

# Bolsa Chica Full Tidal Area Contaminant Cleanup Plan

## Appendices

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# Appendix A – Quality Assurance Project Plan

## 1. Introduction

This site-specific Quality Assurance Project Plan (QAPP) presents the policies, organization, functions, and specific quality assurance (QA)/quality control (QC) activities associated with analytical data generation and assessment for the Bolsa Chica Lowlands project, Orange County, California. The Cleanup Plan involves Verification Sampling in each of the cleanup areas to ascertain whether contaminants of concern have been satisfactorily removed. The verification criteria are the same as the cleanup criteria (see section II of this document).

This QAPP, along with sections of the Bay Protection and Toxic Cleanup Program QAPP<sup>5</sup>, the QAPP presented as Section 5 of the Phase II Environmental Assessment Work Plan for Bolsa Chica Lowland and Pocket Area (Tetra Tech, Inc., 1996), and the QAPP developed for the Confirmatory Sampling and ERA (Reference QAPPs), comprise the QA plan for this effort. Portions of the reference documents are considered part of this QAPP by reference herein, but any sections of this document that differ from or enhance either of the reference documents shall supersede them.

## 2. QAPP Format and Guidance

This QAPP was produced following the format provided in the Bay Protection and Toxic Cleanup Program QAPP<sup>5</sup>. Soil-sampling elements of this project were designed following the format provided in the QAPP presented as Section 5 of the Phase II Environmental Assessment Work Plan for Bolsa Chica Lowland and Pocket Area.<sup>6</sup>

The QA/QC procedures described herein are consistent with standard guidance documents, including those provided by the USEPA<sup>7</sup> and California EPA<sup>8</sup>.

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<sup>5</sup> STEPHENSON, M., M. PUCKETT, N. MORGAN, AND M. REID. 1994. *BAY PROTECTION AND TOXIC CLEANUP PROGRAM: QUALITY ASSURANCE PROJECT PLAN*. STATE WATER RESOURCES CONTROL BOARD, BAY PROTECTION AND TOXIC CLEANUP PROGRAM, SACRAMENTO, CALIFORNIA.

<sup>6</sup> TETRATECH, INC. 1996. *PHASE II ENVIRONMENTAL ASSESSMENT FOR BOLSA CHICA LOWLANDS AND POCKET AREA, HUNTINGTON BEACH, CALIFORNIA*. BOLSA CHICA TECHNICAL COMMITTEE, REPORT NO. TC0798-05. OCTOBER.

<sup>7</sup> U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA). 1997. *ECOLOGICAL RISK ASSESSMENT GUIDANCE FOR SUPERFUND: PROCESS FOR DESIGNING AND CONDUCTING ECOLOGICAL RISK ASSESSMENTS*. EPA INTERIM FINAL PUBLICATION NO. 540/R-097/006. JANUARY.

U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA). 1998. *GUIDELINES FOR ECOLOGICAL RISK ASSESSMENT FINAL*. EPA/630/R-95/002F. RISK ASSESSMENT FORUM, WASHINGTON D.C. U.S. ENVIRONMENTAL PROTECTION AGENCY. APRIL.

<sup>8</sup> CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY. 1996A. *GUIDANCE FOR ECOLOGICAL RISK ASSESSMENT AT HAZARDOUS WASTE SITES AND PERMITTED FACILITIES, PART A: OVERVIEW*. CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY, DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION. JULY 4.

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY. 1996B. *GUIDANCE FOR ECOLOGICAL RISK ASSESSMENT AT HAZARDOUS WASTE SITES AND PERMITTED FACILITIES, PART B: SCOPING ASSESSMENT*. CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY, DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION. JULY 4.

### **3. Project Organization and Responsibilities**

#### **3.1. Laboratory Services**

Laboratories that are selected for this project will have a record of successfully meeting DQOs for projects that have similar requirements to this project will participate in the analyses. Combined, they will provide the full range of required analytical services needed for the project. All selected laboratories will maintain certification under the California Department of Health Services Environmental Laboratory Accreditation Program. Previous analytical services for this project have been provided by Columbia Analytical Services (CAS) located in Redding, California and by Kinnetic Laboratories, Inc. and its associated laboratory, ToxScan, located in Watsonville, CA. Alternative laboratories may be required for rapid turnaround samples for screening purposes. It is possible the laboratory operated by AERA Energy or another facility may be used for rapid analysis of total petroleum hydrocarbons.

### **4. Quality Assurance/Quality Control Program**

#### **4.1. Data Categories**

Two categories of data will be obtained. One category includes data that will be considered primarily qualitative. This will include all analyses conducted onsite using either field test kits or field instrumentation, as appropriate. The second category of data will include all quantitative analyses performed by a State-certified laboratory. The sampling media will be limited to soils or sediments.

#### **4.2. Precision, Accuracy, Representativeness, Completeness, and Comparability**

Detection limits will be established that are low enough to accurately define areas that exceed the cleanup criteria. Analytical methods will be designed to avoid potential interferences and provide comparable data to previous sampling efforts.

This QAPP has been designed to maximize the probability that environmental data collected during this program will meet or exceed the data quality objectives. It provides a systematic approach to data acquisition and management to accomplish the following purposes:

- Ensure that data-collection and measurement procedures are standardized among all participants
- Monitor the performance of the various measurement systems being used in the program to maintain statistical control and provide rapid feedback, so that corrective measures, if needed, can be taken before data quality is compromised
- Periodically assess the performance of these measurement systems and their components
- Verify that reported data are sufficiently complete, comparable, representative, unbiased, and precise, so that they are suitable for their intended use

The data-quality criteria for this project consist of qualitative and quantitative indicators, including precision, accuracy, representativeness, completeness, and comparability. Accuracy,

precision, and completeness requirements for various indicators are shown in Table 4-2 of Stephenson et al. (1994),<sup>5</sup>

#### **4.2.1. Precision**

Precision is a measure of reproducibility of analyses under similar conditions. Precision can be defined as the degree of mutual agreement among individual measurements and represents an estimate of random error. Precision will be evaluated based on laboratory or field duplicates or duplicate matrix spikes. When using matrix spikes, precision will be calculated as the relative percent difference (RPD) between the matrix spike (MS) and the matrix spike duplicate (MSD) recoveries. When using laboratory or field duplicates, it will be calculated as the RPD between the duplicate results when the sample concentration is at least five times the reporting limit, or as the difference between the duplicate results when the sample concentration is less than five times the reporting limit. Field replicates will comprise 5 percent of the sampling effort. MS/MSDs will be field-designated at a 5 percent frequency.

#### **4.2.2. Accuracy**

Accuracy is the degree of agreement between a measured value and the “true” or expected value. As such, it represents an estimate of total error from a single measurement, including both systematic error, or “bias,” and random error, that may reflect variability due to imprecision. Accuracy is expressed in terms of percent recoveries determined from results of MS/MSD and Laboratory Control Sample (LCS) analyses.

#### **4.2.3. Representativeness**

Representativeness is the degree to which sample data accurately expresses the characteristics of a population of samples, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that is achieved through proper sampling-program design using appropriate sampling strategies and techniques. Factors that can affect representativeness include site homogeneity, sample homogeneity at a single point, and available information around which the sampling program is designed. The sampling program has been designed to maximize representativeness through the delineation process.

#### **4.2.4. Completeness**

Completeness can be defined both qualitatively and quantitatively. Qualitative completeness is determined as a function of all factors that contribute to sampling. Quantitative completeness is calculated as the percentage of measurements that are judged to be valid compared to the total number of measurements planned. Effectively, it measures the amount of data available for valid measurement compared to the amount that is lost or destroyed. For this investigation, a completeness factor of 90 percent for all matrices is established, and is strictly defined as the ratio of the number of usable data points.

### **4.2.5. Comparability**

Comparability is a qualitative indicator of the confidence with which one data set can be compared to another. Confidence is achieved by maintaining standard techniques and procedures for collecting and analyzing representative samples and reporting the analytical results in standard units. Standard EPA methods are used for the analytical chemistry throughout this program.

## **4.3. Method Detection Limits, Reporting Limits, and Instrument Calibration Requirements**

### **4.3.1. Method Detection Limits**

The Code of Federal Regulations (40 CFR 136) defines Method Detection Limits (MDLs) as follows: “The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.”

Each participating analytical laboratory will calculate and report an MDL for each analyte of interest in soil prior to analyzing field samples. Each laboratory will calculate MDLs statistically, based on instrument performance, at least once annually for each analytical method employed, as required under 40 CFR 136.

### **4.3.2. Reporting Limits**

Reporting limits are driven by the data quality objectives and must be greater than twice the calculated MDL. Reporting limits used by the laboratory cannot be greater than the required detection limits (RDL) listed in TableA-1.

TABLE A-1  
Constituents of Concern, Analytical Methods, and Target Reporting Limits for Analytical Suites

Analyte	Method	Soil/Sediment dry wt (mg/kg or ppm)
<i>Trace metals</i>		
Arsenic	EPA 7061	0.1
Barium	EPA 6020	0.1
Beryllium	EPA 6020	0.1
Chromium	EPA 6020	0.1
Cobalt	EPA 6020	0.1
Copper	EPA 6020	0.1
Lead	EPA 6020	0.1
Mercury	EPA 7471	0.02
Nickel	EPA 6020	0.1
Vanadium	EPA 6020	2.0
Zinc	EPA 6020	0.1
<i>Organic compounds</i>		
Total DDT	EPA 8081a	0.0005
PCBs	EPA 8082	0.02
<i>Conventionals</i>		
TPH-diesel and waste oil	EPA 8015M	20
Oil and grease	EPA 1664	20

Reporting limits, as well as sample results, must be reported on a dry-weight basis for sediment or soil samples.

### 4.3.3. Instrument Calibration

Laboratory instruments will be appropriately calibrated by qualified personnel prior to sample analysis. Calibration will be verified at specified intervals throughout the analysis sequence. The frequency and acceptance criteria for calibration are specified for each analytical method. When multi-point calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples. Samples must be diluted, if necessary, to bring analyte responses within the calibration range. Tables B-2a through B-2j (See Appendix B) list the specific requirements for each method. Only those data that result from quantitation within the demonstrated working calibration range may be reported by the laboratory. Quantitation based on extrapolation is not acceptable.

### 4.4. Elements of Quality Control

Internal QC checks are used to provide indications of the state of control that prevailed at the time of sample analysis. QC checks that involve field samples, such as matrix and surrogate

spikes and duplicates, provide an indication of the presence of matrix effects. QC samples include method blanks, laboratory control samples, surrogate spikes, matrix spikes, and matrix spike duplicates.

#### **4.4.1. Method Blank**

Laboratory pure water (also called laboratory reagent blank) serves as a method blank to monitor each analytical batch for interference and for contamination from glassware, reagents, and other potential contaminants generated within the laboratory. The method blank is processed through the entire sample-preparation and analytical procedures, along with each sample batch. One method blank per sample batch is analyzed. If a target analyte is found at a concentration that exceeds the acceptance limit, corrective action is triggered to identify and eliminate contamination sources. See Tables B-3a through B-3h for details by method.

#### **4.4.2. Laboratory Control Sample**

Laboratory control samples (LCS) are used as a reference to assess accuracy of an analysis. The LCS for this project will consist of reagent water or cleaned sand spiked with known amounts of analytes that come from a source different than that used for calibration standards. All target analytes are spiked into the LCS for inorganic analyses. In the case of organic analyses, selected target analytes are spiked into the LCS. If LCS results exceed the specified control limits, corrective procedures must be implemented. Quality control limits for LCSs are listed in Table B-2 of this document.

