	AZ0021873		6S	5E	12	Casa Grande				Tertiary effluent

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Name	NPDES #	EXP YR	TOWN-SHIP	RANGE	SECTION	CITY	TRIBUTARY NAME/ RECEIVING WATER	LATITUDE	LONGITUDE	TYPE DISCHARGE
VERDE RIVER BASIN										
Northern Gila Co Sanitary District	AZ0020117		10N	10E	6	Payson	American Gulch	34°14'05"N	111°22'18"W	
SAN PEDRO RIVER BASIN										
Fred L Clark Trucking Co	AZ0022276	87			0	Mammoth	San Pedro River	32°43'19"N	110°38'17"W	Effluent from recycling facilities

Appendix 5-2
Reuse Authorizations in the CAAG Region by Surface Water Basins

Name	Reuse #	Township	Range	Section	Facility
Gila River Basin					
ADOC - Eyman Complex	R-0069-11	04N	10E	44	Florence
City of Coolidge	R-0049-11	05N	08E	29	Coolidge
Town of Florence WWTP	R-0050-11	05S	09E	3	Florence
Gold Canyon Resort & Sewer Co.	R-0029-11	01S	09E	8	Apache Junction
Gold Canyon RV Park WWTP	R-0053-11	01S	09E	7	Apache Junction
Mesa Grande Corporation	R-0027-11	01N	08E	7	Apache Junction
Roadhaven RV Resort	R-0047-11	01N	08e	29	Apache Junction
Saddlebrook WW Treatment Facility	R-0056-11	10S	14E	27	Sun Lakes
Tierra Grande Utility Co. Inc.	R-0026-11	06S	07E	36	Eloy
Salt River Basin					
City of Globe	R-0012-04	1N	15E	15	Globe
Santa Cruz River Basin					
City of Casa Grande WWTP	R-0048-11	06S	05E	12	Casa Grande
Francisco Grande Resort WWTP	R-0068-11	06S	05E	20	Casa Grande
Pacific Coast Manufacturing	R-0051-11	06S	05E	14	Casa Grande
Picacho Peak RV Park	R-0014-11	09S	09E	14	Red Rock
Ross Laboratories	R-0030-11	06S	05E	24	Casa Grande
Verde River Basin					
Northern Gila County Sanitary District	R-009-04	10W	10E	6	Payson
Pine Elementary School WWTP	R-0010-04	12N	08E	36	Pine

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Appendix 5-3
APP/GWPP Authorizations in the CAAG Region by Groundwater AMA or Planning Region

Name	APP	GWPP	Township	Range	Section	Facility Location
Pinal AMA						
Casa Grande WWTP	P-100419		06S	05N	12	Casa Grande
Central Highlands Planning Region						
Buckhead Mesa Sanitary Landfill		G-0007-04	11N	09E	2	Payson
Erma's Self Help Laundry		G-0005-04	09N	13E	25	near Young
Hunter Creek Ranch		G-0001-04	11N	13E	30	near Kohl's Ranch
Magma Copper Co - Miami Tailings Repro		G-0008-04	01N	14E	0	Miami
R-C Boy Scout Ranch		G-0011-04	11N	12E	26	Payson
Sleepy Hollow RV Park		G-0006-04	06N	10E	36	Punkin Center
True Bar Mill & Mining Company		G-0002-04	10N	09E	27	Payson
Southeast Arizona Region						
ADOC - ASP Globe		G-0004-04	01N	16E	19	Globe
Kocide Chemical - Arimetco Inc.		G-0003-04	01N	15E	30	near Globe
Gold Canyon Sewer Company	P-100217		01S	09E	7	SE of Apache Junction

Appendix 5-4 Public Wastewater Treatment Facilities in CAAG Region Existing Conditions

GILA COUNTY
<p><u>Globe</u></p> <p>The City of Globe-Holgate WWTP is no longer in operation (closed September 1993). The City of Globe-Pinal Creek WWTP presently serves the City of Globe. The design capacity of this facility is 1.2 MGD. The plant utilizes a extended aeration-oxidation ditch system. The unit processes include two sedimentation tanks, clarifiers, four sludge drying beds, and a chlorine diffuser. The Pinal Creek WWTP currently has NPDES and Reuse permits and is on the list for an APP permit. A portion of the effluent is used to irrigate turf grasses, off-site; the remainder is treated and discharged into Pinal Creek. The sludge is disposed of by landfilling on-site.</p>
<p><u>Hayden</u></p> <p>The Town of Hayden's collection system was constructed by the Kennecott Copper Company in the early 1960's. The system serves approximately 400 users and consists of 6-inch and 8-inch vitrified clay pipe. The existing treatment system consists of several lift stations that pump the wastewater from the townsite to the ASARCO, Inc. reduction plant tailings line. The mixed wastewater and tailings water is pumped to the 3,000 acre mine tailings pile. The low pH of the tailings water in conjunction with the volumes in both the pipeline and the tailings deposit causes the wastewater flows to rapidly change composition. The water from the tailings deposit is then pumped back to the ore reduction plant for reuse in the production process.</p>
<p><u>Miami</u></p> <p>The Town of Miami WWTP presently serves the Town of Miami and parts of Lower Miami and Claypool. The design capacity of this facility is 0.3 MGD. The treatment process consists of three evaporation ponds, each with a capacity of 1 million gallons, which treat the effluent through evaporation and seepage. The sludge is disposed of by landfilling. The Miami WWTP wants to upgrade the lift station capacity within the next three years and some of the Town's sewer lines are deteriorating. Miami WWTP is on the list for an APP permit. The Miami WWTP may look at upgrading the lift station capacity within the next three years;</p>
<p><u>Northern Gila County Sanitary District (Payson)</u></p> <p>The Northern Gila County Sanitary District's American Gulch Water Reclamation Facility presently serves the City of Payson and the Mesa del Caballo subdivision, north of the City. The design capacity of the facility is 1.7 MGD and is expandable to 2.4 MGD. The treatment process is known as the Bardenpho process which involves a tertiary treatment process and includes biological nutrient removal, filtration, clarification and UV disinfection. During the warmer months, the effluent is then reused for turf irrigation and filling artificial lakes. The excess is disposed of by discharge into the American Gulch, a tributary to the East Verde River. The Sanitary District received a nutrient waiver in 1989 to allow discharge of nitrogen and phosphorus in excess of Verde River water quality standards. The sludge is disposed of as a soil amendment. The Northern Gila County Sanitary District has a NPDES and a Reuse permit, and is on the list for an APP permit. A facility plan update proposes unit process changes for sludge handling and also proposes to modify the filtering unit to meet future capacity requirements.</p>
<p><u>Winkelman</u></p> <p>The Town of Winkelman WWTP presently serves the Town of Winkelman. The design capacity of this facility is 0.12 MGD. The treatment process consists of extended aeration. The effluent is discharged into the Gila River. The sludge is disposed of by landfilling, although, at this time, the Town does not have a place to dispose of the sludge from their wastewater plant. The Town of Winkelman WWTP has a NPDES permit and is on the list for an APP permit. Non compliance problems are associated with monitoring. The Town of Winkelman WWTP may need to upgrade or replace that part of their facility destroyed by the 1993 flooding.</p>

Appendix 5-4 Public Wastewater Treatment Facilities in CAAG Region Existing Conditions

PINAL COUNTY

Superstition Mountain Community Facilities District

The City of Apache Junction currently uses on-site septic disposal systems as the primary means of wastewater treatment. Efforts to finance a publicly owned, tax supported treatment facility have been turned down by voters on several different occasions.

To meet the need, the Superstition Mountain Community Facilities District (SMCFD) has recently formed to provide sanitary sewer service to the City of Apache Junction. This is a voluntary sewer district in which property owners can choose whether or not to petition their property into the District. The system is a tax-exempt, non-profit entity to be supported entirely by user revenues. Residents have been asked to make initial payments. Financial commitments must be obtained before construction can begin. To carry out the provisions of the Areawide Water Quality Management Plan, the City of Apache Junction may delegate to the SMCFD its DMA responsibilities for the proposed service area.

Construction is expected to begin during the fall of 1994 on approximately 390,000 lineal feet of sewer line (approximately 74 miles) and a 1.5 MGD wastewater treatment plant. Initial plans are for the treated effluent to be reused for irrigation purposes, to the maximum extent practicable. The remainder of the effluent will be utilized for groundwater recharge.

There are a number of existing package treatment plants in the planning project area. Each of these existing facilities will need to be addressed in the development of this new system.

Arizona City Sanitary District

The Arizona City Sanitary District WWTP presently serves Arizona City. The design capacity of this facility is 0.5 MGD and the district is currently expanding to this capacity. The new construction includes a concrete lined oxidation ditch, clarifier, sand filter, chlorine contact chamber, and related influent and effluent pumps. The effluent will be reused for turf irrigation on the adjacent golf course. Sludge generated through the treatment process will be transferred to the sludge basin located on the existing primary lagoon area. The Arizona City Sanitary District WWTP holds an Aquifer Protection permit. With the current upgrade to the existing facility, the expected life of the facility is 20 years.

Casa Grande

The City of Casa Grande WWTP presently serves the City of Casa Grande and a several industrial users on the west-side of the city. The design capacity of this facility is currently 4.0 MGD. The treatment process consists of a biological extended aeration system followed by secondary sedimentation using a clarifier, filtration and chlorination. The effluent is then disposed of either by land application for farmers crops and turf irrigation. The sludge is disposed of by landfilling. The City of Casa Grande WWTP has a NPDES and a Reuse permit.

A final design plan has been developed for expanding and upgrading the facility to increase the average daily flow to 4.0 MGD. The plant upgrade and the modification will consist of changing the headworks and using a modified form of an oxidation ditch to treat the wastewater. After modification the WWTP will produce a tertiary effluent with a treatment process involving nitrification, denitrification, chlorination and filtration. Part of the effluent will be pumped to the golf course ponds for irrigation and the remaining will be stored in an on-site 66 million gallon evaporation pond for agricultural irrigation. The effluent will be used at 100% consumptive reuse rates. The sludge will be digested and thickened and hauled off site for disposal. An APP is in process.

Industrial facilities that discharge to the Casa Grande system include: Casa Grande Oil Mill, Hexcel, Kocide Chemical, Mayville Metals, RR Donnelly, and Casa Grande Regional Medical Center.

Coolidge

The City of Coolidge WWTP presently serves the City of Coolidge. The design capacity of this facility is 0.8 MGD. The treatment process consists of facultative lagoons. [how many?] The effluent is then disposed of through evaporation and through reuse for irrigation of farm crops. The sludge is disposed of by landfilling. The City of Coolidge WWTP has a Reuse permit and is on the list for an APP permit. The town is considering upgrading the facility to include a Parshall flume.

Appendix 5-4 Public Wastewater Treatment Facilities in CAAG Region Existing Conditions

Eloy

The City of Eloy WWTP presently serves the City of Eloy, the Petro Truck Stop, and a few other small commercial establishments. The design capacity of this facility is 1.0 MGD. The treatment process consists of a sedimentation pond and a recently built polishing pond. The effluent is then disposed of by evaporation percolation irrigation of turf and non-edible crops. The sludge is disposed of by landfilling. The City of Eloy WWTP has submitted a preapplication for an Aquifer Protection Permit. Prison facilities in Eloy constructed and operated by Concept Inc. and United Correctional Corporation have applied for an APP for a special public facility. The facility description includes an enclosed Santec System with effluent discharge to ponds. At a future date the system will be connected to the Eloy WWTP.

Florence

The Town of Florence WWTP presently serves the Town of Florence and accepts wastewater from the "old" prison and the woman's prison near Florence. The two prisons account for about 70% of the wastewater treated by the WWTP. The design capacity of this facility is 1.5 MGD. The treatment process consists of three aerated lagoons with 3 aerators each, a polishing pond and chlorination. Effluent is disposed of by application to agriculture field crops or by discharge into the Gila River. The sludge is disposed of by adding a probiotic solution which produces a bioactive chemical oxidation and breaks down the sludge. The Town of Florence WWTP has a NPDES and a Reuse permit and is on the list for an APP permit.

Kearny

The Town of Kearny WWTP presently serves the Town of Kearny. The design capacity of this facility is 0.36 MGD. The treatment process consists of aerated lagoons and a polishing pond. Effluent is disposed of by evaporation and percolation or direct discharge to the Gila River. The sludge is disposed of by spreading on pasture land. The Kearny facility has a NPDES permit and has submitted for an APP permit. There is a need to upgrade the wastewater collection system which collapsed during flooding in 1993. Federal EMA has approved the design concept of the wastewater treatment facility damaged by the flood.

Mammoth

The Town of Mammoth WWTP presently serves the Town of Mammoth which includes approximately 25 commercial users. The design capacity of this facility is 0.3 MGD and is currently operating at approximately two-thirds capacity. The treatment process consists of [need this information]. Effluent is disposed of by evaporation and percolation. There is no need for sludge disposal [?]. The Town of Mammoth WWTP is on the list for an APP.

Oracle Sanitary District

The Oracle Sanitary District serves approximately 350 connections in the unincorporated community of Oracle and the surrounding area. The system has a capacity of 0.055 MGD and consists of one primary and one secondary treatment lagoon, and a flow equalization basin, each approximately two acres in size. Effluent is chlorinated prior to discharge to an unnamed wash, which is tributary to Big Wash, which is tributary to Canada Del Oro. The Oracle Sanitary District is on the list for an APP.

Queen Valley Sanitary District

Queen Valley Sanitary District operates a package treatment plant and serves both the Queen Valley mobile home subdivisions and Queen Valley Recreational Vehicle Park. The District's WWTP has a 0.040 MGD design capacity and serves approximately 225 mobile homes and 200 RV spaces. During the summer months it serves approximately 500 persons and during the winter months approximately 2,000 persons. During the winter months the WWTP is nearly at capacity. The treatment process consists of extended aeration/activated sludge and the effluent is disposed of by discharge into an unnamed wash, tributary to Queen Creek. The need for discharge only occurs during the winter months. During the summer months the chlorinated pond takes care of any need to discharge. The Sanitary District hold a NPDES permit for discharge and is on the list for an APP. The sludge is removed taken to the landfill.

Appendix 5-4 Public Wastewater Treatment Facilities in CAAG Region Existing Conditions

Superior Sanitary District

The Superior Sanitary District WWTP presently serves the Town of Superior. The design capacity of this facility is 0.75 MGD. The treatment process consists of a biological process and aeration [need this information]. Effluent is disposed of by discharge into Queen Creek. The sludge is disposed of as on-site fertilizer. The Superior Sanitary District WWTP has a NPDES permit and has applied for a reuse permit. The facility is also on the list for an APP permit. The district may investigate installing an effluent filtering system to improve wastewater quality before discharge into Queen Creek.

Appendix 5-5 Other Large Wastewater Facilities in CAAG Region Existing Conditions

ATC-Children's Colony

The Arizona Training Center (Children's Colony) operates their own wastewater treatment facility consisting of a lift station and five lagoon cells. The facility is on the list for an APP.

Gold Canyon

The Gold Canyon RV Park WWTP presently serves 320 houses (approximately 600 people) and six commercial users including an elementary school. The design capacity of this facility is 0.112 MGD with an average flow rate of 0.08 MGD. The facility is near capacity and the owner is investigating the construction of a new 0.5 MGD facility. The current treatment process consists of extended aeration/activated sludge while the new facility will include effluent filtering and disinfection. Effluent is disposed of by reuse for turf irrigation. The sludge is landfilled.

In the future, plans are being considered to increase the size of the facility to 1.9 MGD to serve a larger population base.

SaddleBrooke

The SaddleBrooke Development Company operates a wastewater treatment facility for the SaddleBrooke Master Planned Community in southern Pinal County. The SaddleBrooke WWTP currently has 861 connections (approximately 2,000 lots). It is using approximately 187 gpd per lot connection. Two aeration lagoons are currently used in the treatment process. The facility has both a reuse and a NPDES permit. There is a discharge limit of 125,000 gpd for the effluent disposal to an unnamed tributary which flows into the Canada del Oro. The reuse permit allows the effluent to be used for golf course irrigation. There are currently no problems with sludge, but it will be landfilled when build-up becomes a problem.

The SaddleBrooke WWTP has a need to either expand the existing facility possibly by removing the lagoon liners and converting to percolation ponds, or adding another lagoon, or by changing the process to a mechanical plant. SaddleBrooke is currently seeking approval for a Phase III expansion of the facility to expand it from .25 MGD to .376 MGD, its maximum capacity.

