

**ARID WEST WATER QUALITY
RESEARCH PROJECT**

QUALITY ASSURANCE PROJECT PLAN

**For
U. S. ENVIRONMENTAL PROTECTION AGENCY
ASSISTANCE AGREEMENT/AMENDMENT
ID NO. XP999267-01-1**

TABLE OF CONTENTS

SECTION

DEFINITIONS/ABBREVIATIONS

A. PROJECT MANAGEMENT

A.1 WQRP Organization/Chart

A.2 Problem Definition/Background

A.3 Project Description

A.4 Data Quality Objectives and Criteria

A.5 Special Training and Certification

A.6 Documentation and Records

B. MEASUREMENT AND DATA ACQUISITION

B.1 Sampling Process Design (Experimental Design)

B.2 Sampling Methods

B.3 Sample Handling and Custody

B.4 Analytical Methods

B.5 Quality Control Requirements

B.6 Instrumentation Testing, Inspections and Maintenance

B.7 Instrumental Calibration and Records

B.8 Supplies and Consumables

B.9 Data Acquisition, non Direct

B.10 Data Management

C. ASSESSMENT/OVERSIGHT

D. DATA VALIDATION AND USABILITY

REFERENCES

APPENDIX I RESPONSES TO RESEARCH NEEDS SURVEY

APPENDIX A QIWP TEMPLATE

DEFINITIONS/ABBREVIATIONS

The following definitions/abbreviations are included to ensure clarity of understanding when reading this document.

DQO -- A Data Quality Objective is a qualitative and/or quantitative statement that defines the intended use of data, explains the kind of data needed, identifies the data collection conditions and parameters, and specifies tolerable limits to minimize uncertainty errors in the data.

EPA -- Environmental Protection Agency.

EPO -- EPA Project Officer.

ESA -- Endangered Species Act.

FWS -- Fish and Wildlife Service.

GIS -- Geographical Information System.

MDL -- Method Detection Limit.

PCWWM -- Pima County Wastewater Management.

PM -- Project Manager for the Arid West Water Quality Research Project.

PQL -- Practical Quantification Limit.

QA -- Quality Assurance is an overall system or strategy for ensuring that the research plan is of adequate quality.

QAC -- Quality Assurance Consultant for the Arid West Water Quality Research Project.

QAM -- EPA Region 9 QA Manager.

QAPP -- Quality Assurance Project Plan is the Pima County document that follows EPA guidance for oversight, review and evaluation procedures for the Arid West Water Quality Research Project.

QC-- Quality Control refers to the specific procedures to be followed at every stage of a research project, including realignment mechanisms to correct unforeseen events.

QIWP -- Quality Integrated Work Plan (QIWP) is the QA/QC document that CONTRACTORS will write and follow to assist them with planning, managing and implementing their research.

RFP -- Request for Proposal.

RM -- Research Manager for the Arid West Water Quality Research Project.

RWG -- Regulatory Working Group for the Arid West Water Quality Research Project.

SAG -- Scientific Advisory Group for the Arid West Water Quality Research Project.

SOP -- Standard Operating Procedure is an officially approved document detailing step-by-step procedures to perform certain routine or repetitive tasks.

TSA -- Technical Systems Audit is an on-site evaluation of all aspects of a project including equipment, training, record keeping, data validation and reporting.

WET -- Whole Effluent Toxicity.

WQRP -- Arid West Water Quality Research Project directed by Pima County.

USGS -- United States Geological Survey.

**QUALITY ASSURANCE PROJECT PLAN
FOR
ARID WEST WATER QUALITY RESEARCH PROJECT
A. PROJECT MANAGEMENT**

A.1 WQRP ORGANIZATION/CHART

The organization chart (Figure 1) shows the flow of work products and communications. Roles and responsibilities of the individuals represented in the chart are explained in the following paragraphs. Throughout the QAPP narrative, the organizational positions responsible for review and decision actions are shown in upper case letters.

The form of the EPA grant is a cooperative agreement; thus there is substantial participation of EPA in the direction and operation of the Project.

The **EPA REGION 9 QA MANAGER (QAM)** approves the WQRP QAPP and provides continuing advice to the EPA PROJECT OFFICER. The QAM also communicates informally with the WQRP QA CONSULTANT (QAC).

EPA PROJECT OFFICER (EPO). The EPA participation normally flows through the EPO who is the primary liaison between EPA and Project personnel. The EPO also communicates directly with the WQRP's PROJECT MANAGER.

The **DIRECTOR**, Pima County Wastewater Management Department (PCWWM), Mr. George A. Brinsko, has overall responsibility for the implementation of the grant, as well as all other activities of the Department, including conformance with EPA and state NPDES requirements. These responsibilities are directly related to the research objectives of the grant, and consequently the DIRECTOR approves all major activities of the grant. The DIRECTOR also serves as Chair of the REGULATORY WORKING GROUP (RWG).

The EPA award document identifies Ms. Kathleen Chavez, an official of PCWWM, as **PROJECT MANAGER (PM)**, in effect the equivalent of principal investigator in the terms of the usual EPA research grant. The PM interacts directly with the EPO. The PM directs all the activities of the Project. The PM is assisted in administering the activities of the Project by the RESEARCH MANAGER (RM), the QAC and Staff. The PM will present the draft QAPP and updates to the EPO for review and approval. The PM will recommend award of research contracts to established scientific and technical entities (CONTRACTORS) for approval by the DIRECTOR. The PM will decide how to address resolution of QA/QC problems with advice from the RM.

