WETLANDS QUALITY ASSURANCE PROJECT PLAN GUIDANCE
Version 1.0
US EPA Region 9
September 30, 2004

EPA Region 9 is pleased to provide this Quality Assurance Project Plan (QAPP) Guidance to assist Region 9 Wetland Grant recipients in documenting the procedural and data requirements for projects involving environmental measurements. When completed and approved by EPA it will meet US EPA Region 9's quality assurance requirements. Sections One through Four of the QAPP provide all the information needed for projects not requiring off-site laboratory analyses; Sections Five through Eight contain information pertaining to off-site laboratory analyses and include sample text that may be used in your document.

For the purposes of this QAPP, wetland projects may include jurisdictional wetlands and non-wetland aquatic resources (e.g., tributary streams, coral reefs, mudflats, etc.) and adjacent riparian vegetation. In addition, certain environmental measures may apply on a landscape scale (e.g., land use, vegetation, soils, etc.). Such projects may involve mapping, classification, assessment of functional condition, and/or other approaches to characterizing aquatic resources, including wetlands and riparian areas. Data collection includes making field measurements and observations as well as collecting and analyzing samples.

Please contact Dr. David Taylor at 415-972-3803 or Mark Kutnink at 415-972-3801 of the US EPA Region 9 Quality Assurance Office for assistance on any aspect of QAPP preparation.

Instructions for Preparation of a Wetland Project QAPP

Region 9 recommends using some form of document identification on each page that includes page numbers, date, title, and revision number (e.g., a document control format block or a "footer" on each page).

1. For projects not using off-site laboratory analyses, all information needed to complete your QAPP is contained in Sections One through Four. Follow the instructions. Retain section headings and insert project specific information, as applicable, or indicate NA. Delete instructions from the final document. Reference and attach your standard operating procedures (SOPs) where applicable.

2. For projects using off-site laboratory analyses, Sections Five through Eight will need to be completed in addition to Sections One through Four. Sections Five through Eight contain instructions and suggested language (found within quotation marks) that can be used as you prepare your plan. Section headings can be retained and template language used, as applicable or, alternatively, develop your own project specific language, or reference and attach appropriate SOPs.

TITLE
AND
APPROVAL PAGE

[Title of Project]

_____

[Name and Address of Organization]

_____

1. Approved by Project Manager: Date:

_____

2. Approved by Project QA Manager: Date:

_____

3. Approved by Region 9 Quality Assurance Manager: Date:

_____

4. Approved by EPA Project Manager: Date:

_____

Name of Plan Preparer Address Phone Number Email Address

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1.0 PROJECT DESCRIPTION

1.1 Project Purpose and Problem Definition

Briefly describe the purpose of the wetland project as it relates to the Wetland Grant program (i.e., questions to be answered, problems to be solved, decisions to be made, or how data will be used to make future decisions). Include a concise statement of project goals, potential wetland project accomplishments, and measures of success.

Identify the type of project (e.g., assessment of functions, development of a monitoring program, restoration planning, etc). Describe the scope and scale of the project.

Identify constraints that might influence the success of the project (e.g., current conditions, challenges, data gaps, seasonal limitations in sampling, etc.).

1.2 Project Area Description

Include, as appropriate, an overview of specific natural resource characteristics, including physical structure, hydrogeology, and biological components. Include a brief description of relevant land use issues (past, present, future). Provide two maps of the area: one (Figure 1.1), large scale, to show the project area(s) within its geographic region; the second (Figure 1.2), larger in scale, to indicate where observations or measurements will be made or samples will be collected within each local area. Maps should include a North arrow, surface water and subsurface water flow arrow (if appropriate), unique wetland and watershed features, etc. Provide longitude and latitude information. Include additional maps as needed to clearly show all types of measurement(s) and sampling locations.

1.3 Responsible Agency and Participating Organizations

Identify the lead organization conducting the project and all other participating organizations. Briefly describe each organization's responsibilities and/or role.

1.4 Project Organization Roles and Responsibilities

Fill out the table and modify or expand it to include titles or positions appropriate to the specific project (suggested responsibilities are included in the table). Ideally, the QA Officer should only be involved in 'data review and oversight' capacity. However, in small projects the project manager or a technical staff person may be listed as the Quality Assurance Officer.

Title/Responsibility	Name/ Qualification*	Agency Affiliation	Number/ email
EPA Project Officer/Oversees Direction of Project			
Project Manager/Directs Day-to-Day Work of Project			
Quality Assurance Manager/Oversees Sampling Quality Assurance			
Staff/Performs Project Tasks**			
Contractor (Company Name)/Oversees Special Work			
Contractor Staff/Performs Special Tasks**			

*Includes special training, certificates, and years of experience relevant to this project.
**If tasks are varied and require different skills, please expand table so it contains the major tasks these individuals perform.

1.5 Permit Requirements for Collection of Environmental Measures

Even though projects funded under Wetland Grants are focused on planning and program development, the collection of environmental measures may require permits. If applicable, identify permits that may be required, and discuss the schedule and actions needed to acquire them.

1.6 History, Previous Studies, Regulatory Involvement

As applicable and relevant, briefly describe past and present activities within the project or sampling area(s) that may have contributed to its present condition including ownership, management practices, point and non-point sources of pollution, etc. Summarize pertinent findings of previous studies within the project area. Describe previous regulatory actions/permitting outcomes. Provide available references.

2.0 PROJECT DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) form a link between the questions to be answered and the measurements that need to be taken (i.e., Will the Data Answer the Questions?). This section is

crucial to plan approval. DQOs are discussed more thoroughly in Section 2.1, below, for both wetlands field activities and, when applicable, for off-site laboratory analyses.

Associated with DQOs will be data quality indicators (DQIs). DQIs define acceptance criteria for quality control (QC) for field and laboratory methods. These are measures to determine whether the data are reliable. DQIs are discussed more thoroughly in Section 2.2, below for wetlands field activities and are discussed in Section 5.1 for off-site laboratory analyses.

2.1 Data Quality Objectives (DQOs)

DQOs for both field-based measurement and analysis activities and for off-site laboratory analyses should be discussed in this section of the plan, and should cover the following items:

A. State the questions to be answered, the decisions to be made, or hypotheses to be tested. Wherever possible, define your project in terms of decisions to be made. Here are some examples of questions based on different types of wetland projects. **These examples are not meant to be comprehensive or to suggest the types of criteria you should use on your own project.** Often these questions are posed in terms of "...if...then..." type statements.

Inventory What different types of wetlands are represented in the study area? If certain types of wetlands within the study area are found to support threatened and endangered species, then special land use zoning will be sought for these areas.

Assessment If we see changes in the following parameters ...(describe the changes that must be observed), then we will conclude that accelerated sediment loading is occurring. How effective are the wetlands in filtering sediment from water?

Trend Monitoring What are the changes in natural wetland acreage over time which are not associated with a specific project?

Project Monitoring What is the change in functional condition as a result of your specific project? If the project results in an improved functional condition (define improved), then it will be concluded that the project was effective. If a Best Management Practice to reduce access of grazing livestock to wetlands areas is implemented, then the level of nitrate found in the waters will be reduced below state water quality criteria.

B. Identify the general categories of information needed to answer the questions.

Inventory Type of wetland classification system to categorize habitats, list of threatened and endangered species, habitat uses of Threatened and Endangered species

Assessment Sediment loading and transport processes, list of parameters associated with accelerated sediment loading, where are the wetlands, how have they changed over time in elevation and concentrations of sediments, water quality downstream of wetlands.

Trend Monitoring Baseline mapping and measurement of changes of key indicators over time in response to environmental stresses

Project Monitoring Changes in wetland conditions pre vs. post project

C. What specific measurements and observations are needed to answer the questions?

Inventory Observations of threatened and endangered species within wetlands or adjacent areas; transects of study area with identification of wetland habitat location, size, content

Assessment Water velocity, temperature, total suspended solids (TSS); stream bank characteristics such as elevation, slope, percent vegetation cover, width; stream bed characteristics such as pebble size, quantity of larger boulders, pools, riffles, gravel bars; wetland sediment cores, sediment deposits; TSS in water downstream of wetlands; wetland location, size, condition

Trend Monitoring Transects of study area with identification of wetland habitat location, size, content; measurements of stressors such as increased percentage of impervious surfaces in adjacent areas, human population growth, increases in exotic species by frequency, types, and magnitude of occurrences

Project Monitoring Identification of pre and post project parameters relevant to the project to measure before and after the project is completed such as percent cover of dominate wetland type flora and fauna, number and amount of invasive species; water velocity and quantity; water quality parameters such as nitrate, phosphorous, TSS, DO; groundwater elevation, etc.

D. What criteria will be used to evaluate each of the measurements and observations? Your criteria may be quantitative or qualitative. Here are some examples:

Inventory If a standard classification system will be used and it is prescriptive in terms of the measurements which are required and the criteria upon which to make

decisions this may be sufficient (cite reference to existing inventory). If not, define the measures and observations which will be used and the criteria which will be used to evaluate the results. Percent dominate species will correspond to dominate species of habitat type. Transects will occur uniformly across study area. A ___% match of dominate vegetation type will be considered to indicate the correct wetland classification.

Assessment Quantity of TSS concentrations in water column over time compared to State water quality standards; reduced boulder count and increased slope of streambank compared to values recommended by geomorphologists, increased rate of sediment deposition in wetlands over time, quantity of TSS concentrations in water column downstream of wetlands compared State water quality standards. A ___% degradation in measured parameters over two years will be considered to indicate a increase in sediment loading.

Trend Monitoring For baseline wetland vegetation discernable at a 1:12,000 scale, a measurable change over three years will be considered indicative of a trend such as a ___% loss of wetland habitat.

Evaluation will be performed using a scoring method of different metrics such as the criteria developed in the Draft California Rapid Assessment Method for Wetlands User's Manual and Scoring Forms v 2.0 dated January 27, 2004 or Version 3.0 (which will be available soon).

Project Monitoring Increase in native plant cover as a result of Arundo donax removal: A ___% increase in native plants will be considered significant. Achievement of State water quality standards will be considered a success. A ___% improvement in concentrations of water quality pollutants. A ___% increase in dominate wetland vegetation types. A reduction in surface water nitrate from its present level to below the state water quality criteria of ___ mg/L will be used to assess the effectiveness of the best management practice.

DQOs can be developed in a tabular form, for example:

A. Questions to be answered, decisions to be made, hypotheses to be tested	**B. General categories of information needed to answer questions.**	**C. Specific measurements/ observations needed to answer questions**	**D. Criteria needed to evaluate each measure or observation**

EPA's Guidance for the Data Quality Objectives Process (EPA, August 2000) may be consulted for more information and a complete discussion of the seven-step data quality objective process.

