320

QUALITY ASSURANCE PROJECT PLAN

FOR

BRAWLEY CONSTRUCTED WETLANDS DEMONSTRATION PROJECT

Prepared by:

Citizen's Congressional Task Force on the New River

Project Participants:

Bureau of Reclamation (USBR)
Fish and Wildlife Service (USFWS)
Geological Survey (USGS)
Imperial Irrigation District (IID)
Desert Wildlife Unlimited (DWU)
Imperial County
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Date:_____

Table of Contents

SECTION		PAGE NUMBER
1.0	INTRODUCTION	5.
1.1	SITE NAME	5.
1.2	SITE LOCATION	5.
1.3	RESPONSIBLE AGENCY	5.
1.4	PROJECT ORGANIZATION	6.
1.5	STATEMENT OF SPECIFIC PROBLEM	7.
1.6	DATA USES	7.
2.0	BACKGROUND	8.
2.1	LOCATION	
2.1.1	Geographic location	8.
2.1.2	Specific location	8.
2.2	GEOLOGICAL INFORMATION	8.
2.3	ENVIRONMENTAL AND/OR HUMAN IMPACT	8.
2.4	PREVIOUS INVESTIGATIONS	9.
2.5	REGULATORY INVOLVEMENT	10.
3.0	PROJECT DATA QUALITY OBJECTIVES	10.
3.1	DATA USES	12.
3.2	PROJECT TASKS	12.
3.3	EXPECTED DATA QUALITY	14.
3.4	DATA QUALITY INDICATORS	23.
3.5	DATA MANAGEMENT PLAN	27.
3.6	ASSESSMENT/OVERSIGHT	27.
4.0	SAMPLING DESIGN	28.
4.1	SOIL	28.
4.2	SEDIMENT	28.
4.2.1	Sampling locations	28.
4.2.2	Analytes of concern	28.
4.3	WATER	28.
4.3.1	Sampling locations	28.

4.3.2 Analytes of concern 28.
4.4 OTHER MEDIA (BIOTA) 28.
4.5 SAMPLE IDENTIFICATION 29.
4.6 SAMPLE PRESERVATION AND HOLDING CONDITIONS 29.

5.0 REQUESTS FOR ANALYSES 30.
5.1 REQUEST FOR ANALYSES TABLES 30.
5.2 ANALYSES NARRATIVE 32.

6.0 METHODS AND PROCEDURES 32.
6.1 FIELD HEALTH AND SAFETY PROCEDURES 32.
6.2 FIELD PROCEDURES 32.
6.2.1 Equipment 32.
6.2.1.1 Equipment Calibration and Maintenance 33.
6.2.2 Field Sampling Procedures 34.
6.2.3 Field Notes 35.
6.2.3.1 Field logbooks 35.
6.2.3.2 Photographs 36.
6.3 SOIL SAMPLING PROCEDURES 36.
6.4 BOTTOM SEDIMENT SAMPLING PROCEDURES 36.
6.5 SURFACE WATER SAMPLING PROCEDURES 36.
6.5.1 Chemical Analysis Sample Collection 36.
6.5.1.1 Sample bottles 36.
6.5.1.2 Sampling procedure 37.
6.5.2 Bacteriological Sample Collection 37.
6.5.2.1 Sample bottles 37.
6.5.2.2 Sampling procedures 38.
6.6 GROUNDWATER SAMPLING PROCEDURES 38.
6.7 PROCEDURES FOR OTHER MATRICES 38.
6.8 DECONTAMINATION PROCEDURES 38.

7.0 DISPOSAL OF RESIDUAL MATERIALS 39.

8.0 SAMPLE DOCUMENTATION AND SHIPMENT 39.

8.1 BOTTLES AND PRESERVATIVES 39.
8.1.1 Soil Samples 39.

8.1.2 Bottom Sediment Samples 39.
8.1.3 Water Samples 40.
8.1.4 Samples of Other Matrices 40.
8.2 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS 40.
8.3 LABELING, PACKAGING, AND SHIPMENT 41.

9.0 QUALITY CONTROL 41.
9.1 FIELD QUALITY CONTROL SAMPLES 41.
9.1.1 Equipment Blanks 41.
9.1.2 Field Blanks 41.
9.1.3 Trip Blanks 42.
9.1.4 Field Duplicate Samples 42.
9.2 LABORATORY QUALITY CONTROL SAMPLES 42
9.3 FIELD VARIANCES 43.

FIGURES

2.1a
2.1b
2.1c

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1.0 INTRODUCTION

The purpose of the Brawley Constructed Wetlands Demonstration Project is to study how wetlands can improve the quality of agricultural drain water, New River water, and all inflows to the Salton Sea. To achieve this goal, the inflow and outflow of the Brawley wetlands will be monitored to determine the effectiveness of the design to improve water quality by removing nutrients, sediment, and selenium.

1.1 SITE NAME: Brawley Wetlands and Imperial Wetlands

1.2 SITE LOCATION: Imperial County California

1.3 RESPONSIBLE AGENCY: Citizens Congressional Task Force on the New River

1.4 PROJECT ORGANIZATION:

Title/Responsibility	Name
Project Manager	Steve Charlton – Bachelor of Science in Civil Engineering with two years experience as an Engineer with IID in the Engineering Services Section of the Water Department.
Quality Assurance Officer	Carol Roberts – Master of Science in Biological Sciences with eight years experience as an Environmental Contaminant Specialist with USFWS
Field Team Leader	Steve Charlton – See above
Sample Coordinator	Steve Charlton – See above
Laboratory Manager	Lawrence Chrystal – Bachelor of Science in Biology with 25 years experience in environmental testing. Laboratory director of Edward S. Babcock and Sons, Inc. (Laboratory) – certified by the State of California Health and Human Services Agency as an environmental testing laboratory pursuant to the provisions of the California Environmental Laboratory Improvement Act of 1988.
Data Manager	Gabe Marcial – Bachelor of Science in Business Administration with emphasis in Information Technology with 24 years of experience in the field and head of Information Technical Department with IID.

Requirements of project personnel:

Project Manager: Minimum three years experience as project chief of broad-scale projects associated with water quality investigations. Experience in water-quality sample collection techniques to include biological samples of invertebrates, algae and plant material. Background and experience in management of water quality data, analysis and interpretation of water quality data (including biological samples), and in producing technical reports dealing with complex systems. Experience in organizing and conducting meetings and seminars along with ability to communicate effectively both orally and in writing.

Quality Assurance Officer: Minimum three years experience in collection of water or biological data. Knowledge of QA/QC procedures for data collection to include but not limited to sample splits, duplicates, matrix spikes, equipment blanks, trip blanks, and laboratory control samples to include but not limited to blank spikes, method blanks, matrix spikes, and calibration samples. Ability to communicate effectively both orally and in writing.

Field Team Leader: Experience in water quality sampling techniques (water, sediment, biota and plant material) and QA/QC procedures. Some limited experience in organizing and conducting field sampling.

Sample Coordinator: Limited knowledge of water quality field techniques. Thorough understanding of the Imperial and Brawley wetland's monitoring plan and sampling requirements. Must have knowledge of personnel involved in all phases of sample collection at the wetlands. Possess ability to communicate effectively and interact with project personnel.

Laboratory Manager: Minimum 10 years experience in analytical chemistry in a production laboratory setting. Must have extensive knowledge of analytical methods and interferences for all constituents for which analyses are performed as well as all QA/QC procedures for a certified water quality laboratory.

1.5 STATEMENT OF THE SPECIFIC PROBLEM:

Water quality in the Salton Sea and in the rivers and drains that discharge to the Sea is degraded by agricultural return from approximately 500,000 acres of irrigated farmland in the Imperial Valley. Water entering the United States via the New River contains municipal and industrial discharges from Mexico that degrade downstream water quality, impair habitat, and also impact the Salton Sea. Agricultural return or drainwater is composed of both tailwater (surface runoff from the fields) and tilewater (flow from tile drains beneath the fields). Drainwater from the fields is discharged to surface drains which in turn empty into the New River, Alamo River or directly to the south end of the Salton Sea. Contaminants present in drainwater include sediment, nitrogen, phosphorus, pesticides, salts and selenium. Water in the New River crossing the international boundary contains high levels of fecal coliform bacteria and organic compounds. The Regional Water Quality Control Board has identified these contaminants as responsible for impairing the beneficial uses of the New and Alamo Rivers and the Salton Sea. The Brawley constructed wetlands demonstration project is intended to reduce loading of these constituents and provide valuable wetland habitat in the Imperial Valley.

1.6 DATA USES

Because this is a demonstration project, a significant portion of the resources is devoted to monitoring and evaluating the ability of the wetland to achieve its goals. Information from this evaluation will provide details to refine wetland design for future expansion to treat larger volumes of drainwater in the Imperial Valley.

2.0 BACKGROUND

2.1 LOCATION

2.1.1 Geographic location: The Brawley wetlands is located at: 32.9566 degrees latitude and 115.5694 degrees longitude. The Imperial wetlands is located at: 32.858 degrees latitude and 115.630 degrees longitude. See figure 2.1a –location of wetland

2.1.2 Specific location: The proposed 7-acre Brawley Site is adjacent to the New River near Brawley, California (see site plan, Attachment 3). The site is located among active agricultural fields with the closest building 1/4 mile from the proposed site. The design for the constructed wetland encompasses the entire 7 acres and will consist of approximately 6 acres of water surface area. Water will be pumped from the New River, flow through the wetland cells and be returned to the river. The site, owned by Imperial County, has been cultivated for at least 20 years. Vegetation on the site consists of a perimeter composed mostly of saltcedar. See figure 2.1b for location of sampling sites within the wetland.