San Manuel

The existing San Manuel WWTP owned and operated by the Magma Copper Company is immediately east of the Magma Copper Plant in San Manuel. The original facilities at the WWTP were constructed in 1953. The WWTP was modified in 1979 to include three secondary ponds downstream of the original oxidation ponds. The WWTP has a rated capacity of 0.67 MGD. Data from Magma Copper indicates that the plant is nearing capacity with a current wastewater flow of approximately 0.61 MGD. The treatment process train includes raw sewage screening, grit removal, flow measurement, primary sedimentation, and secondary treatment in two oxidation ponds. The effluent from the oxidation ponds is collected in a small basin from which it is sprayed over an area of natural vegetation. The sprayed area is rocky and some of the water flows overland to the secondary ponds or to a tailings pond. Overflow from the basin is piped to three secondary ponds, which serve primarily as evaporation ponds. Effluent, not evaporated in the secondary ponds, flows to a mine tailings pond. Sludge and scum are pumped from the primary sedimentation tank to an anaerobic digester. The digested sludge is transferred to one of eight sludge drying beds. The pretreatment facilities appear to be functioning adequately and have sufficient capacity to meet existing needs.

The primary sedimentation tank is overloaded under current wastewater flows. The oxidation ponds are overloaded and there is uneven distribution of flow between the two ponds. The anaerobic digester appears to be functioning adequately, although the waste gas burner needs to be repaired. Sludge heating and mixing systems would improve digester performance.

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**Appendix 5-6
 Existing Municipal or County Owned Solid Waste Facilities**

FACILITY NAME, TYPE AND COUNTY LAST INSPECTION DATE	TYPES OF WASTE ACCEPTED	OPERATOR'S NAME, ADDRESS & PHONE NUMBER	LAND OWNER'S NAME, ADDRESS & PHONE NUMBER	DIRECTIONS, LOCATION, TOWNSHIP, RANGE, SECTION, QUARTER SECTIONS
OPEN SOLID WASTE LANDFILLS				
GILA COUNTY				
BUCKHEAD-MESA MUNICIPAL 07/20/92	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	GILA COUNTY 1400 EAST ASH STREET GLOBE, AZ 85501 (602) 425-3231	USFS-TONTO NATIONAL FOREST P.O. BOX 29070 PHOENIX, AZ 85038	10 MILES NORTH OF PAYSON OF AZ 87, 1 MILE EAST TO SITE. T 11N, R 09E, SEC. 20 1/4:
GLOBE MUNICIPAL 08/20/92	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	GILA COUNTY 1400 EAST ASH STREET GLOBE, AZ 85501 (602) 425-3231	CITIES SERVICE CORP. P.O. BOX 100 MIAMI, AZ 85539	WEST OF U.S. 60 ON RUSSELL ROAD, 1.6 MILES TO ENTRANCE. T 01N, R 15E, SEC. 27 1/4: ES NW SW
MIAMI MUNICIPAL 07/20/92	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	TOWN OF MIAMI/F. CARILLO 500 SULLIVAN STREET MIAMI, AZ 85539	TOWN OF MIAMI 500 SULLIVAN STREET MIAMI, AZ 85539	.5 MILES WEST OF MIAMI ON U.S. 60, .6 MILES SOUTH TO SITE. T 01N, R 14E, SEC. 36 1/4: SE NW SW
PLEASANT VALLEY/YOUNG MUNICIPAL 05/13/91	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	GILA COUNTY 1400 EAST ASH STREET GLOBE, AZ 85501 (602) 425-3231	U.S. FOREST SERVICE 517 GOLD AVENUE ALBUQUERQUE, NM 87102	2.8 MILES SOUTH OF PLEASANT VALLEY SCHOOL ON AZ 288 T 08N, R 132, SEC. 0 1/4: 1 SW NE
PINAL COUNTY				
ADAMSVILLE FEEDLOT MUNICIPAL 04/06/92	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	PINAL COUNTY P.O. BOX 727 FLORENCE, AZ 85232 (602)868-5801	PINAL COUNTY P.O. BOX 727 FLORENCE, AZ 85232 (602)868-5801	.2 MILES NORTH OF MILEPOST 140 ON AZ. 287 T 05S, R 09E, SEC. 09 1/4: SE SE NW
APACHE JUNCTION MUNICIPAL 01/20/89	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	PINAL COUNTY P.O. BOX 727 FLORENCE, AZ 85232 (602)868-5801	AZ. STATE LAND DEPARTMENT 1624 WEST ADAMS PHOENIX, AZ 85007	2.6 MILES SOUTH OF AZ 60/80/89 ON TOMAHAWK DRIVE. T 01S, R 08E, SEC. 04 1/4: SE SE

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FACILITY NAME, TYPE AND COUNTY LAST INSPECTION DATE	TYPES OF WASTE ACCEPTED	OPERATOR'S NAME, ADDRESS & PHONE NUMBER	LAND OWNER'S NAME, ADDRESS & PHONE NUMBER	DIRECTIONS, LOCATION, TOWNSHIP, RANGE, SECTION, QUARTER SECTIONS
OPEN SOLID WASTE LANDFILLS				
CASA GRANDE MUNICIPAL 01/26/90	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	CITY OF CASA GRANDE 300 EAST 4TH STREET CASA GRANDE, AZ 85222 (602) 836-5308	CITY OF CASA GRANDE 300 EAST 4TH STREET CASA GRANDE, AZ 85222	3.2 MILES SOUTH OF CASA GRANDE ON FLORENCE ROAD. T 07S, R 06E, SEC. 07 1/4: NE
COOLIDGE MUNICIPAL 01/26/90	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	CITY OF COOLIDGE P.O. BOX 398 COOLIDGE, AZ 85228 (602) 723-4882	CITY OF COOLIDGE P.O. BOX 398 COOLIDGE, AZ 85228	.5 MILES WEST OF AZ. 87 ON BARTLETT ROAD. T 06S, R 08E, SEC. 04 1/4: NE NE NW
DUDLEYVILLE MUNICIPAL 01/26/89	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	PINAL COUNTY P.O. BOX 727 FLORENCE, AZ 85232 (602)868-5801	AZ. STATE LAND DEPARTMENT 1624 WEST ADAMS PHOENIX, AZ 85007	.4 MILES SOUTH OF MILEPOST 132 ON THE EAST SIDE OF AZ 77. T 05S, R 16E, SEC. 32 1/4: SW SW
ELOY MUNICIPAL 01/26/90	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	CITY OF ELOY 628 NORTH MAIN ELOY, AZ 85231 (602) 466-3129	CITY OF ELOY 628 NORTH MAIN ELOY, AZ 85231	2 MILES NORTH OF I-10 ON TOLTEC ROAD. T 08S, R 07E, SEC. 03 1/4: SW SW
MAMMOTH MUNICIPAL 01/20/89	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	TOWN OF MAMMOTH 617 CLARK STREET MAMMOTH, AZ 85618 (602) 487-2331	TOWN OF MAMMOTH 617 CLARK STREET MAMMOTH, AZ 85618	.9 MILES NORTH OF SAN PEDRO BRIDGE ON THE EAST SIDE OF AZ. T 08S, R 17E, SEC. 06 1/4: SE SE SW
STANFIELD MUNICIPAL 01/26/90	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	PINAL COUNTY P.O. BOX 727 FLORENCE, AZ 85232 (602)868-5801	AZ. STATE LAND DEPARTMENT 1624 WEST ADAMS PHOENIX, AZ 85007	1.2 MILES WEST OF MARICOPA ROAD ON AZ. 84. T 06S, R 03E, SEC. 32 1/4: NW NW NW

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FACILITY NAME, TYPE LAST INSPECTION DATE	TYPES OF WASTE ACCEPTED	OPERATOR'S NAME, ADDRESS & PHONE NUMBER	LAND OWNER'S NAME, ADDRESS & PHONE NUMBER	DIRECTIONS, LOCATION, TOWNSHIP, RANGE, SECTION, QUARTER SECTIONS
CLOSED SOLID WASTE LANDFILLS (CSWLF)				
GILA COUNTY				
CAMP GERONIMO CSWLF	RUBBISH ASBESTOS SEPTAGE MSW LW	BOY SCOUTS OF AMERICA	BOY SCOUTS OF AMERICA	.5 MILES SOUTHEAST OF THE CAMP ENTRANCE T ,R ,Sec. 1/4:
CHRISTOPHER CREEK CSWLF	RUBBISH Y ASBESTOS ? SEPTAGE ? MSW Y LW ?	GILA COUNTY 1400 EAST ASH STREET GLOBE AZ 85501 (602) 425-3231	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	1.5 MILES EAST OF KOHL'S RANCH ON AZ 260, .5 SOUTH. T 11N, R 12E, Sec. 22 1/4:
GISELA CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	GILA COUNTY 1400 EAST ASH STREET GLOBE AZ 85501 (602) 425-3231	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	5 MILES EAST OF AZ 87 AT GISELA. T 09N, R 10E, Sec. 24 1/4: NE SW
HAYDEN CSWLF	RUBBISH Y ASBESTOS ? SEPTAGE ? MSW Y LW ?	TOWN OF HAYDEN 520 VELASCO AVENUE HAYDEN AZ 85235	TOWN OF HAYDEN 520 VELASCO AVENUE HAYDEN AZ 85235	ON AZ 177 .3 MILES NORTH OF MILE POST 139, .6 MILES TO SITE. T 05S, R 15E, Sec. 10 1/4:
HAYDEN No. 2 CSWLF	RUBBISH Y ASBESTOS SEPTAGE MSW Y LW	TOWN OF HAYDEN 520 VELASCO AVENUE HAYDEN AZ 85235		ADJACENT TO THE SOUTHEAST EDGE OF COUNTRY CLUB T 05S, R 15E, Sec. 23 1/4:
PAYSON CSWLF	RUBBISH Y ASBESTOS ? SEPTAGE ? MSW Y LW ?	GILA COUNTY 1400 EAST ASH STREET GLOBE AZ 85501 (602) 425-3231	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	1.6 MILES SOUTH OF AZ 260 ON AZ 87, .75 MILES EAST TO SITE. T 10N, R 10E, Sec. 1/4:

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CLOSED SOLID WASTE LANDFILLS (CSWLF)				
PINE CSWLF	RUBBISH ASBESTOS SEPTAGE MSW LW	GILA COUNTY 1400 EAST ASH STREET GLOBE AZ 85501 (602) 425-3231	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	2 MILES SOUTH OF PINE ON AZ 87, (.1 MILE NORTH OF MILE POST) T 11N, R 09E, SEC. 1/4:2
ROOSEVELT LAKE CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	GILA COUNTY 1400 EAST ASH STREET GLOBE AZ 85501 (602) 425-3231	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	1.5 MILES NORTHWEST OF ROOSEVELT LAKE ESTATE ROAD ON AZ 188 T 03N, R 13E, SEC. 10 1/4: NW SE SE
STAR VALLEY CSWLF	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	GILA COUNTY 1400 EAST ASH STREET GLOBE AZ 85501 (602) 425-3231	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	1 MILE WEST OF STAR VALLEY ON AZ 260. T 10N, R 11E, SEC. 09 1/4: SW NE SW
TONTO BASIN CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	GILA COUNTY 1400 EAST ASH STREET GLOBE AZ 85501 (602) 425-3231	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	.3 MILES NORTH OF PUNKIN CENTER ON AZ 188, .4 MILES TO T 06N, R 10E, SEC. 10 1/4: NW SE SE
PINAL COUNTY				
CENTRAL ARIZONA COLLEGE CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW N LW N	SIGNAL PEAK CAMPUS WOODRUFF AT OVERFIELD COOLIDGE AZ 85228	CENTRAL AZ COLLEGE WOODRUFF AT OVERFIELD COOLIDGE AZ 85228	ON THE SIGNAL PEAK CAMPUS. T , R , SEC. 1/4:
COOLIDGE #1 CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	CITY OF COOLIDGE PO Box 398 COOLIDGE AZ 85228		.6 MILES NORTH OF AZ 287 ON NAFZIGER ROAD T 05S, R 08E, SEC. 12 1/4: NW NW SW
COOLIDGE #2 CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	CITY OF COOLIDGE PO Box 398 COOLIDGE AZ 85228		1 MILE NORTH OF AZ 287 ON CHRISTENSON ROAD T 05S, R 08E, SEC. 12 1/4: SW NW NW

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CLOSED SOLID WASTE LANDFILLS (CSWLF)				
FLORENCE CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	TOWN OF FLORENCE 133 N MAIN STREET FLORENCE AZ 85232	AIR NATIONAL GUARD	ON US 80/89 .35 MILES SOUTH OF MILE POST #138. T 04S, R 09E, SEC. 13 1/4: SW NW NW
STATE PRISON/FLORENCE CSWLF	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW N	AZ DEPT OF CORRECTIONS 1601 WEST JEFFERSON PHOENIX AZ 85007	AZ DEPT OF CORRECTIONS 1601 WEST JEFFERSON PHOENIX AZ 85007	.25 MILES SOUTHEAST OF THE PRISON. T , R , SEC. 1/4:
STATE PRISON/FLORENCE CSWLF	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW N	AZ DEPT OF CORRECTIONS 1601 WEST JEFFERSON PHOENIX AZ 85007	AZ DEPT OF CORRECTIONS 1601 WEST JEFFERSON PHOENIX AZ 85007	5.7 MILES EAST OF THE PRISON ON DIVERSION DAM ROAD. T , R , SEC. 1/4:
KEARNY CSWLF	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	TOWN OF KEARNY PO BOX 338 KEARNY AZ 85237	KENNECOTT COPPER CO PO BOX 8 HAYDEN AZ 85235	1 MILE WEST OF KEARNY ON AZ 177. T 04S, R 14E, SEC. 21 1/4: NW NE NW
KELVIN-RIVERSIDE CSWLF	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	PINAL COUNTY PO BOX 727 FLORENCE AZ 85232	KENNECOTT COPPER CO PO BOX 8 HAYDEN AZ 85235	1.3 MILES SOUTH OF AZ 177 ON MINERAL CREEK ROAD, .3 MILES SE. T 04S, R 13E, SEC. 12 1/4: SE SW NE
MARICOPA #1 CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	PINAL COUNTY PO BOX 727 FLORENCE AZ 85232	GILA RIVER RESERVATION	3 MILES NORTH OF MARICOPA ON MARICOPA ROAD T 04S, R 03E, SEC. 10 1/4:
MARICOPA #2 CSWLF	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	PINAL COUNTY PO BOX 727 FLORENCE AZ 85232	PINAL COUNTY PO BOX 727 FLORENCE AZ 85232	.8 MILES EAST OF MARICOPA RD ON THE NORTH SIDE OF CASA GRANDE T 04S, R 03E, SEC. 27 1/4: NE SE NE

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CLOSED SOLID WASTE LANDFILLS (CSWLF)				
ORACLE CSWLF	RUBBISH Y ASBESTOS N SEPTAGE Y MSW Y LW Y	PINAL COUNTY PO Box 727 FLORENCE AZ 85232	AZ STATE LAND DEPARTMENT 1624 WEST ADAMS PHOENIX AZ 85007	.5 MILES EAST OF AZ 77 ON THE NORTH SIDE OF VALLEY WASH RD T 09S, R 16E, SEC. 30 1/4: SE SW
PICACHO CSWLF 01/27/90	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	PINAL COUNTY PO Box 727 FLORENCE AZ 85232	PINAL COUNTY PO Box 727 FLORENCE AZ 85232	.05 MILES SOUTH OF I-10 ON PICACHO ROAD, .04 MILES EAST TO T 08S, R 08E, SEC. 23 1/4: SW SE SW
RANDOLPH-LA PALMA CSWLF	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	PINAL COUNTY PO Box 727 FLORENCE AZ 85232		2 MILES SOUTH OF RANDOLPH ON AZ 87. T 06S, R 08E, SEC. 16 1/4: NE SE SE
SAN MANUEL CSWLF 01/20/89	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	MAGMA COPPER COMPANY PO Box M SAN MANUEL AZ 85631 (602) 385-3476	MAGMA COPPER COMPANY PO Box M SAN MANUEL AZ 85631 (602) 385-3476	McNAB PARKWAY THROUGH TOWN TO THE DEAD END, LEFT .4 MILES TO T 10S, R 17E, SEC. 05 1/4: SE SE NW
SUPERIOR CSWLF 01/20/90	RUBBISH Y ASBESTOS N SEPTAGE N MSW Y LW N	PINAL COUNTY PO Box 727 FLORENCE AZ 85232	USFS-TONTO NAT. FOREST PO Box 29070 PHOENIX AZ 85038	2.1 MILES SOUTH OF US 60 ON MARY DRIVE. T 02S, R 12E, SEC. 15 1/4: NW NW NW

SOURCE: ADEQ, MARCH, 1993

CHAPTER 6 NON-POINT SOURCE MANAGEMENT

Nonpoint source pollution sources refer generally to pollution that is produced as an indirect result of man's activity, the accumulated pollutants in streams, diffuse runoff, seepage and percolation which contribute to the degradation of surface water and groundwater quality. Such activities in the CAAG region include: irrigated agriculture and rangeland grazing; silviculture; urban runoff and construction; mineral extraction; residual waste disposal; and recreation.