2.2 Data Quality Indicators (DQIs) for Field Activities

Data Quality Indicators (DQIs) for all measurement and analysis activities performed in the field should be discussed in this section of the plan.

The purpose of establishing DQIs and their associated acceptance criteria (often called measurement quality objectives or MQOs) for a project is to measure the quality of data against the values required to answer project questions, test hypothesis, etc. Higher data quality requirements usually result in higher costs to a project so it is important to balance project data uses and the amount of resources available. Expenses for quality assurance work are highly variable, as they depend upon the uses of the data, the amount of uncertainty the project partners are willing to accept, and levels of training needed. Costs could range from ten to twenty-five percent of the project budget.

Qualitative DQIs include the concepts of representativeness and comparability. Quantitative DQIs include the concepts of completeness, precision, accuracy, and sensitivity (method detection limit).

The discussion below defines the different DQI concepts, suggests possible ways in which these may be measured, and requests that the associated acceptance criteria (i.e, the MQOs) be defined for those that are appropriate to your project. DQIs apply both to measurements, observations, and analyses made in the field as well as to measurements performed at off-site laboratories. This section addresses DQIs for field-based measurements, observations, and analyses only. DQIs for off-site measurements are defined in Section 3.2.2 for taxonomic identifications and in Section 5.1 for all other types of off-site analyses.

Representativeness is the expression of the degree to which data reflect a characteristic of an environmental condition or a population. It relates to the locations of interest and the methods of collecting samples. The idea of representativeness should be incorporated into discussions of study design in Section 3 of this guidance. Representativeness is best assured by a well thought out sampling design. For example, the plan should focus on, issues such as why certain wetlands and specific locations within a project area are included or not included, or why a certain sampling method has been selected. The need for, and criteria for selection of, background and reference locations should be included in the discussion. For example, if stream bank measurements are to be made, taking observations at 10 feet intervals will provide a more representative assessment than if observations are made every 50 feet.

Comparability expresses the confidence with which one data set can be compared to another. The use of widely-recognized and established methods from EPA or from some other recognized sources allows the data to be compared with data collected at other wetlands or at other times. This facilitates the evaluation of trends or changes in a wetland, a river, subsurface water, etc. Comparability also addresses whether the methods used are available to others who might want to

repeat the study. Comparability also refers to the reporting of data in comparable units so direct comparisons are simplified (e.g., ppm vs. mg/L).

Completeness is expressed as percent of usable data actually obtained compared to the amount that was expected. Due to a variety of circumstances, monitoring locations may be temporarily inaccessible, samples may be lost, instruments may fail, etc. The minimum percent of completed measurements and observations defined in this section depends on how much information is needed for decision making. Goals in the 75-95% range are typical.

Precision defines the agreement between or among independent measurements of the same parameter at the same location. This section should discuss how precision will be evaluated, and the criteria which will define acceptable agreement. It also should describe corrective actions which will be taken if precision criteria are not met. For example, in the field, the same person, a second person, or second team could repeat the measurement or observation at some percentage of the locations and then the results would be compared to pre-determined acceptance requirements. Failure to meet the criteria might result in an additional measurement being required, some of the data being invalidated, or some of the data being flagged as suspect. Precision may also be expressed as a standard deviation [SD] or relative percent difference [RPD]) when it relates to the analysis of replicate (SD) or duplicate (RPD) laboratory or field samples. For a discussion of precision in the context of laboratory analyses, see Section 5.1. This section should discuss project precision requirements for the different measurements and analyses that will be performed in the field, where applicable. If five people observe a tomato and they all call it a tree frog, the classification is precise but not accurate. If one person observes a tomato and calls it a tomato, the classification is accurate, but there is no way to assess precision with just one person's observation.

Accuracy is the degree of agreement of a measurement with a known or true value. It applies primarily to chemical measurements. In the field, accuracy is most commonly determined by the use of performance samples. To determine accuracy in the laboratory, matrix spikes, surrogate spikes, laboratory control samples (blind spikes) and performance samples are evaluated. For a discussion of accuracy in laboratory analysis, see Section 5.1. Certain non-chemical field measurements and observations may be evaluated for accuracy (e.g., ground truthing of remote sensing data interpretation; aerial photo ortho-rectification accuracy; closure of vertical distances and elevations in cross-section and profile surveys; the use of recognized experts for certain classifications and identifications). For a discussion of accuracy as it relates to taxonomic identifications, refer to Section 3.2.2.

Detection Limit(s) or sensitivity apply to chemical analyses. A critical element to be addressed is how these limits relate to any project action levels or decision threshold values that may apply. For example, if nitrate values at or above 5 mg/L are of concern, then any field (or laboratory methods) used for nitrate should be able to detect nitrate at, and preferably well below, this level.

Acceptance criteria (i.e., the MQOs) for the DQIs of precision, accuracy, completeness, detection limit or sensitivity, can be enumerated in tabular or narrative format in this section. The study

design discussion should provide the basis for definitions of the project's qualitative DOIs (representativeness, comparability). Protocols for field kits and operation manuals for field instruments should provide guidance on precision, accuracy, detection limits and sensitivity.

2.3 Data Review

In this section, describe how the data will be reviewed to determine whether the data are of sufficient quality to answer study questions, confirm hypotheses, or make decisions. Identify what corrective actions will be taken if project data quality requirements are not met.

2.4 Data Management

This section should describe what steps will be taken to ensure that data are transferred accurately from collection to analysis to reporting. For example, discuss the measures that will be taken to review the data collection processes, including in-field review of field notes or field data sheets; to obtain and review complete laboratory reports (over and above any data review that may be performed by a laboratory before it releases its data); and to review the data entry system (e.g., data manually input to electronic format), including its use in reports. The processes for backing-up electronic data and for archiving and retaining all project data should be addressed. Information could be presented as a checklist.

2.5 Assessment Oversight

If samples are to be collected and shipped to an off-site laboratory for any type of analysis (chemical, physical, microbiological, taxonomic, etc.), the plan should include a discussion of how the capability of the laboratory will be assessed. A discussion of the laboratory selection process and criteria is included in Section 7.2 of this QAPP Guidance.

This section should include a discussion of any field and laboratory audits to be performed and how any needed corrective action, such as retraining, will be implemented and documented.

2.6 Acquired or Secondary Data or Non-Direct Measurements

Describe any data that will be obtained from sources other than this project (e.g., databases, literature, or previous studies, and identify the sources). A number of terms are used to refer to these types of data: acquired data, secondary data, existing data, and non-direct measurements. Describe how the quality of these data will be reviewed to determine their adequacy for use in the current study. Indicate who will be responsible for the data quality assessment. Chapter 3 of EPA's "Guidance for Quality Assurance Project Plans" (EPA QA /G-5, December 2002) may be consulted for a discussion of how to evaluate the quality of acquired data. This document can be viewed and downloaded at the following website:

http://www.epa.gov/quality1/qs-docs/g5-final.pdf

3.0 FIELD STUDY DESIGN/MEASUREMENT PROTOCOL(S)

The project's field study design is described in this section of your plan. The following three elements should be discussed:

(1) descriptions of the protocols to be used for all measurements, observations, and analyses required for the project and the rationale for their selection. Cite references as appropriate. Field data can include information collected for mapping, photographs, and other imagery taken at various scales; direct measurements taken with specific equipment; visual estimates; and/or sample material collected for on-site or off-site analysis. Be specific when identifying the measurements and analyses required.. For example, if ortho-phosphate or total Kjeldahl nitrogen data are needed to assess water quality, this should be stated, rather than just specifying "nutrients." Refer to the subsections below for a listing of the broad categories of site characteristics that are often included in wetland projects. Identify and provide a rationale for the measurement protocols that apply to the site characteristics relevant to your wetland project. The discussion should also include descriptions of analytical methods that will be performed on samples in the field and, if applicable, in laboratories off-site.

(2) descriptions of the locations where the measurements and observations will be made, and where samples will be collected for on-site or off-site analyses. Rationales should be provided for the total number of sites and their locations for each measurement, observation, or sample collection and analysis activity. Also include the location and a rationale for all reference sites, if used. If exact locations are not yet known, but will be established in the field, the criteria that will be used to determine exact locations should be listed. Include a map or maps showing the exact or approximate locations where the measurement, observation, and/or sampling activities will take place, when possible.

(3) descriptions of the timing and/or frequency for each measurement, observation, and sampling activity that applies to your study. Indicate the expected duration of the study (e.g., one season, one year, two years, etc.) Include rationales for the timing, frequency, and duration specifications. For some activities, the month or season of the year may be important (e.g., dry months vs rainy months). For other activities, the time of day is also critical (e.g., bird counts, dissolved oxygen, water temperature). Some projects may require that a particular measurement be made only once. Other projects may require measurements before and after some type of intervention; others may require monitoring on a weekly, monthly, seasonal or other basis. For each measurement, observation, or sampling activity, include the timing, frequency, and duration requirements.

The emphasis in this section is on measurement and analysis protocols that will be performed in the field. However, some types of samples may also require analysis at an off-site laboratory (e.g., soil, sediment, water quality, and biological samples). This section should also address the three study design elements for samples that will be collected for off-site analysis. Rationales should be provided for the locations, timing, and frequencies. Sections 6 and 7 discuss protocols for sample collection and for off-site analyses.

The following subsections represent broad categories of site characteristics that are often included in wetland projects. The listed categories are neither comprehensive nor mutually exclusive and may not apply to every project. Considerable overlap among the categories exists and are intended to be used as applicable to a particular wetland project. For a broad overview of related, useful information see "Stream Corridor Restoration, Principles, Processes, and Practices" dated October 1998 developed by U.S. Department of Agriculture, U.S. Environmental Protection Agency, Tennessee Valley Authority, Federal Emergency Management Agency, U.S. Department of Commerce, U.S. Department of Defense, U.S. Department of Housing and Urban Development, and U.S. Department of the Interior. Another useful document is the "Review of Rapid Methods for Assessing Wetland Condition, Environmental Monitoring and Assessment Program" dated January 2004 by US Environmental Protection Agency EPA/620/R-04/009.

3.1 Physical and Chemical Characteristics

Characterizing wetland systems often involves measuring certain aspects of the physical and chemical environment. The following subsections address some broad categories of physical and chemical attributes frequently included in wetland projects. For each category that applies to your project, the three study design elements discussed in Section 3.0, above, should be addressed.

3.1.1 Landscape/Watershed Scale Data

Certain watershed scale attributes such as vegetation, land use, topography, soils, and geology influence the extent and condition of a wetland. Projects using landscape or watershed scale data for Geographic Information System (GIS) and remote sensing analyses should identify the source, year, scale and spatial resolution of the data. For Guidance on GIS visit: http://www.epa.gov/nerlesd1/gqc/pdf/g5g-final.pdf. Describe the type of aerial or remote sensing that will be used for the project to meet the coverage, quality, timing, detail requirements. The time of year, the color, visibility, and consistency with other work should be discussed. Additional consideration is needed to define the process that will be used to interpret remote sensing information and validating it through ground-truthing techniques. Describe what tools will be used to evaluate various different types of landscape information and the steps in the process to meet project needs.