The Imperial Site is located on 68 acres adjacent to the New River near Imperial, California. This site also is located adjacent to active agricultural fields, with the closest building 1/4 mile from the proposed site. The demonstration wetland will occupy the entire 68 acres and will contain approximately 23 acres of water surface area. Agricultural drainwater from IID's Rice 3 Drain will be diverted to the wetland and flow through the treatment cells before it is returned to the New River. Scrub vegetation (saltcedar) on the site has been bladed on a regular basis, but the site has never been cultivated. The site is located between a 70-foot high bluff, the Rice 3 Drain and the New River. Imperial Irrigation District owns this property. Both IID and Imperial County are members of the steering committee for this study and have donated the land for the two wetlands. See figure 2.1c for location of sampling sites within the wetland.

2.2 GEOLOGICAL INFORMATION (Groundwater Sampling Only):

Both sites are located in the flood plain of the New River. The depth to ground water is approximately 3-6 feet.

2.3 ENVIRONMENTAL AND/OR HUMAN IMPACT:

The quality of water entering the United States via the New River at the International Boundary at Calexico, California has been of concern for decades. This water, composed of municipal, industrial, and agricultural effluent and infrequent storm runoff, is highly polluted in fecal coliform bacteria, nutrients, and organic compounds. This

pollution severely impacts part of the New River downstream of the International Boundary producing extremely poor habitat for aquatic biota due to low or zero dissolved oxygen content. In addition to these contaminants, irrigation drainwater adds salt, silt, nutrients, pesticides and selenium that also contaminate the New and Alamo Rivers and stress the biota of the Salton Sea. Although these constructed wetlands do not pose a direct threat to human health because direct human contact with the water itself does not occur, the wetlands potentially could create or expand habitat for insect vectors carrying human disease including encephalitis.

2.4 PREVIOUS INVESTIGATIONS:

Influent water quality to the Imperial Site is expected to be within the range of current valley-wide values. Median concentrations for the major constituents in surface drain water in the Imperial Valley are: dissolved solids = 2,025 mg/L (1,170 to 4,670), nitrate plus nitrite as N = 5 mg/L (0.05 to 42), ammonia as N = 0.2 mg/L (0.02 to 9.8), ammonia plus organic N as N = 1.25 mg/L (0.5 to 11), phosphorus dissolved as P = 0.12 mg/L (0.1 to 0.28), orthophosphate as P = 0.1 mg/L (0.01 to 0.25), and selenium = 6 ug/L (2 to 52). These medians are Imperial Valley-wide concentrations and represent the general range that the wetland will treat. Biochemical Oxygen Demand (BOD) generally is low to absent in tilewater. Pesticides likely will be present at low concentrations coinciding with upstream applications. It also is possible that organochlorine pesticide residues from the breakdown of DDT, DDE and DDD, will be present, adsorbed to finer sediments in surface drain water.

Water treated by the Brawley Site will be pumped to the wetland from the New River near Brawley. Data describing the water quality of the New River in this reach is unavailable, but can be estimated from data collected upstream and downstream of the site. Concentrations of major constituents in the water entering the wetlands will be between that of water crossing the border and water in the New River at its outlet to the Salton Sea. At the border - the dissolved solids concentration ranges from about 2,500 mg/L to 3,400 mg/L; ammonia is the main form of nitrogen with concentrations ranging from about 2.0 to about 7.5 mg/L as N; and organic nitrogen also is present at higher concentrations than in drainwater (2.0 mg/L). One measurement of orthophosphate as P had a concentration of 0.75 mg/L. BOD measured during the 1970's was 20 mg/L. Selenium concentrations average 1 to 2 ug/L, well below the USEPA criterion of 5 ug/L. Water in the New River near Westmorland (outlet to the Salton Sea) reflects agricultural inflow and the effects of "river purification." Ammonia is still present (0.7 to 3.8 mg/L as N) but concentrations of nitrate plus nitrite as N increase to 3.8 to 6.1 mg/L as N. Dissolved solids concentrations range from about 2,720 to 3,350 mg/L and selenium concentrations average between 4 and 5 ug/L. BOD measured in the 1970's was 8.4 mg/L. Higher ammonia concentrations in the water entering the Brawley Site compared to the Imperial Site mean that inflow needs to undergo a nitrification step before proceeding to denitrification. To accomplish this, New River water will be pumped into the Brawley Site via a channel constructed with added surface roughness

that will oxygenate the water and provide conditions for nitrification – bacterial oxidation of ammonia to nitrite and nitrate - to occur.

Information presented above was obtained from: Setmire, J.G., 1984, Water quality in the New River from Calexico to the Salton Sea Imperial County, California: U.S. Geological Survey Water-Supply Paper 2212; Setmire, J.G., Schroeder, R.A., Densmore, J.N., Goodbred, S.L., Audet, D.J., and Radke, W.R., 1993, Detailed study of water quality, bottom sediment, and biota associated with irrigation drainage in the Salton Sea area, California, 1988-1990: U.S. Geological Survey Water Resources Investigations Report, 93-4014; and Setmire, J.G., 1999, Selenium in water, sediment, and transplanted Corbicula in irrigation drainage and wildlife use of drains in the Imperial Valley, California, 1994-1995: U.S. Bureau of Reclamation Report.

2.5 REGULATORY INVOLVEMENT:

The Citizens Congressional Task Force on the New River (Task Force) is a multi-agency effort to improve the quality of water in the New River. The Task Force, formed in October of 1997, represents combined federal, state and local agencies. The initial impetus for "cleaning up" the New River came from Congressman Duncan Hunter. The local lead for the project is Leon Lesicka, representing Desert Wildlife Unlimited, who has been instrumental in the collaboration and coordination among multiple interests in the cleanup of the New River. The U.S. Bureau of Reclamation (USBR) is the lead federal agency with the U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS) and the U.S. Environmental Protection Agency (USEPA) also participating. The California State Water Resources Control Board (SWRCB) along with the Regional Water Quality Control Board (Region VII) (RWQCB), California Department of Fish and Game, and the University of California at Riverside and the UC Extension Service represent the major state interests. Imperial County and Imperial Irrigation District are the primary local participants. Imperial Irrigation District is the local contractor. The USBR, as the lead federal agency, has taken responsibility for acquiring permits from the Army Corps of Engineers and the USFWS, and also for completing the National Environmental Policy Act (NEPA) requirements. The California Department of Fish and Game is the lead agency in completing requirements for the California Environmental Quality Act (CEQA)._Federal funding for the wetlands project has been made available though PL 105-276 in the form of a $3,000,000 grant to be administered by the U.S. Environmental Protection Agency.

3.0 PROJECT DATA QUALITY OBJECTIVES

3.1 DATA USES

A 3-year monitoring program will demonstrate the effectiveness of constructed wetlands to lower non-point source pollutants of concern in the water column, sediment, and biota. Information from this evaluation will provide details to refine wetland design for

future expansion to treat larger volumes of drainwater. All data collected at locations within the wetlands will be compared to the data collected for the source water for each wetland to determine if water quality improvements are being achieved (background or reference site).

The goals for this project are: 1) improve water quality to meet Regional Water Quality Control Board Region VII objectives as described in their "Basin Plan" and within the existing agricultural economy; 2) improve aquatic environmental conditions for wildlife, specifically avian and fish populations. The project will be considered successful if there is any consistent improvement in water quality from inflow to outflow and the wetlands provide habitat for fish and wildlife without increasing exposure to contaminants and disease.

Selenium: To achieve goal number one for selenium, the selenium concentration at the outlet of the wetland should (geometric mean) be less than the current EPA criterion of 5 ug/L for the protection of aquatic life. To achieve goal number two for selenium, further reduction of selenium concentrations to 2 ug/L or less within the wetland cells is desirable.

Nutrients: Numerical objectives for nutrients have not been developed by the Regional Board. The project will be considered a success if nutrient loading to the New River and the Salton Sea are reduced as measured by a consistent reduction in the concentration of nutrients leaving the wetlands.

Sediment: For the Brawley wetland, which treats water from the New River, the objective is to demonstrate the ability of the wetland to reduce the sediment concentration by several fold from inflow to outflow. For the Imperial wetland which treats surface drainwater containing both subsurface drainwater and tailwater runoff, the objective is to demonstrate the ability of the wetland to reduce peak sediment loading in the drain by one order of magnitude. It is expected that similar reductions in hydrophobic pesticide concentrations will occur downstream of the sedimentation cells because of deposition of the sediments within the sedimentation cells.

Hydrophilic pesticides: Although there is no numerical objective for reduction in concentrations of hydrophilic pesticides, it is hoped that the wetland will provide suitable conditions to for the physical, chemical and/or biological degradation of these pesticides.

Pathogens: For the Brawley wetland, no specific objectives for indicator microorganisms are proposed, but it is hoped that the wetland will provide suitable conditions for the physical, chemical, and/or biological degradation of these microorganisms. The Imperial wetland site will be monitored for indicator microorganisms to determine if wildlife use contributes measurable numbers of indicator microorganisms.

3.2 PROJECT TASKS

The effectiveness of these wetlands is the focus of the 3-year monitoring program that will evaluate water, sediment, and biota. Monitoring plans for the Brawley and Imperial sites are essentially identical (See tables 3.2a and 3.2b and figure 3.2). Therefore, the following descriptions apply to both sites. No reference site is required for this project because the comparisons of concern are between the conditions/parameters of the source water and the water leaving the wetland and between conditions/parameters in the wetlands cells and known toxicity thresholds or other appropriate criteria or guidelines for protection of aquatic life and wildlife.

Water Column Sampling

Flow rates will be monitored with electronic data loggers at the inlets to the sediment basins and at the outlets of the final wetland cells.