Because of the diffuse nature of nonpoint source pollution, it is difficult to regulate through traditional permitting programs such as those used for point sources. Until the 1987 amendments to the Clean Water Act, little emphasis was placed on nonpoint sources pollution controls at the federal level. Arizona's 1986 Environmental Quality Act includes requirements for nonpoint source management programs to protect both surface waters and aquifers.

Regulatory programs for nonpoint source pollution are generally designed on a categorical basis and are aimed at certain activities that cause the pollution. This section of the plan will briefly discuss the major nonpoint source control programs in effect in Arizona, provide brief water quality assessments for each basin in the region and discuss the various categories of nonpoint source pollution as they affect those basins. Lastly, the plan will outline opportunities for federal, state, local governments and local agencies involvement to alleviate and reduce nonpoint source pollution.

6.1 NONPOINT SOURCE MANAGEMENT CONTROL PROGRAMS

6.1.1 NPDES Storm Water Runoff Program

The major objective of the federal storm water program is to ensure that urban runoff discharges into the navigable water of the United States meet surface water standards. Section 402(p) of the Clean Water Act requires a permit for storm water discharges associated with industrial activity, construction activity, or a municipal separate storm sewer system.

Municipal storm water permits are currently required for municipalities with a population of over 100,000 persons and are expected to be required for smaller communities in the near future. Individual, group (for similar types of facilities) or general permits may be required for industrial facilities. The permit depends on the type of facility, as defined by the Standard Industrial Classification (SIC) code. If a facility does not specifically qualify for a general permit, it must apply for an individual or group permit. The types of industrial facilities requiring permits include lumber and papermills; chemical and metal industries; landfills; hazardous waste treatment, storage or disposal facilities; wastewater treatment plants with a capacity greater than 1.0 MGD; and construction activities on areas of five acres or more.

Under the general permit program, facilities must file a Notice of Intent with the EPA and develop a pollution runoff prevention plan. Plans must be consistent with local zoning and applicable local ordinances. General permit requirements include use of best management practices, monitoring and record-keeping. Individual and group permits are written and administered by the EPA. Under Section 401 of the Clean Water Act, the state must also certify that the proposed activity will not violate State water quality standards.

The EPA's general permit program for storm water was developed with a risk-based strategy. Most discharges are covered under a minimum baseline general permit. The strategy also

provides for watershed or industry-specific permitting as well as facility-specific permitting, where appropriate.

6.1.2 Section 404 Dredge and Fill Permit Program

Section 404 of the Clean Water Act requires permits for the discharge of dredged or fill materials into navigable waters. This section has been used for the protection of wetlands and riparian areas, although it does not provide protection against the draining or dredging of wetlands nor full protection of all watercourses (i.e., floodplains). Activities which could require a permit include channelization; road and bridge construction; dam construction; mining and dredging operations. The primary activities of concern in the CAAG region are mining, sand and gravel extraction and construction.

The U.S. Army Corps of Engineers has permitting authority for the Section 404 program, using guidelines established by the EPA, to evaluate permit applications. As with the NPDES stormwater permits, ADEQ must certify under Section 401 of the Clean Water Act that permit provisions will not lead to a violation of State water quality standards or other State programs aimed at the protection of water quality.

Executive Order 91-6, "Protection of Riparian Areas", also directs the State to include consideration of Section 404 activities on riparian areas in its Section 401 certifications. In its January, 1992 certification of nationwide permits, ADEQ denied certification for general permits in unique waters and for activities above headwaters.

6.1.3 Aquifer Protection Permit Program

The principal state management program for nonpoint source pollution control is the Aquifer Protection Permit program. Any person responsible for releases of a pollutant to the land surface or to the vadose zone, in such a manner that there is a reasonable probability that the pollutant will reach an aquifer, must obtain an aquifer protection permit. Regulated activities include operation and maintenance of septic tanks; reuse projects; dry wells; mining; agriculture and other activities that may affect aquifers.

APP requirements may be either for general or individual permits. Individual permits require the use of best available demonstrated control technology (BADCT) and include monitoring requirements. General permits can be issued for certain activities that are similar in nature, large in number and for which ADEQ is satisfied there are appropriate conditions that can be written into the general permit to be satisfied by best management practices (BMPs). A general permit may be revoked from any facility that violates the conditions of its permit. The facility would then be required to apply for an individual permit.

The EQA requires development of permit programs for some nonpoint sources of pollution under the APP Program. State programs specific to certain categories of pollution are described below. Currently there are two regulated agricultural activities, the application of nitrogen fertilizers, and concentrated animal feeding operations, that are subject to general APP rules and require implementation of BMPs.

6.2 ARIZONA NONPOINT SOURCE MANAGEMENT PROGRAM

6.2.1 Overview

To comply with the 1987 amendments to the Clean Water Act, the state has developed a Nonpoint Source Water Quality Management Program consisting of a "Nonpoint Source Assessment Report" which identifies the nature and extent of nonpoint source pollution in the state and a "Nonpoint Source Water Quality Management Plan" which outlines the actions which will be taken to manage identified nonpoint source problems.

The federal and state approaches to the development of the Nonpoint Source Water Quality Management Program differ significantly as do the legal requirements of state and federal law. Section 319 of the Clean Water Act requires that the state's management program be developed and implemented, to the maximum extent feasible, on a watershed-by-watershed basis. The EQA requires that the state NPS Management Plan and the associated control programs address nonpoint source pollution on a category by category basis (see Table 6-1). In an effort to address this inconsistency, the state has developed a watershed management zone concept as a first step towards a more holistic approach to controlling water pollution and protecting water quality.

Regional WQM Plans can provide a link between the categorical and watershed approaches by setting priorities and providing a framework for integrating categories of concern with local, regional, state, and federal land and resource management activities.

For those nonpoint source pollution generating activities which are not under the APP Program or any other regulatory program, ADEQ is relying on the voluntary use of BMPs by public land managers and other state agencies through development of memoranda of understanding (MOUs). Designation of nonpoint source management agencies by ADEQ will require a management plan approval by ADEQ and a certification by ADEQ that the appropriate safeguards are in place to ensure the protection of water quality.

Federally-funded demonstration projects are a mechanism for developing information on effective means for nonpoint source pollution control. However, information from these projects must be made available in a useful format to interested agencies and individuals for wider application.

Arizona's Nonpoint Source Program emphasizes the need for public participation, education, and technical assistance. ADEQ Nonpoint Source Program staff coordinate between federal, state, local agencies and interested members of the public in the development of Best Management Practices. Soil Conservation Service (SCS) personnel have also participated in cooperative water quality training meetings. ADEQ, in cooperation with various other agencies including the Agribusiness Council, SCS, and the Cooperative Extension Service, provide workshops on the regulated agricultural activities and BMPs throughout the state.

6.2.2 Prevention Tools

Section 319 of the Clean Water Act requires that the state identify those practices and measures which will be undertaken to reduce pollutant loadings from each nonpoint source category identified as problems in the Arizona Nonpoint Source Assessment Report.

Table 6-1 ARIZONA NONPOINT SOURCE POLLUTION CATEGORIES	
AGRICULTURE	
Irrigated crop production/return flows Rangeland	CAFOs Aquaculture
SILVICULTURE	
Harvesting, reforestation, residue management Forest management	Road construction and maintenance
CONSTRUCTION	
Highway/road/bridge Land development	Military operations
URBAN RUNOFF	
Surface runoff	Dry wells, infiltration basins
RESOURCE EXTRACTION	
Copper mining, milling and refining Precious metal mining and processing Placer mining	Uranium mining, milling refining Industrial minerals mining Sand and gravel mining
LAND DISPOSAL	
Sludge Wastewater reuse Landfills	Recharge On-site wastewater systems
HYDROLOGIC/HABITAT MODIFICATION	
Channelization/dredging Dam construction Flow regulation/hydrologic modification Riparian alteration	Streambank modification/destabilization Canal/irrigation systems Stock tanks Watershed yield/vegetation manipulation
OTHER	
Natural Waste storage/storage tank leaks Highway maintenance and runoff Spills	In-place contaminants Utility Corridors Motor transportation
UNKNOWN	
Land Use	
RECREATION	
Camping Fishing Hiking	Offroad vehicle use Swimming, boating, fishing
UNDERGROUND STORAGE TANKS	
Leaking tanks	Spills & overflows

6.2.2a Best Available Demonstrated Control Technology

Best Available Demonstrated Control Technology (BADCT) is required of all facilities necessitating individual permits for aquifer protection. Nonpoint source pollution categories which impact groundwater and require BADCT include: resource extraction (mining), and land disposal (landfills and septic tanks).

BADCT requires the determination of "optimal" technologies as the first step, where optimal is defined as the most effective discharge controls independent of site conditions. Site characteristics may be substituted for design control technologies to arrive at a final design of BADCT for that facility and site. As a result, operators should be using state-of-the-art design elements to eliminate discharges to groundwater, rather than minimum required control technology.

BADCT guidance documents have been developed for municipal wastewater treatment facilities, landfills, mining and industrial discharges.

6.2.2b Best Management Practices

The EQA defines Best Management Practices as the methods, measures or practices to prevent or reduce discharges and includes structural and nonstructural controls and operation and maintenance procedures (A.R.S. § 49-201.3).

The state process for BMP development has been to identify the water quality problem for a certain category of nonpoint pollution source, assemble an advisory committee to develop BMPs to protect water quality and then make a reasonable attempt to notify persons conducting or managing the activity subject to the requirements of the BMPs.

The effective use of BMP's may result in the improvement of groundwater quality; reduction of suspended solids and acidity; general improvement of surface water quality, and protection of aquifers. If the use of BMP's significantly improves surface and ground water quality, benefits could include a decrease in negative effects resulting from the relationship between livestock and human health and welfare, local and regional beautification, and improved recreational opportunities.

The selection and use of BMP's comes at the discretion of the property owner or manager unless existing laws and regulations are changed. Voluntary implementation of BMPs to improve water quality allows the greatest flexibility to the involved entities, supports education and demonstrations, and promotes cooperation.

6.3 BASIN ASSESSMENTS

Surface and groundwater contamination from nonpoint source pollution is intimately related to land use, except in a small percentage of cases which result from naturally occurring constituents. ADEQ has identified the predominant types of land uses for the major surface water basins in the CAAG region: Middle Gila, Salt River, Santa Cruz, San Pedro, Upper Gila and Verde River Basins.

6.3.1 Middle Gila Basin

The Middle Gila Basin has historically supported agricultural land uses and an agricultural economy. Construction of Roosevelt Dam in 1911 and other impoundments on the Gila, Salt and Verde Rivers tried to insure a dependable water supply for agricultural development. In some

cases this development utilized the same water distribution system originally developed by the Hohokam Indians.

During the last three decades, urban land uses have replaced and displaced agriculture. Those portions of the region in the Middle Gila Basin currently exhibit rural land uses. Agriculture, including cropland irrigation, animal feeding operations and grazing will remain as the primary land uses in these areas.

6.3.2 Salt River Basin

Approximately one-half of the Salt River Basin is within the White Mountain Apache and San Carlos Apache Indian Reservations, and slightly less than one-half consists of National Forest lands. With the exception of the Miami-Globe mining district, the basin is one of Arizona's least populated. Typical densities are 1.0 to 2.5 persons per square mile.

The major land use in the Salt River Basin is recreational in nature, although mining and timber production are also represented. The data currently available on recreational use and its direct or indirect impact on water quality is inadequate for purposes other than speculative judgements. The long-term implications of recreational use are a concern, considering that the available land and facilities serve over 3 million visitor-days of use per year.

Surface Water Quality violations of fecal bacteria, metals, and Ph in both the upper and lower Salt River Basin, most likely are a result of the same nonpoint sources causing elevated turbidity and sediment. Sources of sediment are from unknown activities or a result of rangeland grazing, recreation, mining and hydrologic, or habitat modification sources. Salinity levels in the Salt River system are traceable to a series of springs, upstream of Roosevelt Lake.

6.3.3 Santa Cruz Basin

Approximately one-third of the upper Santa Cruz Basin lies in the CAAG Region. The farming communities of Red Rock, Eloy and Casa Grande flank the river as it winds its way north. While agriculture is a dominant land use north of the Pima County/Pinal County line, industrial development is beginning to broaden the economic base of the communities in the basin.

6.3.4 San Pedro Basin

A very small portion of the San Pedro Basin lies in the CAAG region. Mining, along with some minor agricultural land use, has had a major impact on the area. The present level of mining activity reflects the current market condition for precious metals and copper. San Manuel, Mammoth, Kearny, and Winkelman are communities within this basin whose economy is based on the active mining operations in the area. Copper, silver, gold and small quantities of other minerals are produced at these facilities. Hazardous waste from Mexico is another major concern in the San Pedro Basin.

6.3.5 Upper Gila Basin

A very small portion of the Upper Gila Basin lies in the CAAG region. Historic land uses dominate the area including such activities as agriculture, mining and recreation are important land use activities. The majority of the land is on the San Carlos Indian Reservation and is predominantly used for livestock grazing, lumbering and recreation. Another large portion of the area is managed

by the U.S. Forest Service and much of the remaining land is under BLM or State Lands control. These lands are used primarily for livestock grazing and recreation.

6.3.6 Verde River Basin

A small portion of the Verde River Basin lies in the CAAG Region, including the communities of Strawberry, Pine and Payson. A large portion of the watershed is under the management of the USFS. Principal economic contributors in the Verde Basin are lumber and wood products from the national forests. Tourism and recreation also contribute heavily to the area economy.

6.4 **NONPOINT SOURCE POLLUTION CATEGORIES**

6.4.1 Agriculture

Irrigated agriculture has been a major land use activity in the CAAG region for approximately 2,000 years. The Hohokam Indians developed elaborate irrigation systems to utilize the waters of the Gila River in the production of food crops. After the decline of the Hohokam culture, the Pima Indians and eventually European settlers began using large scale irrigation systems to raise a broad variety of crops in the area.

During the early part of this century, agricultural land and the necessary groundwater resources were widely developed. Water tables in the area declined from around 30 feet below the surface to areas over 1,000 feet today. Present day agricultural activity in the CAAG region is largely dependent on the quantity and quality of water available.

In the early 1980's, the CAAG region contained over 5 million acres of rangeland, representing over 80% of the total land area. Grazing is generally relegated to those portions of the area that do not support urban land uses or irrigated agriculture. Most of this land is managed by public land agencies such as the Forest Service, BLM and the State Land Department.

Nonpoint source pollutants originating from agricultural activities are characterized by: sediment; pesticides; nitrates; and total dissolved solids. Pesticide contamination is associated with chemigation, irrigation return flows and percolation of agricultural waters. Nitrogen contamination is due, in part, to use of nitrogen-based fertilizers and concentrated animal feeding operations such as feedlots and dairies. Sediments and nutrient pollution are a result of land use activities related to rangeland management and grazing. Aquacultural facilities can also result in pollution from increased concentrations of nitrates and phosphates and from artificial fertilization of rearing ponds.

Irrigated agriculture occurs within the Middle Gila, Salt River, San Pedro, Santa Cruz and Verde River Basins. These activities impact groundwater, surface waters and riparian environments. In Gila County, irrigation is limited to: the riverain lowlands in the upper Salt River Basin of the White River Watershed on the White Mountain Apache Indian Reservation; and along the lower reaches of Tonto Creek near Roosevelt Lake. The short growing season and small areas under irrigation in that basin limit the intensity of production and are not known to be causing water quality problems. Impacts attributed to agricultural activities in the Santa Cruz and San Pedro Basins appear to be limited. Irrigation and agricultural activities in the Safford area are believed to affect the quality of the Upper Gila River Basin and may have a significant impact on the quality of water flowing into the Gila River.

Grazing activities appear to have contributed to erosion, sedimentation and siltation problems in all of the basins. Poor range management and grazing activities result in soil compaction, reduced

vegetative cover and an increased surface runoff. Over the long term, siltation in the upper Salt River watershed may gradually eliminate much of the current reservoir capacity for the metropolitan Phoenix water supply.