The **RESEARCH MANAGER (RM)**, supported by Staff will provide support and assistance to the PM in developing technical information, evaluating research results, preparation of scientific articles, and preparation of implementation reports. The RM will advise the PM on how to address resolution of any QA/QC problems. The RM will manage all activities of the SCIENTIFIC ADVISORY GROUP (SAG) and will interact as needed with the RWG to keep them informed of current research activities and to ensure them that the program is meeting EPA

standards on an on-going basis. The RM will be the primary link between the PM and the CONTRACTORS, ensuring that the research projects are being implemented in accordance with each CONTRACTOR'S Quality Integrated Work Plan (QIWP). The RM will evaluate research progress and products and will communicate informally with principal investigators of each contract. The RM, in cooperation with the QAC, will review and approve any non-standard methods submitted by the CONTRACTORS.

The **QUALITY ASSURANCE CONSULTANT (QAC)** is an individual independent of and separate from the PCWWM Department. The QAC will report directly to the PM and informally to the QAM. The QAC will prepare updates to the WQRP QAPP and prepare QIWP templates for each study. The QAC will communicate informally with designated QA/QC individual(s) of each CONTRACTOR organization to assist them in understanding QA/QC requirements. The QAC will review QA/QC plans submitted by CONTRACTORS and advise the RM and the PM of the adequacy of each plan. The QAC will review the data generated by the research contracts and advise the PM and the RM of adequacy or problems, and recommend approaches to solve problems. The QAC, in cooperation with the RM, will review and approve any non-standard methods submitted by the CONTRACTORS. The QAC will review and provide a written critique for the SAG and RM discussing consistency between QA/QC methodologies from different team members or CONTRACTORS.

The **REGULATORY WORKING GROUP (RWG)** advises the DIRECTOR regarding research needs from a regulatory perspective. The RWG will review WQRP's Requests for Proposals (RFPs) and may assist in the review of research proposals submitted by the CONTRACTORS for regulatory significance. Two EPA officials are members of the group: one from Region 9 and one from EPA headquarters. Members of the RWG represent a cross-section of principal data users and decision makers. Data generated from research also will be made available publically, and through publication in technical journals, to other stakeholders who desire to use research results to support regulatory decisions and proposals.

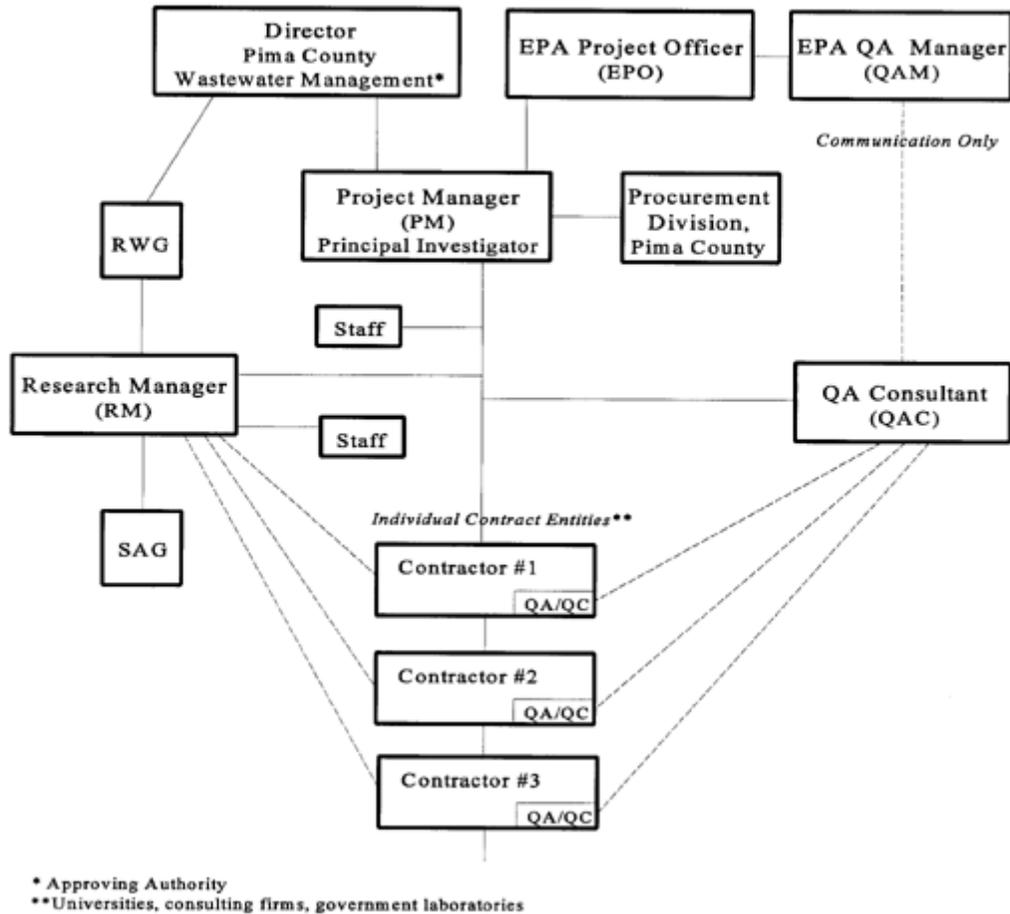
The **SCIENTIFIC ADVISORY GROUP (SAG)** members are solicited and selected according to procedures used by EPA, NSF, and NIH as administered by the PROCUREMENT DIVISION. The SAG will review research proposals submitted by CONTRACTORS for scientific merit. The SAG will provide advice on research needs and approaches and will assist in review of the research products.

The **PROCUREMENT DIVISION** will solicit proposals by publishing request for proposals (RFPs). The PROCUREMENT DIVISION administers the research contracts awarded to the selected CONTRACTORS after award of the contracts is finalized. The PROCUREMENT DIVISION also will administer the selection process according to procedures used by EPA, NSF, and NIH in the solicitation and selection process of SAG members.