#### **4.4.3. Surrogates**

Surrogates are analytes that behave similarly to the analytes of interest, but are not expected to occur naturally in the samples. They are spiked into the samples prior to sample preparation. Recoveries of surrogates can be used as an indicator of the accuracy of the measurement of target analytes. Surrogate recoveries must be reported for each sample preparation/analytical method combination. The acceptance limits for surrogate recoveries are listed in Table B-2.

#### **4.4.4. Matrix Spike/Matrix Spike Duplicate**

A sample matrix fortified with known quantities of specific compounds is called a matrix spike (MS). It is subjected to the same preparation and analytical procedures as the native sample. All target analytes are spiked into the sample for inorganic analyses that are amenable to spiking. When analyzing for Total Organic Carbon in sediment/soil, laboratory duplicate analyses will be performed instead of matrix spikes. In the case of organic analyses, selected target analytes are spiked into the sample. Matrix spike recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. A matrix spike duplicate (MSD) is a second laboratory-fortified sample matrix. The relative percent difference (RPD) between the recoveries from the duplicate matrix spikes is used as a measure of the precision of sample results. Table B-2 lists the acceptance limits for MS/MSDs for this project.

#### **4.4.5. Other Method - Specific Requirements**

Other quality control parameters are described in each method. The frequency and acceptance criteria are listed in Tables B-2 and B-3a through B-3h.

#### **4.4.6. Equipment Blank**

Rinsate blanks are obtained by rinsing decontaminated sampling equipment with ASTM Type II water. The rinse water is collected in sample bottles, preserved, and handled the same as the samples. The frequency of sample collection is described by matrix in the Work Plan.

#### **4.4.7. Field Duplicates/Replicates**

Field duplicates provide yet another means of maintaining quality control by measuring the precision of the sampling process. The laboratory will not be given the identity of the duplicates, but the QA reviewer will receive source information to aid in data review and validation. At a minimum, soil/sediment duplicate samples are collected at a 5-percent frequency.

### **4.5. Quality Control Procedures**

#### **4.5.1. Sample Custody**

Tables 5-1 and 5-2 of the Tetra Tech QAPP<sup>6</sup> specify the holding times and preservation conditions that will apply to this project.

Each laboratory will designate a sample custodian who will log in samples using a standardized Sample Receipt Form. The custody seal will be inspected to verify that it is intact, and the sample custodian will then check the condition of the samples and verify custody records. The presence or absence of ice in the sample cooler will be noted, and the cooler temperature will be recorded. Any breakage, leakage, or other damage will be noted and recorded. The sample custodian will record all tracking information and pass it on to the data librarian and the laboratory project manager. All of this information will appear on the Sample Receipt Form. If discrepancies are noted between the chain-of-custody report and actual contents of the container, these discrepancies will immediately be reported to the project manager. Along with sample receipt documentation, the following information will be documented on Sample Receipt Forms by the sample custodian:

- Date samples received
- Field sample identification number
- Laboratory sample identification number
- Analytical tests requested for the sample batch
- Sample matrix
- Number of samples in the batch
- Container description and location in the laboratory

After being logged in, the samples will be refrigerated as appropriate. The laboratory must have formally documented procedures for sample holding and storage, and laboratory personnel will know the required sample holding times and preservation conditions. If samples are not extracted or analyzed within the required holding time for the appropriate method, the Project manager will be notified immediately for guidance on corrective action. All corrective actions must be fully documented. After confirmation by the Project manager, samples with expired holding times will be discarded.

### 4.5.2. Deliverables

Laboratories that will perform analyses for the Lowlands must have established procedures to conduct data reduction, review, and reporting. The specific procedures and assigned personnel vary among laboratories; however, equivalent data-reduction and review protocols are required to ensure that the overall objectives of analysis and reporting, according to method and project specifications, are achieved. Laboratory-specific procedures are evaluated during technical-systems audits to ensure that the process steps discussed in this section are properly performed. The primary analysts will be responsible for review of their work as their work is being performed. During this process, a case narrative or QC exception report will be generated documenting nonconformance issues and resolution. A designated peer reviewer (i.e., a qualified staff member who is not the primary analyst[s]) will perform an independent review to determine that the project specifications have been met. The Laboratory Manager or designee will be responsible for final approval of the laboratory analytical report prior to sending the report to the project staff. All raw data will be archived in confidential laboratory files.

Most laboratories use a Laboratory Information Management System (LIMS) to store, transfer, and report analytical data. The LIMS files must also undergo a QC check to verify that the results are complete and correct. The laboratory is responsible for generating hard copies (i.e., final analytical report) and electronic files of the analytical results in standard formats needed by the project staff. The specific information and electronic file formats are established and tested prior to analysis of any samples to ensure that the formats will be compatible with the project database, and that all required information is reported.

The hard-copy and electronic laboratory reports for all samples and analyses will contain the information necessary to perform data evaluation. The following information is typically included for each preparation batch (when applicable) and each analytical batch:

- Field identification number
- Date received
- Date prepared
- Date analyzed
- Method
- Result for each analyte (including surrogates)
- Sample specific detection limit
- Surrogate spike recoveries
- Units
- Dilution factor
- Laboratory qualifier flags
- Narrative
- MS and laboratory control spike concentrations
- MS and laboratory control spike results
- MS and laboratory control spike recoveries and relative percent differences (RPDs)
- Method blank results
- Any other QC sample results
- Initial and continuing calibration verification results (required only for hard copy)
- Initial and continuing calibration verification recoveries (required only for hard copy)
- Analytical batch number

- Preparation batch number

Complete documentation of sample preparation and analysis and associated QC information will be maintained by the laboratory for all project samples in a manner that allows easy retrieval in the event that additional validation or information is required.

The electronic analytical data from the laboratory are submitted with hard-copy reports and uploaded to the project database by using a set of programs to read, check, and match the analytical results to the field data in the database. The electronic results are reviewed by project staff to ensure accurate reporting and adherence to project specifications. Ten percent of all electronic results will be reviewed for correct sample identification, dates, sample-specific detection limits, flags, and agreement between the hard-copy and electronic data. If systematic errors or frequent occurrence of random errors are observed, a successively higher percentage of reports will be reviewed. After the analytical reports are used to verify the electronic transfer process, they are permanently stored in project files.

Data flow from the laboratory and field to the project staff and data users follows established procedures to ensure that data are properly tracked, reviewed, and validated for use.

#### **4.5.3. Medium Level Extractions/Waste Dilutions**

In the case where target concentrations and/or the nature of the sample matrix preclude low-level analyses, a medium-level protocol or waste dilution should be used in order to preserve the ability to monitor analytical efficiency by evaluation of measured surrogate recoveries. Medium-level protocol is described in SW-846 method EPA 3550B. Waste-dilution procedures are described in EPA 3580A and EPA 3585.

#### **4.5.4. Additional Cleanup Procedures to Minimize the Effect of Petroleum Hydrocarbons on Recoveries and Reporting Limits**

Hydrocarbons are expected to be present and will interfere with analyte integration/chromatography, resulting in dilutions that raise the reporting limits if cleanups are not performed. In order to maintain the lowest possible reporting limits, appropriate cleanup procedures must be employed. Methods for sample cleanup include but are not limited to gel permeation chromatography (GPC), silica gel, alumina, florisil, mercury (sulfur removal), sulfuric acid and acid/base partitioning. GPC will be performed when necessary to eliminate or minimize matrix interference. When analyzing for pesticides and polychlorinated biphenyls (PCBs), half of the sample extract must be set aside for PCB analysis. This half of the extract must be subjected to sulfuric acid cleanup prior to analysis for PCBs. Method blanks, MS/MSDs, and laboratory control samples must be subjected to the same cleanup procedures performed on the samples to monitor the efficiencies of these procedures.

#### **4.5.5. Sample Dilutions**

Dilution of the samples results in elevated reporting limits and ultimately affects the usability of the data as it pertains to decision-making processes related to potential actions at the sampling site. It is important to minimize dilutions and maintain the lowest possible reporting limits. When dilutions are necessary due to high concentrations of certain target analytes, lesser dilutions should also be reported in order to fully characterize the sample for each of the low-concentration analytes. The level of the lesser dilution is directly related to the analytical system

specified by the method and is defined as the dilution that provides the lowest possible reporting limits without having a lasting deleterious effect on the analytical instrumentation.

## **5. Sampling Procedures**

### **5.1. Field Sampling**

#### **5.1.1. Sample Container**

USEPA-recommended containers will be used for field sampling, and sampling procedures will adhere to USEPA-recommended preservation requirements for each parameter of concern. Use of proper containers and preservation methods will retain sample integrity. Containers and preservatives will be provided by laboratory personnel. The USEPA guidelines for sample containers and preservatives are summarized in Table 5-1 of Tetra Tech, Inc. (1996).<sup>6</sup>

#### **5.1.2. Sample Volumes, Container Types, and Preservation Requirements**

Holding time compliance and proper sample preservation begin during field sampling. Temperature control and pH adjustment are the most common preservation techniques. Field personnel who will perform on this project will be thoroughly trained in proper use of sample collection gear and acceptable sampling procedures. Required holding times for various parameters are summarized in Table 5-2 of Tetra Tech (1996).<sup>6</sup>

Field sampling personnel will maintain a waterproof field logbook that will be completed with each sampling event. The field logbook will contain the following information:

- Date and time of commencement of sampling
- Name of sampling personnel
- Location of sampling station (location coordinates)
- Station description, including designation number
- Type of grab sampling and equipment used
- Field observations (weather, soil, texture, odors)
- Station depth
- Number of grabs made and amount of sample taken
- Type(s) of analyses to be performed

As required by the Project Manager, additional information will be recorded in the field logbook. This information might include visual observations as they relate to boundaries or other discontinuities in the distribution of contaminants.

Samples will be transported to either the field laboratory for qualitative analysis or to the appropriate laboratory daily with proper chain-of-custody (COC) records for each sample. Each person who releases a sample will sign and date the COC form and require the receiver to sign and date the form. Each will keep a copy of the signed form. Each form will consist of a record of all samples taken from each station. Each form will include the sample identification number, phase number, and date collected.

Field sampling personnel will attach labels to the outside and/or inside of the sample container. Jars will not contain hand-written labels. All jars will be pre-labeled by sampling personnel before samples are aliquoted. Labels will include the following information:

- Sample number
- Collection station number
- Station name
- Sampling phase
- Date samples collected

Replicate quality control samples for sediment chemistry will be taken at 5 percent of the sites sampled, as noted above.

Sample containers will be packed with sufficient ice to keep them cool for at least 48 hours. Each container will be double-bagged in pre-cleaned plastic bags closed with cable ties to keep all samples within the container isolated from each another. Ice chests must be driven or flown to the laboratory within 24 hours of collection.

Sample acceptability criteria, cleaning procedures, homogenization, and aliquoting of samples are presented in Section 3 of Stephenson et al. (1994).<sup>5</sup>

## **6. Field Analytical Methods**

### **6.1. Field Instrument Calibration Procedures**

Several types of real-time instruments can be used to monitor and evaluate the physical parameters of soil. These screening level data can be used to monitor worker health and safety and to assist sample collection. Field instruments that may be used for investigations include:

- Photoionization detectors (PIDs), such as HNU®, organic vapor monitor (OVM), and Micro TIP®
- Flame ionization detectors (FIDs) or organic vapor analyzer (OVA)
- Radioactivity meter
- X-ray fluorescence spectrometer

If different or additional field instruments are needed for a specific effort, these will be specified in the Work Plan.