Both dairies and confined animal feeding operations (CAFOs) are located around the periphery of the metropolitan areas. Large feeding operations are located near Maricopa/Stansfield, Coolidge, Florence, and Casa Grande. Waste products from CAFOs have been implicated as nonpoint source pollution contributors of nutrients, organic materials, and coliform bacteria to surface water and nitrate to groundwater. Feedlot and dairy locations correlate with nitrate groundwater contamination at multiple sites within the Santa Cruz and Middle Gila Basins.

Arizona NPS Program

In accordance with the EQA, ADEQ has developed a regulatory program to address two categories of agricultural related pollution: concentrated animal feeding operations (CAFOs) and application of nitrogen fertilizers. Activities are covered under general Aquifer Protection Permits if they comply with broad best management practice (BMP) goals which were adopted into rule. These goals, in turn, are supported by a technical guidance document which identifies activities that comply with the BMP goals. Public education, training, and technical assistance is provided by agencies such as the Soil Conservation Service (SCS) and the Cooperative Extension Service. ADEQ is developing a program using this same approach for control of nonpoint source pollution from grazing.

A Hydrologic Unit Area Project has been initiated by the SCS in the CAAG region. The project objective is to minimize any additional degradation of the groundwater attributable to agriculture. The project will accomplish its objective by promoting BMPs to increase irrigation efficiency and control deep percolation. This will, in turn, reduce the potential for nitrate movement into the groundwater.

The 1978 CAAG WQM Plan designated the Winkelman, Eloy, West Pinal and Florence-Coolidge NRCDs as Designated Management Agencies (DMA) for nonpoint source activities within the CAAG region. These designations will be reaffirmed with the adoption of this plan.

6.4.2 Silviculture

As defined in point source pollution language, silviculture means any discernible, confined and discrete conveyance related to rock crushing, gravel washing, log sorting, or log storage facilities, which are operated in connection with silvicultural activities and from which pollutants are discharged into waters of the United States. The term does not include non-point source silvicultural activities such as nursery operations, site preparations, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance from which there is natural runoff. These activities not included in the point source definition are incorporated within a single category of NPS.

Almost all harvestable timber in the CAAG region is located on the Tonto National Forest, which is managed by the Forest Service. The total acres of harvested timber is relatively small in comparison to the total acreage of the Tonto. The Forest Service manages its forest land on a multiple use sustained yield basis and must prepare an Environmental Impact Statement (EIS) for each timber management plan that is implemented. Each EIS, then, must address NPS impacts

associated with the management plan and propose mitigation measures to reduce these impacts to an acceptable level.

Sediments and increased volumes of organic matter in streams are the most significant pollutant resulting from silvicultural activities. The majority of the problems with sedimentation are caused by improperly located and poorly constructed and maintained logging roads and skidding trails. Tree leaves, cuttings and logs in streams contribute to organic pollution by decreasing the dissolved oxygen and has a detrimental effect on certain aquatic species. Water temperature increases, as a result of decreased canopy cover, can also affect aquatic species.

ADEQ reports that the impact of timber harvesting and associated road construction is locally severe, but has a minimal impact on the overall water quality within each basin. Data indicates that grazing within forest areas is the primary cause of watershed degradation.

Water quality impacts from forestry activities are not a major problems in the CAAG region watersheds. Some soil erosion and associated sedimentation ranging from slight to moderate has been noted in the Tonto National Forest.

Arizona NPS Program

ADEQ and the U.S. Forest Service have signed a Memorandum of Understanding (December, 1990) for cooperation on water quality management under Sections 208 and 319 of the clean Water Act. The Forest Service agrees, among other things, to ensure control of nonpoint source pollution from activities on forest lands such as timber harvesting, grazing, recreation and controlled burns, through implementation of BMPs and to monitor both BMP implementation and effectiveness. ADEQ agrees to designate the Forest Service as the planning and management agency for National Forest System lands under section 208 and to incorporate USFS responsibility for determination of BMPs which meet state water quality program requirements into state water quality plans (Section 208 and 319 plans). The USFS has proposed the use of a 13-step Integrated Resource Management process to decide which BMPs are applicable to specific activities.

ADEQ has developed a similar agreement with the Bureau of Land Management primarily for grazing activities. Silviculture and grazing activities on State Trust Lands are not yet covered under an interagency agreement.

6.4.3 Construction and Urban Runoff

Excessive rainfall can cause storm water runoff, a condition in which the volume of surface waters exceeds the ability of the land to absorb it. Stormwater runoff can cause water pollution problems by transporting a variety of organic and inorganic pollutants into surface water or groundwater. Storm water runoff is another significant problem, primarily with larger urban areas and from industrial sites. Because of the absence of large cities in the CAAG region, it appears that stormwater runoff is not a significant problem at the present time.

Population increases, as well as the expanding market for summer homes, have led to an increase in construction activities in the CAAG region. Road and housing development construction are the most common types of construction-related activities in the CAAG region. Depending on the practices used from site to site, these activities may contribute to watershed degradation through

vegetation removal and channelization which can increase flow velocities. Sediment, oil and grease are the primary pollutants generated by these activities.

Construction and its associated runoff is a problem in the Middle Gila and Santa Cruz Basins as a result of the growth and expansion of the metropolitan Phoenix area. Runoff from construction sites where farmland is converted to urban uses is a suspected mechanism for pollutant transport to soils and riparian areas of the Gila River. Construction around Casa Grande has produced short-term, localized sedimentation problems. Undocumented water quality violations have occurred, however. Soil may also be transported from construction sites and deposited along streets and gutters where it becomes a source of particulate air pollution as well as a potential water quality pollutant. There appear to be no documented water quality effects from construction activity and urban runoff in the CAAG portions of the Salt, San Pedro, Upper Gila or Verde River Basins. Pinal County, Casa Grande, and Coolidge have stormwater retention ordinances for new developments which help to alleviate related problems.

Arizona NPS Program

ADEQ is developing a BMP program for urban runoff based on the model used for the agricultural BMPs. The technical advisory committee began meeting in early 1993 and has developed draft BMPs. This new program intends to complement both the NPDES storm water permitting program and the pollution prevention program.

ADEQ has signed a partnering agreement with the Arizona Department of Transportation for BMP implementation and nonpoint source control for construction and maintenance of State highways and other facilities. Under the Intermodal Surface Transportation Efficiency Act (ISTEA), state transportation plans and programs must also consider any state plan developed pursuant to the Clean Water Act.

Many highway construction projects are federally funded and are therefore subject to NEPA requirements for environmental assessments. However, not all activities associated with these projects are addressed in project Environmental Assessments. Location of asphalt batch plants, water supplies and storage or disposal sites for milled materials are generally considered the responsibility of the sub-contractor and are not considered in the NEPA process. Yet these activities can adversely affect surface and groundwater, as well as fish, wildlife and riparian areas. As statewide water quality planning expands in scope, transportation project environmental assessments should consider the full range of direct and indirect impacts associated with project-specific requirements.

6.4.4 Resource Extraction

Mining activities, both metallic and non-metallic, are widespread throughout the CAAG region and contribute significantly to the economies of both counties. The majority of the metallic mineral mines are copper mines, which are concentrated around the Globe-Miami, Hayden-Winkelman, Mammoth-San Manuel, and Casa Grande areas. A listing of the current mines and the types of minerals under excavation can be found Table 6-2.

**Table 6-2
 ACTIVE MINES AND SAND/GRAVEL OPERATIONS IN CAAG REGION**

County	Mine	Mineral(s)
Gila	Arimetco, Inc., Van Dyke Mine	copper
Pinal	Arimetco, Inc., White Cliff Mine	diatomaceous earth
Pinal	Asarco Inc., Hayden Concentrator & Smelter	cooper
Pinal	Asarco Inc., Ray Mine & Concentrator	cooper
Pinal	Catalina Marble, Inc., White Rock Mine	white marble
Pinal	Central Arizona Materials	sand & gravel
Pinal	Cyprus Copper Company, Casa Grande Facility	copper
Gila	Cyprus Copper Company Miami Facility	cooper
Pinal	Fred Clark Trucking Co., Inc.	sand & gravel
Gila	Guzman Construction	sand & gravel
Pinal	Harborlite Inc., Superior Perlite Mine	perlite
Gila	Kesson and Kesson, Copper Hill Mine	silica flux
Pinal	Kesson and Kesson, Magma Limestone Mine	limestone flux
Gila	Magma copper company, Pinto Valley Mine	copper-molybdenum
Pinal	Magma Copper Company, Magma Mine	copper
Pinal	Magma Copper Company, San Manuel Mine & Smelter	copper-molybdenum
Gila	McKusick Mosaic, Weary Lode Mine	clay
Pinal	National Gypsum Company, Feldman Quarry	gypsum
Pinal	Nord Perlite Company, Chicago Pit	perlite
Pinal	Oracle Ridge Mining Partners, Oracle Ridge Mine	copper, gold, silver
Gila	Payson Concrete & materials, Inc	sand & gravel
Pinal	Pinal Gypsum Corp., White Cross Mine	gypsum
Pinal	Silica Mines, Inc.	silica flux
Gila	Star Valley Granite & Materials	sand & gravel
Pinal	United Metro, Casa Grande Facility	sand & gravel
Pinal	Superior Companies, Winkelman Gypsum Mine	gypsum
Gila	Yellow Hair Trading & Mining, Sleeping Beauty Mine	turquoise

Source: Bureau of Mines, 1993

Copper and sand/gravel extraction are the two most common mining activities carried out in the CAAG area. Copper is mined and processed at most sites, although specific methods of production vary from company to company. Sand and gravel extraction primarily occurs in stream beds and floodplains. Nonpoint source pollution impacts of mining include sediment loading in surface waters and chemical changes in both surface and ground waters.

In stream mining operations, particularly sand and gravel operations, severe channel and bank erosion can occur. Extraction from the stream channel and related screening activities can cause both sediment loading downstream, and channel modification. Indirectly, these sources contribute to increased water temperature and riparian habitat loss. Improper disposal of solid waste, as well as, improper design and maintenance of disposal sites, can result in slope failure and erosion. The current sand and gravel operations in the region are listed in Table 6-2, with locations noted on Map 1.

The improper use of various mining techniques (e.g., leaching, tailing ponds, waste dumps) in the extraction of copper and other minerals, presents a threat to groundwater and surface water quality. Stormwater runoff from waste and tailing dumps may contain various dissolved solids, including metals. Storm drainage systems as well as haul road erosion may further contribute to these problems. Tailing pond process waters and leaching facilities may contain high concentrations of dissolved solids, chemicals and other materials. Improper design and maintenance of these facilities may cause leaching of pollutants to the groundwater or overflow due to heavy rainfall. In addition, smelters have been identified as major contributors of air pollutants, including trace metals, sulfate and acidic precipitation.

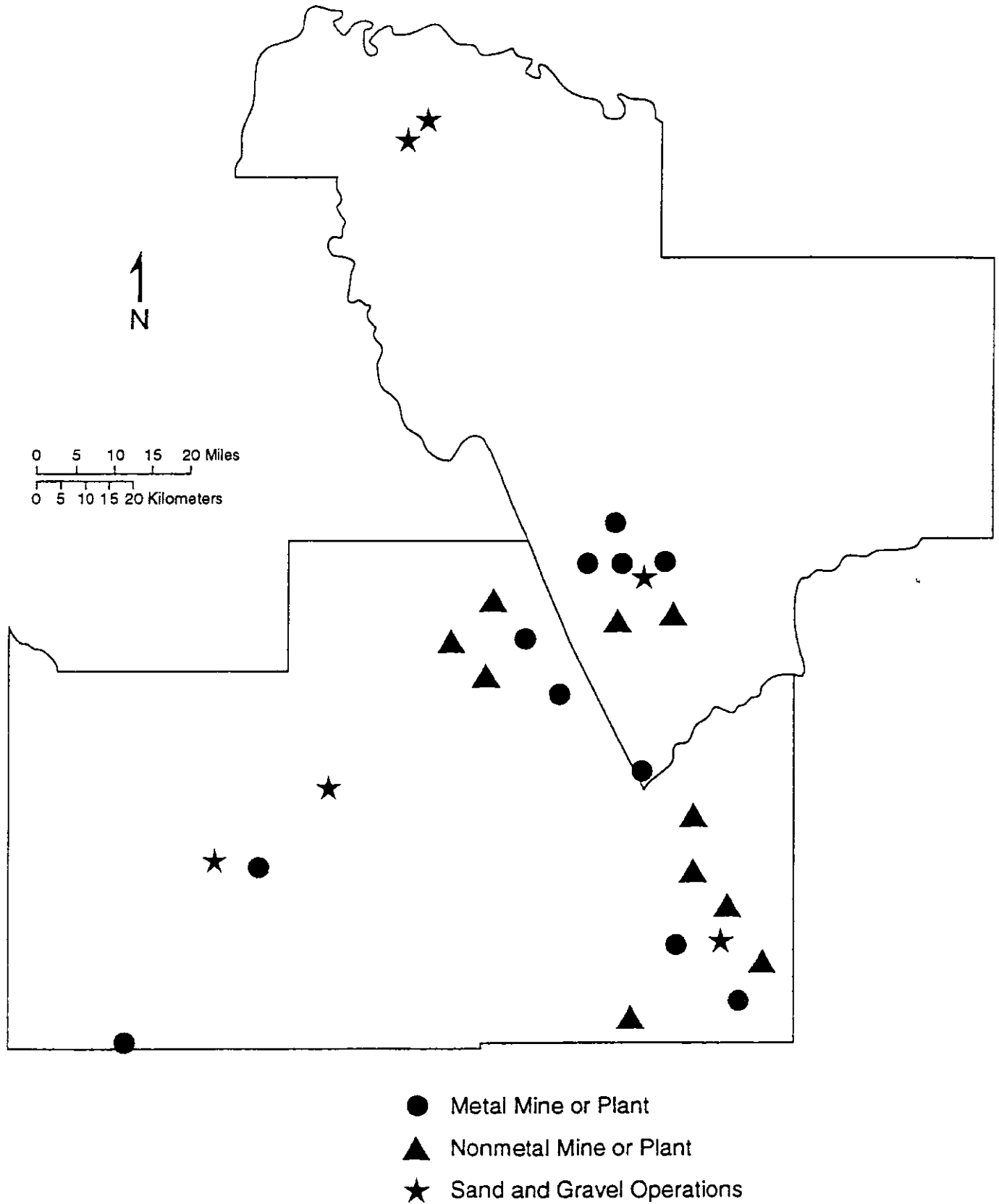
In the Middle Gila Basin, sand and gravel operations are the largest source of sediment load. Construction activities related to urban growth and expansion provide the demand for sand and gravel. In the San Pedro basin, Copper Creek, near Mammoth, has documented violations for pH and metals standards. No surface water quality standards violations have been attributed to mining operations within the Santa Cruz, Upper Gila or Verde Basins.

The Globe-Miami area of the Salt River Basin has supported mining and mineral processing activities since 1873. The Pinal Creek and Pinto Creek sub-basins which drain the Globe-Miami mining districts, flow into Roosevelt Lake, a significant water supply source for Phoenix. One hundred fifty-nine historic and existing mining activities have been identified within the Globe-Miami area. The principal mineral mined and processed is copper. However, various other metals are also extracted from this basin. Surface and groundwater quality in the Globe-Miami area has declined over the past 100 years as a result of the seepage of acidic mining and milling process solutions.

Acid mine drainage has created an acidic groundwater plume containing metals and sulfates which are being transported toward Pinal Creek. These waters have the potential to impact Roosevelt Lake. However, a mining consortium called the Pinal Creek Group is performing extensive interim remediation through the industrial reuse process to prevent or preclude the migration of the acidic plume to the surface waters of Pinal Creek. These remediation efforts are part of a series of studies and assessments which were previously discussed in Section 4.2.3. Overland runoff as well as groundwater discharges to surface water have also contributed to impacts upon surface water quality.

The 1978 CAAG Areawide Water Quality Management Plan identified Globe/Miami as an area of potential, but poorly documented, water quality problems from mining activities. In 1979, the Mineral Extraction Task Force (METF) was formed, as a sub-group of the CAAG Environmental Planning Committee, to compile available information on the magnitude and probable causes of the problems and to identify mitigation measures to address them.

MAP 1
Active Mining Locations within the
CAAG District



Source: Arizona Department of Mines and Mineral Resources, 1993

The three and one half year study, funded by EPA, Bureau of Mines, Department of Health Services and several of the mining companies, produced a series of ten reports. The reports covered the physical inventory of the region, history of mining in the area, geology and hydrogeology, water quality, BMP alternatives and developed a recommended mining activity management program for the Globe/Miami area.