A number of water-quality constituents will be monitored once every two weeks during the first year of the study while vegetation is becoming established, and then increased to every week during the second and third year after vegetation is established and the wetland is fully functional. This sampling scheme will be referred to as the "2W,W,W schedule." Based on the results of weekly sampling in the second year, the schedule for the third year may be modified to include some more intensive, short-term, sampling periods. If for any reason vegetation is not adequately established by the second year, the more rigorous schedule of weekly sampling will be postponed until vegetation establishment is adequate or sample data indicates the need for the more intensive schedule. If feasible, sampling of corresponding inflows and outflows will be separated by the detention time.

Measurements of suspended sediments and selenium concentration will be taken according to the 2W,W,W schedule at the inlets to the sediment cells, the outlets of the sediment cells, and at the outlets of the final wetland cells. Field measurements of dissolved oxygen concentration, pH, specific conductance, and temperature will be made within the sediment cells and at the inflow and outflow of the sediment cells and each of the wetland cells according to the 2W,W,W schedule. Samples to determine nitrogen and phosphorus concentrations (total and dissolved) also will be collected at the sediment basin inlets and at the final wetland cell outlets according to the 2W,W,W schedule. Monthly samples to determine the number of fecal coliform bacteria and total organic carbon concentration will be collected at the inlets to the sediment basins and at the outlets of the final wetland cells. Samples from sediment basin inflow and final cell outflow will be analyzed for major ion chemistry and dissolved organic carbon on a semi-annual basis. Monthly samples for biochemical oxygen demand and the percentage of particles less than 62 microns in size (silt and clay) in suspended sediments will be collected at the

inlets to the sediment basins, the outlets of the sediment basins, and at the outlets of the final wetland cells. Monthly sampling of biochemical oxygen demand will only take place during the first year, but may continue on a less frequent basis thereafter to determine the availability of an electron donor for denitrifying and selenate reducing bacteria.

Bottom Sediments

Bottom sediments will be sampled semi-annually as follows: one sample from the Rice 3 Drain and New River upstream of the sediment basin inlet, four samples from within each sediment basin, and two samples from each of the wetland cells (for a total of 22 sites). Samples will be analyzed to determine concentrations of ammonia, Kjeldahl nitrogen, total organic carbon, selenium, and the percentage of particles less than 62 microns in size.

Benthic Invertebrates

Benthic invertebrates collected semi-annually at the following sites will be analyzed for selenium concentration: one sample from the Rice 3 Drain and New River upstream of the sediment basin inlet, four samples from within each sediment basin, and two samples from each of the wetland cells (a total of 22 sites). See also special studies below.

Aquatic Biota

Aquatic water column biota will be collected semi-annually at the following sites and analyzed for selenium concentration: one sample from the Rice 3 Drain and New River upstream of the sediment basin inlet, one sample from within each sediment basin, and one samples from each of the wetland cells (for a total of 10 sites). See also special studies below.

Submerged Aquatic Plants

Submerged aquatic plants will be collected semi-annually from two sites within each wetland cell and analyzed for selenium concentration. Samples will be taken from the root zone and vegetative section at each site (for a total of 24 samples). If available, seeds will also be sampled.

Bird Eggs

Eggs are collected as individual samples from the nests and chilled in the field. Eggs are examined for cracks or other damage. If the shell is complete, the eggs are rinsed and dried. The eggs are measured and weighed: volume is determined by the water displacement. The egg is bisected using a clean scalpel, and the contents are transferred to a clean glass jar. The samples are frozen until shipped to the laboratory. Each egg will be analyzed individually for selenium and organochlorine pesticide concentrations.

Special Studies

After the vegetation is established, wildlife surveys will be conducted at each wetland for a five-day period during each of the four seasons over the course of one year. This information will be evaluated and reported quarterly. Disease testing will be conducted if a significant number of dead animals are found at any time during the 3-year monitoring program. Other special studies also will be conducted during the monitoring program. Water samples for current use pesticide analysis will be taken at each wetland on a semi-annual basis during the second and third year of the program. These samples will be collected at the inlet to each sediment basin and at the outlet of the final wetland cells. During the third year of the program, each wetland will be sampled to determine the bioaccumulation of organochlorine pesticide residues and selenium in the eggs of birds nesting in or near the wetlands. Composite samples of benthic invertebrates and/or aquatic biota based on the observed wildlife usage also will be collected and analyzed for orgaochlorine pesticide residues. If eggs are not available, sediment samples will be substituted and tested for organochlorine pesticide residues. Time-of-travel studies will be conducted in each wetland to determine detention time as vegetation becomes established.

Technicians conducting the sampling will also be trained to collect mosquito larva for possible identification of disease-carrying insects. Appropriate measures will be taken to control any significant infestations.

Reporting

The water-sampling technician will prepare brief field observation reports after each site visit. As sampling analyses are completed, data shall be promptly compiled and reviewed. Quarterly data reports shall be issued containing all available data in tabular and graphic form. Annual monitoring reports and a final report will be prepared to include water quality, sediment, and wildlife monitoring results, analyses, and conclusions.

To further document wetland conditions throughout the 3-year program, the California Department of Fish and Game will provide monthly aerial photographs of both wetland sites.

Action Levels – This project does not envision triggering any regulatory water quality actions. If conditions develop in the wetlands that pose a threat to wildlife health or reproduction, flow to the wetlands will be shut down and the problem investigated.

3.3 EXPECTED DATA QUALITY

1) Contaminants of concern: nutrients, selenium, pesticides, and fecal coliform bacteria.

2) Expected concentrations: see section 2.4, previous investigations.

3) Action levels (with source) EPA ambient water quality criteria for aquatic environments. Sediments – NOAA Status and Trends data and Province of Ontario sediment quality criteria will be used as guidelines. Biota - Variety of literature references such as selenium recommended levels under National Irrigation Water Quality Program (NIWQP) Guidance Document. The analytical data will be compared to the action levels provided in the above sources and if the data indicate that the project poses an unacceptable risk to human health or wildlife, the flow to the wetlands will be shut down. If adequate modifications cannot be made to address the identified hazards, the project will be terminated.

4) Appropriate analytical methods:

Sample Parameter	**Matrix**	**Analytical Method Reference***
Soluble Orthophosphate	Water	365.1
Total Phosphorus	Water	365.4
Nitrate+Nitrite-N	Water	353.2
Ammonia Nitrogen	Water	350.1
Total Kjeldahl Nitrogen	Water	351.2
Dissolved Silica	Water	200.7
Dissolved Organic Carbon	Water	5310 B
Total Suspended Solids	Water	160.2
Alkalinity	Water	310.1
Dissolved Oxygen	Water	4500-O G
Temperature	Water	2550 B
Conductivity	Water	2551 A
pH Profile	Water	4500-H^+
Turbidity	Water	2130 B
ORP	Water	2580 B
Calcium	Water	200.7
Magnesium	Water	200.7
Sodium	Water	200.7
Potassium	Water	200.7
Carbonate	Water	310.1

Bicarbonate	Water	310.1
Sulfate	Water	300.0
Chloride	Water	300.0
Selenium	Water	Hydride Generation
Pesticide/organics	Water	8140/8080/3540***
Nitrogen	Sediment	Combustion with CHN analyzer
Total Organic Carbon	Sediment	Combustion with CHN analyzer
Selenium	Sediment	Hydride Generation
Particle Size	Sediment	Sieve/hydrometer
Pesticides/Organics	Sediment	8080/8141
Selenium	Biota	Hydride Generation
Pesticides/Organics	Biota	8080

*Method numbers from *Standard Methods*, 1995 except where noted differently.
***SW846

5) Sampling design method: inflow/outflow sampling on a weekly/biweekly/ monthly/semi-annual frequency plus selected studies. See section 3.2.

6) Number of quality control samples – one trip blank for each annual sampling; one equipment blank for each bi-weekly sampling; one duplicate sample for every 10 samples for each matrix.

QA/QC procedures used while collecting surface water samples must identify and determine the magnitude of errors introduced during sample collection. Duplicate samples will be the primary method used to measure the precision of the water sampling procedures and to meet the project QA/QC objectives.

Field QC checks

The use of equipment blanks and trip blanks for field QA/QC performance is analogous to the use of laboratory blanks and standards for laboratory QA/QC performance. The fundamental goal of field QA/QC is to ensure that the sampling protocol is being followed. The Project Manager, with the support of the field crews, will be responsible for field QC during site investigations. The Project QA Officer will make periodic field checks to help ensure compliance with project guidance documents and EPA protocols.

Equipment blanks will be used to evaluate the cleaning of the field sampling equipment. Equipment blanks enable evaluation of system errors and bias which arise due to decontamination, handling, storage, and transport of equipment. The use of equipment blanks is discussed below:

Equipment Blanks: An equipment blank is clean (i.e., de-ionized) water that is poured through a sample collection device to check the adequacy of the field decontamination procedures for the sampling equipment. To ensure that a non-dedicated sampling device has been effectively cleaned, blank water will be used as a final rinse after decontamination procedures and collected in a set of sample containers. The laboratory analyses to be performed on the equipment blanks will be the same analyses performed on the environmental samples being collected. Periodic equipment blanks will be collected during the project.

Field duplicates are two samples collected independently at a sampling location during the same sampling event. Data from duplicate sample analysis will be used as a measure of laboratory performance but will not be used to alter or correct analytical data. A minimum of one duplicate sample will be collected per sampling event and about 10 % of all samples collected will be duplicates. Most environmental concentrations in the study area are expected to greatly exceed detection levels, hence, many more "replicate" than "blank" samples will be collected. Field duplicates will be identified so that laboratory personnel are unable to distinguish them from other samples submitted.