To ensure that the instruments are operating properly and are producing accurate and reliable data, routine calibration will be performed prior to and during use. Factory calibrations will be performed at a frequency recommended by the manufacturer. Field calibrations will be performed at least once per day, prior to instrument use. If field calibration reveals that the instrument is outside established accuracy limits, the instrument will be serviced in the field. If necessary, the instrument will be returned to the manufacturer for immediate repair and servicing. A backup instrument will be available for each of the critical real-time instruments used in the field. Due to the high cost of X-ray fluorescence instrumentation, backup will consist of assuring that an additional rental instrument is available upon short notice.

## **6.2. Real-Time Organic Vapor Monitoring Instrument Calibration**

Real-time OVMs are used to monitor total airborne organic vapors during field operations; measurements are used to evaluate worker health and safety. Personal protective equipment (PPE) requirements and site control decisions will be determined using the results of real-time measurements. Real-time instruments also provide screening level data for volatile organic compound (VOC) concentrations in drill cuttings, soil boring samples, and groundwater wells. Several types of OVMs are available. Generally, these instruments utilize either an FID or a PID detection method for quantifying total airborne VOCs. Suggested calibration frequencies for each commonly used instrument are presented in the following subsections. Due to the rigors of field use, backup instruments should always be available.

### ***6.2.1. Flame Ionization Detector***

FIDs measure total concentrations of hydrocarbon vapors. The instrument response for each specific compound is proportional to its response factor relative to methane. The instruments should be calibrated using methane in air.

The suggested calibration frequencies for field OVAs are:

- Factory calibration and service once per year
- Five-point calibration using four methane-in-air standards and ultra-high purity (UHP) air performed once each quarter
- Three-point calibration using two methane-in-air standards and UHP air prior to daily use
- Single-point calibration check using a representative methane-in-air standard after each 4-hour increment of operation and at the end of each working day

### ***6.2.2. Photoionization Detector***

PIDs measure total organic vapors and are highly sensitive to aromatic compounds, moderately sensitive to unsaturated chlorinated compounds, and less sensitive to aliphatic hydrocarbons. The instrument responds to organic compounds with ionization potentials less than the rated electron voltage (eV) of the ultraviolet (UV) bulb in the unit. Due to its longevity and range of detectable contaminants, the most frequently used UV bulb is a 10.2 eV. Other bulbs are available from the manufacturer (e.g., 9.6 eV, 11.7 eV, etc.). Field personnel will know which bulb is installed in the unit, ensuring that the instrument is capable of detecting the particular contaminant of interest.

Several manufacturers produce instruments with PIDs for field monitoring of airborne VOCs. The manufacturer's calibration requirements should be followed. Suggested guidance for PID calibration includes:

- Factory service and calibration once per year
- The HNU Systems PI-101 requires a three-point calibration on a quarterly basis using UHP air and two representative concentrations of isobutylene-in-air standards

- For any PID instrument, a two-point calibration prior to daily use (UHP air and a representative concentration of isobutylene in air standard)
- Single-point calibrations at the end of each day of use

### ***6.2.3. X-Ray Fluorescence Spectroscopy***

X-ray fluorescence (XRF) spectroscopy is a nondestructive qualitative and quantitative analytical technique used to determine the chemical composition of a variety of sample types. The method is based upon radiating the sample with X-rays. The source of radiation can be either various sealed radioisotopes or an X-ray tube. Incident radiation from the instrument causes electrons from one or more of the inner shells to be knocked out of position. This excess energy is released as electrons from one of the higher energy shells fill the displaced electrons' positions. When this occurs, fluorescent X-rays are emitted by the energized atom. Energies of the characteristic fluorescent X-rays are converted by a detector into electric pulses, the amplitudes of which are linearly proportional to the energy. Each element has a set of characteristic energies based upon the shell from which the electron is dislodged and the number of shells that the electron moves. The number of counts at a given energy provides the basis for quantitative analysis of a particular element.

A number of manufacturers produce XRF instrumentation. Equipment varies from highly portable models that can be carried in the field and used to provide very rapid, direct assessment of sediment contamination to models designed for laboratory use. In this program, it is intended that either a portable field model or bench top unit capable of being operated in the field office be used. The bench top unit may provide better resolution but would not provide the benefit of rapid, in-situ assessments. Calibration and maintenance requirements are specific to the instrumentation and will be addressed in Standard Operating Procedures.

Some issues are relevant to all XRF instruments. Factors influencing the accuracy and precision of XRF analysis include:

- the physical characteristics of the sample matrix
- moisture content
- chemical matrix effects resulting from differing concentrations of interfering elements
- overlap of certain X-ray spectra

Processing the samples to provide a relatively uniform particle size and drying the samples can overcome these problems. Chemical matrix effects can be corrected mathematically through the use of Fundamental Parameter (FP) coefficients. Overlap of spectra can often be addressed by mathematical corrections based upon use of L or M lines. These corrections, however, tend to reduce measurement sensitivity. The operator should have a sound knowledge of the elements that can result in severely overlapped spectra in order to avoid misinterpretation of the results. A secondary calibration using site sediments that have been analyzed in the laboratory and processed to minimize physical matrix effects is recommended to provide the most quantitative results.

## **7. Data Validation**

Measurement data should be consistently assessed and documented to determine whether program DQOs have been met, to assess data quality quantitatively, to identify potential limitations on data use, and to assess whether site-specific DQOs have been met. The data quality evaluations of the chemical data for this project are patterned after the USEPA Contract Laboratory Program Functional Guidelines for Organic and Inorganic Data Review, February 1994.

### **7.1. Chemical Data Evaluation**

A batch QA review will be performed by the contractor for all data. A batch review is typically referred to as data evaluation.

The routine QC procedures conducted in the laboratory are established in the published methods, this QAPP, and the analytical SOPs prepared by each laboratory. The laboratory will be responsible for following the procedures as specified in this QAPP (and/or the site-specific FSP) and operating the analytical systems within statistical control limits. These procedures include proper instrument maintenance, calibration and calibration checks, and laboratory QC sample analyses at the required frequency. Associated QC sample analytical results are reported with the sample results so the project staff can evaluate the analytical process performance.

All project data will be reviewed as part of data evaluation. The review will be conducted on an analytical or preparation batch basis or by evaluating QC samples and all associated field sample results. Project data evaluation procedures established for the project generally include:

- Review of initial and continuing calibration verifications
- Initial review of analytical and field data for complete and accurate documentation, chain-of-custody records, analytical holding time compliance, and required frequency of field and laboratory QC samples
- Evaluation of method and field blank results to identify systematic contamination
- Comparison of all types of spike and duplicate results with project objectives for precision and accuracy
- Statistical calculations for overall method accuracy and precision using the appropriate QC sample results
- Assigning data qualifier flags to the data as necessary to reflect limitations identified by the process
- Calculating completeness by method and matrix or by analyte, if designated

Some of the statistical calculations commonly used for the data evaluation process and ways in which the calculations apply to environmental sample results are presented in Table 8-1. Additional statistical procedures may be applied to the data to assess reporting limits or other quality-related parameters. The calculations and procedures are documented in the QA/QC summary report.

Qualifier flags will be applied to sample results that fail to meet the DQOs according to the flagging conventions in Tables 8-2 and 8-3. The tables should be used as minimum data evaluation criteria. The data evaluator should use professional judgment and apply additional criteria when appropriate. The qualifier codes, or flags, will be stored with the data in the Bolsa Chica database. Circumstances may be encountered which warrant deviations from these flagging guidelines. The technical reasoning will be documented with the data package or the data quality assessment report in these instances. Reanalysis or resampling may be recommended as a corrective action if data are determined to be unacceptable for the intended use. Definitions of the qualifier flags are presented in Table 8-4. Table 8-5 shows the relationships between QC and field samples that may be similarly influenced by QC problems.

A distinction must be made between quality control and data review conducted as a part of laboratory operations and the project-related data evaluation conducted after data have been reported. Planning, use of standard field, analytical, and QC procedures, and auditing performed during field and laboratory activities are designed to control the sampling and analytical processes to produce data of sufficient quality for project needs. If a problem occurs in spite of these controls, the data evaluation must identify the problem, determine which data are affected, state how use of the data may be limited, and make recommendations for corrective actions as necessary.

The QA/QC staff conducting data evaluation is responsible for ensuring that data qualifier flags are assigned as needed based on the established QC criteria, and any limitations are communicated to the data users. These data qualifier flags are not related to any flags that may be assigned by the laboratory. Data qualifier flags explain the type and extent of the limitation placed on a result, while laboratory flags identify QC results that are outside laboratory tolerances and may or may not lead to subsequent data qualifiers assigned during data evaluation. The QA/QC staff is also responsible for initiating corrective actions for analytical or other problems identified during the data evaluation process. Corrective actions range from verifying that the method was in statistical control during the analytical runs to reanalysis of the sample or re-sampling, or re-issuing the laboratory report due to clerical errors in the report.

## **7.2. Chemical Blank Data Evaluation**

Blank results indicate whether any reported analytes may be attributed to laboratory sources (reagents, glassware, and instrumentation) or field sources or conditions (equipment, shipping and handling, ambient conditions) rather than the sample. Laboratory blanks include method or system blanks included in each preparation and analytical batch. Equipment, trip, and ambient blanks are field blanks collected at specified frequencies or under selected conditions to monitor contamination from non-laboratory sources.

The most common laboratory contaminants, methylene chloride, phthalates, acetone, toluene, and 2-butanone are ubiquitous; controlling them within acceptable low levels is part of standard laboratory procedures. When these or other analytes are reported in field samples or field blanks at concentrations within ten times those found in an associated laboratory blank, the field sample results will be "U" flagged to indicate that the analytes should be considered not detected. Common contaminants in field samples not reported in the associated laboratory blank may be

qualified if the contamination appears systematic (i.e., if the contaminant is detected in a majority of the other laboratory blanks).

Field blank results are evaluated individually, and related to the field samples as shown in Table 8-5. The probable contamination source is identified and associated sample results are qualified as necessary based on the relative concentrations between the blank and the sample. For example, if equipment blank results show contamination and the sample collected from the bailer shows the same analyte at concentrations attributable to blank concentrations, the sample results are “U” flagged to indicate that they should be considered not detected. Samples collected before and after the blank are also evaluated to determine the potential sources and impacts of carryover. Because equipment blanks are water samples, contaminant concentrations reported in blanks cannot be directly related to concentrations in soil samples. Judgment must be used to determine whether any analyte reported in the blank and associated soil samples should be qualified.

### **7.3. Chemical Accuracy**

Accuracy is associated with correctness and is a comparison between a measured value and a known or expected value. Accuracy is assessed by comparing LCS, MS, surrogate spike and performance evaluation (PE) sample recoveries with the project objectives presented in Table B-2, and also taking into account manufacturer’s tolerances on commercially purchased PE samples.

#### **7.3.1. Laboratory Control Samples**

LCSs are spikes of method analytes in reagent-grade water (or may be commercially purchased solid LCSs). The LCSs are taken through sample preparation and analysis to assess statistical control of the method. If the recovery is outside the established tolerances, samples from the same preparation and/or analytical batch should be suspected to have similar analyte recoveries and should be qualified. Any not-detected sample results associated with low LCS recoveries may indicate potential false negatives and the reporting limits for the analytes should be flagged as estimated. Positive sample results associated with low or high LCS recoveries should be flagged as estimated. The system must be assessed to determine the reason for the out-of-tolerance occurrence, and corrective action may be indicated, up to and including re-extraction and reanalysis (if still within holding time) or re-sampling of affected samples.