The **CONTRACTORS** are independent research entities. Each CONTRACTOR will submit a research project plan that includes a QIWP to the appropriate representative of WQRP. The CONTRACTOR must specify all research and QA/QC methods to be used in the course of their project. If, after review by the RWG, SAG and PM, the plan is accepted, the CONTRACTOR

will be funded to carry out the defined research project and will report to the RM or his designee. The CONTRACTORS will issue Technical Progress Reports during the course of the Project.

WQRP ORGANIZATIONAL CHART



A.2 PROBLEM DEFINITION/BACKGROUND

Water quality regulatory agencies, wastewater dischargers, and other stakeholders in the use of scarce water resources in the arid and semi-arid western states have felt for years that the national EPA regulatory approaches need to be revised or replaced by methods appropriate for the ecosystems and flow characteristics of western streams, especially ephemeral and effluent-dependent watercourses. The main characteristic that limits or modifies beneficial uses of ephemeral streams is that flow occurs only in response to storm events, and the stream bed is dry most of the time. This limits water uses, and creates ecosystems different than the ones associated with perennial streams in other parts of the Nation, for which EPA criteria and standards may be more applicable. The rationale for the Project was described in more detail in a

report (Baumgartner *et al.*, 1993), based on a study funded by PCWWM. This report describes the programmatic relevance, the uncertainties and conflicts that need to be resolved, and useful research approaches. Information on the nature of the problem was provided in approximately 100 literature citations. (The citations are available on the web site for the project: www.co.pima.az.us/wwm/wqrp). The research objectives proposed at the time are consistent with EPA's current efforts to improve the applicability of standards, given the special environmental circumstances of individual ecosystems, watersheds, and ecoregions (EPA, 1998b).

To update the 1993 report with specific expressions of need, PCWWM conducted a survey in late 1993 and early 1994 to determine the types of criteria and standards problems stakeholders were facing. Research needs received from ten municipalities, six states, EPA Region 9, and five other entities were grouped into three technical categories: chemical criteria, ecological criteria, and Whole Effluent Toxicity (WET) testing, and a category dealing with regulatory policy and implementation guidance. A sample of the needs expressed by the respondents is provided in Appendix I. The needs were discussed and prioritized at a WQRP research planning conference attended by stakeholders and RWG members. A summary of the proceedings has been published (PCWWM, 1997).

A.3 PROJECT DESCRIPTION

The Arid West Water Quality Research Project (WQRP) is conducted by PCWWM (Tucson, Arizona) under the terms of a cooperative agreement with the U.S. Environmental Protection Agency Regional Office 9 (San Francisco, California) to improve the scientific basis for water quality criteria and standards, and other regulatory approaches, for the arid and semi-arid sections of the 17 western states. Emphasis will be on ephemeral and effluent-dependent streams, and will address permitted stormwater discharges, wastewater effluent discharges, and industrial discharges. The research tasks will be conducted primarily through contracts issued by Pima County to qualified institutions. Research proposals will be evaluated for scientific merit by a scientific advisory group (SAG), and for regulatory significance by a regulatory working group (RWG), to assist PCWWM in making funding decisions. The Project is funded through October 2000.

The Project will support research on habitat characterization, development and improvement of chemical, physical, and biological criteria, and improvement of WET testing. Other topics for research can be considered based on issues presented at periodic conferences to be arranged by the Project. Periodic updates to the research agenda and progress of research underway will be communicated to interested parties through the Internet web site (www.co.pima.az.us/wwm/wqrp).

The types of data that will be generated by the various research contracts will include field and laboratory measurements and observations, and laboratory dose-response measurements and observations. Survey and implementation reports will use data generated in the Project as well as published literature data.

Field data will result from determinations of physical, chemical, and biological characteristics of watercourses and the immediately adjacent riparian habitat. Data will be obtained in dry and wet seasons, and possibly in transition periods. Data will be required to support several regulatory applications: differentiation of ephemeral and effluent-dependent habitats of the study region from habitats of perennial streams in regions of the country with greater rainfall, characterization of the habitats of representative watercourses within subsets of the study region, establishment of the basis for assessing impacts at a site compared to reference sites, and development of the ability to attribute the variation of site condition measurements over time to anthropogenic and natural causes. Well established techniques will be used to collect a majority of the field data using methods developed and accepted by EPA, FWS, Forest Service, and USGS. In some cases state agencies have developed methods specifically tuned to state environmental conditions and resources. CONTRACTORS shall specify the methods they will employ and will submit each method in written form. In cases where modifications to standard methods are proposed, CONTRACTORS will have to justify their methods and receive approval from the QAC and the RM before proceeding.

Laboratory data will result from toxicity bioassays performed on simulated and actual wastewater samples using animal and plant species from field study sites and surrogate species. Chemical analysis of waters from the study sites and from laboratory bioassays will be conducted. Laboratory analysis of field samples will yield data on mineral, plant, and animal species richness and diversity, among others. As with the field data collections, standard methods of biological and chemical laboratory analyses will be employed. Suggested methods will be included in each RFP published by the PROCUREMENT DIVISION.

There are qualitative and quantitative technical quality standards and criteria for use of the data collected in the WQRP research contracts. This will require professional judgement by the RM based on a critical review of each contract proposal. In addition, CONTRACTOR proposals will be expected to demonstrate knowledge of and adherence to data criteria of individual state and regional regulatory offices, and recommended performance criteria listed in the appropriate methods manual. The QAC will assess this in advance of SAG review to highlight criteria and methods that might require specific attention in the review. In general, the requirement for SAG and RM funding recommendations is that the proposed research product be publishable in peer-reviewed literature (Baumgartner, 1998). Nevertheless, EPA frequently employs grey literature reports in their regulatory documents, and also discounts some peer-reviewed articles in establishing criteria and standards. Consequently, EPA regulatory offices may arrange *ad hoc* peer review of research results prior to acceptance by a journal to accelerate the incorporation of research results into practice. The PM may follow the EPA approach and arrange for additional peer review of research products prepared for journal publication. The RWG members discussed and endorsed this principle at their July 31, 1997 meeting.