Laboratory QC checks

The laboratory selected for this study is Babcock Laboratory located in Riverside, CA. This facility was chosen because it has successfully conducted chemical analyses on samples collected from the Imperial Valley. Their proximity to the area of interest will insure that samples are received and analyzed in a timely manner. The analysis of QA/QC samples by the laboratory will be an integral part of the study. Specific internal QA/QC procedures are described in the most recent publication of Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). Below is a summary of the types of procedures utilized.

Laboratory control samples, calibration standards, and matrix specific QA/QC samples are generally used as internal checks. Laboratory control samples are laboratory-generated samples used to monitor the laboratory's day-to-day performance of routine analytical methods. Three types of control samples are typically analyzed: blank spikes, duplicate blank spikes, and method blanks (sterility controls for biological analyses). Blank spikes and duplicate blank spikes are used to monitor the precision and accuracy of the analytical process, independent of matrix effects. Method blanks are used to identify any background interference or contamination of the analytical system which may lead to the reporting of false data. Each of these control samples is described below.

The results of the laboratory control samples are compared to well-defined laboratory acceptance criteria to determine whether the laboratory system is "in control".

Controlling lab operations with these samples (as opposed to matrix spike/matrix spike duplicate samples) offers the advantage of being able to differentiate quality problems due to laboratory procedural errors from problems due to sample matrix effects. As a result, procedural errors can be identified and corrected quickly.

Blank Spike Duplicate Samples/Duplicate Laboratory Control Samples: Blank spike duplicate samples are used to monitor the precision and accuracy of the analytical system. Each duplicate spike consists of a standard, control matrix that is spiked with a group of target compounds representative of the method analytes. One duplicate spike pair is analyzed for a predetermined set number of samples processed by a laboratory for a particular analytical method. Duplicate spikes are analyzed with environmental samples to provide evidence that the laboratory is performing the method within accepted QC guidelines for accuracy and precision.

Accuracy data (recovery of each analyte in the spiked sample pair) and precision data (Relative Percent Difference (RPD) between each analyte in the duplicate sample or spiked sample pair) are compared to control limits that have been established for each of the analytes. Initially, control limits for analytes spiked into the samples are taken directly from EPA guidelines. If EPA guidelines are not available, the laboratory's historical data can be used to set the control limits. The control limits are recalculated periodically, as sufficient laboratory data becomes available. Control limits for accuracy for each analyte are based on the historical average recovery (mean of the average recoveries of the spiked sample pairs). Control limits for precision for each analyte are based on the historical RPD. Acceptable RPD's range from zero (no difference between duplicate spike results) to the average RPD plus three standard deviation units. Analytical data that are generated with a duplicate spike pair which falls within the established control limits are judged to be in control. Data generated with a duplicate spike pair which falls outside of the control limits are considered suspect and corrective action must be performed.

Duplicate spike samples have been established for each standard analytical method. Reagent water is used as the control matrix for the analysis of aqueous samples. The spiking compounds are added to the reagent water and carried through the appropriate steps of the analysis. The control matrix for soil samples for organic analyses is a standard, well characterized, approved sand. The spiking compounds are added to the sand and carried through the appropriate steps of the analysis. For metal analyses, a spiked solid matrix from a commercial source may be used or a recommended EPA spiking solution is used.

Blank Spike Samples/Laboratory Control Sample: A duplicate spike pair is analyzed to measure the precision and accuracy of an analysis. However, samples are often analyzed in small lots due to holding time or turn-around time requirements. Since it is necessary to have a measure of laboratory performance with each batch of samples processed, laboratories may also use single blank spike samples.

A blank spike consists of a control matrix that is spiked with surrogate compounds appropriate to the method being used. In cases where no surrogate is required, (e.g., metals) a single duplicate spike pair serves as the control sample. A blank spike is prepared for each sample lot for which the duplicate spike pair is not analyzed. Recovery data generated from the blank spike are compared to control limits that have initially been established for each of the compounds being monitored. EPA established control limits or laboratory historical data are used to set the control limits. Control limits are recalculated periodically as sufficient blank spike data are available. Control limits for blank spike results can be based on the historical average recovery in the blank spike plus or minus three standard deviation units.

Analytical data generated with blank spike samples which fall within the control limits are judged to be in control. Data that are generated with a blank spike which fall outside of acceptance criteria are considered suspect and corrective action must be performed.

Method Blanks: Method blanks are analyzed to assess the level of background interference or contamination, which may exist in the analytical system and which might lead to the reporting of false data. A method blank is typically analyzed with every batch of samples processed. A method blank consists of reagents, specific to the method, which are carried through every aspect of the procedure, including preparation, clean-up, and analysis. The results of the method blank analysis are evaluated, in conjunction with other QC information, to determine the acceptability of the data generated for that batch of samples.

Ideally, the concentration of target analytes in the method blank will be below the quantification limit for that analyte. In practice, however, some common laboratory cleaning solvents and metals are difficult to eliminate to the parts-per-billion levels commonly reported in environmental analyses. Therefore, criteria for determining method blank acceptability are based on consideration of the analytical techniques used, analytes reported, and quantification limits required.

For organic analyses blanks to be considered acceptable, the concentration of target analytes in the blank must be below the quantification limit of that analyte. An exception is made for common laboratory contaminants (example: methylene chloride, acetone, 2-butanone, and phthalate esters), which may be present in the blank at levels up to five times the quantification limit and still be considered acceptable. This policy is consistent with EPA guidelines and has been established in recognition of the fact that these compounds are frequently found at low levels in method blanks due to the materials used in the collection, preparation, and analysis of samples for organic parameters.

For non-routine organic analyses, other components may be established as common contaminants for the particular analysis. If, upon thorough review of the method, it is deemed impossible to eliminate trace amounts of analytes from the process, these analytes can likewise be allowed to be present at up to five times the quantification limit.

For metals and wet chemistry analyses, where the quantification limits are typically near the instrument detection limits, the concentration of the target analytes in the blank may be below two times the quantification limit. If the blank value for a target analyte lies below the quantification limit, the quantification limit for that analyte in the associated samples is unaffected. If the blank value lies between the quantification limit and two times the quantification limit, the quantification limit for that analyte in the associated samples is raised to the level found in the blank. A blank containing an analyte(s) above two times the quantification limit may be considered unacceptable unless the lowest concentration of the analyte in the associated samples is at least ten times the blank concentration (as per EPA protocol) or the concentration of the analyte in all samples associated with the blank is below the quantification limit.

Additionally for wet chemistry tests, the method procedure directs how the blank is treated. Generally, a reagent blank is used both to zero the equipment and as one of the calibration standards. If a preparation step is required for the analysis, then a blank is also analyzed to determine the extent of contamination or background interference. The concentration found in the blank is subtracted from the concentration found in any associated sample prior to calculating the final result when specified by the method. Blanks have no application or significance for some wet chemistry parameters such as pH.

If the blank does not meet acceptance criteria, the source of contamination must be investigated and the appropriate corrective action must be taken and documented. Investigation includes an evaluation of the data to determine the extent and effect of the contamination on the sample results. Corrective action may include reanalysis of the blank, and repreparation and reanalysis of the blank and all associated samples.

For organic and metals analyses and selected wet chemistry tests, method blank results are reported with each set of sample results. Sample results are not corrected for blank contamination unless required by the analytical method. Occasionally, due to limited sample volume or other constraints, the laboratory may report data associated with an unacceptable blank. In those cases, the quantification limit for each analyte contained in the blank is raised to the level found in the blank and is associated with corresponding sample results.

Matrix-Specific Quality Control

Matrix-Specific QC is used to assess the effects of a sample matrix or field conditions on the analytical data. The main elements of Matrix-Specific QC are:

* The analysis of matrix spikes and matrix spike duplicates.

* Method duplicates or laboratory duplicates.

* Monitoring the recovery of surrogate compounds from environmental samples.

* Monitoring the results of standard additions in environmental samples.

Any or all of the above may be used to evaluate matrix effects.

Matrix Spikes/Matrix Spike Duplicates and Post-digestion Spikes

A matrix spike is an environmental sample to which known concentrations of analytes have been added. The matrix spike is taken through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery. The matrix spike is used to evaluate the effect of the sample matrix on the accuracy of the analysis.

A matrix spike duplicate is an environmental sample that is divided into two separate aliquots, each of which is spiked with known concentrations of analytes. The two spiked aliquots are processed separately and the results compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as Relative Percent Difference (RPD) and percent recovery.

A post-digestion spike is the digestate of an environmental sample that is spiked with known concentrations of analytes. This spike is only performed on samples for metals determination. The analyte recovery is calculated and reported as percent recovered. The post-digestion spike is used to evaluate the effect of sample matrix on the analysis accuracy.

Method Duplicates

A method duplicate is an environmental sample which ideally is divided into two separate aliquots. The two samples are processed separately and the results compared to determine the effects of the matrix on the precision of the analysis. Results are expressed as RPD.

Surrogate Recoveries and Standard Additions

Surrogate compounds are organic compounds which are similar to the analytes of interest, but which are not normally found in environmental samples. Surrogates are added to samples to monitor the effect of the matrix on the accuracy of the analysis. Results are reported in terms of percent recovery.

Laboratories normally add surrogates to samples requiring GC or GC/MS analysis. Surrogate recoveries are primarily used by the laboratory to assess matrix effects. However, obvious problems with sample preparation and analysis (e.g., evaporation to

dryness, leaking septum, etc.) which can lead to poor surrogate spike recoveries must be ruled out prior to attributing low surrogate recoveries to matrix effects.

Standard additions are the practice of adding a series of known amounts of analyte to an environmental sample. The fortified samples are then analyzed and the recovery of the analytes calculated. The practice of standard additions is generally used with metal and wet chemistry to determine the effect of the sample matrix on the accuracy of the analyses.