3.1.2 Geomorphology

Geomorphology pertains to the features that characterize the physical form or structure of a particular type of wetland. Geomorphic data can be used: 1) to assist in classifying wetlands (Brinson, 1993, Brinson et al., 1995, Ferren et al., 1996), 2) as a framework for monitoring or assessing change in wetland functional condition (Lee et al., 2001), and 3) in designing restoration (Riley, 1998, Dunne & Leopold, 1978). Geomorphic data may be particularly relevant for projects involving riverine systems. Describe the geomorphic attributes to be measured, the rationale(s) for selecting the attribute(s) and the protocol(s) for taking and analyzing selected measures.

3.1.3 Hydrology/Hydraulics

Hydrology refers to the distribution and movement of surface and subsurface water through the subject wetland; hydraulics refers to the effects of flows on the wetland system. Wetland projects may involve qualitative or descriptive assessments of hydrologic conditions, numeric models to estimate flow, or direct measures of flow. Describe and provide the rationale(s) for the parameters to be measured and/or models to be used and protocol(s) for taking and analyzing the selected measures.

3.1.4 Soil

Soil data may vary from describing surface soil characteristics or evidence of disturbance to the soil profile, to verifying the distribution of certain soil types based on published U.S.D.A. Natural Resources Conservation Service (NRCS) soil surveys, to determining the extent of hydric soils following the protocol in the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual (U.S. Army Corps of Engineers 1987). These data often involve digging a shallow soil pit and describing the upper soil profile. Some projects may involve performing deeper subsurface investigations. Describe and provide a rationale for the locations of soil samples and the choice of soil characteristics to be measured.

If samples will be collected for off-site laboratory analyses, rationales should be provided for sample location choices as well as for the analytical methods which will employed to conduct the off-site analyses. If exact soil sampling locations will be determined in the field based on accessibility, visual indicators, (e.g., discolored soils) and topographical features which may indicate location of interest (e.g., depressions that may indicate a historic excavation, mounds of material deposited by erosion, etc.), then the approach that will be taken should be described. In other words, do not state solely that professional judgement will be used; describe the selection criteria. This section should describe the protocol(s) to be followed for collecting and analyzing soil in the field. Soils collection procedures for off-site analyses should be described in Section 6. Procedures for off-site soil analyses should be described in Section 7.

3.1.5 Sediment

Data pertaining to the types of wetland substrate or the processes of sediment movement into, through, and out of the wetland may be an important component of characterizing the project area's physical conditions, particularly in riverine settings. For instance, sediment data can be used to assist in classifying certain types of wetlands, to generally assess inputs of sediment based on adjacent land uses and other upgradient disturbances, or to more specifically describe channel bed materials using direct measures such as pebble counts. Describe and provide a rationale for the locations of sediment samples and the choice of sediment characteristics to be measured. The section should describe the protocol(s) to be followed for collecting and analyzing sediment.

If samples will be collected for off-site laboratory analyses, rationales should be provided for sample location choices as well as for the analytical methods which will employed to conduct the off-site analyses. If exact sediment sampling locations will be determined in the field based on accessibility, visual indicators, (e.g., bottom sediments from slow moving water, fast moving

water, historically deposited sediments, etc.) then the approach that will be taken should be described. In other words, do not state solely that professional judgement will be used; describe the selection criteria.

3.1.6 Water Quality

Wetland projects may include a water quality component involving parameters such as total dissolved solids, total suspended solids, nutrients, temperature, pH, and/or conductivity. Provide a general overview of the water sampling event, including rationales for choosing the sampling location(s), the parameters to be measured, the timing and frequency of sampling, and the choice of analytical procedures. For example, probes, test kits, field spectrometers, and color charts are possible analytical procedures to measure water quality in the field. The QAPP should describe what technique would be used and provide a rationale for its choice. The section should describe the protocol(s) to be followed for collecting and analyzing water quality in the field. Specify and provide a rationale for any filtering requirements. For example, dissolved metals, which require filtration to determine, may impact the environment in a different way than total metals and the study may be designed to investigate one of or both of these impacts.

If samples will be collected for off-site laboratory analyses, a rationale should be provided for the choice of sample locations as well as for the methods which will employed to conduct the off-site analyses.

If exact surface water sample locations will be determined in the field, this should be stated. Describe the criteria that will be used to determine where surface water samples will be collected.

3.2 Biological and Habitat Characteristics

Wetland projects typically include observations and/or measures of certain biological and habitat aspects of the wetland system. The following subsections of a wetlands QAPP address some broad categories of biological and habitat attributes frequently included in wetland projects. For each category that applies to your project, the three study design elements discussed in Section 3.0, above, (i.e., a description of the protocol, a description of the locations and a rationale for their selection, and a description of the timing and frequency of the measurements) should be addressed.

3.2.1 Field Data

3.2.1.1 Vegetation

The units of vegetation should be based on published classification systems (e.g., Brown 1982, Cowardin et al., 1979; Ferren et al., 1996; Holland, 1986; Sawyer and Keeler-Wolf, 1995). Describe the vegetative units recognized and cite references as appropriate. Provide a rationale for the classification system used. If the project involves producing a map, provide the scale, north arrow, site elevations, topographic contours, and vegetation boundaries, as appropriate. Describe the mapping protocol used.

3.2.1.2 Habitat Assessment

Refers to the capacity of the wetland to support one of more faunal species. Habitat assessments typically focus on the spatial structure of habitats in terms of the hydrologic, topographic, and vegetation conditions within a wetland ecosystem. Available assessment protocols include the: 1) Habitat Evaluation Procedure which uses habitat models developed for specific species (U.S. Fish and Wildlife Service, 1980); 2) Hydrogeomorphic Approach (HGM) which uses models for the range of ecosystem functions, including faunal support functions (Lee et al., 2001); 3) Wetland Evaluation Technique, an earlier wetland assessment method (Adamus et al., 1987); 4) California Department of Fish and Game's California Stream Bioassessment Procedure which focuses on the benthic macroinvertebrate community and physical/habitat characteristics in wadeable streams (www.dfg.ca.gov/cabw/cabwhome.html) . Other assessment tools currently being developed in Region IX include HGM Regional Guidebooks for riverine wetlands in the Santa Margarita River Watershed (Lee et al., 2004) and vernal pools in San Diego County (in preparation), and the California Rapid Assessment Method (www.wrmp.org/cram.html), designed specifically for monitoring wetland condition.

3.2.1.3 Botanical Surveys

Botanical surveys usually involve documenting the overall diversity of plant taxa occurring within the project area. Wetland projects may also include more focused surveys designed to document the distribution and abundance of populations of specific targeted species, such as species of conservation concern.

Describe and provide a rationale for the protocol used to conduct the survey, including methods for identifying the plant taxa observed. Address any applicable seasonal constraints. Cite published floras or other botanical literature as appropriate.

3.2.1.4 Faunal Surveys

Depending on the project objectives, faunal surveys may focus on one or more broad taxonomic groupings such as amphibian, reptilian, avian, mammalian, fish species, and aquatic invertebrates. Wetland projects may also include more focused surveys designed to document the distribution, abundance, and habitat of specific targeted species, such as species of conservation concern. U.S. Fish and Wildlife Service has developed specific protocols for surveying certain federally listed species and other faunal groups, such as vernal pool crustaceans. The California Department of Fish and Game's bioassessment procedure cited above includes protocols for collecting benthic macroinvertebrates.

Describe and provide a rationale for the protocol used to conduct the survey, including methods for identifying the faunal taxa observed. Address any applicable seasonal constraints. Cite established protocols or other biological literature as appropriate.

3.2.2 Voucher Specimens for On or Off-Site Identification

Accurate determination of biota may require the preparation of voucher specimens to be identified in the field, at an off-site museum, or other appropriate facility. This section should discuss the purpose(s) for their collection (i.e., off-site confirmation of problematic identifications made in the field, off-site identification of the entire sample set, etc.). For botanical and faunal collections, the plan should describe the protocol(s) for preparing voucher specimens, the rationale for the level of effort in identifying the specimens, and the specific measures to ensure accuracy of the identifications. Include the criteria for selecting the museum or laboratory (for example, experience of the organization's staff, availability of appropriate reference specimens and literature, availability of specialized facilities or equipment, etc.). The following subsections provide further guidance.

3.2.2.1 Botanical

Standardized techniques for collecting, preserving, and archiving botanical specimens exist at the California Native Plant Society website, under Archive Policy (www.cnps.org).

The level of effort involved may vary from identifying voucher specimens in the field, to identifying voucher specimens at an off-site herbarium, to requesting that a curator of a herbarium provide the identifications, to sending particular specimens to recognized specialists for determination. Universities and private museums may be contacted regarding the availability of qualified taxonomists and the applicability of a particular herbarium collection to the wetland project area.

3.2.2.2 Faunal

Faunal voucher specimens are typically restricted to the collection of fishes, amphibians, and terrestrial and/or aquatic invertebrate taxa. Describe protocols and standards for collecting, preserving, and archiving specimens. Museums, including the California Academy of Sciences and the Natural History Museum of Los Angeles County have developed specific protocols. Universities, private museums, and laboratories may be contacted regarding the availability of reference collections and trained taxonomists. Where appropriate, specify the taxonomic level needed to meet project objectives.

4.0 FIELD PREPARATION AND DOCUMENTATION

Wetland projects typically require some level of advance preparation to support work in the field. Once in the field, accurate record keeping is needed to maintain the quality of the data collected.

4.1 Field Preparation

Describe the preparations to be made prior to going into the field. Suggested items are listed below.

- Obtain required permit(s) and access to project area.

- Collect and review relevant background information, such as:
  Published maps
  Air photos and other imagery
  GIS maps
  Geologic, hydrologic, soils or environmental reports
  Published literature on the project area.

- Establish boundaries for and stratify, as appropriate, the project area and sample sites using preliminary office delineations followed by confirmation and refinement of preliminary boundaries/sample sites in the field.

- Review the proposed protocol(s) and identify the equipment needs for each category of field measurement and observation. (If protocols are further refined in the field, document the revisions)

- Coordinate equipment and materials. A partial list may include: safety gear (e.g., water, foil blanket, power bars, signal flares, radios/cell phone, matches, first aid kit) pertinent NRCS soil surveys; aerial photos; maps; GIS maps; shovel(s)/auger(s); Munsell color charts; measuring tapes; clipboard; ruler(s); camera & film; plot quadrats; nets or other faunal collecting tools; plastic bags/specimen jars/fixatives; plant press; permanent markers, pencils; calculator; field logbook; field forms; GPS; laptop computer; reference materials (floras, field guides, etc.).