The study concluded that groundwater quality in the shallow alluvial aquifer of the Pinal Creek Basin has been degraded over the past 40 years due to mining and other activities in the Globe/Miami area. BMPs were identified to correct current groundwater quality problems or minimize or prevent future problems. The study found that almost all of the BMPs listed were used as part of the mining procedures or pollution control measure in the Globe/Miami district.

Arizona NPS Program

ADEQ is developing a BMP program for sand and gravel mining operations based on the model used for the agricultural BMPs. This program is intended to complement the federal CWA Section 404 "dredge and fill" permit program. No programs have been defined for control of nonpoint source pollution from abandoned mines.

Active mining operations are point source dischargers and require Aquifer Protection Permits. Some operations also require NPDES permits if they discharge to surface waters. In FY 92, ADEQ participated in a tour of the proposed Carlotta Mine site. ADEQ will be involved in future meetings to assist in the CWA Section 401 certification review. Concern has been expressed by ADEQ as well as Arizona Game and Fish Department and U.S. Forest Service on the impact that a mining operation might have on the downstream riparian area along Pinto Creek.

The Watercourse Alteration Technical Advisory Group (WATAG) has been meeting to develop BMPs to protect stream courses from degradation by sand and gravel activities.

6.4.5 Land Disposal

Sludge disposal, wastewater reuse, landfills, on-site wastewater systems and solid and hazardous wastes disposal are subcategories of nonpoint source pollution in this category. Each of these, except solid and hazardous waste disposal, are covered under the point source section of this plan. This discussion deals primarily with the handling of solid and hazardous wastes.

Most of the demonstrated impacts of waste disposal and storage practices on water quality are focused on urban/urban fringe areas and are confined primarily to the Middle Gila Basin. Disposal of pesticide containers in agricultural areas has been identified as a potential source of surface and groundwater contamination. There are no documented water quality problems in the CAAG portion of the Salt, Santa Cruz, San Pedro, Upper Gila and Verde River Basins which are directly attributed to land disposal. Non-hazardous liquid waste disposal, however, is a problem in the CAAG region.

6.4.6 Hydrologic and Habitat Modification

The hydrological modification of streams and washes is a continuing problem within the CAAG region (i.e. dams, reservoirs, diversion canals, removal and destruction of riparian areas,

deforestation for cloud seeding, irrigation return flows). Dams modify hydrologic systems through: sediment build up behind the dams; a scouring effect below the dams, and significant changes in habitat (temperature altered flows and depth). The changes in the natural characteristics of the watercourses directly affects native fish, plants and wildlife. Other problem areas, including dry streams, which often exist below diversion canal headgates and effluent dominated water streams, can also change the physical, biological and chemical properties of surface water.

The development of stringent water quantity management programs to provide adequate water supplies for irrigated agriculture, combined with flood control facilities, have produced a system of artificial, highly managed rivers throughout the Middle Gila Basin. Groundwater withdrawals, combined with surface water impoundments have resulted in a situation where perennial flowing streams with associated wetlands have changed to dry-barren stream channels in both the Middle Gila and the Santa Cruz Basins. Portions of the Santa Cruz, north of the Pinal/Pima county line, support riparian vegetation through irrigation return flows and seasonal runoff events.

The extraction of sand and gravel from streamcourses has caused hydrologic changes in the Middle Gila Basin. Studies indicate land and structure near sand and gravel extraction operations have been threatened or damaged during floods. Contributions of nonpoint source pollution by hydrologic and habitat modifications has not been documented in the CAAG portions of the San Pedro, Upper Gila and Verde River Basins.

6.4.7 Other & Unknown

The "other" category of nonpoint source pollution contains several subcategories on which little information is documented. Among these "other" sources are naturally occurring nonpoint source pollution and manmade hazards. Natural sources of sediment, minerals, metals and other substances may affect the use of waters for various purposes; but, their occurrence at natural background levels is not considered to be pollution. There is currently insufficient data available to determine what constitutes natural background levels of certain pollutants, although recent programs, such as the NAWQA program discussed in Section 4.1.4, may be able to provide much needed baseline data. One of the manmade hazards that is getting increased attention is underground storage tanks (UST), which are covered below.

The "unknown" category includes contamination sites from multiple pollution sources. Sources can often be identified based upon existing land uses in the contaminated area. In an unknown case, there may be insufficient evidence to indicate one specific type of land use as solely responsible for the problems.

ADEQ does not currently have any programs to address naturally caused pollution of either surface or groundwater. Groundwater contamination from natural sources may require treatment and/or management programs in some areas where drinking water supplies are affected. Unknown sources will be undefined until specific monitoring efforts can identify the specific sources and their relative contribution to the total contamination of the site.

6.4.8 Underground Storage Tanks

One of the manmade hazards of nonpoint source pollution are leaking underground storage tanks (LUSTs). LUSTs can lead to contamination of drinking water supplies with petroleum or hazardous chemicals. Underground storage tanks are regulated under Subtitle I of RCRA and Arizona's Underground Storage Tank Act of 1986. Requirements include registration of USTs, installation and maintenance of leak detection systems, reporting to ADEQ, corrective action in the event of a

leak, and design requirements for new tank installations. There is also a trust fund program (LUST Trust) to provide financial assistance for remediation of contamination caused by LUSTs.

ADEQ has developed a database with information about underground storage tanks including tank age, construction and corrosion protection. Statistics show that tanks over 15 years old and constructed of uncoated, bare steel pose the highest risk for release. ADEQ data shows that of the current 2,246 open UST sites in the state, 134 or 6% of which are located in the CAAG region. The location of these tanks is shown in Table 6-3. Map 2 identifies the open UST Sites for the State of Arizona.

6.4.9 Recreation

The increasing popularity of outdoor recreation in the CAAG region presents potentially negative environmental impacts on water quality. Recreational activities include camping, hiking, off-road vehicle use and water-based activities such as swimming, boating and fishing. The impacts of these recreational uses on water quality are related to the intensity and type of use. Three broad types of water pollution are associated with these various types of recreation: sedimentation, solid waste, and human waste.

The demand for developed recreation sites exceeds the availability of improvements on the whole, particularly around lakes and streams. Campgrounds on state and federally developed recreational lands in the Verde, Tonto Creek and Salt River basins represent potential sites of nitrate/nitrite and coliform bacterial contamination. Recreational use has also increased the nutrient and bacterial loading of these water bodies. Operation of off-road vehicles is an increasing problem which has resulted in resource damage and erosion, causing added sediment loading throughout some of the basins.

Current improvements to the Roosevelt Dam, resulting in increased capacity of Roosevelt Lake, and the construction of the expanded recreational facilities proposed by the USFS, will also affect the Salt River Basin.

Arizona NPS Program

ADEQ does not yet have any programs in place for development of best management practices for recreation. The major opportunities for prevention or minimization of impacts due to recreational activities are through methods such as public education and mitigation measures identified in land or resource management plans.

6.5 WATERSHED TRANSITION

There is a movement at the EPA towards a more holistic approach to management of water quality on a watershed basis. Watershed management, on a large scale or by sub-watershed, offers an opportunity to look at the cumulative effects of multiple sources of water pollution. Priorities, standards, and/or load limits (TMDLs) may be established which take into account the uses and characteristics of a specific watershed as well as naturally occurring pollution. Watershed management also allows an opportunity to integrate a number of water pollution control programs which address point and nonpoint sources of pollution for both groundwater and surface water.

Table 6-3 LUST SITES IN CAAG REGION	
GILA COUNTY	
Location	# Sites
Claypool	1
Forest Lakes	1
Globe	13
Hayden	5
Miami	7
Payson	12
Roosevelt	2
Tonto Basin	1
Winkelman	2
Total Sites	44
PINAL COUNTY	
Location	# Sites
Apache Junction	9
Arizona City	2
Casa Grande	28
Coolidge	9
Eloy	14
Florence	92
Kearny	3
Mammoth	4
Maricopa	4
Oracle	2
Picacho	1
Picacho Peak	2
Queen Creek	1
San Manuel	2
Total Sites	90

Regional nonpoint source plans should prioritize categories of nonpoint source pollution which have the greatest impacts in the region. Watersheds and sub-watersheds in the region should also be prioritized for use to determine where more intensive monitoring, management plans or development of load allocations is recommended or would be most appropriate.

As mentioned earlier, the EQA requires that ADEQ approach nonpoint source pollution on a categorical basis. ADEQ is taking some initial steps towards a fully integrated program with its "Nonpoint Source Management Zone" concept. The program will attempt to integrate wellhead protection and nonpoint source program, thereby, addressing protection of both groundwater and surface water quality.

Funding for watershed management activities will be available from several sources in the future. EPA has various publications listing the federal programs which may provide assistance for watershed management projects. A majority of these funding sources, and these proposed transitions in approaches, are contingent on the reauthorization of the Federal Water Pollution Control Act (CWA) in the near future.

There are a number of issues that could probably be better addressed at the watershed level, including:

- * evaluation of the cumulative impacts of projects and developments
- * evaluation of impacts of new and modified discharge permits
- * prioritization of issues and projects in the various watersheds
- * development of TMDLs
- * integration of surface and groundwater quality/quantity issues
- * highest and best land uses
- * composite rating of watersheds based on local and regional values

Some specific issues which have been identified for major watersheds in the CAAG region area listed in Appendix 6-1.

6.6 MONITORING

The 1978 CAAG WQM Plan noted that much of the available water quality data is insufficient to allow a definitive assessment of water quality in the region. As a result, the existing data does not portray a complete, accurate picture of water quality for individual segments or for the entire area. The plan called for development and implementation of a coordinated data collection program.

While monitoring is required under the CWA and the EQA, only a small percentage of waters in the state and the region have been monitored as described in Chapter 4. Monitoring for nonpoint source pollution requires different techniques from conventional water quality monitoring. Monitoring may be done to determine the impacts of specific projects, evaluate the effectiveness of BMPs or it may be done to determine cumulative impacts of land management activities which may generate nonpoint source pollution. Different activities have various impacts on the condition of the watershed which in turn can affect the types and quantities of pollution reaching surface waters or leaching to groundwater.

A statewide network of surface water monitoring stations has been established in cooperation with the U.S. Geological Survey (USGS) and others to determine compliance with water quality standards and trends, to support waste load analysis, toxics assessment and water quality standards programs.

ADEQ has developed a state wide groundwater quality monitoring strategy. Monitoring networks are needed for many reasons, including the requirements to provide baseline information on groundwater quality and subsequent information on water quality changes. This information is necessary in order to meet statutory mandates for water quality protection.

Results from statewide surface and groundwater monitoring networks, and monitoring results from special studies or programs (like the pesticide program) will be combined with the results of monitoring conducted by facilities and management agencies to evaluate compliance and effectiveness of the program.

6.6.1 NAWQA Program

In 1994, USGS began the National Water Quality Assessment Program (NAWQA) in Arizona. NAWQA is a nationwide program with sixty study units, one of which is located in Arizona labeled the Central Arizona Basins. This will be an on-going program repeating in 10 year cycles including planning, retrospective analysis and reconnaissance reviewing existing data, intensive data collection and interpretation including in field testing, reporting and low-intensity sampling. NAWQA's purpose is to ascertain and describe the current baseline status of water quality on a national basis and assess long term trends and compare and contrast study areas including interdisciplinary analysis. The goals of NAWQA are to provide long term monitoring, study and research, timely interpretation of information and better availability and use of information.

6.7 RECOMMENDATIONS

6.7.1 Storm Water Runoff

- (1) **Local governments** need to develop and adopt ordinances to control storm water runoff for permitted activities such as construction, parking lots and various industries.
- (2) **Local governments** should adopt guidelines or ordinances for new development to reduce or prevent urban runoff problems.
- (3) **Local governments and agencies** should request the opportunity to review and comment on ADEQ CWA Section 401 certifications, especially in sensitive areas such as riparian habitats.
- (4) **Local governments and agencies** should raise issues/concerns during the NEPA process/Environmental Assessment development for federally funded projects or projects on federal lands.
- (5) **Counties and Cities** should work together to produce storm water ordinances and management programs that are consistent and compatible, especially within common watersheds.
- (6) **Mining operations** in the region are encouraged to take additional precautions to protect against flooding of tailing ponds during floods which exceed the 100 year floodplain and current storm water holding capacities.

6.7.2 Dredge and Fill Program

- (1) **Local governments** should develop zoning and floodplain ordinances that specifically address riparian area/wetlands.
- (2) **Local governments and agencies** should request the opportunity to review and comment on ADEQ CWA Section 401 certifications, especially in sensitive areas such as riparian habitats and unique waters.
- (3) **Local governments and agencies** should raise issues/concerns during the NEPA process/Environmental Assessment development for federally funded projects or projects on federal lands.

6.7.3 Nonpoint Source Pollution Categories

- (1) Agriculture Category Recommendations:
 - (a) Grazing is a nonpoint pollution source of concern in the CAAG region and should be addressed by the **DMAs** through comprehensive watershed protection programs which include BMP implementation.
 - (b) The **NRCDS** should continue their conservation activities in developing conservation plans for all irrigated cropland in the CAAG region.
 - (c) **CAAG** should expand the membership of the Environmental Planning Committee to include National Resource Conservation District (NRCD), Soil Conservation Services (SCS) and other state and federal agencies and landowners.
 - (d) **CAAG** should include a NPS assessment for the region in the annual State of the Region report.
 - (e) **CAAG**, through the Environmental Planning Committee, should encourage all **local governments** to work with other agencies toward implementation of the conservation plans.
- (2) Silviculture Category Recommendations:
 - (a) **Local governments, other agencies and private citizens** are encouraged to raise issues and provide comments during the project development process for timber sales, grazing allotment plans and other specific projects on federal lands.
 - (b) **State and federal agencies** should recognize the cross media impacts of their activities and provide for cross media coordination and evaluation of these projects.
 - (c) **Land management agencies** need to address associated impacts of their implementation measures (i.e., air quality impacts from controlled burns). There are opportunities to do this through the EIS/EA process, forest planning and public education.

- (3) Construction and Urban Runoff Category Recommendations:
 - (a) Environmental Assessments for federally-funded highway construction projects on federal, state or local roads should include the impacts of all associated activities. **ADOT** or the project sponsor should be the agency accountable for reducing impacts through the successful implementation of mitigation measures.
 - (b) All types of nonpoint source pollution impacts **county or municipal** road construction and/or maintenance activities which are not federally-funded should be considered during the environmental review process. Mitigation measures for NPS impacts should be identified and implemented.
 - (c) **Local governments** are encouraged to develop and maintain public education programs regarding: 1) the impacts of activities on private land which result in urban runoff pollution; and 2) actions that individuals can take relative to those activities in order to prevent or reduce nonpoint source pollution.
 - (d) **ADEQ and/or CAAG** should develop educational materials for use by local governments and planners to guide the development and implementation of BMPs.

- (4) Resource Extraction Category Recommendations:
 - (a) **ADEQ** should develop BMPs for both active and abandoned mining operations.
 - (b) **CAAG** should expand the Environmental Planning Committee membership to include state and federal agencies and industry representatives with interests in resource extraction.
 - (c) If new resource extraction or expansion of an existing resource extraction process, is to take place, **ADEQ** should require assurance, beyond the applicable permits, that the region's water quality will be substantially protected.

- (5) Land Disposal Category Recommendations:
 - (a) **ADEQ** should provide public education and information on waste disposal options, and the impacts of individual actions with regard to waste production.
 - (b) **CAAG and ADEQ** should assist local governments in the development of local waste disposal guidelines to ensure continued best management practices.

- (c) **ADEQ** should encourage local governments to adopt recycling programs by ordinance and should encourage the development of markets and uses for recycled goods/end products.
- (6) Hydrologic and Habitat Modifications Category Recommendations:
 - (a) **Local governments** are encouraged to adopt ordinances for the protection of riparian areas on lands under their jurisdiction.
 - (b) **Local governments** are encouraged to: 1) work with federal and state agencies in the development of mitigation program performance standards for riparian areas; and 2) meet habitat requirements for aquatic and other species.
- (7) Recreation Category Recommendations:
 - (a) **ADEQ and USFS** should conduct further research concerning long range affects of increased recreational opportunities at Roosevelt Lake and the potential impacts on the Salt River Basin.
 - (b) **ADEQ** should restrict the future requests for NPDES permits which would allow any further discharge into Roosevelt Lake. Instead, ADEQ should require issuance of reuse permits.