Corrective actions

Laboratory QC samples must meet the criteria specified either by the particular EPA SW-846 Methods, or requirements established by the laboratory. If the criteria are not met, the following corrective action procedures must be employed:

Method Blank - Evaluate the system, locate the source of the contamination, and perform a system blank to confirm the system blank meets acceptance criteria. Continue to perform system blanks until acceptance criteria are met. Reanalyze the method blank and associated samples. If the method blank still contains positive identifications above the acceptable criteria, re-extract or redigest the method blank and all associated samples (if applicable) and reanalyze.

System Blank - Continue to perform system blanks until acceptance criteria are met.

Initial Calibration Blank - Evaluate the system, locate the source of the contamination, and perform a system blank to confirm the system blank meets acceptance criteria. Continue to perform system blanks until acceptance criteria are met. Do not begin analysis of investigative samples until criteria are met.

Continuing Calibration Blank - Evaluate the system, locate the source of the contamination, and perform a system blank to confirm the system blank meets acceptance criteria. Continue to perform system blanks until acceptance criteria are met. Reanalyze the blank and associated samples.

Initial Calibration Verification - Recalibrate the instrument and reanalyze ICV. Do not begin analysis of investigative samples until criteria are met.
Continuing Calibration Verification - Evaluate the standard to determine if it is faulty. If deemed faulty, prepare a new standard and reanalyze the CCV and any samples bracketed by the failed standard. If the standard is not faulty, reanalyze the CCV and any samples bracketed by the failed standard. If necessary, recalibrate the instrument. Do not continue analysis of investigative samples until criteria are met.

Laboratory Control Sample/Duplicate Laboratory Control Sample - Verify the calculations. Evaluate the standard to determine if it is faulty. If deemed faulty, prepare a new standard and reanalyze the LCS and associated samples. If the standard is not

faulty, reanalyze the LCS and associated samples. If necessary, recalibrate the instrument.

Post-digestion Spike - Verify the calculations. If these are acceptable, and the spike addition produces a minimum level of 10 times to a maximum of 100 times the IDL, matrix effects should be suspected.

Matrix Spike/Matrix Spike Duplicate - Verify the calculations and evaluate the LCS/LCSD percent recoveries. If these are acceptable, determine if matrix interference is a factor in the poor recoveries. If so, proceed with analysis. If not reanalyze the MS and/or the MSD and associated samples. If appropriate, re-extract or redigest and reanalyze.

Method Duplicate - Verify the calculation and evaluate the LCS/LCSD RPD. If these are acceptable, determine if matrix interference or inhomogeneous sample representation is a factor in the poor RPD. If so, proceed with analysis. If not, re-extract, redigest and/or reanalyze the associated samples.

Laboratory Duplicate - Laboratory analysts who cannot duplicate their own counts on the same plate within 5% and the counts of other analysts within 10% must discover the cause of the discrepancy and correct such disagreements prior to continuation of analyses.

Equipment Blank/Trip Blank/Ambient Condition Blank - Evaluate all associated QC. If it is acceptable, and these QC samples contain positive identifications above the criteria, contact the client contact immediately and include the deviation in a case narrative which will accompany the final report.

3.4 DATA QUALITY INDICATORS

Information on project detection limits, precision, and accuracy for parameters to be analyzed is listed in the following table. This table was developed in conjunction with the selected laboratory and indicates the data quality necessary for this study. The listed precisions and accuracies are acceptable for meeting the project DQO.

The analytical laboratory (Babcock Laboratory) will be responsible for preliminary review and validation of all analytical data generated by their facility. If problems are identified, the laboratory will be responsible for the corrective actions described above (Section 3.3). The Project Manager will provide a final review of all analytical data received from the laboratory to assure that all DQO's have been met and the data is adequate to support the decision making process.

Measurement Performance Criteria

Parameter	Detection Limit (mg/L)	Reporting Limit (mg/L)	Estimated Accuracy (%)	Accuracy Protocol*	Estimated Precision (%)	Precision Protocol**
Soluble Orthophosphate	0.001	0.005	75-125	% recovery	<20	RPD
Total Phosphorus	0.005	0.005	75-125	% recovery	<20	RPD
Nitrate+Nitrite-N	0.016	0.030	75-125	% recovery	<20	RPD
Ammonia Nitrogen	0.009	0.01	75-125	% recovery	<20	RPD
Total Kjeldahl Nitrogen	0.05	0.1	75-125	% recovery	<20	RPD
Dissolved Silica (As silicon)	0.02	0.02	75-125	% recovery	<20	RPD
Dissolved Organic Carbon	0.5	1.5	85-115	% recovery	<20	RPD
Total Suspended Solids	4	4	N/A	N/A	N/A	N/A
Alkalinity	1.0 mg/L as $CaCO_3$	1.0 mg/L as $CaCO_3$	85-115	% recovery	<20	RPD
Dissolved Oxygen	0.01	0 – 20	± 0.2 mg/L	Instrument response	N/A	Instrument Response ***
Temperature	-5EC	-5 - 50EC	± 0.15EC	Instrument response	N/A	Instrument Response ***
Conductivity	1 ΦS/cm	0 - 100 mS/cm	± 1%	Instrument response	N/A	Instrument Response ***
PH	N/A	0 – 14 units	± 0.2 units	Instrument response	N/A	Instrument Response ***
Turbidity	1 NTU	0 - 100 NTU & 100 - 1000 NTU	± 5%	Instrument response	N/A	Instrument Response ***

ORP	N/A	-999 - 999 mV	± 20 mV	Instrument response	N/A	Instrument Response ***
Secchi depth	0.01 m	0.1 m	N/A	N/A	N/A	N/A
Light penetration	0.1 m	0.1 m	N/A	N/A	N/A	RPD
Carbonate	1.0 mg/L as $CaCO_3$	1.0 mg/L as $CaCO_3$	85-115	% recovery	<20	RPD
Bicarbonate	1.0 mg/L as $CaCO_3$	1.0 mg/L as $CaCO_3$	85-115	% recovery	<20	RPD
Sulfate	0.2	1.0	75-125	% recovery	<20	RPD
Chloride	0.2	1.0	75-125	% recovery	<20	RPD
B	0.004	0.01	75-125	% recovery	<20	RPD
Ca	0.002	0.03	75-125	% recovery	<20	RPD
Mg	0.002	0.03	75-125	% recovery	<20	RPD
K	0.601	1.00	75-125	% recovery	<20	RPD
Se	0.001	0.005	75-125	% recovery	<20	RPD
Na	0.010	0.03	75-125	% recovery	<20	RPD
Pesticide/ Organics	varies	Varies	varies	varies	varies	Varies

*Accuracy is estimated by % recovery, calculated from the formula: $\%R = (S - u)/C_{sa}$, where S is the measured concentration in the spiked aliquot, u is the measured concentration in the unspiked aliquot, and C_{sa} is the actual concentration of the spike added.
**The precision of duplicate samples collected for QC purposes is determined as Relative Percent Difference, calculated from the formula: $RPD = (C_1-C_2)x100/(C_1 + C_2)/2$, where C_1 is the larger of the two observed values and C_2 is the smaller of the two values.
***Precision and accuracy for temperature, dissolved oxygen, pH, conductivity, turbidity, and ORP profiles are based on performance limits reported by instrument manufacturer.

Data Completeness

Data will be considered complete and usable for decision making when all results have been reviewed and are in accordance with the sampling and analytical methodology and the required QA/QC practices listed in this project plan. It is recognized that some data loss may occur as a result of unavoidable factors such as sampling equipment malfunction, losses during sample handling, or analyses outside of laboratory acceptance limits. Samples will be re-analyzed by the analytical laboratory if results are outside of laboratory acceptance limits, providing that sufficient sample volume is

available and that holding times for the affected parameter(s) have not been exceeded. Additional samples will be collected if losses exceed 25 percent of the parameters expected for any single sampling event or 10 percent of the total number of samples expected for the project.

Data Representativeness

Representativeness is the degree to which the sample data represent actual environmental conditions. Representativeness shall be satisfied by making certain that sampling and testing locations are selected properly and a sufficient number of the correct type of samples and test data are collected.

Although the wetlands have a number of cells, the overall goal of the project is to determine the effectiveness of the wetland to remove specific compounds. The critical locations are the inflow and outflow locations. Sampling sites are located at these major points. The sediment basin also has a specific functionality: to allow sufficient time for suspended sediment to settle, and for aqueous nitrate to denitrify and to reduce selenate. For these reasons, inflow and outflow of the sediment basin is also measured as well as outflow from the final cell.

Collection of samples at different depths in the water column of the sediment basin and from the inflow and outflow of the wetland at the selected frequencies over the three-year period should provide representative information on the functioning of the wetland. The time-of-travel studies also will provide detailed information on retention time within each cell of the wetland.

Sediments will be composite samples to best represent the overall concentration in each of the cells. Semi-annually, four composite samples will be collected from the sediment cells and two from the wetland cells.

Biota samples will be collected semi-annually and will include benthic invertebrates, aquatic (water column) invertebrates and fish, and aquatic plants. This sampling scheme will provide information on a variety of food chain organisms exposed to the drainwater and the sediment.

Bird eggs will be sampled if available to assess potential for impacts to organisms foraging in the wetland cells.

Data Comparability

Comparability expresses the confidence with which one data set can be compared with another. This project requires that the sampling and testing methods employed, the Chain-of-Custody methods used, and the analytical techniques implemented be performed in a uniform manner. The laboratory methods used are standard analytical

methods that will also allow comparisons with data from other projects. Similarly, all field methods will be performed in accordance with standard procedures and the instrument manufacturers' operating procedures and guidelines such that data comparability may be achieved.