- Maintain and calibrate field equipment, as appropriate. Describe the procedures by which field equipment is prepared for sampling, calibration standards used, frequency of calibration and maintenance routines, and any recalibrations that need to be done in the field.

- Develop procedures for field health and safety considerations. However, approval of the QAPP is not dependent on it being included in the document.

4.2 Field Notes

4.2.1 Field Logbooks

Describe how you will document where, when, how, and from whom any vital project information was obtained. Document entries should be complete and accurate enough to permit reconstruction of field activities. Documentation should have consecutively numbered pages. All entries should be legible, organized, and contain only factual, objective language.
Record for each day in the field, if appropriate:

- Team members and their responsibilities
- Time of arrival/entry on site and time of site departure

- Other personnel on site
- Summary of any meetings or discussions with land owners, agency personnel, contractors, etc.
- Deviations or variances from sampling plans, site safety plans, and QAPP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Calibration readings for any equipment used and equipment model and serial number

4.2.2 Field Data Sheets and Forms

Attach example copies of all sheets/forms for recording field observations and measurements whether prepared specifically for the project or taken from standardized, published SOPs. If data sheets will not be used, put in "Not Applicable."

4.2.3 Photographs

If photographs will be taken, the following language may be used as is or modified as appropriate.

Photographs will be taken at the observation locations, sampling locations and at other areas of interest on site or in the sampling area. They will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

- Time, date, location
- Description of the subject photographed
- Name of person taking the photograph

4.3 Documentation of Sample Collections

As appropriate, the following information should be recorded during the collection of each sample:

- Sample location and description
- Site or sampling area sketch showing sample location and measured distances
- GPS reading or other specific locational data as an aid for future sampling
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (soil, sediment or water)
- Type of sampling equipment used
- Field instrument readings and calibration
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Sample preservation
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers

- Shipping arrangements (overnight air bill number)
- Name(s) of recipient laboratory(ies)

4.4 Labeling of Sample Collections

The following paragraph provides a generic explanation and description of the use of labels. It may be incorporated as is, if appropriate, or modified to meet any project-specific conditions.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. A copy of the sample label is included in Appendix __. The samples will have preassigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: sample location, date of collection, type of sample, parameter(s), and method of preservation. Every sample, including samples collected from a single location but going to separate laboratories, will be assigned a unique sample number.

4.5 Field Variances

It is not uncommon to find that, on the actual sampling date, conditions are different from expectations such that changes must be made to the QAPP once the samplers are in the field. The following paragraph provides a means for documenting those deviations, or variances. Adopt the paragraph as is, or modify it to project-specific conditions.

As condition in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate and feasible, the EPA Project Officer will be notified before implementing the changes. Minor or temporary modifications should be documented in field logbooks or field data sheets and in the final report as appropriate. Significant or major changes to the approved plan may require prior approval by the EPA Project Officer and will need to be documented in the final report. If the project is on-going the QAPP may need to be revised or amended.

5.0 QUALITY CONTROL FOR SAMPLES COLLECTED FOR OFF-SITE ANALYSIS

Quality control samples collected for off-site analyses are intended to help evaluate conditions resulting from field activities and are intended to accomplish two primary goals, assessment of field contamination and assessment of sampling variability. The former looks for substances introduced in the field due to environmental or sampling equipment and is assessed using blanks of different types. The latter includes variability due to sampling technique and instrument performance as well as variability possibly caused by the heterogeneity of the matrix being sampled and is assessed using duplicate or co-located sample collection. Hence, quality control samples are used in assessing the precision and accuracy of the sampling and analysis activities.

Section 5.1 discusses data quality indicators (DQIs) and their associated acceptance criteria (i.e., the measurement quality objectives) that apply to the project's off-site laboratory analyses. Sections 5.2 through 5.6 discuss the quality control samples that are being collected to support the

off-site sample analyses. This includes the following types of QC samples: blanks (equipment, field, trip, and temperature); field duplicate or co-located samples; background; field screening; confirmation; splits; and laboratory QC). The locations at which the QC samples will be collected should be identified and a rationale provided for the choice of location. Frequency of collection should be discussed. All samples, except laboratory QC samples, should be sent to the laboratory blind, wherever possible. Laboratory QC samples should be identified and additional sample (e.g., a double volume) collected for that purpose.

5.1 Data Quality Indicators for Off-Site Analyses

DQIs (accuracy, precision, completeness, representativeness, comparability, and method detection limits) refer to quality control criteria established for various aspects of data gathering, sampling, or analysis activity. In defining DQIs for the project, the acceptable level of uncertainty associated with each measurement is also specified. Definitions of the different terms are provided below.

Accuracy is the degree of agreement of a measurement with a known or true value. To determine accuracy, a laboratory or field value is compared to a known or true concentration. Accuracy is determined by such QC indicators as: matrix spikes, surrogate spikes, laboratory control samples (blind spikes) and performance samples.

Precision is the degree of mutual agreement between or among independent measurements of a similar property (usually reported as a standard deviation [SD] or relative percent difference [RPD]). This indicator relates to the analysis of duplicate laboratory or field samples. An RPD of <20% for water and <35% for soil, depending upon the chemical being analyzed, is generally acceptable. Typically field precision is assessed by co-located samples, field duplicates, or field splits and laboratory precision is assessed using laboratory duplicates, matrix spike duplicates, or laboratory control sample duplicates.

Completeness is expressed as percent of valid usable data actually obtained compared to the amount that was expected. Due to a variety of circumstances, sometimes either not all samples scheduled to be collected can be collected or else the data from samples cannot be used (for example, samples lost, bottles broken, instrument failures, laboratory mistakes, etc.). The minimum percent of completed analyses defined in this section depends on how much information is needed for decision making. Generally, completeness goals rise the fewer the number of samples taken per event or the more critical the data are for decision making. Goals in the 75-95% range are typical.

Representativeness is the expression of the degree to which data accurately and precisely represent a characteristic of an environmental condition or a population. It relates both to the area of interest and to the method of taking the individual sample. The idea of representativeness should be incorporated into discussions of sampling design. Representativeness is best assured by a comprehensive statistical sampling design, but it is recognized that this is usually outside the scope of most wetlands projects. QAPPs should focus on issues related to judgmental sampling and why

certain areas are included or not included and the steps being taken to avoid either false positives or false negatives.

Comparability expresses the confidence with which one data set can be compared to another. The use of methods from EPA or "Standard Methods" or from some other recognized sources allows the data to be compared facilitating evaluation of trends or changes in a site, a river, groundwater, etc. Comparability also refers to the reporting of data in comparable units so direct comparisons are simplified (e.g., this avoids comparison of mg/L for nitrate reported as nitrogen to mg/L of nitrate reported as nitrate, or ppm vs. mg/L discussions).

Detection Limit(s) (usually expressed as method detection limits (MDLs) or Quantitation Limit(s) for all analytes or compounds of interest for all analyses requested must be included in this section. These limits should be related to any decisions that will be made as a result of the data collection effort. A critical element to be addressed is how these limits relate to any project specific action levels, decision threshold values, or applicable water quality criteria.

DQI/MQO tables are available from the QA Office for most routinely ordered methods. These tables can be attached to the QAPP and referenced in this section. If an organization wishes to use different limits or acceptance criteria, the table should be modified accordingly.

5.2 Assessment of Field Contamination (Blanks)

Field contamination is usually assessed through the collection of different types of blanks. Equipment blanks are obtained by passing distilled or deionized water, as appropriate, over or through the decontaminated equipment used for sampling. They provide the best overall means of assessing contamination arising from the equipment, ambient conditions, sample containers, transit, and the laboratory. Field blanks are sample containers filled in the field. They help assess contamination from ambient conditions, sample containers, transit, and the laboratory. Trip blanks are prepared by the laboratory and shipped to and from the field. They help assess contamination from shipping and the laboratory and are for volatile organic compounds only. Region 9 recommends that equipment blanks be collected, where appropriate (e.g., where neither disposable or dedicated equipment is used). Field blanks are next in priority, and trip blanks next. Only one type of blank must be collected per event, not all three.

5.2.1 Equipment Blanks

In general, equipment (rinsate) blanks should be collected when reusable, non-disposable sampling equipment (e.g., trowels, hand augers, and non-dedicated subsurface water sampling pumps) are being used for the sampling event. Only one blank sample per matrix per day should be collected. If equipment blanks are collected, field blanks and trip blanks are not required under normal circumstances. Equipment blanks can be collected for soil, sediment, and ground water samples. A minimum of one equipment blank is prepared each day for each matrix when equipment is decontaminated in the field. These blanks are submitted "blind" to the laboratory, packaged like other samples and each with its own unique identification number. Note that for samples which

may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water which is often used for equipment and field blanks, can contain VOCs if it is not purged.

If equipment blanks are to be collected describe how they are to be collected and the analyses that will be performed. A maximum of one blank sample per matrix per day should be collected, but at a rate to not exceed one blank per 10 samples. The 1:10 ratio overrides the one per day requirement. If equipment rinsate blanks are collected, field blanks and trip blanks are not required under normal circumstances. Use the language below or reference the appropriate sections in a Quality Control SOP and state in which Appendix the SOP is located.

Provided below is some suggested language to be used if equipment blanks are to be collected.

This paragraph can be used if blanks will be analyzed for both metals and organic compounds.

"Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring High Performance Liquid Chromatography (HPLC) organic-free (for organics) or deionized water (for inorganics) over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for _____" (Include names of target analytes, e.g., metals, total petroleum hydrocarbons, volatile organic compounds, etc.).

This paragraph can be used if blanks will be analyzed only for organic compounds.

"Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring High Performance Liquid Chromatography (HPLC) organic-free water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for _____" (Include names of target analytes, e.g., metals, total petroleum hydrocarbons, volatile organic compounds, etc.).

This paragraph can be used if blanks will be analyzed only for metals.

"Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring deionized water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing deionized water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for metals."

It is recommended that this paragraph always be included.

“The equipment rinsate blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.“

5.2.2 Field Blanks

Field blanks are collected when sampling water or air and equipment decontamination is not necessary or sample collection equipment is not used (e.g., dedicated pumps). A minimum of one field blank is prepared each day sampling occurs in the field, but equipment is not decontaminated. These blanks are submitted "blind" to the laboratory, packaged like other samples and each with its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water which is often used for equipment and field blanks, can contain VOCs if it is not purged.

The following paragraphs can be used, as appropriate, if field blanks will be collected. Note that only one blank sample per matrix per day should be collected. If field blanks are prepared, equipment rinsate blanks and trip blanks are not required under normal circumstances.