6.7.4. Underground Storage Tanks

- (1) **Local governments** should adopt planning and zoning restrictions on the siting of facilities with underground storage tanks (USTs) near well recharge areas or well fields.
- (2) **Local governments** should define requirements with planning and zoning ordinances governing USTs as to what actions are required to be taken in the event of a release.
- (3) Public outreach and education with regard to USTs should be undertaken at all levels of **county and municipal government** to ensure public awareness and involvement.
- (4) **ADEQ** should consider designation of certain agencies as DMAs for NPS pollution, in particular those agencies that deal with USTs and LUSTs on a routine basis.

6.7.5 Watershed Transition

- (1) **Watershed management projects** are encouraged for watersheds across the CAAG region.
- (2) **CAAG** should work with local governments, other agencies and ADEQ to identify priorities for watershed protection projects.

6.7.6 Monitoring

- (1) Project monitoring sites and parameters should be selected by **ADEQ and land management agencies** which allow project impacts to be isolated from impacts of other activities in the watershed.
- (2) Increased resources should be dedicated by **ADEQ and land management agencies** to monitor nonpoint source pollution programs. Federal and State agencies should also develop baseline data, identify pollution sources, evaluate trends in watershed condition and water quality and for enforcement of water quality standards.
- (3) Monitoring programs should be designed and implemented as cooperative efforts among **public land management agencies or other agencies involved in land use** activities that may contribute to nonpoint source pollution. Monitoring activities should be included in MOUs between **ADEQ and land management agencies**.
- (4) **ADEQ** in conjunction with **USGS**, should continue their study of Theodore Roosevelt Lake.
- (5) **ADEQ** and the **Pinal Creek Group** should keep CAAG apprised of all studies completed in the Theodore Roosevelt Lake area concerning the acidic and metal contamination in the Pinal Creek area.
- (6) **ADEQ** should test for contamination, and baseline water quality data. Surface water testing is currently based on complaints or known problems. Monitoring should begin at new test sites in areas where testing has not previously been completed to compile baseline data and identify water standards.
- (7) **ADEQ** should not change standards and parameters annually, as this makes comparison of assessments from one year to the next difficult.
- (8) **ADEQ** should have an adequate, statewide reporting system in place to report incidence of bathing area restrictions, and identification of waterborne diseases of man which affect public health and aquatic life.
- (9) **ADEQ**, in conjunction with USGS, should conduct further trend analysis using additional data sources to address water quality problems in the Verde River Basin.

6.8 REFERENCES

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**Appendix 6-1
Projects and Activities in the CAAG Region**

HYDROLOGIC UNIT AREA PROJECTS

Two hydrologic Unit Area Projects have been located in Arizona, based in part upon groundwater contamination data compiled by the Arizona Department of Environmental Quality. The Casa Grande-Coolidge Hydrologic Unit Area has been established as a result of the detection of three major and five minor "hot spots" of high nitrate levels in Pinal County well water.

The consumption of waters containing high levels of nitrate has been known to cause a potentially fatal condition called Methemoglobinemia or "blue baby syndrome." Methemoglobinemia occurs when nitrate is converted to nitrite in the digestive system. Nitrites in the bloodstream attach to receptor sites in hemoglobin which causes a reduction of sites available for oxygen attachment thus greatly reducing the oxygen carrying capacity of the blood. When nitrite attachment occurs, hemoglobin is then called methemoglobin. Physically, a person with methemoglobinemia may exhibit a slight bluish tint to the lips and extremities, hence the name "blue baby syndrome." Although the condition may be fatal, the disease can be reversed if it is quickly diagnosed.

The Casa Grande-Coolidge Hydrologic Unit Area Project in Pinal county has therefore focused on groundwater nitrate contamination and the potential for contamination from non-point sources. Non-point sources of nitrate often refer to cumulative effect on an area, such as a farming community, that may be slowly contributing nitrate to groundwater over time. The Pinal County nitrate data base has been compiled from both historical and current data for two reasons: to in an effort to increase public awareness of the levels of nitrate in the area; and to reveal historical nitrate levels or area trends in the groundwater supplies of Pinal County (Reffruschini, et.al., 1992).

BMPs FOR THE MARICOPA-STANFIELD IRRIGATION AND DRAINAGE DISTRICT (MSIDD)

A report was presented February 18, 1993 to the Planning Area 2 (Farm Profitability and Sustainability) working group regarding the results of a review of preliminary management plans by the Hydrology and Water Assessment Section of ADEQ. The program has the potential for fostering an improvement in the performance of irrigated agriculture in the MSIDD area. Implementation of the proposed strategies may also provide an opportunity to verify the effectiveness of agricultural BMPs. ADEQ will participate in technical review of farm specific management plans to ensure the incorporation of BMPs. In addition, information will be provided regarding outreach and educational programs and their relationship to water quality BMP programs. During subsequent meetings held on February 22 and 23, 1993 the "On Farm Management Team" was selected.

The agencies/group represented included:

- Maricopa Stanfield Irrigation and Drainage District,
- Soil Conservation Service,
- Cooperative Extension,
- Irrigation Management Service, and
- Growers.

The Arizona Department of Environmental Quality and the Arizona Department of Water Resources will serve in advisory roles (NPS (I.A.), 1993).

APPENDIX 6-1

NONPOINT SOURCE MANAGEMENT ZONES

Region 9 has encouraged Arizona to develop an integrated and holistic multi-program approach for implementation of the Arizona Nonpoint Source Water Quality Management program on a watershed by watershed basis. The Arizona Department of Environmental Quality and Region 9 have committed to work cooperatively to better integrate and coordinate the watershed approach into Arizona's mandated category-specific Nonpoint Source Program.

The selected NPS Management Zones have been characterized by numerous and diverse NPS impacts including: application of nitrogen fertilizers, concentrated animal feeding operations; rangeland activities; silviculture; urban runoff; construction; resource extraction; recreation; and underground storage tanks. Groundwater quality is a major concern because groundwater is the principal source of regional drinking water supplies. Groundwater is also an important component of our river and wetland environments.

For each NPS Management Zone the approach includes the same five phases:

- Information compilation
- Development of watershed-specific BMP implementation plans through coordinated resource management, planning and advisory groups
- Execution of BMP Implementations plans, including program/activity coordination
- On-going monitoring
- Encouragement of NPS demonstration projects

To identify NPS Management Zones, GIS overlay maps are developed. Information such as well locations, hydrographic features (streams), surface water and groundwater quality data, land use patterns, areas of documented water pollution (water quality-limited segments, wells/contaminated areas), and riparian habitat assessment are gathered, field checked and represented on maps and other graphics. The assembled GIS overlays are used to identify and prioritize pollutant sources for targeted action.

Once NPS sources are identified and prioritized, a BMP implementation plan is developed that is specific to each watershed or NPS Management Zone through coordinated resource management planning and advisory group support. The plans characterized each identified NPS problems within a watershed or area, outline a priority ranking for action, and identify pollution controls and measures that may be adopted to manage or mitigate the problems.

The Arizona Nonpoint Source Program is developing and establishing 5 (five) Nonpoint Source Management Zones for priority watersheds. The Salt River/Lower Verde River NPS Management Zone is the primary zones central to the CAAG Region.

The proposed Salt River/Lower Verde River NPS Management Zone encompasses the Lower Verde Watershed and the Salt River Watershed. This zone includes the critical surface water supplies stored in Lake Roosevelt, Canyon Lake, Apache Lake, Saguaro Lake and Bartlett Lake. The 1988 NPS Assessment Report, 1992 305(b) and 1994 305(b) reports document Nonpoint Source impairments to water quality because of Agriculture, Construction, Urban Runoff, Resource Extraction, Land Disposal, and Hydrologic/Habitat Modification category activities.

APPENDIX 6-1

SILVICULTURE: TONTO NATIONAL FOREST - CARLOTTA MINE DRAFT

From January 1, 1993 through March 31, 1993 the Nonpoint Source Unit - Forestry Team received 58 U.S. Forest Service (USFS) project proposals, public updates and final notices of decisions of which seven received substantial review by ADEQ. The Forestry Team was able to conduct five major USDA-FS proposal reviews. The Tonto National Forest - Carlotta Mine Draft EIS was the only silviculture review from the CAAG Region (NPS (I.A., 1993).

NONPOINT SOURCE PUBLIC EDUCATION OUTREACH PROJECT

Passage of the Arizona Educational Act (A.R.S. 15-706) mandates that Arizona's public schools must develop and integrate environmental education into their curricula by FY 93. The Nonpoint Source Unit at ADEQ proposes to develop an Environmental Education Outreach Program to integrate into the public school education curriculum. This project will seek to support educational efforts by instilling a pollution ethic within Kindergarten through twelfth (K-12) grade students in Arizona's public schools (NPS (P.E.O.P.), 1992).

CHAPTER 7.0 DRINKING WATER

INTRODUCTION

In an effort to make the Water Quality Management Plans more comprehensive, this section on drinking water systems has been added. The intent of this new section is to provide some background information on requirements for drinking water systems and needs in the region, to identify possible issues for future consideration and to make some preliminary recommendations towards protecting drinking water supplies and correcting some of the compliance issues.

7.1 FEDERAL AND STATE REQUIREMENTS

7.1.1 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) was passed by Congress in 1974, and has been amended several times since its adoption. The purpose of the Act was to make sure that drinking water supplied to the public was safe and wholesome. To accomplish this goal, the Environmental Protection Agency (EPA) sets national drinking water quality standards, which all water supplied to the public, must meet. The SDWA currently does not provide funds for construction of new water systems or ongoing operation and maintenance.

The requirements of the SDWA apply to all public water systems. In Arizona, the ADEQ has been given primacy for the safe drinking water program. The EPA provides guidance, technical assistance and some funding to ADEQ to run this program.

7.1.2 Classification

The State of Arizona rules define a "water system" as any facility that collects, pumps, treats, stores or distributes water to four or more residential service connections or to nonresidential service connections for uses such as drinking, processing, storing, serving food or drink; bathing or personal hygiene; or for washing clothes. A system that delivers water solely for irrigation purposes is not, by definition, a water system.

Drinking water systems can be classified based on the number of people served by the system and whether the system operates year round. Systems with fewer than three connections are considered domestic or private agriculture systems. Systems with 3 to 15 connections, serving less than 25 persons, are classified as semi-public but are monitored and regulated on an exception basis when a problem occurs. Systems with more than 15 service connections or which serves 25 or more persons, 60 or more days per year are classified as public water supply systems.

Drinking water systems can be further classified as either community or noncommunity systems. Community systems serve 25 or more year-round residents. Non-community systems may be either transient or non-transient, depending on whether the same 25 persons are served for six months or more per year. (See Table 7-1: Water System Service Type)

Table 7-1 Water System Service Type				
Average Population Served				
< 25 or not known				>=25
Primary Service Area	Service Connections < 3	3 > Service Connections < 15	Service Connections > 15	
Residential Houses, mobile home parks with at least 25 annual residents	Domestic Water System	Semipublic Water System	Community Public Water System	Community Public Water System
Semi-Residential Schools, institutions, hospitals, industrial agricultural, daycare centers	Domestic Water System	Semipublic Water System	Nontransient Non Community Public Water System	Nontransient Non Community Public Water System
Transient Recreation areas, service stations, summer camps, restaurants, bars, highway rest areas, hotels, motels	Domestic Water System	Semipublic Water System	Transient Non Community Public Water System	Transient Non Community Public Water System
Other Interstate carrier, wholesaler, bottled or vended with no distribution	Domestic Water System	Semipublic Water System	Other Public Water System	Other Public Water System

SOURCE: ADEQ, 1993

Only domestic water supply systems are not regulated by ADEQ. Private agriculture, public and semi-public water systems are required to comply with drinking water standards, and additional requirements may be required if a standard is violated or a threat to public safety and/or health is identified. Depending on the type of system, additional requirements may be required for certain types of public drinking water systems.

7.1.3 Design, Operation and Maintenance

Public drinking water systems in Arizona require an approval to construct from ADEQ before construction can begin and an approval of construction before beginning service. The system design must meet the minimum criteria set forth in ADEQ's Engineering Bulletin #10. New system requirements include use of backflow prevention devices on all new systems and the retrofitting of older systems by 1994.

Amendments to the Safe Drinking Water Act in 1986 require the filtration and disinfection of surface water supplies and for groundwater under the direct influence of surface water. ADEQ will

determine, on a case-by-case basis, which systems are using groundwater influenced by surface water. New treatment technique requirements are expected, in the future, for the control of corrosion in distribution systems to protect against lead and copper contamination.

State rules require that public water supply and distribution systems must be operated by a certified operator, with the grade and training dependent on the type and size of the system. ADEQ is required to conduct sanitary surveys every five years for community systems and every ten years for non-community systems. Community systems will also be required to have emergency operation plans in effect by January, 1994.

A.A.C. § R18-4-232 requires public water systems to protect their potable water from contamination caused by backflow through unprotected cross connections. Reference is made in that code to the Manual of Cross Connection Control published by the University of Southern California (8th Edition). Policy statements have been published by ADEQ to assist in interpreting the Rule; and those policies are still in effect. The only exception, at this time, is that ADEQ will not require that Class I and Class II Fire Suppression systems, as defined in HB 2111, install Backflow Prevention Assemblies (BPAs), unless a specific public health hazard is identified at a singular location. All other portions of the rule will be enforced.

As the deadline for retrofit has past, ADEQ has begun to draft Consent Orders for those water systems which are not in compliance with the Backflow Program.

7.1.4 Water Quality Standards and Monitoring

There are two types of drinking water quality standards: primary and secondary. Primary standards are health-based and enforceable; secondary standards are based on aesthetics of the water and are non-enforceable guidelines.

Primary drinking water standards may be either Maximum Contaminant Levels (MCLs) or treatment techniques. An MCL Goal is a numerical contamination level with no adverse health effects. The EPA has set MCLs as close to goals as practical, while taking costs and technology into consideration. The MCL is the numeric standards against which compliance or noncompliance is measured. Treatment techniques such as filtration, corrosion control or chlorination are set for contaminants which are too difficult or costly to measure but require protection for public health. Secondary Maximum Contaminant Levels (SMCLs) are associated with the aesthetic quality of the water (e.g., taste, odor, color, clarity).

The SDWA requires sampling and reporting, recordkeeping and public notification for reported violations in all public drinking water supply systems. In Arizona, state drinking water quality standards (MCLs) apply to public, semi-public, and private agricultural water supply systems.

The type and frequency of sampling varies by class and size of system, the specific parameter and whether the water supply is ground or surface water. Community systems must monitor for inorganics, synthetic organics, radionuclides, microbiological and volatile organic compounds (VOCs). Noncommunity systems are only required to sample for microbiologicals and nitrates/nitrites. All public systems, using surface water supplies, must monitor for turbidity. Generally, more frequent monitoring is required for larger systems.

VOC sampling requirements are new since the 1986 amendments to the SDWA. Initial sampling was required to be completed by 1992. Repeat monitoring is required every five years unless the

system's water supply is considered vulnerable to contamination. Vulnerability is based on the number of people served and whether VOCs have been found in the supply.

The 1986 amendments to the SDWA also call for standards and monitoring of increased numbers of contaminants each year. These additional requirements are implemented in Arizona as ADEQ implements new rules.

7.1.5 Proposed MCLs, Monitoring and Treatment Rules and Requirements

The 1986 amendments to the SDWA mandated the development of MCLs or treatment techniques for 83 specific contaminants by June, 1989. EPA began to develop National Primary Drinking Water Regulations in phases based upon the availability of data to support the establishment of MCLs.

Phase I addresses MCLs. In Phase II, EPA regulated concentrations of 38 synthetic organic chemicals, volatile organic chemicals and inorganic chemicals. Final rules established MCLs and monitoring, reporting and public notification requirements for each contaminant. Phase II regulations also introduced the concept of the standardized monitoring framework for regulated contaminants.

Under Phase III, EPA will regulate certain radionuclides. Under Phase IV, EPA will regulate certain disinfection by-products. Under Phase V, EPA regulated 23 inorganic chemicals and synthetic organic chemicals.

ADEQ has proposed state rules to address Phase II through V and adoption of these state rules is projected for November, 1994.

7.2 WATER SUPPLY SYSTEMS IN THE CAAG REGION

There are approximately 300 active public and semi-public drinking water systems in the CAAG region, of which just under 90% are public systems. Table 7-2 shows that Gila and Pinal Counties have roughly the same number of active systems at 154 and 171, respectively. The two counties exhibit similar breakdowns as to types of systems. The greatest proportion of systems in the region are community systems at 45%. Almost one-quarter of the systems in the region are transient non-community; with the balance evenly split between non-transient non-community systems and semi-public systems.