CONTRACTORS proposing to conduct research will generally be expected to have the necessary personnel and equipment for the field and laboratory studies. In a small number of cases, innovative approaches may suggest the need for specialized training, and acquisition of specialized personnel (e.g., part time) and equipment. In these cases, the proposal must contain appropriate justification.

Research proposals (CONTRACTORS) must provide a description of quality assessment activities specific to the tasks to be conducted and the regulatory application intended. RFPs announcing the opportunity for competition will advise potential applicants of the requirement for a Quality Assurance Plan. CONTRACTORS will follow the format of a Quality Integrated Work Plan (QIWP) Template to create their QA/QC plans. The QIWP template has been prepared by the QAC and RM and can be found in Appendix A of this document. This template is derived from the QIWP created by the North American Research Strategy for Tropospheric Ozone (NARSTO) partnership and cited in EPA guidance (EPA, 1998a). The NARSTO QIWP is included as "Appendix A" of the NARSTO Quality Planning Handbook (Hook *et al.*, 1998). The WQRP template will be provided on the WQRP website (www.co.pima.az.us/wwm/wqrp) for retrieval by respondents to the RFP. Additional guidance is available to potential CONTRACTORS in the EPA QAPP guidance and other reports on quality assurance (EPA, 1998a). Information provided in this format will allow the QAC and RM to evaluate QA/QC practices, and then confer with successful CONTRACTORS as necessary regarding any questions that may arise. Several contracts may be awarded simultaneously to cover the same research question in different regions, requiring uniformity in methodology. CONTRACTORS will issue Technical Progress Reports which will permit assessment of the progress of each research task. Schedules for each task and their respective progress milestones will be set at the time of contract award.

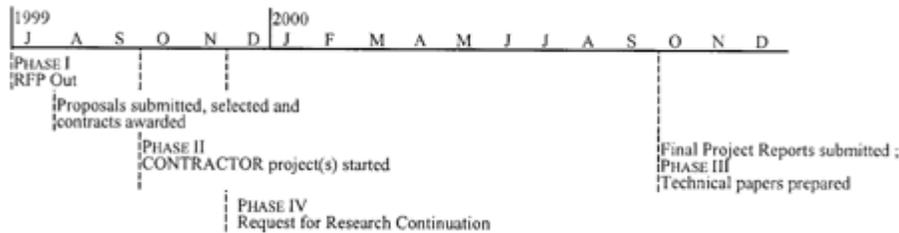
Quality assessment practices for this Project are discussed in more detail in Section C below. Since the WQRP involves many CONTRACTORS, assessment practices and frequency will be determined according to the complexity of the proposed project defined by each CONTRACTOR. However, assessment practices will include in general:

- Evaluation of each CONTRACTOR QIWP by the RM and QAC to ensure all QA/QC aspects have been addressed;
- Performance of at least one inspection by the RM, QAC or their designee(s) as appropriate during the course of a CONTRACTOR research project. Depending on the project objectives, the inspection will be either systems- or performance-based or a combination of the two. The inspection will evaluate the project's scientific and technical aspects and the implementation of QA as defined in the CONTRACTOR QIWP and SOPs.
- The Technical Progress Reports provided by the CONTRACTOR will be reviewed by the RM and QAC to ensure that the CONTRACTOR project is proceeding in a timely fashion and that Project Data Quality Objectives are being met.

The WQRP will generate many Project documents to ensure that the Project is efficiently and properly administered and carried out. These documents and records will need review and signature approval by the approved management individuals. The first quality document of importance is the QAPP that defines all aspects of the Project. Of equal importance is the QIWP generated by a CONTRACTOR as described above. Both the QAPP and each QIWP define those actions needed to produce quality research results and implementation of the Project criteria. Each of these documents defines other Project-related and quality documentation needed for carrying out the Project. An example would be the periodic Technical Progress Reports cited in the QAPP that must be submitted by each CONTRACTOR. Other important Project records

are contracts between PCWWM and the CONTRACTOR and reports generated by performance or technical system audits (TSA) performed by the RM and the QAC.

The estimated time-line for the WQRP is presented below:



A.4 DATA QUALITY OBJECTIVES AND CRITERIA

The Arid West Water Quality Research Project (WQRP) is intended to improve the scientific basis for water quality criteria and standards, and other regulatory approaches, for the arid and semi-arid sections of the 17 western states of the United States. Water quality regulatory agencies, wastewater dischargers, and other stakeholders in the use of scarce water resources in the arid and semi-arid western states have felt for years that the national EPA regulatory approaches need to be revised or replaced by methods appropriate for the ecosystems and flow characteristics of western streams, especially ephemeral and effluent-dependent watercourses. Research activities will study ephemeral and effluent-dependent streams, and will address permitted stormwater discharges, wastewater effluent discharges, and industrial discharges. Ultimate users of the data will be regulatory agencies at the local, state and federal levels.

Research tasks will be conducted and resultant data compiled primarily by qualified institutions or individual CONTRACTORS who are contracted by Pima County. Types of data generated by the various research contracts will include field and laboratory measurements and observations, and laboratory dose-response measurements and observations. Survey and implementation reports will use data generated in the Project as well as published literature data.