This paragraph can be used if blanks will be analyzed for both metals and organic compounds.

“Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring High Performance Liquid Chromatography (HPLC) organic-free water (for organics) and/or deionized water (for inorganics) into a sampling container at the sampling point. The field blanks that are collected will be analyzed for _____” (Include names of target analytes, e.g., metals, volatile organic compounds, etc.).

This paragraph can be used if blanks will be analyzed only for organic compounds.

“Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring High Performance Liquid Chromatography (HPLC) organic-free water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for _____” (Include names of target analytes, e.g., volatile organic compounds, total petroleum hydrocarbons, etc.).

This paragraph can be used if blanks will be analyzed only for metals.

“Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to contamination from sample containers. Field blank samples will be obtained by pouring deionized water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for metals.”

This paragraph should always be included.

"Field blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory."

5.2.3 Trip Blanks

Trip blanks are required only if no other type of blank will be collected for volatile organic compound analysis and when air and/or water samples are being collected. If trip blanks are required, one is submitted to the laboratory for analysis with every shipment of samples for VOC analysis. These blanks are submitted "blind" to the laboratory, packaged like other samples and each with its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. Laboratory water which is used for trip blanks, can contain VOCs if it is not purged.

This subsection can be used if trip blanks will be collected. Only one blank sample per matrix per day should be collected. Trip blanks are only relevant to volatile organic compound (VOC) sampling efforts.

"Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the samples, and if cross contamination in the form of VOC migration has occurred between the collected samples. A minimum of one trip blank will be submitted to the laboratory for analysis with every shipment of samples for VOC analysis. Trip blanks are 40-mL vials that have been filled with HPLC-grade water that has been purged so it is VOC free and shipped with the empty sampling containers to the site or sampling area prior to sampling. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same cooler with the samples collected for volatile analyses. The trip blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each trip sample and it will be submitted blind to the laboratory."

5.2.4 Temperature Blanks

This paragraph should be included with all plans.

"For each cooler that is shipped or transported to an analytical laboratory a 40 mL VOA vial will be included that is marked "temperature blank." This blank will be used by the sample custodian to check the temperature of samples upon receipt."

5.3 Assessment of Field Variability (Field Duplicate or Co-located Samples)

Duplicate samples are collected simultaneously with a standard sample from the same source under identical conditions into separate sample containers. Field duplicates will consist of a homogenized sample divided into two fractions or else two samples collected "side by side" or else sequentially from the same location (these are usually referred to as co-located samples).

Each duplicate portion should be assigned its own sample number so that it will be, ideally, sent blind to the laboratory. A duplicate sample is treated independently of its counterpart in order to assess laboratory performance through comparison of the results. At least 10% of samples collected per event should be field duplicates. At least one duplicate should be collected for each sample matrix, but their collection can be stretched out over more than one day (e.g., if it takes more than one day to reach 10 samples). Every group of analytes for which a standard sample is analyzed will also be tested for in one or more duplicate samples. Duplicate samples should be collected from areas of known or suspected contamination. Since the objective is to assess variability due to sampling technique and possible sample heterogeneity, source variability is a good reason to collect co-located samples, not to avoid their collection.

Provided below are some suggestions on language to discuss field duplicates.

"Duplicate soils samples will be collected at sample locations _____ (Identify soil sample locations from which duplicate or collocated samples will be obtained.)"

"Duplicate samples will be collected from these locations because _____ (Add sentence(s) here providing a rationale for collecting duplicate samples from these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.)"

This paragraph can be included if collecting soil samples and analyzing for compounds other than volatiles.

"Soil samples to be analyzed for _____ (List all analytical methods for this sample event except for volatiles.] will be homogenized with a trowel in a sample-dedicated 1-gallon disposable pail. Homogenized material from the bucket will then be transferred to the appropriate wide-mouth glass jars for both the regular and duplicate samples. All jars designated for a particular analysis (e.g., semivolatile organic compounds) will be filled sequentially before jars designated for another analysis are filled (e.g., metals). **"**

This paragraph if collecting soil samples and analyzing for VOCs.

"Soil samples for volatile organic compound analyses will not be homogenized. Equivalent Encore samples from a co-located location will be collected identically to the original samples, assigned unique sample numbers and sent blind to the laboratory."

These paragraphs can be used if collecting sediment samples. If volatile organic compound analysis will be performed on sediment samples, modify the above paragraph for soil sample volatile analyses by changing "soil" to "sediment."

"Duplicate sediment samples will be collected at sample locations _____ (Identify sediment sample locations from which duplicate or co-located samples for duplicate analysis will be obtained.)"

"Duplicate samples will be collected from these locations because _____" (Add sentence(s) here explaining a rationale for collecting duplicate samples from these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.)

"Sediment samples will be homogenized with a trowel in a sample-dedicated 1-gallon disposable pail. Homogenized material from the bucket will then be transferred to the appropriate wide-mouth glass jars for both the regular and duplicate samples. All jars designated for a particular analysis (e.g., semivolatile organic compounds) will be filled sequentially before jars designated for another analysis are filled (e.g., metals)."

This paragraph can be used if collecting water samples.

"Duplicate water samples will be collected for water sample numbers _____ [water sample numbers which will be split for duplicate analysis]. Duplicate samples will be collected from these locations because _____" (Add sentence(s) here explaining a rationale for collecting duplicate samples from these locations; e.g. samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.)

"When collecting duplicate water samples, bottles with the two different sample identification numbers will alternate in the filling sequence (e.g., a typical filling sequence might be, VOCs designation GW-2, VOCs designation GW-4 (duplicate of GW-2); metals, designation GW-2, metals, designation GW-4, (duplicate of GW-2) etc.). Note that bottles for one type of analysis will be filled before bottles for the next analysis are filled. Volatiles will always be filled first."

Always include this paragraph.

"Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. A separate sample number and station number will be assigned to each duplicate, and it will be submitted blind to the laboratory."

5.4 Background Samples

Background samples are collected in situations where the possibility exists that there are native or ambient levels of one or more target analytes present or where one aim of the sampling event is to differentiate between on-site and off-site contributions to contamination. One or more locations are chosen which should be free of contamination from the site or sampling location itself, but have similar geology, hydrogeology, or other characteristics to the proposed sampling locations

that may have been impacted by site activities. For example, an area adjacent to but removed from the site, upstream from the sampling points, or up gradient or cross gradient from the subsurface water under the site. Not all sampling events require background samples.

The plan should specify the sample locations that have been designated as background. It should include a rationale for collecting background samples from these locations and describe or reference the sampling and analytical procedures which will be followed to collect these samples.

5.5 Field Confirmation and Split Samples

Most short-term wetland projects utilizing standardized field test kits do not require confirmation by a laboratory. However, this section should be completed should the project data quality objectives require confirmation of field test kit performance (typically in situations using non-standard field test kits, immunoassay kits, or soil gas measurements or equivalent, but not situations using a mobile laboratory which generates data equivalent to a fixed laboratory). QC acceptance criteria should be defined in these sections for any fixed laboratory confirmation tests or split sample analyses which will be conducted.

5.5.1 Confirmation Samples

If the planned sampling event includes a combination of field screening and fixed laboratory confirmation, this section should describe the frequency with which the confirmation samples will be collected and the criteria which will be used to select confirmation locations. These will both be dependent on the use of the data in decision making. It is recommended that the selection process be at a minimum of 10% and that a selection criteria include checks for both false positives (i.e., the field detections are invalid or the concentrations are not accurate) and false negatives (i.e., the analyte was not detected in the field). Because many field screening techniques are less sensitive than laboratory methods false negative screening is especially important unless the field method is below the action level for any decision making. It is recommended that some "hits" be chosen and that other locations be chosen randomly.

The plan should describe confirmation sampling. The discussion should include the frequency with which samples will be confirmed and how location will be chosen. Acceptance criteria for the confirmation results (e.g., RPD$\leq$25%) should be defined and corrective actions to be taken if samples are not confirmed should be provided.

5.5.2 Split Samples

Split Samples are defined differently by different organizations, but for the purpose of this guidance, Region 9's QA Office considers split samples as ones that are divided among two or more laboratory for the purpose of providing an inter-laboratory or inter-organization comparison. Usually one organization (for example, a responsible party) collects the samples and provides sufficient material to the other organization (for example, EPA) to enable it to perform independent analyses. It is expected that the sampling party will have prepared a sampling plan

which the QA Office has reviewed and approved that describes the sampling locations and a rationale for their choice, sampling methods, and analyses.

The QAPP should describe the purpose of the split sampling. Include references to the approved sampling plan of the party collecting the samples. Provide a rationale for the sample locations at which split samples will be obtained and how these locations are representative of the sampling event as a whole. Describe how results are to be compared and define criteria by which agreement will be measured. Discuss corrective action to be taken if results are found to not be in agreement.

5.6 Laboratory Quality Control Samples

Laboratory quality control (QC) samples are analyzed as part of standard laboratory practice. The laboratory monitors the precision and accuracy of the results of its analytical procedures through analysis of QC samples. In part, laboratory QC samples consist of matrix spike/matrix spike duplicate samples for organic analyses, and matrix spike and duplicate samples for inorganic analyses. The term "matrix" refers to use of the actual media collected in the field (e.g., routine soil and water samples).

Laboratory QC samples are an aliquot (subset) of the field sample. They are not a separate sample, but a special designation of an existing sample.

The following language can be used if soil samples are to be collected for other than VOCs..

“A routinely collected soil sample (a full 8-oz sample jar or two 120-mL sample vials) contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.”

This language can be used if soil samples are to be collected for other than VOCs.

“Soil samples for volatile organic compound analyses for laboratory QC purposes will be obtained by collecting double the number of equivalent Encore samples from a co-located location in the same way as the original samples, assigned a unique sample numbers and sent blind to the laboratory.”

This language can be used if water samples are to be collected.

“For water samples, double volumes of samples are supplied to the laboratory for its use for QC purposes. Two sets of water sample containers are filled and all containers are labeled with a single sample number.”

For VOC samples this would result in 6 vials being collected instead of 3, for pesticides and semivolatile samples this would be 4 liters instead of 2, etc.

The laboratory should be alerted as to which sample is to be used for QC analysis by a notation on the sample container label and the chain-of-custody record or packing list. The plan should also discuss the frequency with which samples will be collected. For example, this language could be used.

"At a minimum, one laboratory QC sample is required per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated."

"For this sampling event, samples collected at the following locations will be the designated laboratory QC samples." (If a matrix is not being sampled, delete the reference to that matrix.):

"• For soil, samples _____ (List soil sample locations and numbers designated for QA/QC)."
- For sediment, samples _____ (List sediment sample locations and numbers designated for QA/QC).

- For water, samples _____(List water sample locations and numbers designated for QA/QC)."