#### **7.3.2. Matrix Spikes**

Matrix spike results are assessed by comparison with the recovery ranges presented in this QAPP. If MS recoveries are outside this range, two conditions must be evaluated:

- The spike concentration relative to the parent sample concentration
- The associated LCS recovery

If the parent sample concentration is greater than four times the spike concentration, the spike concentration is considered insignificant, relative to sample dilution and/or analytical variability. Since the recovery does not represent the ability to recover the analyte from the matrix, it is generally not calculated, or at least should not be used to qualify data.

If MS and/or MSD recovery is outside the specified range and the associated LCS is within specification, a matrix interference is demonstrated and sample results are qualified as estimated or are rejected if recoveries are extremely high or low. If systematic matrix interference is exhibited, similar sample results such as those from the same site or lithology must be evaluated. The reviewer's judgment is used to determine if the results should be qualified.

The qualified data are discussed in the sampling task QC report, and specific limitations such as poor or enhanced recovery for specific analytes are discussed. Further investigation or corrective action may be taken to find alternatives to reduce interferences.

### **7.3.3. Surrogate Spikes**

Surrogate spike results, associated with organic analyses, are used to assess target analyte recovery for each sample and measure system performance and matrix interference. Surrogate spike recoveries are compared to the recovery tolerances presented in this QAPP. Surrogates represent the different types or classes of analytes measured by a method, and the results are used to qualify similar analytes (e.g., acid extractable, phenolic, etc.). Field sample results that have surrogate recoveries outside the project specifications are qualified as estimates or are rejected if recoveries are very low or zero. Where surrogates coelute with non-target analyses or are low due to sample dilution, qualification of data will not be required.

## **7.4. Precision**

Precision is a measure of variability between duplicate analyses and is calculated for field and laboratory duplicates. Precision is evaluated by comparing the relative percent difference (RPD) between MS and MSD results, and between laboratory duplicate results with the RPD criteria listed in Table B-2. Precision criteria for field duplicate results are specified in Tables A-3 and A-4.

If RPDs exceed the criteria, the analytical results for the samples collected by the same sampling team, from the same equipment, from the same site, from similar matrices (soil samples), or on the same day, may be affected. Close evaluation of the results should indicate the most likely source of variability, and the corresponding samples are qualified as warranted.

If all analytical specifications are satisfied and sampling error is not suspected, the RPD results may indicate variability in the matrix. RPD results should be used to initiate further evaluation but are not necessarily considered to be indicators of the state of control during analysis or of field conditions. Estimated qualifier flags may be assigned for samples or matrices with high RPDs to indicate sample heterogeneity or high matrix variability rather than a data quality problem.

An average RPD may be calculated and reported as a measure of overall analytical precision or matrix variability for methods and analytes with many duplicate samples or analyses.

## **7.5. Completeness**

Completeness is calculated for each method and matrix after the QC data have been evaluated and data qualifiers assigned.

## **7.6. Interlaboratory Data Comparison**

Multiple laboratories may perform the same analytical methods on project samples. An interlaboratory comparison may be conducted to identify laboratory contamination or conditions that may influence the comparability of the results. The complexity of the comparison will depend upon the number of samples and volume of QC results reported by each laboratory. At a minimum, a qualitative evaluation must be performed to evaluate:

- Blank contaminants and concentrations reported
- LCS and MS/MSD recoveries and RPD ranges
- Surrogate spike recovery ranges
- PQLs and dilution factors

TABLE A-2  
Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	$\bar{X}$	$\frac{n}{\sum_{i=1}^n \frac{X_i}{n}}$	Measure of central tendency	Needed for additional statistical calculations
Standard Deviation	S	$\left[ \frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1} \right]^{1/2}$	Measure of relative scatter of the data	Needed for additional statistical calculations
Coefficient of Variation	CV	$\left( \frac{S}{\bar{X}} \right) \times 100$	Also called the relative standard deviation (RSD); adjusts for the magnitude of observations	Used to assess precision for replicate results
Pooled CV	CV	$\left[ \frac{\sum_{i=1}^n (CV_i)^2 df_i}{n \sum_{i=1}^n df_i} \right]^{1/2}$	Measure of overall variability of a series	Used to assess overall performance for compounds or methods with multiple measurements
Relative Percent Difference	RPD	$\left[ \frac{(X_1 - X_2)}{\left( \frac{(X_1 + X_2)}{2} \right)} \right] \times 100$	Measure of variability that adjusts for the magnitude of observations	Used when there are only two observations; mathematically related to CV

TABLE A-2  
Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Average Relative Percent Difference	$\overline{RPD}$	$\frac{\sum_{i=2}^n RPD}{n}$	Average relative percent difference -- analogous pooled CV for duplicate measurements	Used to assess overall performance for compounds with multiple measurements
Confidence Interval	CI	$\frac{X \pm t_{(\alpha, n-1)} S}{n^{1/2}}$	Interval about X that contains the true value, with probability $\alpha$	Assign confidence intervals or error bars to measurement data
Percent Recovery	R	$\left( \frac{X_{meas}}{X_{true}} \right) \times 100$	Recovery of spiked compound in pure matrix	Recovery of LCS, surrogate spikes
Percent Recovery	R	$\frac{\text{value of spiked sample} - \text{value of unspiked sample}}{\text{value of added spike}} \times 100$	Recovery of spiked compound in sample matrix	MS recovery

X: observation (concentration)  
n: number of observations  
df: degrees of freedom, usually (n-1)  
t: statistic from students' "t" distribution

TABLE A-3  
Flagging Conventions for Bolsa Chica—Minimum Data Evaluation Criteria for Organic Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for extraction or analysis Holding time exceeded by a factor of two	J positive results UJ non-detects R non-detects	Sample
Sample Preservation EPA 8015 Modified	Sample not preserved	J positive results UJ non-detects	Sample
Temperature blank	> 6°C	J positive results (except PCBs will not be flagged) UJ non-detects (except PCBs will not be flagged)	All samples in same cooler
Initial Calibration	%RSD > 20% (EPA 8015; EPA 8081) <u>AND</u> calibration curve not used; <u>OR</u> calibration curve used, but with coefficient of correlation or determination $\leq 0.99$	J positive results, UJ non-detects	All associated samples in analysis batch
Calibration Verification (ICV, CCV)	%Drift above 15% (EPA 8015; EPA 8081)	J positive results, UJ non-detects	
Laboratory Control Sample (LCS)	%R > UT %R < LT	J positive results J positive results, UJ non-detects	All samples in extraction batch
Calibration Blank Method Blank Equipment Blank	Convert to soil units, if applicable, multiply the highest blank concentration by 5 (10 for common lab contaminants)	U reported results < calculated value	All samples in extraction batch and/or analytical batch, whichever is appropriate as associated with method blank or calibration blank  All samples, same site, matrix and date (water); or all samples, same site, matrix (soil) associated with equipment blank  All samples shipped in the same cooler as the trip blank
Matrix Spikes			
	%R > UT	J positive results	Flag matrix spike analytes in parent sample only
% Recoveries	%R < LT	J positive results UJ non-detects	
RPDs	RPD > UT	J positive results	Flag matrix spike analytes in parent sample only
Unspiked reported analytes	RPD > UT	J positive results	Flag matrix spike analytes in parent sample only
	Compound reported in only one sample	J positive results UJ non-detects	Flag matrix spike analytes in parent sample only

TABLE A-3  
Flagging Conventions for Bolsa Chica—Minimum Data Evaluation Criteria for Organic Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Surrogates	%R > UT	J positive results	All analytes in associated sample
GC Methods	%R < LT and > 10%	J positive results UJ non-detects	
	%R < 10%	J positive results R non-detects	All analytes in associated sample
Field duplicates	Reported in both samples, RPD > UT (30% for water; 50% for soil/sediment/tissue)	J positive results	Field duplicate pair
	Reported in one sample	J positive results UJ non-detects	
Presence of PCB, chlordanes, or toxaphene analytes	PCB, chlordanes, or toxaphene peaks coelute with some single-analyte organochlorine pesticides on either column and PCB, chlordanes, or toxaphene reported	J positive results of PCB, chlordanes or toxaphene R affected single-analyte organochlorine pesticide results	Sample
Confirmation (Methods EPA 8081)	RPD between primary and confirmation results > 25%	J positive results	Sample

Organic Methods include: EPA 8015, EPA 8081.

Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of 4 or more.

Number of surrogates varies with GC Method; For Method EPA 8081, two or more surrogates must exceed the criteria for qualification of results.

For GC Method EPA 8081 the qualification of non-detects applies to primary column tolerances (either of the two GC columns may be designated as the primary column).

Where one MS recovery meets acceptance criteria and the other MS of the pair does not, professional judgment may be used to determine if the parent sample should be qualified for matrix effects by comparing the matrix spike recoveries to other quality control results within the batch or sample site.

Qualifier may not apply in cases where a surrogate coelutes with a non-target analyte.

Qualifier may not apply in cases where low surrogate recoveries are due to sample dilution.

CCV: continuing calibration verification

LT: lower tolerance

MB: method blank

UT: upper tolerance

PQL: practical quantitation limit

ICV: initial calibration verification

RPD: relative percent difference

%R: percent recovery

MDL: method detection limit

TABLE A-4  
Flagging Conventions for Bolsa Chica—Minimum Data Evaluation Criteria for Inorganic Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for digestion or analysis Holding time for digestion or analysis exceeded by a factor of 2	J positive results R flag mercury, UJ non-detects for all other methods R non-detect results	Sample only
Sample Preservation	Sample preservation requirements not met (If sample preservation was not done in the field, but was performed at the laboratory upon sample receipt, no flagging is required)	J positive results UJ non-detects for all methods except mercury R mercury non-detects	Sample
Temperature Blank	> 6°C	J mercury positive results UJ mercury, non-detects	Samples in same cooler
Initial Calibration (Multi-point only)	Correlation coefficient $\leq 0.995$	J positive UJ non-detects	All associated samples in analytical batch
Calibration verification (ICV, CCV)	%R > UT %R < LT	J positive results J positive results, UJ non-detects	All associated samples in analytical batch
Interference check sample EPA 6020 only)	%R > UT %R < LT	J positive results J positive results UJ non-detects	All associated samples in analytical batch
Laboratory Control Sample	%R > UT %R < LT	J positive results J positive results UJ non-detects	All samples in digestion batch
Blanks: MB, ICB, CCB, Equipment Blank	Multiply highest blank concentration by 5, convert to soil units if applicable	U reported results < calculated value	All samples in digestion batch (MB); All samples in analysis batch (ICB, CCB); All samples, same site, matrix (soil/sediment) associated with equipment blank
Matrix Spikes	%R > UT %R < LT RPD > UT	J positive results J positive results UJ non-detects J positive results	All samples from same site as parent sample
Laboratory Duplicates	One or both sample results < 5 times the RDL and a difference of $\pm$ RDL for water ( $\pm 2$ times RDL for soil) not met. Concentration of reported analyte > 5 times RDL in either sample and RPD > UT.	J positive results J positive results	All samples in digestion batch

TABLE A-4  
Flagging Conventions for Bolsa Chica—Minimum Data Evaluation Criteria for Inorganic Methods

Quality Control Check	Evaluation	Flag	Samples Affected
Dilution Test (Metals only)	If concentration is >25 times MDL and % difference >UT	J positive results UJ non-detects	All samples from same site as parent sample if analytical spike not performed
Post-digestion Spikes (Metals only)	Spike results do not indicate performance of MSA		All samples in digestion batch if MSA not performed
	%R > UT	J positive	
	%R < LT	J positive results, UJ non-detects	
MSA (GFAA only) for samples where analytical spike fails (only perform analytical spike as a result of out-of-specification serial dilution)	MSA not done	J positive results	Sample
	MSA spike levels inappropriate	J positive results	
	$r < 0.995$	J positive results	
Field Duplicates	Concentration of reported analytes are > 5 times RDL in either sample and RPD > UT (35% for soil/sediment).	J positive results	Field duplicate pair
	One or both sample results < 5 times the RDL and a difference of $\pm 2$ times RDL for water ( $\pm 4$ times for soil).	J positive results UJ non-detects	

Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of 4 or more.