3.5 DATA MANAGEMENT PLAN:

A data management protocol (to be developed by the Project Manager) will be used to guide project personnel by insuring the proper collection, processing, inventory, archiving, and retrieval of data from the investigation. Quality, accuracy, and completeness of the acquired data are required for successful completion of the project. The information will be tracked to insure data integrity from laboratory, field, and office sources onto a relational database; inventory of the database; tracking of project files; and retrieval and archiving of data for analysis and reporting.

Project data will be derived from three distinct sources: field, laboratory, and office. Data types will be chemical and physical. Project data flow will be in a logical and chronological format. Data from field investigations or historical background data derived in the office will be checked and pre-validated after analyses have been completed. The project manager will perform data entry into and checking of the database. The project manager will be responsible for the completeness and accuracy of the database. The project manager will track entry into the database and all data transfers such that no modified data can be entered into the database without approval and checking. This will insure that the integrity of the database will remain intact for future analyses.

3.6 ASSESSMENT/OVERSIGHT

System audits consist of inspections of records, QC data, calibrations, and conformance to the work plan. System audits will be performed on field, laboratory, and office operations. Each investigation type will be the subject of at least one system audit. Audits will be performed as early in the investigation as practicable. The Project Manager will perform field audits and the laboratory will perform office operation and laboratory audits. Investigations to be audited include field sampling, laboratory testing, data management, and data reporting. The Project Manager will also review all final reports and deliverables to ensure compliance with the project contract and work plan.

Performance audits will include evaluation and analysis of checked samples. A performance evaluation sample for inorganic and organic compounds from the EPA is analyzed periodically along with the regular samples. If the laboratory has recently participated in a performance evaluation study, the results will be used to provide information as to historical performance.

Immediately prior to beginning each type of field investigation or task, a readiness review will be conducted by the Project Manager and appropriate team members and

support personnel. The objective of the readiness review will be to assess the readiness of the investigation team to begin field work with DQO's, QA/QC procedures, and documents in mind. A checklist of prerequisite issues, such as necessary equipment, controlled documents, necessary training, assignments, spare parts, calibrating field arrangements, etc., will be prepared by the Project Manager. The team will review checklist items and resolve any deficiencies and weaknesses. The program manager will prepare a summary of each readiness review and indicate successful resolution of any issues prior to commencement of the field work or task.

4.0 SAMPLING DESIGN

4.1 SOIL – not applicable

4.2 SEDIMENT

4.2.1 Sampling locations - Bottom sediments will be sampled on a semi-annual basis as follows: one sample from the Rice 3 Drain and New River upstream of the sediment basin inlet, four samples from within each sediment basin, and two samples from each of the wetland cells (for a total of 22 sites, see figures 2.1b and 2.1c).

4.2.2 Analytes of Concern – Nitrogen species, TOC, selenium, particle size. Analyses of organochlorine pesticide residues will be conducted on a limited basis as part of special studies.

4.3 WATER

4.3.1 Sampling Locations - samples to determine concentrations of selected constituents will be collected at the inlets to the sediment basins, the outlet of the sediment basins and the outlets of the final wetland cells (See 2.1b and 2.1c). The objective is to determine the reduction or changes in concentrations as a result of processes operating within the wetland cell.

4.3.2 Analytes of Concern – Field parameters, major ions, nutrients, DOC, TOC, Se, suspended sediments and fecal coliform bacteria. Current use pesticides will be analyzed during special studies.

4.4 OTHER MEDIA (BIOTA)

Sampling Locations/Analytes of Concern

Benthic Invertebrates

Semi-annual samples of benthic invertebrates will be analyzed for selenium from the following sites: one sample from the Rice 3 Drain and New River upstream of the sediment basin inlet, four samples from within each sediment

basin, and two samples from each of the wetland cells (for a total of 22 sites, see figures 2.1b and 2.1c). Analyses of organochlorine pesticide residues will be conducted on a limited basis as part of special studies.

Aquatic Biota

Semi-annual samples of aquatic biota will be analyzed for selenium from the following sites: one sample from the Rice 3 Drain and New River upstream of the sediment basin inlet, one sample from within each sediment basin, and one sample from each of the wetland cells (for a total of 10 sites, see figures 2.1b and 2.1c). Analyses of organochlorine pesticide residues will be conducted on a limited basis as part of special studies.

Submerged Aquatic Plants

Semi-annual samples of submerged aquatic plants will be analyzed for selenium from two sites within each wetland cell. Samples will be taken from the root zone and vegetative section at each site (for a total of 24 samples)(See figures 2.1b and 2.1c). If available, seeds will also be sampled.

Bird Eggs

Eggs are collected as individual samples from the nests (sites not identified) and chilled in the field. Eggs are examined for cracks or other damage. If the shell is complete, the eggs are rinsed and dried. The eggs are measured and weighed: volume is determined by the water displacement. The egg is bisected using a clean scalpel, and the contents are transferred to a clean glass jar. The samples are frozen until shipped to the laboratory.

Special Studies

After vegetation establishment, wildlife surveys will be conducted at each wetland for a five-day period during each of the four seasons over the course of one year. This information will be analyzed and reported on a quarterly basis. If, at any time during the 3-year monitoring program, a significant number of dead animals are found, disease monitoring will be conducted.

4.5 SAMPLE IDENTIFICATION

Sampling numbers will begin with a site locator (I for Imperial and B for Brawley); specific location identifier such as RD for Rice Drain, NR for New River, SI for sediment cell inflow, SO for sediment cell outflow, C1, C2, C3, and C4 for wetland cells and CO for final cell outflow; matrix identifier: WA for water, SE for sediment, BI for benthic invertebrates, AB for aquatic biota, AP for aquatic plants, and BE for bird eggs: 2 digit number for place in series, and date and time of collection.

4.6 SAMPLE PRESERVATION AND HOLDING CONDITIONS

See Tables under 5.1 for this information.

5.0 REQUEST FOR ANALYSES

5.1 REQUEST FOR ANALYSES TABLES

Water Column

Analysis	Container	Sample Volume	Method of preservation	Holding time
Soluble orthophosphate	Plastic with lid	1 L	Chill to <4°C	28 days
Total Phosphorus	Plastic with lid	1 L	H_2SO_4	28 days
Total Nitrate+Nitrite-N	Plastic with lid	1 L	Chill to <4°C	48 hours
Total Ammonia Nitrogen	Plastic with lid	1 L	H_2SO_4	28 days
Total Kjeldahl Nitrogen	Plastic with lid	1 L	H_2SO_4	28 days
Dissolved Silica	Plastic with lid	1 L	H_2SO_4	28 days
Dissolved Organic Carbon	Plastic with lid	40 ml	H_2SO_4	28 days
Total Suspended Solids	Plastic with lid	1 L	Chill to <4°C	7 days
Alkalinity	Plastic with lid	1 L	Chill to <4°C	14 days
Dissolved Oxygen	In situ			
Temperature	In situ			
Conductivity	In situ			
pH	In situ			
Turbidity	In situ			
ORP	In situ			
Calcium	Plastic with lid	1 L	HNO_3	6 months
Magnesium	Plastic with lid	1 L	HNO_3	6 months
Sodium	Plastic with lid	1 L	HNO_3	6 months
Potassium	Plastic with lid	1 L	HNO_3	6 months
Carbonate	Plastic with lid	1 L	None	14 days
Bicarbonate	Plastic with lid	1 L	None	14 days
Sulfate	Plastic with lid	1 L	Chill to <4°C	28 days
Chloride	Plastic with lid	1 L	None	28 days
Se	Plastic with lid	1 L	HNO_3	6 months
Pesticides/Organics	Glass jar with lid	1 L	Chill to <4°C	Indefinite

Fecal Coliform	Sterile plastic or glass with lid	100 ml	Chill to <4°C	6 hours

BOTTOM SEDIMENT Chill to <4°C

Analysis	Container	Sample Volume	Method of preservation	Holding time
Total Nitrogen	Sterile plastic	200 gms	Chill to <4°C	14 days
Total Organic Carbon	Sterile glass jar	200 gms	Chill to <4°C	14 days
Selenium	Sterile plastic	100 gms	Chill to <4°C	6 months
Particle Size	Sterile plastic	200 gms	None	Indefinte
Pesticides/Organics	Sterile glass jar	200 gms	Chill to <4°C	Indefinite

BENTHIC INVERTEBRATES

Analysis	Container	Sample Volume	Method of preservation	Holding time
Selenium	125 ml glass jar	100 gms	Chill to <4°C	6 months
Pesticides/Organics	125 ml glass jar	Varies	Chill to <4°C	Indefinite

AQUATIC BIOTA

Analysis	Container	Sample Volume	Method of preservation	Holding time
Selenium	125 ml glass jar	100 gms	Chill to <4°C	6 months
Pesticides/Organics	125 ml glass jar	Varies	Chill to <4°C	Indefinite

SUBMERGED AQUATIC PLANTS

Analysis	Container	Sample Volume	Method of preservation	Holding time
Selenium	500 ml glass jar	100 gms	Chill to <4°C	6 months

BIRD EGGS

Analysis	Container	Sample Volume	Method of preservation	Holding time
Selenium	60 ml glass jar	Varies	Chill to <4°C	6 months
Pesticides/organics	60 ml glass jar	Varies	Chill to <4°C	Indefinite

5.2 ANALYSES NARRATIVE

Sampling scheme is described in section 3.2. Analytical methods are specified in section 3.3. Sample volumes are described in the tables in section 5.1 for each matrix.

6.0 METHODS AND PROCEDURES

To monitor the effectiveness of the wetland to improve water quality, samples to determine concentrations of selected constituents will be collected in the water column at the inflow and outflow from the wetland, in the bottom sediments, and in the biota utilizing the wetland. The section 5.1 tables specify the type and volume of sample container as well as the method of sample preservation. Clean, disposable latex or other appropriate gloves will be worn at all times during sampling and processing, Section 8.3 describes how samples will be tracked and shipped.