The QAPP should include a paragraph explaining why these sample locations were chosen for QA/QC samples. QA/QC samples should be samples expected to contain moderate levels of contamination. A rationale should justify the selection of QA/QC samples based on previously-detected contamination at the site or sampling area, historic site or sampling area operations, expected contaminant deposition/migration, etc.

6.0 FIELD SAMPLE COLLECTION PROTOCOLS FOR OFF-SITE ANALYSES

This section should describe the sample collection methods to be used for collection of samples for off-site analysis. It is broken down by the type of matrix to be collected. As before, state "not applicable" if a particular matrix is not relevant to your project. If your wetlands project does not include any off-site laboratory work (other than voucher specimen identification), then the remainder of the QAPP from this section on can probably be eliminated.

In an introductory paragraph, the QAPP should provide an overview of the nature and types of sampling and analyses that will be discussed. This should be followed with specific information in the various sections.

The sampling discussion should be consistent with the samples identified in Section 3. Example text for procedures are provided below in highlighted text, but the organization's own procedures can be used instead. In that case, provide relevant text or attach a copies of applicable Standard Operating Procedures (SOPs). Some sampling SOPs are available from the EPA QA Office..

6.1 Field Equipment

The QAPP should list all the equipment that will be used in the field to collect samples for off site analyses. This should also include decontamination equipment, if used. The plan should discuss the availability of back-up equipment and spare parts.

6.2 Sample Collection by Matrix

6.2.1 Soil

6.2.1.1 Surface Soil Sampling

This subsection should describe the collection of surface soil samples. These are samples that are to be collected within 6-12 inches of the ground surface. The QAPP should specify the method (e.g., hand trowels) that will be used to collect the samples. The QAPP can use the suggested language below, provide its own language, or reference the appropriate sections of a Soil Sampling SOP.

If surface soil samples are being collected for non-volatile inorganic analytes (metals, nutrients, etc.), or non-volatile or semivolatile organic analytes (e.g., pesticides), this paragraph can be used.

"Surface soil samples will be collected as grab samples (independent, discrete samples) from a depth of 0 to ___inches below ground surface (bgs). Surface soil samples will be collected using a stainless steel hand trowel. Samples to be analyzed for volatile organic compounds will be collected first (see below). Samples to be analyzed for _____ [List all analytical methods for soil samples except for volatile organic compounds] will be placed in a sample-dedicated 1-gallon disposable pail and homogenized with a trowel. Material in the pail will be transferred with a trowel from the pail to the _____ [fill in size and type of container]. Sample containers will be filled to the top, taking care to prevent soil from remaining in the lid threads prior to being closed to prevent potential contaminant migration to or from the sample. Sample containers will be closed as soon as they are filled. Semivolatile and pesticide samples will be chilled to 4°C. Metals and anion samples will not be chilled.**"**

If surface soil samples are to be analyzed for volatile organic compounds (VOCs), this paragraph can be used.

"Surface soil samples for VOC analyses will be collected as grab samples (independent, discrete samples) from a depth of 0 to ___[inches or feet] below ground surface (bgs). Surface soil samples will be collected using a 5 gram Encore sampling device, and will be collected in triplicate. Samples will be sealed inside the Encore sampler and placed in a zip lock bag or else transferred directly from the sampler into a VOA vial containing either 10 mLs of methanol or sodium bisulfate solution. Sealed Encore samplers will be stored no more than two days prior to analysis. Frozen Encore sampler samples will be stored for no more than 4 days prior to analysis. If samples are preserved by ejecting into either methanol or sodium bisulfate solution the holding

time is two weeks. Preserved samples will be chilled to 4˚C immediately upon collection. Consult EPA Method 5035 for details on preservation options for VOC samples. The samples will be wrapped in bubble wrap prior to shipment to the laboratory."

6.2.1.2 Subsurface Soil Sampling

This subsection is subsurface soil samples that are to be collected 12 inches or more below the surface. Specify the method (e.g., hand augers) that will be used to access the appropriate depth and then state the depth at which samples will be collected and the method to be used to collect and then transfer samples to the appropriate containers or reference the appropriate sections of a Soil Sampling SOP. If SOPs are referenced, they should be included in an Appendix.

If subsurface soil samples are being collected for other than volatile organic compounds, this paragraph can be used.

"Subsurface samples will be collected by boring to the desired sample depth using _____ [whatever method is appropriate or available]. Once the desired sample depth is reached, the _____ [hand- or power-operated device, such as a shovel, hand auger, trier, hollow-stem auger or split-spoon sampler] will be inserted into the hole and used to collect the sample. Samples will be transferred from the _____ [sampling device] to a sample-dedicated 1-gallon disposable pail and homogenized with a trowel."

"Material in the pail will be transferred with a trowel from the pail to the _____ [size and type of container]. Sample containers will be filled to the top taking care to prevent soil from remaining in the lid threads prior to being sealed to prevent potential contaminant migration to or from the sample. Sample containers will be closed as soon as they are filled. Semivolatile and pesticide samples will be chilled to 4°C. Metals and anion samples will not be chilled."

If subsurface soil samples are to be analyzed for volatile compounds, this paragraph can be used.

"Samples to be analyzed for volatile organic compounds will be collected first. Subsurface samples will be collected by boring to the desired sample depth using _____ _____ [hand- or power-operated device, such as a shovel, hand auger, trier, hollow-stem auger or split-spoon sampler, or other appropriate device]. Once the desired sample depth is reached, soil samples for VOC analyses will be collected as independent, discrete samples. Subsurface soil samples will be collected using a 5 gram Encore sampling device, and will be collected in triplicate. Samples will be sealed inside the Encore sampler and placed in a zip lock bag or else transferred directly from the sampler into a VOA vial containing either 10 mLs of methanol or sodium bisulfate solution. Sealed Encore samplers will be stored no more than two days prior to analysis. Frozen Encore sampler samples will be stored for no more than 4 days prior to analysis. If samples are preserved by ejecting into either methanol or sodium bisulfate solution the holding time is two weeks. Preserved samples will be chilled to 4˚C immediately upon collection. Consult EPA Method 5035 for details on preservation options

for VOC samples. The samples will be wrapped in bubble wrap prior to shipment to the laboratory."

This final paragraph should be used regardless of what analyses will be used for subsurface soil samples.

"Excess set-aside soil from the above the sampled interval will then be re-packed into the hole."

If requested analyses include metals and/or anions, this paragraph can be used.

"Surface soil samples to be analyzed for metals and/or anions will be homogenized and transferred from the sample-dedicated homogenization pail into 8-oz, wide-mouth glass jars. For each sample, one 8-oz glass jar will be collected for each laboratory. Samples will not be chilled. Subsurface samples will be retained in their original brass sleeves or other container unless transferred to bottles."

6.2.2 Sediment (Water and Stream-bed) Sampling

This subsection should be included if sediment samples are to be collected. The QAPP should specify the method that will be used to collect the samples and at what depth samples will be collected. If a SOP will be followed rather than the language provided, the SOP should be referenced and included in the appendix. It is assumed that sediment samples will not be analyzed for volatile compounds.

The QAPP should include language to describe collection of sediment samples. For example, EPA Region 9 has a sediment sampling SOP which is available upon request. Appropriate sections can be paraphrased here, if relevant. Included in the Region 9 sediment sampling SOP are the following sections:

1. Sampling surface sediments with a trowel or scoop from beneath a shallow aqueous layer.
2. Sampling surface sediments with a thin wall tube auger from beneath a shallow aqueous layer.
3. Sampling deep sediments with augers and thin wall tube samplers from beneath a shallow aqueous layer.
4. Sampling surface sediments from beneath a deep aqueous layer with an Eckman or Ponar dredge.
5. Sampling subsurface sediments from beneath a deep aqueous layer with a sample coring device.

A final paragraph describes sample homogenization if applicable, which is especially important if the sample is to be separated into solid and liquid phases. The filling of containers should also be discussed.

"Samples to be analyzed for _____ [List all analytical methods for sediment samples] will be placed in a sample-dedicated 1-gallon disposable pail and homogenized with a trowel. Material in the pail will be transferred with a trowel from the pail to the _____ [fill in size and type of container]. Sample containers will be filled to the top, taking care to prevent soil from remaining in the lid threads prior to being closed to prevent potential contaminant migration to or from the sample. Sample containers will be closed as soon as they are filled. Semivolatile and pesticide samples will be chilled to 4°C. Metals and anion samples will not be chilled."

6.2.3 Water Quality Sampling

6.2.3.1 Surface Water Sampling

This subsection should be included if samples are to be collected in rivers, streams, wetlands, lakes and reservoirs, or from standing water in runoff collection ponds, gullies, drainage ditches, etc. Describe the sampling procedure, including the type of sample (grab or composite - see definitions below), sample bottle preparation, and project-specific directions for taking the sample. State whether samples will be collected for chemical and/or microbiological analyses. Alternatively, reference the appropriate sections of attached SOPs.

Grab

The QAPP should describe how grab samples will be collected.. Note that water samples collected for microbiological analysis must be grab samples, not composites. Here is some suggested language to describe the collection of grab samples.

"Samples will be collected at one time from one location. When samples are taken from flowing, rather than stagnant water, the sampler will face upstream in the middle of the stream. Samples will be collected by hand or with a sample bottle holder. For samples taken at a single depth, the bottle will be uncapped and the cap protected from contamination. The bottle will be plunged into the water mouth down and filled 6 to 12" below the surface of the water. If it is necessary to take samples at depth, special samplers [indicate whether Niskin, Kemmerer Depth Samplers, or some other equipment will be used]. After filling the bottle(s), some of the sample will be poured out leaving a headspace of 2.5-5cm (1-2in). For microbiological samples, bottles and caps will be sterile. If sampling of chlorinated water is anticipated, sodium thiosulfate at a concentration of 0.1 mL of a 10% solution for each 125 mL (4 oz) of sample volume will be put into the bottle before it is sterilized."

Water Sampling at Depth

The QAPP should describe the procedure to be used to collect samples at depth, if relevant. Use the language below, as appropriate, or provide either your own language or reference a SOP. The language below comes from a Region 9 SOP.

"When discrete samples are desired from a specific depth, and the parameters to be measured do not require a Teflon® coated sampler, a standard Kemmerer or Van Dorn sampler will be used. The Kemmerer sampler is a brass cylinder with rubber stoppers that leave the ends of the sampler

open while being lowered in a vertical position, thus allowing free passage of water through the cylinder. The Van Dorn sampler is plastic and is lowered in a horizontal position. In each case, a messenger (signaling unit) is sent down the rope when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised. Water is removed through a valve to fill respective sample containers. With multiple depth samples, care will be taken not to stir up the bottom sediment and thus bias the sample."