CCB: continuing calibration blank.	CCV: continuing calibration verification.
ICB: initial calibration blank.	ICV: initial calibration verification.
LT: lower tolerance.	MSA: method of standard addition.
MB: method blank.	RPD: relative percent difference.
UT: upper tolerance.	%R: percent recovery.
PQL: practical quantitation limit.	MDL: method detection limit.

TABLE A-5  
Qualifier Flag Definitions

J	Analyte was present but reported value may not be accurate or precise.
R	This result has been rejected.
U	This analyte was analyzed for but not detected at the specified detection limit.
UJ	The analyte was not detected above the reported PQL. However, the reported PQL is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample

TABLE A-6  
QC and Field Sample Relationships

QC Samples	Tracking Parameters	Associated Field Samples
Method blank	Analytical batch, preparation date	Samples prepared and analyzed in the same analytical or preparation batch
LCS	Analytical batch, preparation date	Samples prepared and analyzed in the same analytical or preparation batch
MS/MSD	Analytical batch, preparation date, matrix	Samples prepared and analyzed in the same analytical or preparation batch; similar matrix conditions (same soil type, site, well, boring, etc.)
Surrogate spikes	Sample ID, location, preparation date	Sample spiked
Equipment blanks	Equipment ID, sample dates	Samples collected in the same time period at the same site, similar sampling conditions (used as indicator)
Field duplicates/ Replicates	Sample ID, location, sampling team, matrix	Samples collected from similar conditions/matrix using similar procedures
Laboratory duplicates	Sample ID, analytical batch, preparation batch, matrix	Samples in the same analytical or preparation batch, similar matrix conditions
ID:	identification number	
LCS/LCSD:	laboratory control sample/laboratory control sample duplicate	
MS/MSD:	matrix spike/matrix spike duplicate	
QC:	quality control	

If the types or concentrations of blank contaminants differ, further data assessment and qualification may be warranted. The spike recovery ranges and RPD ranges should be evaluated for large differences that may indicate greater analytical variability in one laboratory than that in another. Recoveries and ranges for one laboratory that are consistently higher or lower than others could indicate a systematic bias that should be addressed with corrective action. Influence on sample results should be addressed in the project report, and corrective actions should be initiated if systematic problems are indicated. Performance evaluation samples submitted to all participating laboratories may be considered as a follow-up check on the findings of the comparison.

## **8. Data Management**

### **8.1. Purpose and Objectives**

This section describes the processes used to collect, validate, disseminate, and archive new analytical data as they are generated during the field investigation.

### **8.2. Manage Sampling Data - Laboratory Data**

For new data being generated as part of the field effort, the data management system revolves around six somewhat overlapping phases of activity:

- 8.2.1. Planning: The approved SAP (combined FSP and QAPP) is used as the basis for incorporating sampling and analysis information into a sampling and analysis program.
- 8.2.2. Field work: Field efforts are carried out according to the information in the cleanup plan.
- 8.2.3. Sample analysis: Analyses are performed in accordance with the QAPP. Hard-copy and/or electronic data are delivered to the data management team in the agreed upon format.
- 8.2.4. Data handling: Hard copy and electronic data are entered into their physical and electronic placeholders, and are tracked, imported, and catalogued as appropriate.
- 8.2.5. Database management and data validation: The electronic data are checked for completeness and consistency with hard copy data reports.
- 8.2.6. Data reduction: Summary statistics and data reports are generated for the project team. In addition, files are generated for downloading into ArcView.

### **8.3. Data Filing**

The following procedures for filing are followed for analytical and field data:

- 8.3.1. All hard copies of data are date stamped upon arrival.
- 8.3.2. Data are logged into an internal tracking system using unique identifiers.
- 8.3.3. Data are filed both in electronic format and hard copy according to unique identifiers.

These procedures are followed throughout the project. Once the project has been completed, the data are archived. Electronic data are stored on a compact disc and hard copies are boxed and moved to storage.

## **9. Corrective Action**

During the activities at Bolsa Chica, the project manager, Quality Assurance Coordinator (QAC), field managers, and sampling team members must verify that all measurement and field procedures are followed as specified in this QAPP and the Work Plan and that measurement data meet the prescribed acceptance criteria. If a problem arises, prompt action to correct the problem is imperative.

## 9.1. Analytical Request Form

Problems or questions about analytical data quality that may require corrective action are documented by the use of an analytical request form (ARF) or similar document. The QC chemist, QAC, or a data management staff member initiates the request if QC results exceed method or project criteria and a QC exceptions report or narrative is not present, if reporting or flagging errors are identified, or if requested information has not been reported. Laboratory response usually involves a written explanation of the problem or reissuing laboratory reports and/or electronic data files. If significant data quality problems have occurred and the data are critical to decision making, samples may be reanalyzed or recollected and reanalyzed. That determination must be made by the Project Manager.

## 9.2. Recommendation for Corrective Action

Significant and/or systematic deficiencies identified during audits or other independent QA reviews of field and laboratory activities will be addressed as follows:

- A Recommendations for Corrective Action (RCA) report will be completed by the QAC or auditor. The RCA must specify the problems or deficiencies that were identified, and request a timeframe for response and corrective action implementation.
- The RCA is sent to the responsible party with a copy to the project files.
- The responsible party sends a written response to the QAC indicating corrective action to be taken and the timeframe for implementation.
- If satisfactory resolution is not obtained, the RCA is transmitted to the Project Manager until a corrective action is agreed upon, or until another response is deemed sufficient.

## 10. Preventive Maintenance

The primary objective of a preventive maintenance program is to promote the timely and effective completion of a measurement effort. The preventive maintenance program is designed to minimize the downtime of crucial sampling and/or analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas:

- Establishment of maintenance responsibilities
- Establishment of maintenance schedules for major and/or critical instrumentation and apparatus
- Establishment of an adequate inventory of critical spare parts and equipment

These are discussed in the following subsections.

### 10.1. Maintenance Responsibilities

Equipment and apparatus used in environmental measurement programs fall into two general categories:

- Equipment permanently assigned to a specific laboratory (e.g., Gas Chromatography [GC] Laboratory, Gas Chromatography/Mass Spectrometry [GC/MS] Laboratory, etc.)
- Field sampling equipment available for use on an as-needed basis (e.g., field meters, pumps, vehicles, XRF, etc.)

Maintenance of laboratory instruments is the responsibility of the laboratory contracted to perform the analytical portion of this program. Generally, the laboratory manager or supervisor of a laboratory is responsible for the instruments and equipment in his or her work area. The laboratory manager will establish maintenance procedures and schedules for each major

equipment item. Although this responsibility may be delegated to laboratory personnel, the manager retains responsibility for ensuring adherence to prescribed protocol. All laboratories are bound by analytical contractual agreements to maintain the ability to produce data that meet the project objectives and to follow method specifications. This ensures that adequate spare parts, maintenance schedules, and emergency repair services are available.

Maintenance responsibilities for field equipment are assigned to the field manager and task leaders for specific sampling tasks. However, the field team using the equipment is responsible for checking the status of the equipment prior to use and reporting any problems encountered. The field team is also responsible for ensuring that critical spare parts are included as part of the field equipment checklist. Non-operational field equipment is removed from service and a replacement obtained.

All field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during hot or cold weather working conditions. It is recommended, but not required, that at the end of each working day, all field equipment be taken out of the field and placed in a cool, dry room for overnight storage.

## **10.2. Maintenance Schedules**

The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each piece of equipment. Other maintenance activities are conducted on an as-needed basis. Manufacturers' recommendations provide the primary basis for established maintenance schedules, and manufacturers' service contracts provide primary maintenance for many major instruments (e.g., GC/MS instruments, atomic absorption spectrometers, analytical balances, etc.).

Each analytical instrument is assigned an instrument logbook. All maintenance activities are recorded in the instrument log. The information to be entered includes:

- Date of service
- Person performing service
- Type of service performed and reason for service
- Replacement parts installed (if appropriate)
- Date of next scheduled service
- Miscellaneous information

## **10.3. Spare Parts**

In addition to a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment down time. The inventory includes those parts and supplies that:

- Are subject to frequent failure
- Have limited useful lifetimes
- Cannot be obtained in a timely manner should failure occur

Field managers and the respective laboratory managers are responsible for maintaining an adequate inventory of spare parts. In addition to spare parts and supply inventories, an in-house source of backup equipment and instrumentation should be available.

## **11. Audits**

Technical systems and performance audits are independent assessments of sample collection and analysis procedures. Audit results are used to evaluate a system's ability to produce data that fulfill program objectives and identify any areas requiring corrective action. A technical systems audit is a qualitative review of the overall sampling or measurement system, while a performance audit is a quantitative assessment of a measurement system.

Audits are conducted by a person(s) familiar with the objectives, principles, and procedures being reviewed, but who has authority to act independently. A detailed checklist is prepared for each procedure and contains items that delineate the critical aspects of the procedure under review. All observations are documented, and the checklist is submitted with a written assessment and recommendations to the Quality Assurance Coordinator (QAC), project manager, representatives of the audited sampling or analytical task, and others as appropriate. This information and any corrective action documentation are also summarized and included in project reports. Additionally, the auditor may check to ensure that personnel training and laboratory certification files are up-to-date. The project report is submitted to the regulatory agencies.

Audit records for the laboratories are reviewed by the QAC or designated staff to determine whether laboratory data will fulfill the program objectives. A systems audit for designated methods may be conducted, or additional information may be requested if data quality problems are indicated.

The following audits may be performed by the contractor and/or the regulatory agencies during Bolsa Chica activities:

- Technical systems audits may be performed for each field activity and for each analytical laboratory analyzing samples.
- One set of performance evaluation (PE) samples, single or double blind, (i.e., one performance audit) may be submitted to each laboratory performing analyses on samples for the applicable method(s). PE samples will only be submitted for methods performed on at least 50 samples, if PE samples can be purchased or prepared (e.g., particle size PE samples are not available).

### **11.1. Technical Systems Audit**

A technical systems audit is an onsite, qualitative review of the field sampling or laboratory system. Audits are conducted, preferably at the beginning of the field or laboratory activity, by the QAC or a qualified technical staff member who has the authority to act independently of the project staff.

The technical systems audit for the laboratory results are used to review operations and ensure the technical and documentation procedures provide valid data.

Critical items for a technical systems audit of the laboratory include:

- Calibration procedures and documentation
- Treatment and handling of standards
- Completeness of data forms, notebooks, and other reporting requirements
- Data review and verification procedures
- Data storage, filing, and recordkeeping procedures
- Sample custody procedures
- Quality control procedures, tolerances, and documentation
- Operating conditions of facilities and equipment
- Documentation of staff training and instrument maintenance activities
- Systems and operations overview

Critical items for a technical systems audit of the field sampling include:

- Calibration procedures and documentation for field meters
- Complete field activity documentation in logbooks and on sampling data sheets
- Provisions for minimization of potential sample contamination in the field
- Proper equipment decontamination procedures
- Proper sample collection, storage, and transportation procedures
- Compliance with the established chain-of-custody procedures for sample documentation and for transfer to the laboratory

The checklist for each audit contains detailed questions pertaining to each critical item, yes/no answer blocks, and comments. A debriefing session is held for all participants to discuss the preliminary audit results. The auditor then completes the audit evaluation and submits a Technical Systems Audit (TSA) report, including observations of strengths and deficiencies and recommendations for improvement.