Table 7-2 Types of Active and Inactive Drinking (A/I) Water System in the CAAG Region					
County	Community Public Water System	Nontransient Noncommunity Public Water System	Transient Noncommunity Public Water System	Other Public Water System	Totals
Gila	62	22	49	0	133
A/I	54/8	19/3	45/4	0	118/15
Pinal	137	33	46	10	226
A/I	91/46	21/12	30/16	5/5	147/79
Totals A/I	145/54	40/15	75/20	5/5	265/94

SOURCE: ADEQ 1994

Table 7-3, Systems by Number of Persons Served, provides a breakdown as to the number of water systems by population served. Most drinking water systems in the region are small to very small systems. Over 85% of the systems serve fewer than 500 persons; over half (52%) serve 100 persons or less. Less than 10% of the systems serve more than 1000 persons.

Table 7-3 TYPES OF SYSTEMS 481 Systems Total 304 Active/177 Inactive						
	Semipublic Water System	Community Public Water System	Nontransient Non-commu nity Public Water System	Transient Non-commun ity Public Water System	Other Public Water System	Totals
GILA	19	62	22	49	0	189
ACTIVE/INACTIVE	19/0	54/8	19/3	45/4	0	154/35
PINAL	31	127	33	46	10	292
ACTIVE/INACTIVE	19/12	91/46	21/12	30/16	5/5	171/121
TOTALS	38/12	45/54	40/15	75/20	5/5	303/106
% ACTIVE	12%	45%	13%	23%		

SOURCE: ADEQ 1994

This high percentage of small systems in the region has a direct relationship to the cost of compliance with new regulations and increased monitoring requirements. As stated earlier in the federal and state requirements section of this chapter, systems using surface water supplies must provide filtration and disinfection, regardless of system size. Sampling requirements and frequencies are based on the type of system and only in a few instances are frequencies lower for

system serving fewer people. This makes the per capita cost of compliance much higher for smaller systems.

7.3 REVIEW OF COMPLIANCE DATA

Each year ADEQ publishes Water Quality and Waste Programs Annual Report which summarizes the compliance status of each regulated water and wastewater system in the state. A review of the compliance data for the years 1990-92 indicate that the frequency of some violations is on the decline while other types are increasing. This data is presented in Tables 7-4 and 7-5 by system type and system size.

Table 7-4 Violations by Type of System for Region									
	Community			Transient Non-community			Non-Transient Non-community		
	90	91	92	90	91	92	90	91	92
Certified operator	66%	37%	59%	63%	67%	80%	69%	20%	78%
Operating & Management	21%	14%	16%	25%	32%	16%	25%	16%	15%
Sampling	68%	86%	44%	50%	56%	24%	44%	92%	39%
Quality	86%	7%	8%	51%	9%	7%	50%	8%	-

NOTE: Percentages were determined by dividing total number of violations (by type) by the total number of systems reporting.

(SOURCE: ADEQ WATER QUALITY AND WASTE PROGRAMS ANNUAL REPORT FOR 1990,1991 AND 1992.)

Table 7-5 Violations by System Size for Region										
	< 100		100-500		500-1000		1000-10K		+ 10K	
	91	92	91	92	91	92	91	92	91	92
Certified Operator	39%	78%	46%	68%	33%	60%	-	35%	0%	0%
Operating & Management	27%	23%	14%	13%	0%	0%	7%	4%	0%	0%
Sampling	81%	51%	81%	33%	67%	47%	79%	22%	100%	30%
Quality	8%	11%	6%	4%	11%	0%	14%	4%	30%	30%

NOTE: Percentages were determined by dividing total number of violations (by type) by the total number of systems reporting.

(SOURCE: ADEQ WATER QUALITY AND WASTE PROGRAMS ANNUAL REPORT FOR 1990, 1991 AND 1992.)

The data indicates that the greatest increase in violation type is for lack of certified operators, regardless of system type or system size. Operation and maintenance violations appear to be declining overall for public water systems, but the smallest of systems (serving less than 100 persons) have a higher percentage of problems in this category. Across the region, sampling violations appear to be declining or holding steady. Both the very small and the very large size systems have higher percentages of violations in this area. The percentage of large systems with violations may be related to the number of those systems that are community systems and, therefore, have more sampling and monitoring requirements. Water quality violations appear to be declining in most instances. The larger systems, which test for more parameters, have higher percentages of violations in this category.

7.4 WATER QUALITY PROGRAMS

The majority of water systems in the CAAG region rely on groundwater supplies. For example, currently 100% of the City of Casa Grande's domestic water supply comes from groundwater. According to ADWR, the static water level in the area surrounding Casa Grande is approximately 280 feet and water is being pumped from depths of 400-600 feet. Due to years of groundwater overdraft, a large portion of the City of Apache Junction's drinking water is supplied by the Central Arizona Project (CAP) canal. As the population of the region grows, cities and water companies will need to look at ways of increasing their water supplies to meet demand. At the same time, they must look at ways of protecting this valuable resource.

There are several programs, required under the SDWA and CERCLA as amended by SARA, RCRA, and the HSWA amendments to RCRA, that specifically address groundwater protection. The current program of interest is the Wellhead Protection Program.

The Wellhead Protection (WHP) Program, established by the 1986 amendments to the SDWA, is intended to protect groundwater supplies from contamination and prevent the need for treatment of wells to meet drinking water standards. The WHP is a non-regulatory program that relies on local educational measures to address a variety of potential contamination sources.

Arizona's WHP Program is designed to try and improve groundwater protection through voluntary, cooperative efforts with municipalities and other agencies. Local governments are encouraged to develop their own WHP programs and delineate "wellhead protection areas", as well as to take a more active role in state programs. Arizona's program was approved by EPA in March, 1992.

Wellhead protection areas are those areas which are significant for protection of water quality for drinking water supplies and are identified on a site-specific basis. These may be areas close to wells or major recharge areas for aquifers. Delineation of wellhead protection areas generally requires expertise in hydrogeology.

Some obvious benefits of effective wellhead protection programs include the avoidance of costs that would be incurred if contamination were to occur. The EPA has issued technical guidance documents that include a number of management tools which can be used at the local level to protect drinking water supplies. These include zoning and subdivision ordinances, regulations prohibiting the use of chemicals or hazardous materials or underground storage tanks in certain areas, and public education.

EPA awarded a "Wellhead Protection Demonstration Project" grant to the Gila River Indian Community to model local wellhead protection areas and initiate a WHP program. The tribe initially plans to delineate large zones of contribution for existing wells, to model time-of-travel for

the groundwater, and develop and implement restrictions on land uses. (ADEQ, Annual Section 319 Report, 1992).

Those communities who are using or will begin using Central Arizona Project (CAP) water to augment their drinking water supplies, should investigate the problems associated with CAP water. The different chemical components in Colorado River water delivered to Tucson through the CAP aqueduct has caused some corrosion of preexisting deposits within pipes, water heaters and other appliances. Local communities should look for ways to prepare for and mitigate these problems prior to beginning delivery. Water treatment plants may also be needed in certain areas to improve the taste and quality of the CAP water. These types of capital improvements will require planning and public acceptance prior to commitment.

7.5 SYSTEM VIABILITY

ADEQ defines a viable public water system as one that is "self-sustaining, has a reliable water supply, has the commitment and has the managerial, technical, operational and financial capabilities to reliably meet performance requirements applicable to that system on a long-term basis". (ADEQ, Compliance Assurance Plan, 1991). As regulations become more numerous and costly to implement, it will be increasingly difficult for many systems, especially the small ones, to remain viable.

As stated earlier, additional treatment requirements such as filtration and disinfection or monitoring must be met regardless of system size. This means that the cost of complying with these new regulations is significantly higher for the small systems. Often it is these small systems that have neither the financial or technical resources for achieving compliance or remaining viability.

The region needs to begin examining strategies to deal with this emerging issue. As with wastewater systems, regionalization of facilities helps reduce the costs of operating multiple small systems. Consolidation is another option for small systems in close proximity. State and local level controls which require demonstration of financial, technical and managerial capability for approvals may also be appropriate to ensure viability of new systems. Lastly, as with all program areas, increased effort should be made towards providing public education to existing systems and operators to increase compliance and assist in long-term viability.

7.6 RECOMMENDATIONS

- (1) As with wastewater treatment facilities, monitoring and sampling requirements should be "batched" or grouped by the smaller providers and a "circuit rider" system set up in order to reduce transportation costs. A system is currently in effect with some of the operators, but it can be expanded.
- (2) **ADEQ** should compile a database of all compliance inspection results, in order to provide local government officials current, accurate information about systems in their jurisdiction.
- (3) **ADEQ** should require demonstration of financial and managerial capability prior to giving approval for the construction of new water supply systems.

- (4) **ADEQ, in cooperation with local governments**, should stress the formation of special taxation districts in order to ensure that drinking water supplies are adequate to serve the public.
- (5) Where economic conditions are such that a system's viability is in question, **ADEQ and local government** officials should encourage regionalization and/or consolidation of water supply systems in order to ensure an adequate, safe supply for the public.
- (6) **ADEQ** must continue to provide technical assistance to the smaller providers whenever required and to ensure compliance with existing regulations through technical assistance and inspection visits.
- (7) **ADEQ** should update Engineering Bulletin 10.
- (8) **ADEQ** should encourage the establishment of regional labs to reduce cost of analyzing samples and associated transportation costs.
- (9) **ADEQ** should look at adjusting monitoring and sampling requirements based on the system's size, past sampling performance and source of supply.

7.7 REFERENCES

ADEQ, Annual Section 319 Report for Fiscal Year 1992, October, 1993.

ADEQ, Compliance Assurance Plan, 1991.

ADEQ, "Quick Look Report" for Active Water Systems, April 20, 1993.

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CHAPTER 8 REGIONAL CONTINUING PLANNING PROCESS

Introduction

The purpose of this section is to identify Central Arizona Association of Government's (CAAG's) Regional Continuing Planning Process so the plan can be maintained and updated. This will outline a process to ensure the Water Quality Management Plan (WQMP) remains responsive to changes in and/or adoption of new federal and state laws, regulations and/or programs and describe a process by which local community problems and needs can be addressed by the Water Quality Management Plan (WQMP).

This section will first describe the general history of water quality management planning in the CAAG region; it will outline the responsibilities of the Designated Planning Agency (DPA) and CAAG's role in the planning process; develop a mechanism for CAAG's own continuing planning process to meet the minimum federal requirements for plan amendments, public participation and consistency review and attempt to establish minimum regional requirements for plan amendments and consistency reviews for NPDES, APP and Effluent Reuse Permits; and will describe how plan amendments should be proposed and implemented.

8.1 HISTORY OF WATER QUALITY MANAGEMENT PLANNING IN THE CAAG REGION

On April 26, 1976, Governor Raul Castro designated the Central Arizona Association of Governments (CAAG) as the areawide Water Quality Management Planning agency for Gila and Pinal Counties and the incorporated cities and towns of Apache Junction, Casa Grande, Coolidge, Eloy, Florence, Globe, Hayden, Kearny, Mammoth, Miami, Payson, Superior and Winkelman. According to the 1990 U.S. Census, this area has a population of 156,595 and encompasses approximately 10,096 square miles.

CAAG applied for a grant from the Environmental Protection Agency (EPA) to develop a Water Quality Management Plan (WQMP) for the region as required under Section 208 of the 1972 Clean Water Act (CWA). This plan was completed in October, 1978 and last updated in 1990.

A comprehensive update to the Areawide Water Quality Management Plan is now essential for Waste Water Treatment Facility planning, nonpoint source pollution control and general water quality management planning. Many changes have occurred since the last revision to the plan and in addition, it is becoming clear that issues such as solid waste management, nonpoint source pollution, large scale use of septic systems and the need for alternative on-site disposal methods should be addressed on a regional basis.

8.2 PARTICIPANTS IN THE WATER QUALITY MANAGEMENT PLANNING PROCESS IN THE CAAG REGION

8.2.1 Designated Planning Agencies

Responsibility for water quality management planning is shared by a wide variety of federal, state, regional and local agencies. The Arizona Department of Environmental Quality (ADEQ) is the lead agency for achieving the mandates of the CWA and SDWA and is identified in the Environmental Quality Act (EQA) as the state planning agency for environmental quality management programs and state wastewater management authority. In order to accomplish state WQM goals, ADEQ depends upon and encourages the participation of all interested and affected entities in the region.

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The ADEQ can extend WQM responsibility to other agencies through its local delegation authority (A.R.S. § 49-107). "Delegation" is the authorization of one agency to act as the representative agent for another. The Director of ADEQ may delegate to a local environmental agency, health department or municipality or a county board of health, any functions, powers or duties which can be competently, efficiently and properly performed by the local agency. The local agency must accept the delegation and agree to perform according to the standards of performance required by law and ADEQ.

As stated earlier, in 1976, CAAG was appointed by the Governor to serve as the Designated Planning Agency (DPA) for the entire two-county region of central Arizona. A DPA is an established local, regional, state or federal agency or another entity with adequate resources, authority and desire to assume responsibility for WQM planning activities in a particular area.

As the regional Designated Planning Agency, CAAG's responsibilities include revisions to the Areawide Water Quality Management Plan; consistency reviews for proposed wastewater treatment systems in the CAAG area coordinated with the Arizona Department of Environmental Quality; provision of technical assistance to its member entities, coordination with related state agencies on water quality issues, participation in the Water Quality Management Working Group (WQMWG), public participation efforts and conducting special studies at the request of CAAG's member entities.

CAAG fulfills its water quality planning mission with the aid of the CAAG Environmental Planning Committee (EPC). The Committee is composed of representatives from the two-county region who have a working knowledge of water quality concerns and issues in the area. Non-voting members of the committee may include the general public, special interest groups or representatives from industry. All meetings are open and noticed to the public. Members of the Environmental Planning Committee may be nominated by any voting member, petitioned through CAAG, CAAG's Management Committee or CAAG's Regional Council. The Environmental Planning Committee meets at least quarterly and may meet more often if a need is identified. The committee discusses environmental issues and makes recommendations to CAAG's Management Committee and CAAG's Regional Council.

As the Designated Planning Agency (DPA) CAAG has the responsibility to ensure that the Council of Governments (COG) and its member entities remain involved in development of laws, regulations and programs affecting water quality management planning throughout the region. The regularly scheduled meetings of the Environmental Planning Committee will serve as a vehicle to:

1. Provide information on proposed legislation, rules, regulations and programs to affected parties in a concise, understandable summary with an evaluation of potential impacts.
2. Provide input to legislators, regulators and managers using individual/agency input and develop a regional position if appropriate.
3. Identify areas where existing laws or programs should be changed or where new programs are needed.
4. Disseminate information on adopted laws and regulations and provide clear, concise, understandable information to affected parties. Summarize requirements for implementation with schedules for compliance.

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All recommendations are forwarded to the Management Committee for their review before presentation to the Regional Council. The Management Committee may approve, disapprove or amend the proposed recommendations prior to review by the Regional Council.

8.2.2 Designated Management Agencies

Several of the member entities of CAAG play a particularly important role in the planning process as Designated Management Agencies (DMAs). A Designated Management Agency is an entity with adequate resources, authority and a desire to implement and enforce portions of the Areawide Water Quality Management Plan. The Governor, in consultation with the Designated Planning Agency, designates DMAs for specific areas. The DMAs in CAAG vary in their specific characteristics and capabilities but all are required to maintain:

- Appropriate legal authority to carry out designated responsibility.
- Financial solvency including, if appropriate, the ability to raise revenue through taxes or fee collection, the ability to accept grants or funds from other sources for water pollution management purposes and the ability to incur short- and/or long-term indebtedness for water quality management.
- Administrative competence with the organizational resources, personnel resources, equipment and facilities necessary to provide administrative and management support required for effective water quality management programs.
- Technical competence with the personnel resources, equipment and facilities needed to carry out the required technical water quality management activities.
- Public acceptability so that the Designated Management Agency will be recognized and accepted as a legitimate entity with the appropriate water quality management mission within its management area.
- Political accountability so that the leadership of the management agency is accountable to the public served within the agency's management area.

The 1978 Plan stated that one of the fundamental responsibilities of the WQM Plan is to identify and designate DMAs for publicly-owned waste treatment works in the region. The Plan should also identify the service area for which the DMA will accept responsibility. Based on the criteria above, the only agencies that qualify for DMA status are municipalities, sanitary districts and some improvement districts. Historically, the DMA designation has primarily referred to large scale point source dischargers and Waste Water Treatment Facility management.

8.2.3 Designation Process

An eligible entity desiring DMA status is required to hold a public meeting in the affected area regarding the designation to become a DMA, consistent with SWA 40 CFR 25. The governing body of the DMA would then pass a resolution requesting DMA status. Such resolution must be passed at a public hearing requiring a legal notice. The entity submits the designation package to CAAG with a self-certification letter which states that the entity possesses the financial,

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administrative, managerial and technical capabilities to carry out the responsibilities and a map showing the service area.