6.1 FIELD HEALTH AND SAFETY PROCEDURES

All field activities will be conducted as specified in the USGS's National field manual for the collection of water-quality data: Techniques for Water-Resources Investigations Book 9-Handbooks for Water-Resources Investigations, 9 chapters, 1997-99). Information on safety in field activities is also available on the USGS's internet site http://water.usgs.gov/owq/FieldManual/index.html. The USBR Lower Colorado Region has issued a health directive for personnel working in the Imperial Valley in and around the New River. The memo, written by Larry Street (Regional Safety Specialist), reiterates that the New River contains significant levels of pathogenic bacteria and viruses. Precautions such as use of latex gloves, avoiding splashing with contaminated water, and awareness of pesticide applications should be exercised. Those who inadvertently contact the water should seek medical assistance. Appropriate cleaning of equipment with a non-phosphate detergent will be used. Appropriate caution in and around the New River must be practiced and field personnel will have available a suitable biocide (for example, Betadiene) for washing should inadvertent contact with environmental samples occur.

6.2 FIELD PROCEDURES

6.2.1 Equipment

The following equipment will be used for sampling, sample processing and equipment cleaning:
DH-81 or appropriate earlier version of hand held isokinetic sampler
Hydrolab multi-parameter water quality monitor (pH, DO, temp, sp. Cond., ORP)
Capsule filters and peristaltic pump
Modified Ekman Box Core sampler
Piston Core Sampler

Dissolved organic carbon filter and pressurized nitrogen tank
Bucket sieve and assorted screened sieves
Portable table
Ice chests for storage and sample shipment
Stainless steel spatulas, tweezers, and spoons
Teflon wash bottles
Glass bowls for sediment compositing
Modified Van Dorn point sampling water bottle
Machete and pruning sheers
Light traps
Dip nets
Plankton net
Sample bottles, jars, and containers
Chemical treatment supplies
Thermometers
Calibration standards
Secchi disk
Tape measure
Certified deionized water
Rinse buckets
Disposable latex gloves
Incubators for fecal coliform bacteria
Membrane filtration sampling setup for bacteria testing
Rubber raft/Johnny Junior boat

Back up equipment will be available for the Hydrolab by means of specific meters for DO, pH, Temp, and Specific Conductance. Additional bottom sediment sampling dredges also will be available. Sample bottles, jars and containers will be maintained in sufficient numbers. A backup peristaltic pump also will be available. Many items are readily available at local stores if replacements are needed. A blanket purchase authority also will be established at a scientific supply company providing overnight shipment, if necessary.

6.2.1.1 Equipment Calibration and Maintenance - All equipment and instruments used during the field activities will be maintained and calibrated to operate within manufacturers' specifications so that the required sensitivity and precision are assured. Personnel familiar with the equipment and the particular calibration and maintenance documented in a logbook will conduct specific instrument calibration and maintenance at the site. The Hydrolab multi-parameter meter will be calibrated in the office prior to sampling and verified in the field. The dissolved oxygen probe is calibrated with barometric pressure and temperature; the temperature probe is calibrated against a certified thermometer; pH is calibrated using pH4, 7 and 10 buffers from a scientific supply house; and specific conductance is calibrated to standards bracketing the known field conductivity. If a malfunction in the equipment occurs during field operations the

instrument will be repaired or replaced. Preventive maintenance programs ensure that equipment which may be damaged or is out of calibration can be repaired and calibrated to proper working order in a timely manner.

Standard operating procedures developed for field equipment ensure that the equipment is operated properly and that the data obtained are acceptable. Manufacturer's equipment operating procedures generally include:

* Operational theory
* Operational instructions for use
* Calibration procedures
* Functional operational checks
* Routine maintenance, upkeep, and repair
* Special environmental operating conditions and precautions
* Deactivation and storage procedures

The Program Manager will be directly responsible for selecting and controlling equipment inventories; providing training for the operation and maintenance of equipment; implementing and controlling calibration records and maintenance activities; and developing or implementing standard operating procedures for proper use of field equipment, sampling protocol, and operation of field analytical equipment.

The sample coordinator will also perform preventive maintenance to keep testing equipment in proper working order. Responsibilities for maintaining laboratory equipment are assigned to the laboratory manager. The laboratory manager will establish maintenance procedures and schedules for each major equipment item. These are documented in maintenance logbooks assigned to each instrument.

6.2.2 Field Sampling Procedures – All samples will be collected according to the USGS's National field manual for the collection of water-quality data: Techniques for Water-Resources Investigations Book 9-Handbooks for Water-Resources Investigations, 9 chapters, 1997-99). Information on sample collection, equipment, equipment cleaning and calibration can be found on the USGS's internet site at http://water.usgs.gov/owq/FieldManual/index.html.

Water samples from sites located at the inflow to the wetland, inflow and outflow of the sediment cells, and from the outflow from the wetland will be collected according to standard procedures established by the USGS (1997-99 cited above). At sites where water is flowing and the water depth is sufficient, a depth integrated Equal Transit Rate or Equal Discharge Increment methods will be used. Sampling will be by DH-81 or appropriate earlier version of hand held isokinetic sampler. If water depth is insufficient, or if turbulence is sufficient to ensure thorough mixing, dip (grab) sample will be collected. Field measurements of DO, pH, temperature, and specific conductance will be made in the cross section to determine the homogeneity of the water. Water from these samples will be composited prior to sample treatment and shipment. Water samples from

the sedimentation pond will be collected from selected depths using a modified Van Dorn water bottle.

Bottom sediment samples will be collected using a piston corer with plastic liners at sites where the water depth is less than 3.0 feet and with a modified Ekman sampler from a small boat when the water depth is greater than 3.0 feet. Surface material will be collected (top 2 inches or less) using clean Teflon spatulas or scoops from the sampling device and composited for each sample. Samples will be chilled or frozen prior to shipment.

Samples to determine selenium concentrations in benthic invertebrates will be collected using the modified Ekman or a plastic scoop. The material will be sieved in the field using a bucket sieve and native water prior to freezing pending shipment to the laboratory. Samples will be composites of individuals belonging to the same species if possible, or same family at a minimum.

Aquatic invertebrate samples will be collected using dip nets, plankton nets or light traps. If fish are available, baited minnow traps will be used for collection. Samples will be composited by species if possible or by family at a minimum, and placed in the appropriate sample container and frozen prior to shipment.

Aquatic plants will be sampled by cutting portions of the culms by hand. Culms from several plants will be composited in appropriate containers and frozen prior to shipment.

Addled bird eggs will be removed after surviving chicks have left the nest. Eggs will be chilled until returned to the office where they will be processed. The eggs will be weighed, measured, and the contents removed by bisecting the egg at the equator with a clean scapel. Egg contents will be placed in appropriate sample containers and frozen prior to shipment to the laboratory.

6.2.3 Field Notes - Detailed descriptions of the field conditions will be an integral part of the Field Logbook. The appearance, color, any other unusual characteristics and any odor present in the wetland will be noted in the logbook. Weather conditions also will be described in relation to temperature, humidity, wind conditions (speed and direction) and cloud cover, which all affect the biota inhabiting the wetland. Number and type of birds utilizing the wetland also will be noted.

6.2.3.1 Field logbooks - A field logbook will be kept for each site under control of the Project Manager. The following information will be stored in the logbook in a format similar to that provided in figure 6.2.3.1:

Sample location and description
Site sketch showing sample locations and measured distances
Sampler's name(s)
Date and time of sample collection

Type of sample collected
Sampling equipment used
Field instrument readings
Preliminary sample descriptions
Sample preservation
Sample identification numbers
Shipping arrangements (overnight air bill number)
Name(s) of recipient laboratory(ies)
Time of arrival at the site and time of departure
Calibration readings for any equipment used

6.2.3.2 Photographs - Photographs will be taken upon arrival at the site to document the field notes' descriptions. The following information will be recorded for each photograph:
Time, date, location, and weather conditions
Description of the subject photographed
Name of photographer

6.3 SOIL SAMPLING PROCEDURES

No soil samples will be collected.

6.4 BOTTOM SEDIMENT SAMPLING PROCEDURES

Exact sediment sampling locations will be determined in the field. Care will be taken to obtain representative samples. Bottom sediment samples will be collected using an Ekman box core type sampler or a piston corer to a depth of approximately 2 inches or less. Bottom sediment samples will be composited from individual cores. Samples will be frozen or chilled prior to shipment to the laboratory.

6.5 SURFACE WATER SAMPLING PROCEDURES

Water samples will be collected from the Rice 3 drain or New River (source of water for the wetland), at the inflow and outflow of the sediment cells, and at the outflow of the final wetland cell. Where depth and flow are sufficient, samples will be collected using a depth-integrated sampler. When depth is too shallow or the flow rate too slow, water samples will be collected using a wide-mouth glass or Teflon sampling jar. Water from the sampler or jar will be composited in a churn splitter prior to sub sampling for different analytical methods for treatment and shipment. Water samples from depths greater than 3.0 feet will be collected using a modified Van Dorn point sampling water bottle. Water will be composited prior to sub sampling for treatment and shipping.

6.5.1 Chemical Analysis Sample Collection

6.5.1.1 Sample Bottles - The type of sample bottle used for each parameter is described in the tables provided in section 5.1. All sample

bottles are pre-cleaned and supplied by the laboratory for each type of analysis.