If the auditor identifies procedures which could result in unacceptable data quality, he or she is authorized to stop sample collection until corrective action is taken and sampling procedures are altered.

The TSA report will be reviewed by the QAC. Copies of the report will be distributed to the QAC and the project manager. The report will be summarized in the project report that is sent to the regulatory agencies. The original TSA report, associated checklist, and other documentation are retained in the project files.

## **11.2. Performance Audits**

Performance audits quantitatively assess the data produced by a measurement system. A performance audit involves submitting certified samples, either single or double blind, for each analytical method and/or analytical instrument. The matrix standards are selected to reflect the concentration ranges expected for the sampling program while taking into account any limitations of the specific analytical methods. The performance audit evaluates whether the measurement system is operating within tolerance and the data produced meet the analytical quality assurance specifications.

The PE samples are procured from an independent source and are developed from standard reference materials, National Institute of Standards and Technology (NIST) traceable materials,

USEPA quality control materials, or neat compounds of the highest purity available. The samples are prepared in a clean matrix or medium that allows evaluation of the analytical success of the method assuming no matrix interferences. When possible, the samples are submitted as a field sample to realistically assess the accuracy of the field samples with which they were submitted. In some cases, a PE sample may be prepared from an actual sample matrix (e.g., soil). In those cases, the QC staff coordinate with the field coordinator and vendor to ensure that representative materials are collected and provided to the vendor. The PE samples can be analyzed by independent laboratories (at additional cost) to provide confirmation of the analytes and concentrations in the prepared samples. A discussion of PE samples, their frequency, acceptance criteria and corrective action for non-compliance will be detailed in the site-specific FSPs as necessary.

Critical items for performance evaluation audits are:

- Accurate identification of the analytes included in the PE samples
- Quantitation within acceptable limits (i.e., the manufacturer's acceptance criteria)
- Accurate reporting of results and any problems identified
- Acceptable analytical batch QC sample results

These items are used to determine whether a system is operating within acceptable tolerances. Appropriate corrective action indicated by the results of a performance audit must be identified by the QAC and addressed by the laboratory. Any unresolved problems identified with PE samples must be evaluated to determine the impact on sample analyses conducted during the same time period.

### **11.3. Data Quality Audits (DQAs)**

DQAs may be performed (by an entity independent of the laboratory) to verify whether an analytical method has been performed according to method and program specifications, and the results have been correctly calculated and reported. DQAs are modeled after those presented in the USEPA Data Validation Functional Guidelines for Evaluating Inorganic (February 1994) and Organic Analyses (February 1994). DQAs involve reviewing all documentation, instrument output, and analytical reports associated with selected samples or groups of samples. Checklists are developed for each class of analytical methods (inorganics, GC, GC/MS) and used to document the audit process.

The samples or groups of samples to be audited will be selected during the planning stages of the task. Selection may focus on critical methods or samples, or a random analytical batch may be selected. A request is made to the laboratory to provide a data package containing all required information to perform the audit. The laboratory will be notified at the beginning of the field activity that a data package(s) will be requested; there may be additional costs required to provide this information.

Specific items that are reviewed during the audit are:

- Chain-of-custody records
- Documentation of laboratory procedures (e.g., run logs, data reduction and verification)
- Accuracy of data reduction transcription and reporting
- Adherence to project measurement quality objectives

The results of all DQA activities will be reported in narratives, which supplement the checklists and data packages. Requests for additional information and any other follow-up documentation and response are also added to the DQA package. If corrective action is required based on the audit findings, the Recommendations for Corrective Action (RCA) procedure described in Section 10.0 will be followed. The DQA results will be reviewed by the QAC, and will be summarized in the project report that is sent to the regulatory agencies. Copies of the RCA report will be distributed to the QAC and the project manager. The original DQA report, associated checklists, and other documentation are retained in project files.

#### **11.4. Recommended Audit Frequency**

In addition to audits conducted for Bolsa Chica tasks, most laboratories undergo systems and performance audits conducted internally or by various state agencies and private clients. All audit results should be available for review upon request.

## Appendix B – Analytical Requirements

Table B-1 lists the analytes for each analytical method and the methods to be used. These methods supersede those specified in the Work Plan. The accuracy and precision limits are listed in Table B-2. Calibration and QC requirements are specified in Tables B-3a through B-3f.

TABLE B-1  
Analytical Methods for Sediment or Soil Samples

Analyte	Method
Arsenic	EPA 7061
Mercury	EPA 7471
All other metals	EPA 6020
TPH –diesel and waste Oil	EPA 8015 Modified
Organochlorine pesticides and PCBs	EPA 8081a/8082 (see section 4.5.4 for PCB analysis)
Oil and grease	EPA 1664 HEM
Moisture content	D2216

TABLE B-2  
Accuracy and Precision Limits

Method	Analyte	Accuracy (%R)	Precision (%RPD)
EPA 6020, 7061, 7471	All metals and general inorganic chemistry parameters	75-125	≤20
EPA 8081a/8082	4,4'-DDT	23-134	≤50
	Aroclor 1254	50-150	≤50
	Tetrachloro-m-xylene (Surr.)	30-150	-
	Decachlorobiphenyl (Surr.)	30-150	-
EPA 8015 <sup>a</sup> Modified	Diesel and Waste Oil	50-150	≤50
	o-Terphenyl (Surr.)	65-125	-
	Octacosane (Surr.)	25-162	-
	Triacotane (Surr.)	30-150	-

<sup>a</sup> At least one surrogate must be spiked.

TABLE B-3A  
Calibration and QC Requirements for EPA 6020

QC Check	Frequency	Criteria	Corrective Action
MS tuning	Prior to initial calibration	Per EPA 6020, Section 5.8	Retune instrument and reanalyze tuning solution.
Initial calibration (a blank and at least one standard)	Before initial sample analysis, every 24 hours, whenever modifications are made to the analytical system, or when continuing calibration verification fails	N/A	N/A
Initial calibration verification (ICV); must be from second source	Immediately following each initial calibration	All analytes within $\pm 20\%$ of expected value	Correct problem and repeat initial calibration.
Calibration blank	After every calibration verification (ICV and CCV)	No analytes detected at or above the RDL	Correct the problem, then reanalyze previous 10 samples.
Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 10\%$ of expected value	Recalibrate and reanalyze all samples since the last acceptable CCV.
Method blank	At least one per analytical batch	No analytes detected at or above the RDL	Correct the problem and re-prepare and reanalyze all associated samples.
Interference check standard (ICS)	At the start and end of each analytical sequence or twice during an 8-hour period, whichever is more frequent	All analytes within $\pm 20\%$ of expected value	Correct the problem, recalibrate, reanalyze ICS and all affected samples.
MS/MSD	One set per 20 Bolsa Chica samples	All analytes within limits specified in Table B-2	None
LCS	At least one per analytical batch	All analytes within limits specified in Table B-2	Correct the problem, and re-prepare and reanalyze the LCS and all samples in the analytical batch.
Dilution test	Each new sample matrix	Result from 1:5 dilution must be within $\pm 10\%$ of the undiluted sample result (applies only if undiluted sample result is at least 25 times the MDL)	Perform post-digestion spike addition.
Post-digestion spike addition	When dilution test fails	Recovery within 75-125% of expected value	None
Internal standards	Every sample	IS intensity within 30-120% of the IS intensity in the initial calibration	Perform corrective action as described in EPA 6020, Section 8.3.

TABLE B-3B  
Calibration and QC Requirements for EPA 7471

QC Check	Frequency	Criteria	Corrective Action
Multi-point initial calibration (a blank and at least five standards)	Before initial sample analysis, every 24 hours, whenever modifications are made to the analytical system, or when continuing calibration verification fails	Correlation coefficient of linear regression is $\geq 0.995$	Correct the problem and repeat the initial calibration.
ICV; must be from second source	Immediately following each initial calibration	All analytes within $\pm 20\%$ of expected value	Correct the problem and repeat initial calibration.
Calibration blank	After every calibration verification (ICV and CCV)	No analytes detected at or above the RDL	Correct the problem, then reanalyze previous 10 samples.
CCV	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 20\%$ of expected value	Recalibrate and reanalyze all samples since the last acceptable CCV.
Method blank	At least one per analytical batch	No analytes detected at or above the RDL	Correct the problem and re-prepare and reanalyze all associated samples.
MS/MSD	One set per 20 Bolsa Chica samples	All analytes within limits specified in Table B-2	None
LCS	At least one per analytical batch	All analytes within limits specified in Table B-2	Correct the problem, and re-prepare and reanalyze the LCS and all samples in the analytical batch.
Dilution test	Each new sample matrix	Result from 1:5 dilution must be within $\pm 10\%$ of the undiluted sample result (applies only if undiluted sample result is at least 25 times the MDL)	Perform post-digestion spike addition.
Recovery test	When dilution test fails	Recovery within 85-115% of expected value	Dilute sample to reduce background, if necessary, and repeat recovery test; otherwise, analyze all samples by MSA.

TABLE B-3C  
Calibration and QC Requirements for Metals by Graphite Furnace and Gaseous Hydride

QC Check	Frequency	Criteria	Corrective Action
Multi-point initial calibration (a blank and at least three standards)	Before initial sample analysis, every 24 hours, whenever modifications are made to the analytical system, or when continuing calibration verification fails	Correlation coefficient of linear regression is $\geq 0.995$	Correct the problem and repeat the initial calibration.
ICV; must be from second source	Immediately following each initial calibration	All analytes within $\pm 10\%$ of expected value	Correct the problem and repeat initial calibration.
Calibration blank	After every calibration verification (ICV and CCV)	No analytes detected at or above the RDL	Correct the problem, then reanalyze previous 10 samples.
CCV	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 10\%$ of expected value	Recalibrate and reanalyze all samples since the last acceptable CCV.
Method blank	At least one per analytical batch	No analytes detected at or above the RDL	Correct the problem and re-prepare and reanalyze all associated samples.
MS/MSD	One set per 20 Bolsa Chica samples	All analytes within limits specified in Table B-2	None
LCS	At least one per analytical batch	All analytes within limits specified in Table B-2	Correct the problem, and re-prepare and reanalyze the LCS and all samples in the analytical batch.
Dilution test	Each new sample matrix	Result from 1:5 dilution must be within $\pm 10\%$ of the undiluted sample result (applies only if undiluted sample result is at least 25 times the MDL)	Perform post-digestion spike addition.
Recovery test	When dilution test fails	Recovery within 85-115% of expected value	Dilute sample to reduce background, if necessary, and repeat recovery test; otherwise, analyze all samples by MSA.