It will be incumbent upon each CONTRACTOR as part of his QA Plan to define DQOs specific to his research task(s). Measurement performance and quality assurance criteria to be applied to the methodologies used for each research task will be evaluated at the time of contract award, depending on the CONTRACTOR's response to section A.6. If not already complete, the first task will be to provide the final Quality Assurance Plan for the task including the sampling, analysis, data management and assessment procedures. Sections 1.0 through 1.5 of the QIWP will be critically reviewed by the QAC and the RM before passing the proposal on to the SAG and the RWG for additional review to ensure these sections meet the overall Project objectives. It is expected that only very well-founded proposals will be forwarded.

Sections 3.2 through 4.5 of the QIWP will prompt the CONTRACTORS to provide explanation of data acquisition and evaluation procedures. These sections also will be reviewed critically by the RM and QAC.

A.5 SPECIAL TRAINING AND CERTIFICATION

The members of the WQRP administrative team as discussed in Section A.1 and presented in the Organization Chart will have the training and educational background relevant to the specific responsibilities of their respective position. For example, in order to effectively evaluate the scientific merit of proposals submitted by CONTRACTORS, members of the SAG should be proficient in and familiar with various scientific disciplines and methodologies. The Curriculum Vitae (CV) for each participating member will indicate the individual's education, training and experience. All CVs will be kept on file and updated as needed by the Staff of PCWWM.

Since CONTRACTORS will be performing different tasks, training and or certification criteria will be task-dependent. However, universal to all tasks is the documentation of each individual's educational background and special certification(s). The CVs and certification documents must be kept in the CONTRACTORS' personnel files. When CONTRACTOR employees receive new training, the instruction and/or demonstration of proficiency will be documented. CONTRACTORS will be provided guidance from Sections 1.6 and 1.7 of the QIWP in addressing these areas. The material in Sections 1.6 and 1.7 of the QIWP submitted by the CONTRACTORS will be reviewed by the SAG, the RM and the QAC.

A.6 DOCUMENTATION AND RECORDS

Many documents will be critical to the implementation and monitoring of this program. Documents will include but not be limited to:

- Quality Assurance Project Plan (QAPP-01.0) and any revisions thereof,
- Legal Contracts between PCWWM and CONTRACTORS, and
- Quality Integrated Work Plans (QIWP).

Other important Project records include:

- CONTRACTOR Technical Progress Reports,
- Audit/Inspection Reports, and
- Review Reports evaluating QIWPs, Technical Progress Reports, and other documentation submitted by CONTRACTORS to WQRP management.

Technical Progress Reports as submitted by CONTRACTORS will follow a uniform format presenting the Project number (assigned at the time of contract issuance); dates for the period discussed; name of CONTRACTOR and address; dated signature of CONTRACTOR; objective(s) of the research for the period of the report; data indicating that objective has been met or if it has not been met, why; and objective(s) for the next study period. Progress reports will be submitted on a schedule specified in the contract.

PCWWM Staff will be responsible for ensuring that all persons on the Distribution List receive any copies of updated or new management documents as issued. The records of WQRP Management will be organized by PCWWM Staff and stored in a controlled area until no longer relevant to the Project at which time they will be moved into the Permanent Archive at PCWWM. PCWWM Staff will be responsible for maintaining the Permanent Archive.

The information and data records each CONTRACTOR will produce will vary somewhat according to the specific task being undertaken. However, every CONTRACTOR must have

- A QIWP as discussed previously;
- Documentation that each participant has sufficient education and/or training to perform a given Project element; and
- Data logbooks or forms.

Specific data records and the format for each contract or RFP will vary somewhat depending, for example, on whether the study is a field or laboratory effort, whether or not interlaboratory sharing of samples is required, and whether or not data (or samples) are to be transferred to a collaborating institution for follow-up work. Sections 5 and 6 of the QIWP provide guidance to the CONTRACTORS for completing this section of their proposal. In addition, documentation requirements are discussed in more detail in the following section.

CONTRACTORS will store their records securely until submission to the PM for inclusion in the Permanent Data Archive or until completion of the Project. At that point, they will be required to make all data available to PCWWM and EPA either in hard copy or electronic format as requested by PCWWM and EPA. Field observations, measurements, and samples must be identified in a standard location code for use in GIS programs.

Upon completion of all Project tasks and compilation of a Final Report(s), original records will be stored at and for a period of time as designated by EPA.

B. MEASUREMENT AND DATA ACQUISITION

PCWWM and the individuals/groups as discussed in Section A.1 and cited below will have overall responsibility for management and implementation of the Arid West WQRP and to ensure that the Project objectives are attained. However, each CONTRACTOR is responsible for the actual collection of data, whether in the library, field or laboratory. Therefore, he must address in his QIWP proposal the following areas as they apply to his research task and Project objective(s).

B.1 SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)

RFPs published by PCWWM will stress the importance of detailed explanations in proposals of sampling strategies, experimental design, and procedures for analysis of variance. RFPs will also list methods that have been used and accepted by EPA, and by scientists whose work has been accepted by EPA in criteria documents. Proposals also must list the credentials of principal investigators in the successful employment and interpretation of study designs in their research. If innovative methods of design and analysis are proposed, they will have to be supported by substantial justification as to the need for departure from accepted methods. Critical review of these research design factors will be provided by the SAG, RM and QAC.

In the overall process of proposal review for scientific merit, it is anticipated that the reason many of the proposals might fail to be recommended for funding would be due to deficiencies in explanation of sample design and analysis. Sections 1.5 and 1.6 of the QIWP template provide general guidance on the type of explanation to be included in proposals. It is likely the proposals passing the review of scientific merit will be those demonstrating significant sophistication in this regard. The SAG and technical Staff of WQRP will provide citations of reports, books, and other reference material to be used for referee purposes (e.g., Sokal and Rohlf, 1995; Kuehl, 1994) to aid CONTRACTORS in their proposal preparation.