Time Composite:
"Samples will be collected over [state period of time, e.g., 24 hours] interval. If a composite sample is required, a flow- and time-proportional automatic sampler will be positioned to take samples at the appropriate location in a manner such that the sample can be held at 4^{o}C for the duration of the sampling."

Spatial Composite:
"Samples will be collected from different representative positions in the water body and combined in equal amounts. A Churn Splitter or equivalent device will be used to ensure that the sample is homogeneously mixed before the sample bottles are filled. Volatile organic compound samples will be collected as discrete samples and not be composited."

If samples will be filtered before preservation, the following section can be used or modified, as appropriate

"Samples designated for _____ [state analysis, e.g., metals] analysis will be filtered. A ___ [state size] micron filter will be used to remove larger particles that have been entrained in the water. A sample-dedicated Teflon tube will be attached to the output of the ____ [describe filtration device]. A clean, unused filter will be used for each filtered sample collected. Filtered water will be transferred from the filtering device directly into the appropriate sample containers to which preservative has been added. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, the Teflon tube and filter will be removed and an unfiltered sample will be collected. A sample number appended with an "Fl" will represent a sample filtered with a ___ [state size] micron filter."

Depending on the type of analysis (organic or inorganic) requested, and any other project-specific analytical requirements, sample bottles should be plastic (inorganics) or glass (organics), pre-cleaned (general decontamination procedures) or low-detection level pre-cleaned (extensive decontamination procedures).

The QAPP should describe the type of bottles that will be used for the project, including the cleaning procedures that will be followed to prepare the bottles for sampling if precleaned bottles are not used.

6.2.3.2 Subsurface Water Sampling (Well Sampling)

This subsection contains procedures for water level measurements, well purging, and well sampling. Relevant procedures should be described under this heading with any necessary site-specific modifications. Alternatively, reference appropriate SOP(s).

6.2.3.2.1 Water-Level Measurements

The following language may be used as is or modified to meet project needs.

"All field meters will be calibrated according to manufacturer's guidelines and specifications before and after every day of field use. Field meter probes will be decontaminated before and after use at each well."

"If well heads are accessible, all wells will be sounded for the depth of the water column. Prior to purging, the depth of the water and the total well depth will be determined from the top of the well casing. An electronic sounder, accurate to the nearest +/- 0.01 feet, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column, the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water and most electronic water level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.1 feet."

"Water-level sounding equipment will be decontaminated before and after use in each well. Water levels will be measured in wells which have the least amount of known contamination first. Wells with known or suspected contamination will be measured last."

6.2.3.2.2 Purging

The QAPP should describe the method that will be used for well purging (e.g., dedicated well pump, bailer, hand pump). Reference the appropriate sections in the Ground Water SOP and state in which Appendix the SOP is located. Some suggested language is provided below.

[VERSION A]

"Procedures for purging and sampling wells can be found in Appendix ____. "

[VERSION B]

"All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using a hand pump, a submersible pump, or a bailer,

depending on the diameter and configuration of the well. When a submersible pump is used for purging, clean flexible Teflon tubes will be used for subsurface water extraction. All tubes will be decontaminated before use in each well. Pumps will be placed 2 to 3 feet from the bottom of the well to permit reasonable draw down while preventing cascading conditions."

[VERSION C]

"All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using the dedicated well pump, if this is feasible. If the well cannot be purged, the sample will be collected directly from the outlet. When samples are collected from the well, the container will be placed directly below the outlet without coming in contact with the spigot."

[ALL VERSIONS - should be included in all sample plans]

"Water will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as:

$$\mathbf{V = \pi d^2 h / 77.01}$$

where:

V is the volume of one well casing of water ($1ft^3 = 7.48$ gallons);
d is the inner diameter of the well casing (in inches);
h is the total depth of water in the well (in feet).

It is most important to obtain a representative sample from the well. Stable water quality parameter (temperature, pH and specific conductance) measurements indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

- temperature range is no more than $\pm 1^{\circ}C$;
- pH varies by no more than 0.2 pH units;
- specific conductance readings are within 10% of the average.

The water in which measurements were taken will not be used to fill sample bottles.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If the well casing volume is NOT known, measurements will be taken every 2.5 minutes after flow starts. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease, which will be noted in the logbook, and ground water samples will be taken. The depth to water, water quality measurements and purge volumes will be entered in the logbook.

If a well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and dewatered once more. After water levels have recharged to 80% of the static water column, subsurface water samples will be collected."

6.2.3.2.3 Sampling

The QAPP should describe the method that will be used to collect samples from wells. (This will probably be the same method as was used to purge the wells.) Specify the sequence for sample collection (e.g., bottles for volatile analysis will be filled first, followed by semivolatiles, etc.). State whether samples for metals analysis will be filtered or unfiltered. Include the specific conditions, such as turbidity, that will require samples to be filtered. Alternatively, reference the appropriate sections in the Ground Water SOP and state in which Appendix the SOP is located.

ALL VERSIONS - should be included in all sample plans

"At each sampling location, all bottles designated for a particular analysis (e.g., volatile organic compounds) will be filled sequentially before bottles designated for the next analysis are filled (e.g., nutrients). If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analysis are filled. In the filling sequence for duplicate samples, bottles with the two different sample designations will alternate (e.g., volatile organic compounds designation GW-2, volatile organic compounds designation GW-4 (duplicate of GW-2), metals designation GW-2, metals designation GW-4 (duplicate of GW-2). Subsurface water samples will be transferred from the tap directly into the appropriate sample containers with preservative, if required, chilled if appropriate, and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the tap to the sample container."
"

If samples are to be collected for volatile organic compound analysis, the following paragraph can be used.

"Samples for volatile organic compound analyses will be collected using a low flow sampling device. A [specify type of pump] pump will be used at a flow rate of _____. Vials for volatile organic compound analysis will be filled first to minimize the effect of aeration on the water sample. A test vial will be filled with sample, preserved with hydrochloric acid (HCl) and tested with pH paper to determine the amount of preservative needed to lower the pH to less than 2. The appropriate amount of HCl will then be added to the sample vials prior to the addition of the sample. The vials will be filled directly from the tap and capped. The vial will be inverted and checked for air bubbles to ensure zero headspace. If a bubble appears, the vial will be discarded and a new sample will be collected."
"

If some samples for nutrients, metals, (or other) analysis are to be filtered, depending upon sample turbidity, the following paragraph can be used.

"After well purging and prior to collecting subsurface water samples for metals analyses, the turbidity of the subsurface water extracted from each well will be measured using a portable turbidity meter. A small quantity of subsurface water will be collected from the well using the tap and a will be transferred to a disposable vial and a turbidity measurement will be taken. The results of the turbidity measurement will be recorded in the field logbook. The water used to measure turbidity will be discarded after use. If the turbidity of the subsurface water from a well is above 5 Nephelometric Turbidity Units (NTUs), both a filtered and unfiltered sample will be collected. A [specify size]-micron filter will be used to remove larger particles that have been entrained in the water sample. A sample-dedicated Teflon tube will be attached to the tap closest to the well head. The filter will be attached to the outlet of the Teflon tube. A clean, unused filter will be used for each filtered sample collected. Subsurface water samples will be transferred from the filter directly into the appropriate sample containers with a preservative and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, the Teflon tube and filter will be removed and an unfiltered sample will be collected. A sample number appended with an "Fl" will represent a sample filtered with a ____ [state size] micron filter."

If samples are to be filtered for metals (or other) analyses regardless of sample turbidity, the following paragraph can be used.

"Samples designated for metals analysis will be filtered. A ___ [state size] micron filter will be used to remove larger particles that have been entrained in the water sample. A sample-dedicated Teflon tube will be attached to the tap closest to the well head. The filter will be attached to the outlet of the Teflon tube. A clean, unused filter will be used for each filtered sample collected. Subsurface water samples will be transferred from the filter directly into the appropriate sample containers to which preservative has been added and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, the Teflon tube and filter will be removed and an unfiltered sample will be collected. A sample number appended with an "Fl" will represent a sample filtered with a ___ [state size] micron filter."

6.2.3.3 Preservation of Water Samples

Preservation of water samples is dependent on the analyte of interest. The preservation and holding times for water samples should be described. A table is recommended. See 40 CFR 136, Standard Methods for the Examination of Water and Wastewater, your analytical laboratory's specifications, or SW-846.

This section requires a reference to the types of bottles to be used, preparation and preservatives to be added for samples sent for off-site analysis or identification. The organization responsible for adding preservatives (i.e., the field team or the laboratory) should be identified.

"The number of sample containers, volumes, and materials are listed in Section ___ The containers are pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added by _____ (add the name of agency/organization doing the sampling) to the containers prior to shipment of the samples to the laboratory."

If requested analyses do not require preservation, this paragraph can be included. A separate paragraph should be included for each bottle type.

"_____[Include all requested analysis(es), e.g., Anions, Pesticides, Semivolatile organic compounds]. Low concentration water samples to be analyzed for _____[Specify analysis(es), e.g., semivolatile organic compounds] will be collected in _____ [Specify bottle type, e. g., 1-liter(L) amber glass bottles]. No preservative is required for these samples. Two bottles of each water sample are required for each laboratory."

If the requested analyses include volatile organic compounds, this paragraph can be used.

"Volatile Organic Compounds. Low concentration water samples to be analyzed for volatile organic compounds will be collected in 40-mL glass vials. 1:1 hydrochloric acid (HCl) will be added to the vial prior to sample collection. During sample collection, the pH will be measured using a pH meter to test at least one vial at each sample location to ensure sufficient acid is present to result in a pH of less than 2. The tested vial will be discarded. If the pH is greater than 2, additional HCl will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial will be discarded. The vials will be filled so that there is no headspace. The samples will be chilled (quenched in ice water) to 4˚C immediately upon collection. Three vials of each water sample are required for each laboratory."

If the requested analyses include metals and/or anions, this paragraph can be used.

"Metals and/or anions. Water samples collected for metals analysis will be collected in 1L polyethylene bottles. The samples will be preserved by adding nitric acid (HNO_3) to the sample bottle. The bottle will be capped and lightly shaken to mix in the acid. A small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be $\leq$2. The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary. The samples will be chilled to 4˚C immediately upon collection. One bottle of each water sample is required for each laboratory."

"General Chemistry (Water Quality) Parameters. Water samples collected for water quality analysis [Specify what parameters are included. Examples include (but are not limited to) anions (nitrate-N, nitrite-N, sulfate, phosphate), total phosphorus, ammonia-N, total dissolved solids, total suspended solids, alkalinity (may include carbonate, and/or bicarbonate), hardness, cyanide, MBAS (methylene blue active substances), etc.], will be collected in [Specify size of container] polyethylene bottles. The [Specify analysis] samples will be preserved by adding [Describe preservative appropriate to each sample type] to the sample bottle. The [Specify analysis] samples will not be preserved. If preservative is added, the bottle will be capped and lightly shaken to mix

in the preservative. Where the preservative affects the pH, a small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be within the appropriate range. The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary. Samples will be chilled to 4˚C immediately upon collection. Samples from each location that require the same preservative will be placed in the same bottle if being analyzed by the same laboratory."