TABLE B-3D  
Calibration and QC Requirements for EPA 8015 Modified

QC Check	Frequency	Criteria	Corrective Action
Multi-point initial calibration (minimum five points)	Prior to sample analysis, or when calibration verification fails	If the average %RSD is $\leq 20\%$ , the average RRF may be used for quantitation; otherwise use calibration curve with coefficient of correlation or determination $\geq 0.99$ .	Correct the problem and repeat the initial calibration.
CCV	At the start of each analytical sequence and after every 10 samples, and at the end of the sequence	All analytes within $\pm 15\%$ of expected value	Correct the problem, then recalibrate and reanalyze all samples since the last acceptable CCV.
Method blank	At least one per analytical batch	No analytes detected at or above the RDL	Correct the problem and re-prep and reanalyze all associated samples
Surrogate spike	Every standard, sample, method blank, MS/MSD, and LCS	All surrogates in samples, method blank, MS/MSD, and LCS within limits specified in Table B-2	Correct the problem and reanalyze (re-prep if necessary).
MS/MSD (Diesel)	One set per 20 Bolsa Chica samples	Within limits specified in Table B-2	None
LCS (Diesel)	At least one per analytical batch	Within limits specified in Table B-2	Correct the problem, and re-prep and reanalyze the LCS and all samples in the analytical batch.
Surrogate spike	Every standard, sample, method blank, MS/MSD, and LCS	All surrogates in samples, method blank, MS/MSD, and LCS within limits specified in Table B-2	Correct the problem and reanalyze (re-prep if necessary).
MS/MSD (Diesel)	One set per 20 Bolsa Chica samples	Within limits specified in Table B-2	None
LCS (Diesel)	At least one per analytical batch	Within limits specified in Table B-2	Correct the problem, and re-prep and reanalyze the LCS and all samples in the analytical batch.

TABLE B-3E  
Calibration and QC Requirements for EPA 8081a/8082

QC Check	Frequency	Criteria	Corrective Action
Multi-point initial calibration (minimum five points) for single-response pesticides and individual PCB congeners (single-point calibration for Toxaphene and Chlordane); multi-point calibration for Aroclors 1016 and 1260 only, but include mid-point standard for all other Aroclors for pattern recognition; if a specific Aroclor is found in any sample, quantitation for that Aroclor must be done using 5-point calibration.	Prior to sample analysis, or when calibration verification fails	If the average % RSD is $\leq 20\%$ , the average RRF may be used for quantitation; otherwise use calibration curve with coefficient of correlation or determination $\geq 0.99$ .	Correct the problem and repeat the initial calibration.
CCV—pesticides and Aroclors 1016 and 1260 (or Aroclors identified in samples)	At the start of each analytical sequence, after every 12 hours or 10 samples, whichever is more frequent, and at the end of the sequence	All analytes within $\pm 15\%$ of expected value	Correct the problem, then recalibrate and reanalyze all samples since the last acceptable CCV.
Endrin/DDT breakdown check	At start of each 12 hour period	Breakdown of either Endrin or DDT $\leq 15\%$	Evaluate injector port and take corrective action; re-calibrate and reanalyze affected samples if necessary.
Method blank	At least one per analytical batch	No analytes detected at or above the RDL	Correct the problem and re-prepare and reanalyze all associated samples.
Surrogate spike	Every standard, sample, method blank, MS/MSD, and LCS	At least one of the surrogates in samples, method blank, MS/MSD, and LCS within limits specified in Table B-2	Correct the problem and reanalyze (re-prepare if necessary).
MS/MSD	One set per 20 Bolsa Chica samples	Within limits specified in Table B-2	None
LCS	At least one per analytical batch	Within limits specified in Table B-2	Correct the problem, and re-prepare and reanalyze the LCS and all samples in the analytical batch.
Second column confirmation (not required for Aroclors)	All samples with detections at or above the RDL must be confirmed within the holding time	Confirmation to be done using second column of dissimilar phase and retention characteristics (or GC/MS if sample concentration is sufficiently high)	Failure to perform confirmation will result in potential resampling and analysis at no cost to the project.

TABLE B-3F  
Calibration and QC Requirements for General Inorganic Chemistry

QC Check	Frequency	Criteria	Corrective Action
Multi-point initial calibration (minimum three points); for titrimetric methods, titrant must be standardized in duplicate, and the average concentration used; for gravimetric methods, balance must be calibrated using standard weights that bracket sample weights	Prior to sample analysis, or when calibration verification fails	Correlation coefficient for linear regression must be $\geq 0.995$ (not applicable to titrimetric and gravimetric methods)	Correct the problem and repeat the initial calibration.
Continuing calibration verification (CCV) – does not apply to titrimetric and gravimetric methods	At the start of each analytical sequence, after every 10 samples, and at the end of the sequence	All analytes within $\pm 10\%$ of expected value	Correct the problem, then recalibrate and reanalyze all samples since the last acceptable CCV.
Method blank	At least one per analytical batch	No analytes detected at or above the RDL	Correct the problem and re-prepare and reanalyze all associated samples
MS/MSD (One MS and one set of laboratory duplicates may be substituted for MS/MSD)	One set per 20 Bolsa Chica samples	Within limits specified in Table B-2	None
LCS	At least one per analytical batch	Within limits specified in Table B-2	Correct the problem, and re-prepare and reanalyze the LCS and all samples in the analytical batch.

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## Appendix C – Dewatering Plan

(For RWQCB NPDES No. CAG998001 Permit Application) May 2004

### (1) Background

The objective of this plan is to satisfy Application Requirement I.2.c of Order No. R8-2003-0061, NPDES No. CAG998001, “General Waste Discharge Requirements for Discharges to Surface Waters That Pose an Insignificant (De Minimus) Threat to Water Quality.” Specifically, this document includes the following, as listed in Application Requirement I.2.c:

- Characterization of the proposed wastewater discharge;
- The name of the receiving water;
- The estimated average and maximum daily flow rates;
- The frequency and duration of the discharge;
- A description of the proposed treatment system – Not applicable – see below for further discussion;
- A map showing the path from the point of initial discharge to the ultimate location of discharge.

The Bolsa Chica Wetland is located in an unincorporated area of Orange County, California adjacent to the City of Huntington Beach. The objective of the Project is to restore tidal influence to approximately half of the 5,050,000 m<sup>2</sup> (1248 acres) of Bolsa Chica Lowlands. To achieve this goal, a direct connection with the ocean, an artificial ebb bar, a full tidal basin (FTB) and a muted tidal basin (MTB) will be established.

There are four types of water discharge associated with this project:

- Dewatering discharge associated with excavation. There are two options considered for excavation of the FTB: dredging and dry excavation. Dredging will require flooding of the FTB, while dry excavation will require dewatering of the shallow aquifer present at the Project site. The majority of this document addresses this latter (dry) option.
- Surface water removal prior to dewatering and excavation.
- Stormwater runoff during construction.
- Long-term groundwater control barrier pumping. Another aspect of the Project is a long-term groundwater control barrier and pumping system along the northern perimeter of the Project site, implemented as part of the operations phase. The initial dewatering permit application will be modified at a later date to include this long-term dewatering plan.

In November and December 2003, GeoSyntec conducted dewatering tests on the Bolsa Chica Lowlands, (reference NPDES No. CAG998001, Order No. R8-2003-0061-071). The tests were performed to aid in defining the hydrogeology of the FTB area and to investigate the potential feasibility of construction dewatering in the FTB. The field test activities included drilling, logging and construction of two dewatering wells, installing four piezometers, excavating two test trenches, conducting a pumping test, and dewatering a test area. The data gathered from these tests provides much of the basis of the dewatering plan herein.

## **(2) Discharge Water Characterization**

Representative groundwater sample(s) have been analyzed for constituents as part of the groundwater test discussed above. The monitoring report was transmitted to the RWQCB on 29 January 2004. A summary of the results is provided in Table 1.

## **(3) Receiving Waters Characterization**

There are several potential discharge points: Inner Bolsa Bay (IBB), offshore ocean, and within the Project site. These receiving areas are shown in Figure 1. Inner Bolsa Bay is a 708,000 m<sup>2</sup> (175 acre) salt marsh adjacent to the FTB site; the dewatering discharge will be piped from the dewatering sites into a northern pocket of IBB, and the stormwater discharge will be piped to either the same location or into an eastern (currently degraded) pocket of IBB. The offshore ocean discharge site would be at the ebb bar fill location just offshore of the newly-constructed ocean inlet; the wastewater would be used to supply water to the dredged material slurry that is used for the ebb bar fill. The dredge pump intake is located at the southern edge of the FTB (shown in figure). Discharge within the Project site will be where as needed for dust control and transported via truck to these areas.

## **(4) Water Discharge Rates**

Prior to excavation, it is necessary to remove surface water; the estimated amount of surface water to be removed and discharged is shown in the table below. The numbers are based on an estimate of the current amount of surface water present on-site, (several areas at a water depth of approximately 0.5 m (1.6 ft)), and utilization of several pumps totaling 2270 L/min (600 gpm).

<b>Surface Water Removal</b>			
Discharge Site	Discharge Rate (2270 L/min (600 gpm) total )	Duration	Total Discharge (~103M liters (27.1M gallons))
Inner Bolsa Bay (90%)	2040 L/min (540 gpm)	31 days	92.4M liters (24.4M gallons)
On-site (10%) for dust control	227 L/min (60 gpm)	31 days	10.2M liters (2.7M gallons)
<i>The percentages above in parentheses are estimates of the amount of total surface water that will be discharged into IBB versus for dust control on-site; these percentages may change significantly depending upon the contractor's operations plan.</i>			

In order to excavate the FTB, it is necessary to dewater to a level approximately 0.61 m (2 ft) below the proposed maximum excavation depth of the FTB (-1.274m NAVD88), i.e. dewater to an elevation of -1.9m NAVD88. The estimated pump rates to achieve this are based on the dewatering tests referenced above and groundwater flow modeling. In order to dewater a 4047 m<sup>2</sup> (1 acre) area by lowering the groundwater table by 1.7m (6 ft) to an elevation of -1.9m NAVD88, the following is required:

- Aquifer pumping test results indicated specific yield (storativity) values ranging from 0.016 to 0.04; for a specific yield of 0.016:
  - For initial dewatering: pump 12 wells at a combined total rate of approximately 71.1 L/min (18.8 gpm) over a 48-hour (2-day) period to extract approximately 204,000 liters (54,000 gallons) of groundwater.
  - For maintenance dewatering: pump 12 wells at a combined total rate of approximately 18.2 L/min (4.8 gpm) to maintain the water levels at or below – 1.9m NAVD88.
  
- For a specific yield of 0.04:
  - For initial dewatering: pump 12 wells at a combined total rate of approximately 114 L/min (30 gpm) over a 96-hour (4-day) period to extract approximately 587,000 liters (155,000 gallons) of groundwater.
  - For maintenance dewatering: pump 12 wells at a combined total rate of approximately 22.7 L/min (6 gpm) to maintain the water levels at or below –1.9m NAVD88.
  
- The pumping rates above assume:
  - All surface water is removed prior to dewatering.
  - The groundwater elevation is approximately –0.2m NAVD88.
  - The elevation of the groundwater table during dewatering should be no shallower than –1.9m NAVD88, or the saturated thickness to be dewatered is approximately 1.7m (6ft).
  - The aquifer characteristics of the dewatering test site are similar to the rest of the FTB.

The FTB excavation area to be dewatered is approximately 797,000 m<sup>2</sup> (197 acres) based on 681,000 m<sup>2</sup> (168 acres) within the dredge footprint plus 116,000 m<sup>2</sup> (29 acres) of slope-zone-perimeter-area excavated to design grade). For a construction plan to dewater and excavate 80,940 m<sup>2</sup> (20 acres) at a time, this would constitute a maximum of 240 wells being pumped at any given time. The numbers provided in this plan are based on this scenario. The wells will be approximately evenly distributed in a grid pattern in such a way as to avoid the capped oil well locations. Assuming the maximum specific yield value, this produces a maximum discharge rate of 2270 L/min (600 gpm) for the initial dewatering period of 4-days and 454 L/min (120 gpm) for the maintenance-dewatering period of 2-weeks while excavation is completed on the dewatered section of the site. Assuming an average specific yield value, the initial dewatering discharge rate would be 1847 L/min (488 gpm) and the maintenance dewatering discharge rate would be 409 L/min (108 gpm). The FTB excluded and contaminated sites will be dewatered and excavated first, prior to the construction of the offshore discharge pipe, (and thus offshore discharge is then not an option). The maximum discharge rates into each of the receiving waters/areas are shown below for each earthwork phase.