CAAG's Environmental Planning Committee will review this request at one of its regularly scheduled meetings and make a recommendation to CAAG's Management Committee and Regional Council. Final regional approval rests with the Regional Council.

CAAG's 1978 WQM Plan identified and granted DMA status to ten entities responsible for wastewater treatment known as publicly owned treatment works. Each of these met the criteria listed in Section 208(c)(2). Since 1978, three entities have been granted DMA status through the Plan Amendment process. This Plan recommends the designation of additional management agencies through the Plan Amendment process to carry out areawide wastewater management.

The existing municipalities with Designated Management Agency status within the CAAG Region are: Apache Junction (delegated through the Superstition Mountain Community Facilities District), Coolidge, Eloy, Globe, Miami, Hayden, Mammoth, and Florence. The Sanitary Districts with Management Agency designation are Arizona City, Cobre Valley, Northern Gila County, Oracle, Payson and Pinal.

8.2.4 Planning Implications, Designated Management Agencies

The majority of waste water treatment facilities in the CAAG Region are managed by non-municipal agencies, including private investors and federal, state or other public agencies. These are not eligible for management agency designation according to Section 208(b) of the CWA. However, organizations who are eligible for management agency designation that have not yet received designation at this plan update, will be encouraged to follow the procedure outlined in this document.

Other organizations in the region are interested in the water quality planning process, what changes to the WQM Plan are needed in their particular area of concern and how the process affects lands under their jurisdiction. Public agencies include the NRCs, RC&Ds, public land managers and private organizations such as the Nature Conservancy. The region should look toward expanding its customary definitions of DMA to include these other agencies and entities in their appropriate areas of interest and expertise.

8.3 CONSISTENCY REVIEW GUIDELINES

Consistency reviews for water quality management planning are performed to help improve the coordination and integration of federal, state and local programs and permitting activities that regulate pollution prevention for both point and non-point sources. As outlined in Section 2, various federal and state laws, regulations and programs require water pollution control actions to be consistent with the areawide Water Quality Management Plan. As changes occur in federal and state laws and programs, the plan must also be updated to be consistent with these laws and programs.

Federal and state laws require consistency review for certain activities including individual facility permits, approvals to construct, subdivision approval and projects seeking funding through the State Revolving Fund (SRF). The WQM Plan is the reference document used to ensure that activities such as awarding of the State Revolving Fund loans, construction of waste water treatment facilities and the issuance of National Pollution Discharge Elimination System (NPDES) permits are consistent with the region's water quality management planning goals. Proposed

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actions which are found to be inconsistent with the WQM Plan are required to be modified to be consistent with the existing Plan or the Plan must be amended.

Consistency review is currently performed by ADEQ with input from CAAG as needed. ADEQ is the decision-making body for consistency determination but CAAG is formulating recommendations that will more involve the COG in this process. Implementation of these recommendations would require both the delegation of authority by the State to CAAG and amendment of this Plan.

Consistency review should start at the local or regional level with regional input to ensure areawide goals are implemented. The DPAs or DMAs should provide technical assistance and recommendations concerning the project to ADEQ. Potentially controversial requests could be taken to the Environmental Planning Committee and/or the Regional Council as needed. Proposed actions found to be inconsistent may require a plan amendment.

Plan amendments and consistency reviews can be time consuming and the required public participation process further adds to these costs. The region should improve the current fee structure for technical assistance and consistency reviews to non-member entities as a means of recouping some of these costs.

8.3.1 Planning Implications, Consistency Review

Consistency review requirements will require all governmental officials be aware of the provisions of the regions' WQM Plan, as they may find themselves in a position of being requested to make a decision regarding development of an area within their jurisdiction that would require a plan amendment. This could conceivably slow the development process. Secondly, if CAAG becomes more involved in the consistency review process, it needs to avoid potential conflicts of interest in funding an inconsistent proposal and then charging a fee to process an amendment. Lastly, at present, consistency review is only required for certain activities, i.e. NPDES permits and approval to construct and operate certain types of wastewater facilities. Central Arizona Association of Governments (CAAG), working together with ADEQ, could require consistency review for all facilities requiring permits to include reuse permits and APPs in order to keep the Environmental Planning Committee involved and aware of all water quality matters in the region.

8.4 PLAN AMENDMENT PROCESS

8.4.1 Conditions Which Require a Plan Amendment

Amendments to the region's Water Quality Management Plan may be required for any of the following:

1. New WQM planning and/or management agency designations.
2. New or renewed National Pollution Discharge Elimination System (NPDES) permits, Aquifer Protection Permits (APP) or any other type of water quality permits that are found to be inconsistent with the existing WQM Plan.
3. When changes occur in the service area, planning area boundaries and/or population figures used in the current Waste Water Treatment Facility (WWTF) plans or WQM Plan.
4. For proposed construction and permitting of a WWTF, regardless of the funding source, which is inconsistent with the existing WQM Plan.

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5. Construction activities or expansion of existing WWTFs and changes in effluent discharge method and/or quality of the effluent discharged.
6. Changes in or adoption of the site-specific water quality standards occur, TMDLs or other major changes affecting water quality planning in the region.

In addition, if there are regional instances when a plan amendment is necessary or some type of enforcement action is required, CAAG will consider this as part of the plan update. The following are examples of instances that might require a WQM Plan amendment:

1. When ADEQ enforcement actions are taken without the prior written notification of CAAG and/or when such actions are inconsistent with the current WQM Plan.
2. When new rules, regulations, standards and/or policies are determined to cause substantial and burdensome economic consequences to a DMA as defined by the Regulatory Flexibility Act of 1980.
3. The plan amendment process will be initiated when a system reaches 85% capacity and should commence a preliminary design and engineering study.

Central Arizona Association of Governments is a regional planning organization and therefore, has no enforcement capabilities. Enforcement will be difficult if not impossible in some instances. The member entities may have to enact local ordinances and zoning regulations to bring about changes. Actual enforcement of these regulations will fall to the jurisdictions and the state.

This plan update has been designed so that much of the information, figures and statistics that change frequently can easily be changed. These are provided in an appendix format. These appendices can be updated by the COG as needed without going through a formal amendment process to change the body of the plan. This change in format is intended to make the plan more flexible and to streamline the amendment process.

8.4.2 Plan Amendment Process

The formal amendment and approval process for the region's Water Quality Management Plan is outlined in the ADEQ "Continuing Planning Process (April, 1993). The general amendment process in the CAAG region is as follows:

8.4.2a Request and Amendment Process

1. A request for a WQM Plan amendment is prepared by the appropriate Designated Management Agency (DMA) or facility owner. Developers or other non-DMA entities should go to the local political jurisdiction or DMA to obtain sponsorship of the amendment request. Sponsorship is required for regional consideration of the request but does not necessarily guarantee endorsement by the sponsoring agency.
2. The amendment author coordinates the preparation and content of the draft WQM Plan amendment with CAAG, affected local government officials and the DMA, if applicable. These entities can provide input on the technical aspects and completeness of the plan amendment. ADEQ should also be consulted throughout the process.

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8.4.2b Regional Review and Approval Process

1. In order to facilitate the formal required review, CAAG will provide ADEQ with a copy of the draft amendment and checklist no later than 30 days prior to the public hearing. The DPA and ADEQ staff will work together, as resources allow, to identify and resolve issues prior to the close of the public review period.
2. Whenever possible, the regional review process will incorporate input from federal, tribal and state landowner especially when they adjoin the proposed planning service area or are affected.
3. Consistent with SWA 40 CFR 25, public participation requirements, CAAG will conduct a local public hearing on the plan or plan amendment with a notice at least 45 days prior to the hearing. Amendment materials must be available for public review at least 30 days before the hearing. CAAG will be responsible for the preparation of a transcript of the hearing and provide personnel to accomplish this.
4. CAAG will coordinate the review and approval of the plan/plan amendment. A packet consisting of the proposed amendment, documentation of the public participation process and the responsiveness summary will be submitted to the Environmental Planning Committee for review and recommendations. Amendments, including the Environmental Planning Committee's recommendation, will be forwarded to CAAG's Regional Council for their review and decision.

8.4.2c State and Federal Review and Approval

1. After regional approval, CAAG will present the plan/plan amendment to the state Water Quality Management Working Group (WQMWG). The Working Group, after reviewing the document and the public participation process involved, makes a recommendation to the Director of ADEQ concerning amendment adoption.
2. CAAG will submit the responsiveness summary for the public hearing, as well as the plan/plan amendment, verification of appropriate approvals, self-certification letter and the completed checklist to ADEQ for formal review. Within 30 days of submittal ADEQ will review the plan/plan amendment for consistency with federal and state laws and regulations and state procedures.
3. Once the amendment is approved by the ADEQ Director, the plan/plan amendment is submitted to the Governor for state certification that the amendment has been incorporated into and is consistent with the state WQM Plan.
4. ADEQ will submit all certified areawide WQM Plan amendments affecting federally-funded waste water facilities, water quality standards and other federal water programs to EPA for review and approval. The submittal to EPA includes the amendment, all necessary approvals and certifications, a summary of public participation activities, including documentation of local public hearings and a responsiveness summary.

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8.4.3 Planning Implications, Plan Amendment Process

It is recognized that counties and municipalities may have developed their own water quality plans and may amend these plans in such a way that they would, at that time, be inconsistent with the regional plan. Environmental Planning Committee members are encouraged to coordinate with offices of the governmental agency they represent to ensure that local plans and ordinances, where they exist, are consistent with the area Water Quality Management Plan. If these local plans are subsequently amended in such a manner that they conflict with the regional plan, it is incumbent upon the Environmental Planning Committee member to offer the appropriate amendment to the area plan in order to ensure consistency between the two plans. A general reconciliation between all local water quality plans and the regional plan will take place during scheduled comprehensive updates of the plan.

The plan amendment process is currently at no cost for all CAAG member entities and consultants doing work under contract for CAAG members. The region should update fee schedules for charging private developers and consultants for the plan amendment process. Updated fee schedules for plan amendments, consistency reviews and ancillary activities should be developed by CAAG and presented to the Regional Council for review and approval.

8.4.4 Public Participation in the WQM Process

One of CAAG's responsibilities as the Designated Planning Agency for Gila and Pinal Counties is to provide opportunity for public participation and public input into the WQM process. Public participation requirements include the following:

1. Holding public hearings on all revisions to the WQM Plan.
2. Maintaining at least one set of documents relevant to the appropriate WQM Plan in a location which is accessible to the public.
3. Developing, maintaining and utilizing a notification list of persons or organizations interested in or significantly affected by the WQM Plan and amendments.
4. Publishing public notices 45 days before hearings. Notification may be reduced to 30 days or waived in some circumstances upon EPA approval.
5. Making relevant documents available at least 30 days before hearings.
6. Keeping records of public hearings.
7. Developing a responsiveness summary for each public hearing.

Central Arizona Association of Governments (CAAG) should encourage informal public meetings early in the WQM Plan amendment process so that public views and concerns may be considered during the planning process.

8.5 WQMP MAINTENANCE AND UPDATE PROCESS

8.5.1 Financing the Update of the WQM Plan

When the 1978 WQM Plan was developed, federal funds financed the planning effort and these funds were expected to be available in the future for plan implementation. However, funding has become very limited and is not expected to be readily available for water quality planning implementation during the 1990s.

Because of limited financial resources, updating existing WQM Plans may be difficult, but at a minimum, a plan update should occur biannually. Such an update should take into consideration and incorporate changes in population, economic growth, new rules and regulations, new treatment technologies, changes to the water resources in the region, new funding sources and successful mitigation of problem areas.

It became apparent during the review of the 1978 WQM Plan and the 1980 updated plans that if plans are not updated on a regular basis, they soon become so outdated that they are clearly not consistent with goals of the region or with state rules and policies. Applications for new facilities and construction projects could be approved by ADEQ, even though they would not be supported by the region's governing bodies.

As the Designated Planning Agency (DPA) for the region, CAAG is responsible for plan amendments and revisions and must ensure that a process is in place to accommodate them. Currently, ADEQ has some limited funding in the form of a 604(b) grant funding which will provide for basic water quality planning for the region. The basic activities would include baseline planning, public involvement and participation, consistency reviews and the compilation of information for periodic updates of the plan. CAAG must develop a mechanism that will efficiently use limited resources and incorporate the elements identified above.

With federal and state pass-through funding diminishing, CAAG must also actively pursue new funding sources in order to continue water quality planning in the region. If no outside source of funding can be identified, CAAG must determine if the member entities are willing to fund the planning process through some type of assessment or fee schedule.

Other avenues of funding that should be explored include: increased assessments for all member entities specifically earmarked for water quality planning activities; fees for processing plan amendments to include some type of reduced fee structure for CAAG member entities; actively seeking other federal grant funds for water quality and other environmental grants to include air quality funds.

8.5.2 Planning Implications, Finance and Update of the WQM Plan

Funding for the Water Quality Management process will continue to be an issue. If water quality planning is to continue, CAAG must look at financing alternatives other than solely federal and state funding.

Plan amendments and consistency review can be time consuming and the required public participation process further adds to these costs. Some mechanism needs to be developed to recover these costs. Member entities already pay yearly assessment dues and would most likely balk at the prospect of an increased cost for services they perceive as having little or no tangible benefit. The majority of the cost should be incurred by the agency, entity, private developer or

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individual that will receive the most benefit from an amendment. Additionally, increased information and publicity of the effort that goes into water quality planning for the region and the benefits to the region, both tangible and intangible, should be fostered at all Management Committee and Regional Council meetings.

8.6 RECOMMENDATIONS

8.6.1 Designated Management Agencies (DMAs); as amended

Reaffirmation of Designations Made in 1978 Plan:

- (1) **Natural Resource Conservation Districts (NRCs)** are designated to identify excessive erosion and sediment areas within their boundaries, assist in the development and implementation of best management practices and develop an educational program to encourage land and water conservation.
- (2) **Growers and turf managers** within the NRC are encouraged to request the services of the Irrigation Management Service in the Pinal AMA, and the Water Conservation Management Program, in AMA (both of which are funded by ADWR), to their irrigation water management skills.
- (3) **Public land managers** are designated as responsible for the management and control of all point and nonpoint sources of pollution originating on lands under their jurisdiction. These land managers are also responsible for development of technical assistance and educational programs to inform users of BMPs on those lands.
- (4) **Private landowners** are designated responsible for control of any point or nonpoint sources of pollution discharged from their lands.
- (5) **Counties and incorporated municipalities** are designated responsible for enforcing existing ordinances and regulations regarding activities on private lands.

New Designations:

- (1) The Plan recommends that the **Resource Conservation and Development Districts (RC&Ds)** are designated responsible for identifying, measuring, prioritizing and planning for the abatement of nonpoint sources of water pollution originating on private, non-Indian lands.
- (2))All eligible entities currently performing duties as a **DMA** should be so designated.
- (3) **ADEQ, in cooperation with CAAG**, should look at expanding the use of the DMA designation to include federal, other public and private agencies that have the desire and technical expertise to perform the function.
- (4) **Local governments** should ensure that guidelines are available to assist rural communities in forming sanitary and improvement districts and provide technical advice and assistance to such entities when requested.

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8.6.2 Consistency Review Process

- (1) **ADEQ, in coordination with CAAG**, should continue to make final determinations of consistency with the CAAG Areawide Water Quality Management Plan.
- (2) **CAAG** should review plans and permits for consistency and supply information and other technical reports to ADEQ for use in their determination of consistency.
- (3) The **CAAG Environmental Planning Committee** should take a larger role for the region in the consistency review process and make recommendation to the CAAG Management Committee and the Regional Council.
- (4) **CAAG** should consider establishing fees for services to applicants for technical assistance and consistency reviews.

8.6.3 Finance and Update of the WQMP

- (1) **CAAG** should develop a schedule of fees for processing plan amendments and consistency review. CAAG should also ensure that these costs are recovered and go back into water quality planning activities for the region.
- (2) **CAAG** should review the activities of the region's Environmental Planning Committee at each Management Committee and Regional Council meeting to ensure that elected officials and administrators remain informed and involved with the planning process.
- (3) **CAAG** should research other possible funding sources for water quality planning and pollution prevention activities in the region. These include loans and grants from CDBG, FmHA, DEA and the RCAC. Could also include a grant from the Pinal or Phoenix AMA out of the Conservation Assistance Augmentation funds.
- (4) **ADEQ**, should fund a full time environmental planner position at each of the COGs to establish effective water quality planning for the state.