6.5.1.2 Sampling Procedure - Grab: The sample will be taken from flowing, not stagnant water, with the sampler facing upstream. If depth is sufficient, the sample will be collected at 3-5 points in the cross-section and composited in a churn splitter. If depth is too shallow and the flow is homogeneous in the cross-section, the sample will be collected by hand or with a sample bottle holder. For grab samples, the bottle will be held 6-12 inches below the surface of the water. A modified Van Dorn point sampler will be used if samples are to be taken at specific depths based on vertical stratification in the sedimentation basins where water depth exceeds 3 ft.

Water from the sample bottle will be emptied into a churn splitter that has been cleaned with phosphate-free detergent and rinsed with deionized water, then rinsed again with sample water. Sample bottles will be rinsed with an aliquot of sample water from the churn splitter. Compositing, filtering and splitting of samples will take place either in a van or using plastic shields to prevent contamination from atmospheric dust.

6.5.2 Bacteriological Sample Collection - Samples to determine the number of fecal coliform bacteria in the water will be collected at the inflow to the sediment basins and outflow of the final wetlands cells. The Brawley wetland will receive water directly from the New River, which contains municipal effluent from Mexico. Fecal coliform bacterial counts in the New River at the International Boundary at Calexico historically were as high as several million bacteria forming colonies per 100 milliliters. At the wetland's withdrawal point near Brawley, numbers of fecal coliform bacteria have been substantially reduced but will likely still exceed criteria for human contact. The goals of the fecal coliform bacterial sampling are to determine the level of concern for those working in and around the wetland, to assess the ability of the wetland to reduce bacterial numbers, and to measure the contribution of the wildlife using the Imperial wetland to the bacterial numbers. The number of fecal coliform bacteria will be determined at both wetlands to see how drainwater and river water differ. The method will be as specified in Standard Methods using either membrane filtration or most probable number and serial dilutions.

6.5.2.1 Sample Bottles - For bacteriological sampling, sterile bottles and caps will be used. Bottles prepared to contain samples of chlorinated water will have sodium thiosulfate, at a concentration 0.1 mL of a 10% solution for each 125 mL of sample volume, placed in the bottle before it is sterilized. However, since no chlorine is expected to be present, sodium thiosulfate will only be added at the request of the laboratory.

6.5.2.2 Sampling Procedures - Bacteriological samples will be grab samples collected at one time from one location. The sample will be taken from flowing, not stagnant water, with the sampler facing upstream in the middle of the stream. Samples may 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 modified Van Dorn point water sampler will be used to take samples at depth and the water emptied into the glass sample bottle. After filling, some sample will be poured out to leave a bottle headspace of 2.5 to 5 cm.

6.6 GROUNDWATER SAMPLING PROCEDURES

Not applicable.

6.7 PROCEDURES FOR OTHER MATRICES

See field sampling procedures in section 6.2.2 for biota collection procedures.

6.8 DECONTAMINATION PROCEDURES

The decontamination procedures that will be followed are in accordance with approved procedures. Decontamination of sampling equipment must be conducted consistently so as to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated sediment 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 steam-cleaned or decontaminated according to EPA Region IX recommended procedures.

Between the Brawley and Imperial Sites, phosphate free detergents will be used to clean all equipment followed by hydrochloric acid and a rinse with deionized water. Sampling equipment for pesticide analyses will be cleaned as above followed by final rinse with pesticide free methanol and water. Exposed parts of the equipment will be wrapped with aluminum foil, shiny side out, for transportation to the sampling sites. Between sites within each wetland, equipment will be rinsed with native water followed by deionized water.

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. Materials to be stored more than a few hours will also be covered.

7.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples at the Imperial and Brawley wetlands during the Brawley Constructed Wetlands Demonstration Project, the sampling team will generate different types of potentially contaminated Investigation Derived Wastes (IDW):

Used personal protective equipment will not be hazardous and will be double bagged and disposed of in closed trash containers.

Non-phosphate detergent rinse water will be disposed of in the sanitary sewer system.

HCL rinse water will be neutralized in a container with dolomite before disposal in the sanitary sewer system.

Methanol rinse water will be disposed of in the surface drain where it will be rapidly dispersed and metabolized in the environment.

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan will follow the Office of Emergency and Remedial Response (OERR) Directive 9345.3—02 (May) which provides the guidance for the management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

8.0 SAMPLE DOCUMENTATION AND SHIPMENT

8.1 BOTTLES AND PRESERVATIVES

The number of sample containers, volumes, and materials are listed in the Section 5.1 tables. The containers are pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added by study team prior to shipment of the sample containers to the laboratory or added to the bottles in the field.

8.1.1 Soil samples - No soil samples will be collected.

8.1.2 Bottom Sediment Samples - Bottom sediment samples will be collected for analysis of constituents listed in the Section 5.1 table. Bottom sediment samples will be homogenized and transferred from the sample-dedicated homogenization pail into 8oz wide-mouth glass jars. The samples will be chilled to 4°C immediately upon collection.

8.1.3 Water Samples - Water samples for analysis of selenium and major cations will be collected in 1L polyethylene bottles. The sample will be preserved by adding 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 less than 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. Water samples for analysis of nutrients will be collected in 1L polyethylene bottles. The sample will be preserved by adding H_2SO_4. The remaining procedure is the same as described above for treating with HNO_3. Water samples for analysis of other constituents require no special preservation.

8.1.4 Samples of Other Matrices

Benthic invertebrate samples arecollected and treated as described in table, Section 5.1 .

Aquatic biota samples are collected and treated as described in table, Section 5.1.

Submerged aquatic plant samples are collected and treated as described in table, Section 5.1

Bird eggs are collected and treated as described in table, Section 5.1.

8.2 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

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 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 Steve Charlton, Imperial Irrigation District, Imperial, CA. He, or his designee, will sign the chain-of-custody form under the "relinquished by" box and note date, time, and air bill number.

A QA/QC summary form will be completed for each laboratory and each matrix of the sampling event. The sample numbers for all rinsate samples, laboratory QC samples, and duplicates will be documented on this form (See section 9.0). The original form will be sent to the QA Program; a photocopy will be made for the Imperial Irrigation District's files.

No custody seals will be used for this project.

8.3 LABELING, PACKAGING, AND SHIPMENT

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have preassigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: station location, date of collection, analytical 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.

All sample containers will be placed in a strong shipping container, such as an insulated plastic chest. The following outlines the packaging procedures that will be followed. All samples will be placed in coolers with the appropriate chain-of-custody forms. All forms will be enclosed in a large plastic bag affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Vermiculite will also be placed in the cooler to absorb spills. Bags of ice will be placed on top and around the samples. Each ice chest will be securely taped shut with fiberglass strapping tape.

If the EPA laboratory is used for sample analysis, the Region IX RSCC will be notified daily of the shipment schedule (Friday shipments must be reported no later than noon) and will be provided with the following information:

Sampler's name and organization
Name and location of the site
Case number
Total number(s) by concentration and matrix of samples shipped to each laboratory
Carrier, air bill number(s), method of shipment (e.g., priority, next day)
Shipment date and when it should be received by lab
Irregularities or anticipated problems associated with the samples
Whether additional samples will be sent or if this is the last shipment.

9.0 QUALITY CONTROL

9.1 FIELD QUALITY CONTROL SAMPLES

9.1.1 Equipment Blanks - For bottom sediment, benthic invertebrate, aquatic biota and submerged aquatic plant matrices, equipment blanks will be collected to evaluate field sampling and decontamination procedures by pouring HPLC organic—free (for organic s) or deionized water (for inorganics) over the decontaminated sampling equipment. One equipment rinsate blank will be collected for every 10 samples collected for each matrix.

9.1.2 Field Blanks - Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during water column sampling in the Brawley and Imperial Wetlands. Field blanks 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 the suite of chemicals listed in the Section 5.1 table for Water Column analyses..

The field blanks will be preserved and packaged in the manner described. A separate sample number and station will be assigned to each sample, and it will be submitted blind to the laboratory.

9.1.3 Trip Blanks – One trip blanks will be collected per annual.

9.1.4 Field Duplicate Samples - Duplicate samples will be collected at the inflow to the sediment cell and outflow from the final cell at the Imperial wetland and at the inflow to the first cell and outflow from the final cell at the Imperial wetland. Duplicate samples will be collected from these locations because they best indicate how effectively the wetland is functioning. When collecting duplicate water samples, the water sample will be distributed among all bottles equally with additional sampling continuing until all bottles are full (represents a split duplicate). A sequential or consecutive duplicate also will be collected in which the entire sample is collected, and then collected again immediately thereafter. The "split" gives indication of laboratory variability while the "sequential" give both laboratory and field variability. Bottles for one type of analysis will be filled before bottles for the next analysis are filled.

Duplicate samples will be preserved and packaged 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.

9.2 LABORATORY QUALITY CONTROL SAMPLES

At a minimum, one laboratory QC sample is required per week or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 1 week, or involves collection of more than 20 samples per matrix, additional QC samples will be designated. For this sampling program, samples collected at the following locations and frequencies will be the designated laboratory QC samples.

For bottom sediment – over the 3 year monitoring program, 7 samples from the sedimentation cell will be analyzed for the constituents identified in table 5.1.

For water - over the 3 year monitoring program, 39 samples from the sedimentation cell will be analyzed for the constituents identified in table 5.1.

For benthic invertebrates, over the 3 year monitoring program, 7 samples from site C1 will be analyzed for the constituents identified in table 5.1.

For aquatic biota, over the 3 year monitoring program, 3 samples from site C1 will be analyzed for the constituents identified in table 5.1.

For submerged aquatic plants, over the 3 year monitoring program, 7 samples from site C1 will be analyzed for the constituents identified in table 5.1.

For bird eggs, over the 3 year monitoring program, 2 samples from birds nesting in the vicinity of the wetland will be analyzed for the constituents identified in table 5.1.

9.3 FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the QA Program will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.