Research proposals should also describe the quality of the data to be generated as supplemental or non-critical for Project conclusions, e.g., data for screening purposes. Similarly, data cited from existing databases or the literature as support information should be assessed as to its reliability and applicability to the study objectives.

Aside from the quantitative aspects of sampling design, CONTRACTORS must describe the basis for selecting field study sites in terms of relevance to overall WQRP objectives, and to EPA and state regulatory practices. This will require discussion of the expected range of condition variables at various locations, including control (reference) sites, and effects on the condition variables that might be related to causal factors. There are no standard references or test methods that can be used to generate acceptable answers for this demonstration. Rather, quality judgements will be highly subjective. While the SAG and other technical reviewers will have some sense of what is needed for a favorable assessment, the RWG may provide comments on regulatory significance of proposals passing the SAG review.

B.2 SAMPLING METHODS

To enhance the opportunity for the WQRP to make comparisons with studies at other sites and to optimize prospects for regulatory implementation, EPA methods should be used whenever possible for the Project. If alternative methods are proposed by the CONTRACTOR, the methods must be justified and approved by the PM and RM or their designee.

The type of samples (e.g., solid, aqueous, tissue), and the equipment, materials, and special techniques necessary to gather them (e.g., pumps, filters, containers, "clean chemistry") must be described. In addition, any procedures to clean or decontaminate equipment prior to or during sample collection to prevent contamination of existing samples, or in order to prepare for the next sampling, should be described. Any samples of a hazardous nature which could affect the safety of the sampler(s), such as site selection, or access, must also be evaluated and discussed. Analytical method minimum volumes, number of specimens, preservatives, and holding times and conditions (e.g., temperature control) must all be considered when designing sampling methods. Section 7 of the QIWP provides substantial guidance for CONTRACTORS.

B.3 SAMPLE HANDLING AND CUSTODY

The CONTRACTOR should address the need for, and the level of documentation for, sample security and integrity, commonly incorporated in a "chain-of-custody" procedure. A form for this purpose is usually combined with an Analysis Request form, indicating analyses to be conducted, preservatives in specific types of sample bottles, and allowable times for storage of particular types of samples. Many research studies conducted by EPA, and for EPA regulatory purposes by others, do not require formalized chain-of-custody protocols. Proposals should provide explanation of the relevance of this subject for the objectives envisioned. Field studies may require greater attention to this than do lab studies. The degree to which the intended results are expected to be used as the primary support base for regulatory purposes may be the key consideration. In addressing this, CONTRACTORS should receive guidance from the regulatory agencies they believe would be likely to use the results. This is not likely to be a pass-fail test in either the SAG or RWG review of otherwise meritorious application, as it is a task that can be added to contracts as a condition of award. Sections 3 and 7 of the QIWP provide general guidance.

B.4 ANALYTICAL METHODS

Standard Operation Procedures (SOPs) based upon standard referenced methods as relevant to the specific project must be listed by CONTRACTORS in their proposal. Modifications to standard methods must be justified, including discussion of sample preparation (extraction, digestion, etc.), measurement, and method response under the conditions of testing (specific instrumentation, calibration, linear range, etc., and quality control acceptance criteria). Each analytical method description must address precision, bias or accuracy (usually in percent recovery of spiked samples), detection limits for each parameter reported, and quality control evaluations applicable to the specific sample matrix.

B.5 QUALITY CONTROL REQUIREMENTS

Each CONTRACTOR proposal must address the procedures and techniques to be employed in data generation and analysis to provide confidence that conclusions drawn from the investigations will be supported by the data. In some cases, QC criteria have been established and are included in the methods referenced in EPA method reports. Use of these criteria is acceptable. Since proposals may be developed by several team members, consistency among sections of the proposal will be evaluated. The QAC will conduct a preliminary review and provide a written critique to assist the reviews by the SAG and the RESEARCH MANAGER. If several proposals address a similar problem, perhaps at different locations, consistency between proposals also needs to be evaluated in these reviews. Section 3.3 of the QIWP identifies six requirements for attention.

Corrective action procedures to be followed in the event that problems arise and established QC criteria are not met need to be described by the CONTRACTORS. These corrective actions might include, but are not limited to, rerunning the test, re-preparing and analyzing the sample, re-sampling, or redoing the standards inventory, as appropriate. Proficiency in the execution of all analytical methods employed must be demonstrated. The proposed method of reporting censored data must be explained.

B.6 INSTRUMENTATION TESTING, INSPECTIONS AND MAINTENANCE

CONTRACTORS must show that instrumentation requirements specified in referenced analytical methods, or as contained in the SOPs, can be met. Instrumentation installation date and subsequent modifications, updates and maintenance activities must be documented in each instrument/instrument system log book, supported by the manufacturer's verification as appropriate. Instrument manufacturer's recommended maintenance schedules and spare parts inventory should be adhered to and documented. These must be available for inspection during performance audits/inspections. This is discussed in Section 7 of the QIWP.

B.7 INSTRUMENTAL CALIBRATION AND RECORDS

Documentation that instrumentation is functioning properly to allow generation of the highest data quality is demonstrated by an acceptable Initial Calibration Verification analysis of a standard sample set from a different source (vendor) than the on going standard preparation sources. Continued set or batch analyses calibration is verified with Continuing Calibration Verification. All calibration and/or analyses will be documented in each instrument/system logbook. The CONTRACTOR'S plan for conducting these verifications and the related record-keeping system will be subject to approval by the QAC. See also Section 7 of the QIWP.

B.8 SUPPLIES AND CONSUMABLES

The CONTRACTOR shall describe how and by whom supplies and consumables will be inspected and approved for use in the project. The plan for conducting these verifications and the related record-keeping system will be subject to approval by the QAC. See also Section 7 of the QIWP.