<b>Excluded / Contaminated Areas (214,000 m<sup>2</sup> (53 acres))</b>		
<b>Dewater Discharge Rates</b>		
Discharge Site	Initial Dewatering (2270 L/min (600 gpm) total discharge)	Maintenance Dewatering (454 L/min (120 gpm) total discharge)
IBB* (90%)	2040 L/min (540 gpm)	409 L/min (108 gpm)
On-site (10%) for dust control	227 L/min (60 gpm)	45 L/min (12 gpm)
<i>The percentages above in parentheses are estimates of the amount of total dewatering water that will be discharged into IBB versus for dust control on-site; these percentages may change significantly depending upon the contractor's operations plan.</i>		

<b>Non-Excluded/ Non-Contaminated Areas (583,000 m<sup>2</sup> (144 acres))</b>		
<b>Dewater Discharge Rates</b>		
Discharge Site	Initial Dewatering (2270 L/min (600 gpm) total discharge)	Maintenance Dewatering (454 L/min (120 gpm) total discharge)
IBB* (45%)	1020 L/min (270 gpm)	204 L/min (54 gpm)
Offshore (45%)	1020 L/min (270 gpm)	204 L/min (54 gpm)
On-site (10%) for dust control	227 L/min (60 gpm)	45 L/min (12 gpm)
<i>The percentages above in parentheses are estimates of the amount of total dewatering water that will be discharged into IBB versus offshore versus for dust control on-site; these percentages may change significantly depending upon the contractor's operations plan.</i>		

In addition to the dewater wastewater, there is the potential for an additional 946 L/min (250 gpm) of stormwater runoff to be pumped into Inner Bolsa Bay, periodically, during storm events. This would occur during the peak of a 10-year storm from water pumped into Freeman Creek from Springdale pump station. The total volume pumped during such an event is 10M liters (2.6M gallons) of runoff.

##### **(5) Water Discharge Frequency and Duration**

The FTB excluded and contaminated sites will be dewatered and excavated first as part of the Project Phase 2 in 80,940 m<sup>2</sup> (20-acre) parcels. As the dewatering and excavation of an 80,940 m<sup>2</sup> (20-acre) parcel is coming to completion, the dewatering equipment will be moved to the next 20-acre parcel. There are 214,000 m<sup>2</sup> (53 acres) of excluded/contaminated areas to be dewatered and excavated; accordingly, the wastewater discharge frequencies and durations for the excluded/contaminated areas are estimated as follows:

<b>Excluded / Contaminated Areas Dewater Discharge Schedule</b>		
	Initial Dewater (2270 L/min (600 gpm) discharge)	Maintenance Dewater (454 L/min (120 gpm) discharge)
Parcel #1 (20-acres)	Day 1-4	Day 5-18
Parcel #2 (20-acres)	Day 19-22	Day 23-36
Parcel #3 (13-acres)	Day 37-40	Day 41-54

The remaining portion of the FTB excavation area (583,000 m<sup>2</sup> (144-acres)) will be dewatered and excavated at a later timeframe (Project Phase 4), in 80,940 m<sup>2</sup> (20-acre) parcels. Approximately 45% of this dewatering water will be used to supply water to the dredged material slurry that is pumped offshore and used for the ebb bar fill. As before, as the dewatering and excavation of an 80,940 m<sup>2</sup> (20-acre) parcel is coming to completion, the dewater equipment will be moved to the next 20-acre parcel. The wastewater discharge frequencies and durations for these areas are estimated as follows:

<b>Non-Excluded/Non-Contaminated Areas Dewater Discharge Schedule</b>		
Discharge Water	Initial Dewater (2270 L/min (600 gpm) discharge)	Maintenance Dewater (454 L/min (120 gpm) discharge)
Parcel #1 (20-acres)	Day 1-4	Day 5-18
Parcel #2 (20-acres)	Day 19-22	Day 23-36
Parcel #3 (20-acres)	Day 37-40	Day 41-54
Parcel #4 (20-acres)	Day 55-58	Day 59-72
Parcel #5 (20-acres)	Day 73-76	Day 77-90
Parcel #6 (20-acres)	Day 91-94	Day 95-108
Parcel #7 (20-acres)	Day 109-112	Day 113-126
Parcel #8 (4-acres)	Day 127-130	Day 131-144

The total wastewater discharge amount is estimated at 320-million liters (85-million gallons), not including stormwater runoff.

The expected timeframes for performing the dewater activities are as follows:

- Drain surface water and install dewater system equipment: September 2004 to December 2004.
- Dewater and excavate excluded/contaminated areas within FTB: December 2004 to April 2005.
- Dewater and excavate remaining areas within FTB: October 2005 to March 2007.

**(6) Discharge Water Treatment**

Based on the GeoSyntec dewater test water quality monitoring results, (Table 1, Reference 2), there is not a need to treat the discharged water from this Project site. However, this need will be reassessed continuously based on water quality monitoring performed during the dewater periods.

**(7) Water Discharge Locations Map**

Appendix C, Figure 1 provides a map of the:

- footprint of the FTB excavation area,
- excluded and contaminated sites to be dewatered,
- location/routing of the water discharge pipe to the Inner Bolsa Bay receiving site,
- location/routing of the discharge pipe to the offshore ebb bar fill site.
- potential areas for water discharge on-site for dust control
- location/routing of the pumped stormwater runoff to the Inner Bolsa Bay receiving site.

**(8) References**

“Draft Dewatering Test Report, Bolsa Chica Lowlands Project, Orange County, California,”  
GeoSyntec Consultants, 15 March 2004.

Letter to Mr. Jun Martirez, RWQCB, “Discharge Monitoring Report for Discharge of  
Wastewater Under the General Permit, “General Waste Discharge Requirements for Discharges  
to Surface Waters that Pose an Insignificant (De Minimus) Threat to Water Quality”.”,  
GeoSyntec Consultants, 29 January 2004.

**WASTEWATER ANALYTICAL RESULTS  
BOLSA CHICA LOWLANDS  
ORANGE COUNTY, CALIFORNIA**

GENERAL CHEMISTRY	METHOD	UNITS	EFFLUENT SAMPLE	RL	MDL	QUALIFIER	DILUTION FACTOR
Oil and Grease	EPA 413.1	mg/L	ND	1.0	0.77	--	1
Total Residual Chlorine	SM 4500-C1 F	mg/L	0.070	0.10	0.042	J	1
Total Suspended Solids	EPA 160.2	mg/L	5.4	1.0	0.95	--	1
TPH as Gasoline	DHS LUFT (EPA 5030B)	µg/L	ND	100	44	--	1
TPH as Diesel	DHS LUFT (EPA 3510C)	µg/L	ND	1000	860	--	1
Nitrate – Nitrite (as N)	EPA 353.3	mg/L	ND	0.10	0.029	--	1
Total Kjeldahl Nitrogen (TKN)	EPA 351.3	mg/L	3.6	0.5	0.46	--	1
Total Nitrogen (calculated) *	EPA 353.3/351.3	mg/L	3.6	0.5	--	--	1

Total Nitrogen calculated from Nitrate/Nitrite as N and Total Kjeldhal Nitrogen (TKN)

ND: Not Detected

J: Analyte was detected at a concentration below the reporting limit. Reported value is estimated.

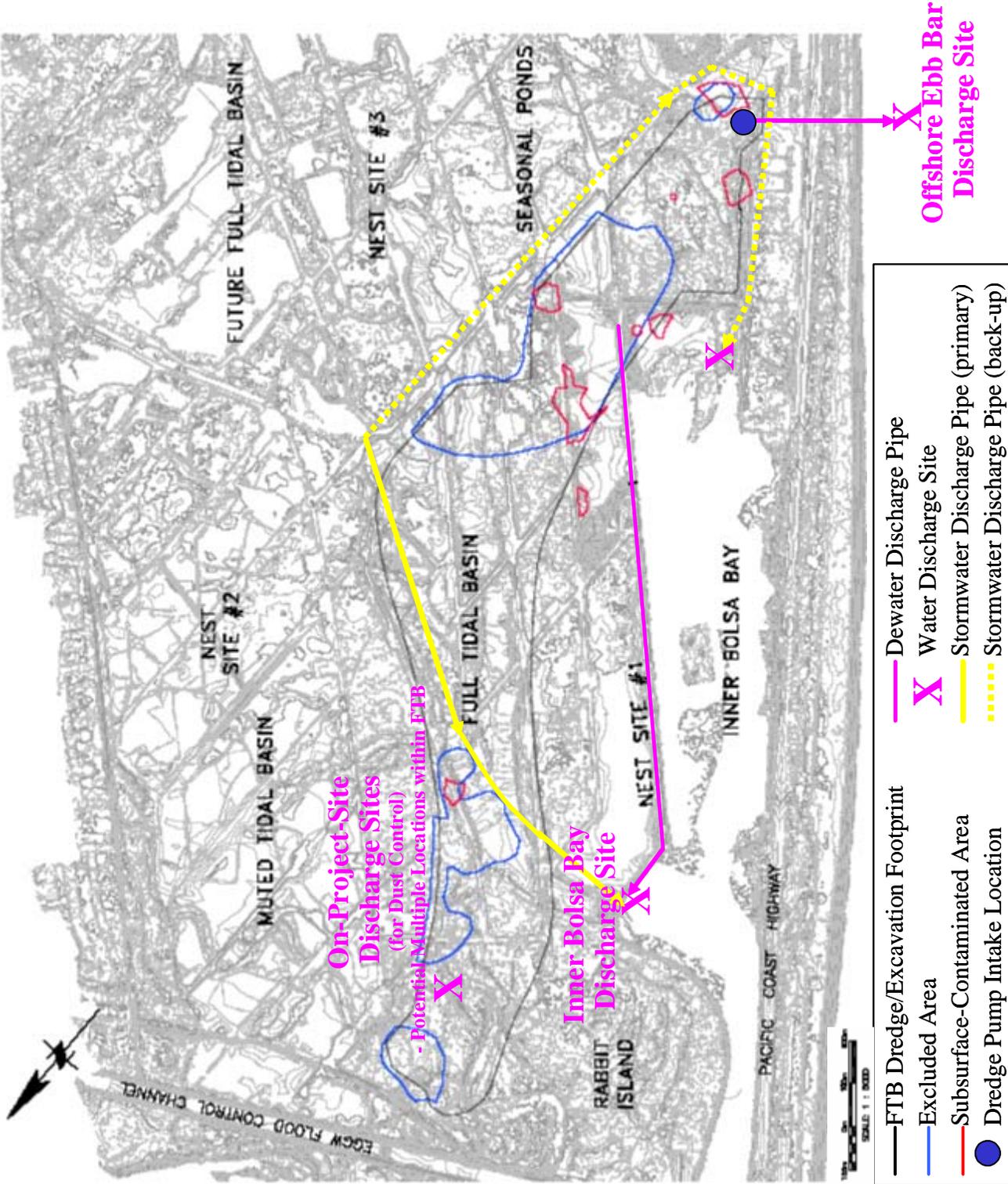


Figure 1 - Bolsa Chica Lowlands Restoration Project Dewater Map

Figure 1