6.2.4 Biological Sampling for Chemical Analyses

If biological samples are to be collected for chemical analysis, the QAPP should the analyses that will be performed. Use the language below or reference the appropriate sections in a sample collection SOP and state in which appendix the SOP is located.

The two most common types of biological being collected for chemical analysis are foliage and fish samples (however, other matrices are also possible, but no example language is provided). The following paragraphs are suggested, but field circumstances may dictate alternative collection procedures. If a SOP will be followed, reference it and include it in an appendix.

6.2.4.1 Foliage Samples

"A representative foliage sample will be collected from the sampling area. The following plants will be collected: _____, _____, and _____. These plants are being collected because they are were most likely affected by chemicals used in the area. Only foliage showing visible signs of stress or damage will be collected. Woody tissue, dead leaves, and twigs will be discarded; live leaves only will be collected. The same type of material _____ (Describe material, mature leaves, young shoots, roots, stems, etc.) will be obtained from each plant type. Provided contamination is uniform, material will be composited from several plants to yield a total of about (specify quantity e.g., gram(s) of material). Control samples will also be collected from a nearby unaffected area (Describe area), if available. Latex gloves will be worn during the collection of all samples. Samples will be stored in [describe container, plastic bags, bottles, etc.] and brought to the laboratory as soon as possible to prevent sample deterioration."

The QAPP should describe the containers that will be used for the project. Usually foliage samples are collected in clean zip lock bags, but bottles or other containers can be used. Paper bags are not recommended. Here is some sample language.

"Foliage samples will be placed in one gallon zip lock bag. A self adhesive label will be placed on each bag and the top sealed with a custody seal."

6.2.4.2 Fish Samples

This language can be used if collecting fish. Alternatively, reference appropriate SOPs.

"Fish will be collected using _____ [name method; nets, electroshocking, lines, etc.]. _____ [specify number of fish] _____ [indicate species of fish, e. g., trout, catfish, etc.] will be collected from each _____ [specify area]. Efforts will be made to collect fish of approximately the same size and maturity by checking to make sure that lengths and weights do not differ by more than 20%. Once collected the _____ [indicate whether whole fish or fillets] will be wrapped in aluminum foil and sealed in zip lock bags and frozen as quickly as possible. Samples will be shipped using dry ice to the laboratory selected to perform the analysis."

If samples are to be composited by the laboratory, also discuss that in this section.

6.3 Equipment Cleaning and Decontamination Procedures

The QAPP should specify the decontamination procedures that will be followed if non-dedicated sampling equipment is used. Alternatively, appropriate sections in the organization's SOPs can be referenced. The QAPP should state in which appendix the SOP is located, or use the language suggested below.

"The decontamination procedures that will be followed are in accordance with approved procedures. Decontamination of sampling equipment must be conducted consistently as to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated soil or water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. All sampling devices used, including trowels and augers, will be decontaminated according to EPA Region 9 recommended procedures."

The following, to be carried out in sequence, is an EPA Region 9 recommended procedure for the decontamination of sampling equipment

Use the following decontamination procedure if samples are collected for organic analyses only.

"• Non-phosphate detergent and tap water wash, using a brush if necessary
• Tap-water rinse
• Deionized/distilled water rinse
• Pesticide-grade solvent (reagent grade hexane) rinse in a decontamination bucket
• Deionized/distilled water rinse (twice)"

The following decontamination procedures can be used if samples are collected for inorganic (metals) analyses only. Note: nitric acid should not be used to decontaminate equipment used to collect samples for nitrate and/or nitrite analyses.

"• Non-phosphate detergent and tap water wash, using a brush if necessary
• Tap-water rinse

- 0.1 N nitric acid rinse
- Deionized/distilled water rinse (twice)"

The following decontamination procedures can be used if samples are collected for both organic and inorganic analyses. Note: nitric acid should not be used to decontaminate equipment to be used to collect samples for nitrate and/or nitrite analyses.

"• Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- 0.1 N nitric acid rinse
- Deionized/distilled water rinse
- Pesticide-grade solvent (reagent grade hexane) rinse in a decontamination bucket
- Deionized/distilled water rinse (twice)"

"Equipment will be decontaminated in a predesignated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered."

NOTE: A different decontamination procedure may be used; but if so, a rationale for using the different approach should be provided.

7.0 LABORATORY ANALYSES AND SELECTION

This section should discuss analytical support for the project including the analyses requested, analytes of concern, turnaround times, available resources, available laboratories, etc. If samples will be sent to more than one organization it should be clear which samples go to which laboratory. Field analyses for pH, conductivity, turbidity, or other field tests should have been discussed previously in the QAPP. This section applies to off-site analyses only.

The following section should be completed concerning the analyses for each matrix for which off-site chemical samples will be collected. It is recommended that one or more tables, one for each matrix (soil, sediment, water, insects, fish, foliage, etc.), should be provided. Each table should list analytical methods for each type of sample. The extra volume needed for laboratory QC samples (for water samples only) should be noted in the table. The tables should include the critical information concerning the number of samples, matrix, analyses requested and QC sample identification (e.g., field blanks, duplicates, etc.). The selected analyses must be consistent with earlier discussions.

7.1 Summary of Laboratory Analyses

The following language can be used by filling in the blanks. The QAPP should provide information for each analysis requested. Information should be deleted as appropriate.

"As enumerated in Table __, ____[indicate matrix, e.g., water, soil, fish, etc.] samples will be taken at ____[indicate total number of locations] locations. _____["Single" or "Double" depending on laboratory requirements] volume ____[matrix] samples collected at the following sample locations will be identified for use as laboratory QC samples: _____[QC sample numbers]. Duplicate ____[matrix] samples will be collected at the following sample locations: _____. Describe requested analyses e.g., nitrate by EPA method 353.4."

The table should include provisions for field duplicates. The locations and a rationale for the choice of sample locations should have been provided in previous sections.

7.2 Selecting a Laboratory

The QAPP should discuss the selection of the analytical laboratory and briefly discuss how the capability of the laboratory was assessed. The laboratory(ies) should have both the capability and capacity to provide analytical services for the project. A QA Plan from the laboratory or SOPs for the methods to be performed must accompany the project QAPP. EPA does not approve or certify laboratories, however, it will review the laboratory's QA Plan and provide comments to the QAPP preparing organization's author concerning whether the laboratory's QA/QC program appears to be adequate to meet project objectives. Any issues raised should be discussed with the laboratory, and must be resolved before work commences.

When a grantee organization contracts for analytical work it has two options. In Option 1, acceptance criteria (i.e., MQOs) to satisfy DQI requirements for laboratory work are defined in the project QAPP. These DQI acceptance criteria are then provided to the laboratory which then acknowledges that it is capable of meeting these criteria, and also states it is willing to meet them. In Option 2, the grantee organization reviews the laboratory's QA/QC Program, QA documentation, and QC acceptance criteria and determines whether the laboratory can meet project needs. The QAPP would then contain a statement acknowledging this review had occurred and the grantee organization felt the laboratory's QA plan was sufficient to meet project objectives.

If the first approach is taken, the organization writing the QAPP should include the appropriate DQI/MQO tables in the QAPP. A QA Plan and/or SOPs from the laboratory should be included with the plan and the QAPP should state explicitly that the laboratory has agreed to meet the defined MQO criteria. The QA Office has tables with DQI acceptance criteria available for most routine analyses. Plan preparers are free to request these tables, review them for their appropriateness for the project, and incorporate all or some of them in original or modified form into their QAPP.

If the second approach is taken, the grantee organization must acknowledge that it understands and agrees to the DQI/MQO criteria defined by the contract laboratory which will be used for the project. MQOs for work performed by the laboratory will be found in either the laboratory's QA Plan and/or its SOPs. Whichever document contains this information must be included with the project QAPP.

8.0 SAMPLE SHIPMENT TO OFF-SITE LABORATORY

8.1 Sample Chain-Of-Custody Forms and Custody Seals

The following paragraphs provide a generic explanation and description of the use of chain-of-custody forms and custody seals. They may be incorporated as is, if they are appropriate, or modified to meet any project-specific conditions.

"The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of _____[name of agency/ organization conducting sampling]. The sampling team leader or designee will sign the chain-of-custody form in the "relinquished by" box and note date, time, and air bill number (as appropriate)."

"The sample numbers for all rinsate samples, reference samples, laboratory QC samples, and duplicates will be documented on this form. A photocopy will be made for the _____'s [name of agency/ organization conducting sampling] master files."
"

"A self-adhesive custody seal will be placed across the lid of each sample. A copy of the seal is found in Appendix _. For VOC samples sent off-site, the seal will be wrapped around the cap. The shipping containers in which samples are stored (usually a sturdy picnic cooler or ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated."
"

8.2 Packaging and Shipment

The following paragraphs provide a generic explanation and description of how to pack and ship samples. They may be incorporated as is, if appropriate, or modified to meet any project-specific conditions.

"All sample containers will be placed in a strong-outside shipping container (a steel-belted cooler). The following outlines the packaging procedures that will be followed.

1. When ice is used, pack it in zip-locked, double plastic bags. Seal the drain plug of the cooler with fiberglass tape to prevent melting ice from leaking out of the cooler.

2. The bottom of the cooler should be lined with bubble wrap to prevent breakage during shipment.

3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.

4. Secure bottle/container tops with clear tape and custody seal all container tops.

5. Affix sample labels onto the containers with clear tape.

6. Wrap all glass sample containers in bubble wrap to prevent breakage.

7. Seal all sample containers in heavy duty plastic zip-lock bags. Write the sample numbers on the outside of the plastic bags with indelible ink.

8. Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid.

9. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment.

10. Ice used to cool samples will be double sealed in two zip lock plastic bags and placed on top and around the samples to chill them to the correct temperature.

11. Each ice chest will be securely taped shut with fiberglass strapping tape, and custody seals will be affixed to the front, right and back of each cooler."

"Records will be maintained by [organization]'s sample custodian of the following information:

- Sampling contractor's name (if not the organization itself)
- Name and location of the site or sampling area
- Total number(s) by estimated concentration and matrix (soil, sediment, water) of samples shipped to each laboratory for chemical analysis
- Total number(s) of biological samples sent off-site for chemical analysis
- Total number(s) of biological samples sent off-site for identification or for census purposes
- Carrier, air bill number(s), method of shipment (priority next day)
- Shipment date and when it should be received by laboratory
- Irregularities or anticipated problems associated with the samples
- Whether additional samples will be shipped or if this is the last shipment."

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