B.9 DATA ACQUISITION, NON DIRECT

Data acquired from the literature, outside databases or other reference sources should be defined as to its quality. See also section B.5 QUALITY CONTROL REQUIREMENTS.

B.10 DATA MANAGEMENT

A system of data and records management must be described in each CONTRACTOR Work Plan. This can be accomplished in many cases with the use of an electronic system. If an electronic system is used, it must be validated and security maintained so that data and records cannot be altered. Sections 4, 5 and 6 of the QIWP provide descriptions of the type of records to be kept.

During the Project, the CONTRACTOR will send an extra copy of any issued reports, findings, etc., to the PM for retention in the Permanent Data Archive. The Permanent Data Archive will be maintained by the WQRP Staff.

The CONTRACTOR will ensure that all logbooks, data forms, status reports, etc. will be adequately identified by Project ID number, CONTRACTOR name, date and content and sent to the PM for retention in the Permanent Data Archive at the completion of the Project.

C. ASSESSMENT/OVERSIGHT

The number, type, and frequency of assessment activities will vary over the course of the Project because of the variability in the types of contracts that will be awarded, and the variability in the term of contracts. All contracts and defined research projects will be subject at a minimum to the following assessment actions:

1. Threshold review of proposals by PROCUREMENT DIVISION and RM for conformance with procurement specifications and technical scope as published in the RFP.
2. Review for scientific merit by one or more members of SAG.
3. Ranking of scientifically meritorious proposals by a quorum of SAG members.
4. Review of ranked scientifically meritorious proposals by PCWWM and possibly RWG for regulatory significance and implementation potential.
5. Review of meritorious proposals by QAC for inclusion of essential QA/QC elements. Review of CONTRACTORS QIWP plans by QAC.
6. Interim telephone and written memorandum reports between PCWWM management and CONTRACTORS. Telephone reports shall be documented with a written summary by PCWWM Staff for the WQRP file and copied to the relevant CONTRACTOR.
7. Final Report draft as prepared by CONTRACTOR reviewed by independent reviewer(s), e.g., one or more SAG members (or equivalent) and PCWWM Staff as appointed by PM and RM. The Final Report will result in a written record of Project results for WQRP files and a review report will provide an official acceptance of CONTRACTORS project results.

As part of QA/QC, each contract/study should have at least one on-site visit to determine compliance with QA objectives for the Project. The site visit may involve a systems or performance inspection depending on the type of study and the study objectives. The CONTRACTOR will be notified prior to the visit. The site visit will be performed by the RM, QAC and other personnel as needed and designated by the PM. One or more members of the SAG may participate in site visits, particularly if the visit is a performance evaluation.

For project terms of greater than six months, an interim site visit may be specified, and depending on the type of study, the visit may be to the CONTRACTOR site or the WQRP location. For projects of one to two years, a minimum of two site visits may be specified. For work involving laboratory or field sampling and analysis, at least one interim visit will be to the lab or field location.

A WQRP technical Staff person will be assigned to each contract/project to maintain awareness of progress, to provide project status reports to PCWWM management, and to provide information to the CONTRACTOR to facilitate performance of the contract objectives.

Following site visits and inspections, a Review Report will be written by those performing the visits discussing results of the inspection and whether the CONTRACTOR is complying with the Project study objectives. The Review Report will be submitted to the PM and/or DIRECTOR or their specified designee(s) and to the CONTRACTOR. If deviations are noted, they will be discussed as part of the Review Report.

Each CONTRACTOR will be responsible for responding to the written review and assessment comments within 30 days of receipt, explaining corrective actions that will be taken. Designated WQRP Staff will review responses and evaluate compliance with contract terms. If Staff determines that the contract terms are not being met in either a timely or technical manner, they will inform the RM and/or QAC who will attempt resolution of the problem. If the situation cannot be resolved, the RM and/or QA will inform the PM. The PM will take corrective action to resolve the problem, by recommending in writing to the Pima County PROCUREMENT DIVISION that steps be taken to suspend contract payments until performance adjustments are made. The PROCUREMENT DIVISION may request the PM to obtain an independent technical review of the project performance before suspending payments. If performance adjustments cannot be made satisfactorily to both the PM and the CONTRACTOR, the contract will be terminated.

Section 8 of the QIWP provides guidance for the CONTRACTOR in establishing procedures within the performing organization for continuing review and assessment, and for describing the procedures in proposals or in a QA/QC plan before initiating research.

D. DATA VALIDATION AND USABILITY

Each CONTRACTOR is assumed to have the technical knowledge to be able to evaluate the data output contained in his Final Report as being representative of the Project Data Quality Objectives. The data should be verified against the QA Plan methodologies and should be validated to ensure that the Project conclusions are correct. The RM and selected members of the SAG also will review the results to ensure that data have been handled properly. This is also discussed in Sections 4 and 5 of the QIWP.

REFERENCES

- Baumgartner, D.J., E.L. Smith, R.J. Frye, J.J. Riley, and K.A. Smith-Otero. 1993. Rationale for a Program of Research to Develop Water Quality Criteria for Effluent-dependent Ephemeral Streams and Riparian Habitats in the Arid West. Report to Pima County Wastewater Management. Environmental Research Laboratory Report # 93-1. The University of Arizona. Tucson, AZ. 54 pp.
- Baumgartner, D.J. 1998. Attaining Quality in the Products of the Arid West Water Quality Research Project. Report to Pima County Wastewater Management Department, Tucson, AZ. April 10, 1998. 17 pp.
- EPA. 1998a. EPA Guidance for Quality Assurance Project Plans: EPA QA/G-4. EPA/600R-98/018. Office of Research and Development. U.S. Environmental Protection Agency. Washington, D.C., February, 1998. (Available at http://es.epa.gov/ncercqa/qa/qa_docs.html).
- EPA. 1998b. Water Quality Criteria and Standards Plan: Priorities for the Future. *INTERIM FINAL*. 822-R-98-003. June, 1998. 57 pp.
- Hook, L. A., M. D. Cheng, and T.A. Boden. 1998. Appendix A, NARSTO Quality Planning Handbook. Environmental Sciences Division Publication No.4786. April, 1998. Oak Ridge National Laboratory. Oak Ridge, TN. 56 pp. (Available at http://cdiac.esd.ornl.gov/programs/NARSTO/pdf/qphb_v1.pdf).
- Kuehl, R.O. 1994. *Statistical Principles of Research Design and Analysis*, Duxbury Press, Belmont, CA. 686 pp.
- PCWWM. 1997. The Arid West Water Quality Project First Annual Conference Summary, April 23-25, 1997. Pima County Wastewater Management Department. Tucson, Arizona. 60 pp. Available for downloading from the WQRP web site. (www.co.pima.az.us/wwm/wqrp)
- Sokal, R.F., and F.J. Rohlf. 1995. *Biometry: the Principles and Practice of Statistics in Biological Research*. W. H. Freeman and Company, New York. 887 pp.

APPENDIX I

RESPONSES TO RESEARCH NEEDS SURVEY

PCWWM conducted a survey in late 1993 and early 1994 to determine the types of criteria and standards problems stakeholders were facing. Research needs received from ten municipalities, six states, EPA Region IX, and five other entities were grouped into three technical categories: chemical criteria, ecological criteria, and WET testing, and a category dealing with regulatory policy and implementation guidance. As with any cryptic listing, each item listed may appear to require detailed elaboration of the subtle point of the research need in light of the state of the art, an effort that was beyond the scope of the survey as well as of this report.

CHEMICAL CRITERIA

- Identify chemicals and compounds of specific concern for agencies and regulators, including ammonia, arsenic, cadmium, copper, diazaron, dissolved oxygen, lead, mercury, molybdenum, phthalates, selenium, silver, and zinc.
- Develop data on pollutants and places presenting special compliance problems for dischargers (using existing data to the extent clean chemistry requirements are met).
- Quantify the influence of hardness, alkalinity, and Total Organic Carbon regarding metal toxicity to aquatic and wildlife species.
- Demonstrate analytical or other rational approach to apply water quality standards to stormwater flows.
- Investigate and quantify problems with dechlorination and the effectiveness of specific dechlorination systems in relation to chlorine residual compliance.
- Quantify the fate and effects of nitrogen transformations that occur at the soil/water interface as surface waters percolate into ground waters.
- Define the strength of metal-organic ligands that render metals non-bioavailable and define the conditions under which farfield release of bound metals into a bioavailable form are likely to occur.
- Investigate the toxicity of metals and ammonia to salt-tolerant plant species important in arid West ecosystems.

ECOLOGICAL CRITERIA

- Develop laboratory toxicity data for arid West species for use in expanding the national database to cover currently unrepresented species and to develop site-specific criteria, use designations and toxicity testing protocols.
- Develop data necessary to assess public health risks due to subsistence fishing in drains and canals.
- Develop a list of indicator terrestrial and aquatic species not currently included in national criteria documents.
- Evaluate food chains representative of important arid West wildlife species, including threatened and endangered (T&E) species.
- Investigate the net ecological benefit of reuse and recharge programs.

- Develop measurable decision criteria for use attainability questions. What level of use is attainable, what conditions fully protect a use, what data are needed to set site-specific criteria?
- Develop data necessary to promote beneficial reuse of treated wastewater to protect and enhance aquatic ecosystems (e.g., to develop protocols for evaluating "net environmental benefits").
- Evaluate tissue concentrations in aquatic life and wildlife for mercury, selenium and other bioaccumulative pollutants.
- Develop data on actual biological systems needed to assess the feasibility of developing wildlife criteria, and to develop wildlife criteria (e.g., mercury).

WHOLE EFFLUENT TOXICITY TESTING

- Develop evaluations of whole effluent toxicity as it relates to T&E species.
- Modify protocols for biomonitoring testing to allow ceriodaphs/fatheads to be more tolerant of arid Western waters.
- Support studies to determine the Method Detection Level (MDL) and Practical Quantification Level (PQL).
- Determine WET testing variability compliance.
- Determine appropriate use of biomonitoring and WET testing.
- Investigate the relationship between ammonia toxicity, pH, and temperature.

POLICY AND IMPLEMENTATION GUIDANCE

- Develop protocols for implementing hardness-dependent metal criteria in waters above 400 mg/l CaCO₃.
- Review fish consumption designated use in canals and waters where use does not currently exist.
- Develop protocols for evaluating flows of ephemeral and effluent-dependent streams for TMDL, mixing zone, and effluent limit development purposes.
- Review Endangered Species Act (ESA) impact on water quality standards; bioaccumulation.
- Investigate the issues involved in applying the biological integrity concept.
- Protection of habitats/uses through minimum discharge requirements.
- Develop an "Effluent-Created Ecosystem" use definition in terms of the physical, biological, and chemical characteristics.
- Develop protocols for developing criteria appropriate for ephemeral and effluent-dependent waters.
- Develop arid West-sensitive protocols for evaluating economic impacts of standards implementation for use in use attainability analyses.
- Review reuse criteria and standards for arid West ecosystems.
- Analyze impact of tribal water quality standards.
- Review toxics standards guidelines numeric/narrative including effluent toxicity.

APPENDIX A

[QUALITY INTEGRATED WORK PLAN TEMPLATE](#)