February 20, 2007
W-101-200-000

Mr. Joe Karkoski
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, # 200
Rancho Cordova CA 95670-6114

SUBJECT: SACRAMENTO RIVER WATER SAMPLING DATA FOR 303(d) LISTING/DELISTING PROCESS

This office is submitting data for consideration in the upcoming 303(d) listing/delisting process. This data was collected as part of the City of Redding Upper Sacramento River Trace Metals Monitoring Study.

Data submitted and certified by:
Ms. Marcia Ames, City of Redding, Industrial Waste Division, P.O. Box 496071, Redding, CA 96049-6071 Tel: (530) 224-6049, Fax: (530) 224-5062
Email: mames@ci.redding.ca.us

Software used to format data: MS Excel, ver.2003

Bibliographic citations for published information: Not applicable

Name and Exact area of water body the information concerns:
The City of Redding sampled the Sacramento River at Caldwell Park Boat Ramp between Keswick Dam and Cottonwood Creek. Location Map, See Figure 1
Latitude/Longitude: 40° 35' 38" N, 122° 23' 51" W

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Please feel free to contact me at (530) 224-6049 with any questions regarding this data.

Sincerely,

Marcia Ames
Industrial Waste Supervisor

ma/jh
c: Dennis McBride, Wastewater Utility Manager
Ms. Stacy Gotham
z:industrial waste/tracy/303 data submittal

Quality Assurance Plan

1. Objectives:

The City of Redding began collecting water samples from the Sacramento River at Caldwell Park starting in January 1998 using EPA 1669 ultra-clean sampling techniques and ICP/MS metals analyses. The project was initiated in response to the proposed Total Maximum Daily Load for the Upper Sacramento River (TMDL) for dissolved cadmium, copper, and zinc due to historic mining operations in the watershed.

The sampling schedule has varied from monthly to quarterly and back to monthly again during the 9-year study. This study has been incorporated as part of the NPDES permit for the Clear Creek Wastewater Treatment Plant. Monthly sampling data is currently required. Background metals concentrations in the Sacramento River have declined in recent years due to remediation efforts at Iron Mountain Mine and other mines above Shasta Lake with significant reductions seen after May 2004 following the completion of the debris dam at Slickrock Creek.

2. Methods used for sample collection and handling:

River sampling events are currently conducted monthly at the Caldwell Park boat ramp using EPA 1669 ultra-clean techniques and filtered at our contract lab, Frontier Geosciences. Grab samples are collected approximately 8 feet from the river bank and capped at approximately 2 inches below the water surface.

3. Field and laboratory measurements and analysis:

Metals	Frontier GeoSciences FGS-054 (similar to EPA 1638), ICP/MS
Total Mercury	Frontier GeoSciences FGS-069 (CV-AFS, Cold Vapor Atomic Fluorescence Spectroscopy).
Hardness (mg/l)	Method 2340B
TOC (mg/l)	Method 415.1
TKN (mg/l)	Method 351.2
NH3-N (mg/l)	Method 4500 NH_3 G
NO3-N (mg/l)	Method 4500 NO_3 E
Turbidity (NTU)	Method 2130 B
TDS (mg/l)	Method 2540 B
TSS (mg/l)	Method 2540 D
pH (units)	Field pH meter
Temp (C)	Field thermometer, as part of conductivity meter
Conductivity (uS/cm)	Field conductivity meter

Hourly Keswick Release (cfs)	California Data Exchange Center	CDEC Website
24 Hour Average Keswick Release (cfs)		CDEC Website

Note: Each field instrument is calibrated immediately prior to use, according to the procedures required by the instrument manufacturer.

4. Chain of Custody

All samples are controlled under Chain of Custody procedures. For each sample event, the field crew provides the contract laboratory with copies of the Chain of Custody forms for all samples submitted for analysis. At a minimum, the following sample-specific information is provided for each sample collected:

- sample ID (unique for each sample and replicate)
- date and time(s) of collection
- requested analyses (specific parameters or method references).

5. Data Management/Recordkeeping:

Hard copies of all laboratory analytical data and chain of custody documentation are kept on file at the City of Redding, Industrial Waste Division. Laboratory analytical data are manually entered into spreadsheets for data electronic storage. Data is included in Table 1.

6. Data Validation

All analyses, except field analyses, were performed by California State Certified Laboratories. Each laboratory follows a State Certified QA/QC plan and reports QA/QC data routinely as part of each data submittal. Data validation is part of the laboratory QA/QC process, and the laboratory is responsible for ensuring the data are calculated and reported correctly to the City of Redding.

The standard data validation procedures documented in the contract laboratory's Quality Assurance Manuals will be used to accept, reject, or qualify the data generated by the laboratory. Each laboratory's QA officer will be responsible for validating data generated by the laboratory. The Quality Assurance Manager will be responsible for final validation and for qualifying all data based on the evaluation of field and laboratory quality control samples.

Laboratory personnel will verify the measurement process was "in control" (i.e., all specified data quality objectives were met or acceptable deviations explained) for each batch of samples before proceeding with the analysis of a subsequent batch. In addition, each laboratory will establish a system for detecting and reducing transcription and/or calculation errors prior to reporting data. Only data which have met data quality objectives, or data which have acceptable deviations explained, will be submitted by the laboratory. When QA requirements have not been met, the samples will be reanalyzed when possible and only the results of the reanalysis will be submitted, provided they are acceptable.

7. Laboratory QA/QC

For basic water quality analyses, quality control samples prepared in the contract laboratory(s) will typically consist of method blanks, standard reference materials, laboratory duplicates, matrix spikes, and matrix spike duplicates. Laboratory QA/QC data is summarized in Table 2.

a. Method Blanks

The purpose of analyzing method blanks is to demonstrate the analytical procedures do not result in sample contamination. Method blanks will be prepared and analyzed by the contract laboratory at a rate of at least one for each analytical batch. Method blanks will consist of laboratory-prepared blank water processed along with the batch of environmental samples. The method blank should be prepared and analyzed before analysis of the associated environmental samples. If the result for a single method blank is greater than the MDL the source(s) of contamination should be corrected, and the associated samples should be reanalyzed.

b. Laboratory Control Samples

The purpose of analyzing laboratory control samples is to demonstrate the accuracy of the analytical method. Laboratory control samples are typically analyzed at the rate of one per sample batch. Laboratory control samples will consist of laboratory fortified method blanks. If recovery of any analyte is outside the acceptable range for accuracy, the analytical process is not being performed adequately for that analyte. In this case, the sample batch should be prepared again, and the laboratory control sample should be reanalyzed.

c. Laboratory Duplicates

The purpose of analyzing laboratory duplicates is to demonstrate the precision of the analytical method. Laboratory duplicates are typically analyzed at the rate of one pair per sample batch. Laboratory duplicates will consist of duplicate laboratory fortified method blanks. If the Relative Percent Difference (RPD) for any analyte is greater than the precision criterion and the absolute difference between duplicates is greater than the RL, the analytical process is not being performed adequately for that analyte. In this case, the sample batch should be prepared again, and laboratory duplicates should be reanalyzed.

d. Matrix Spikes and Matrix Spike Duplicates

The purpose of analyzing matrix spikes and matrix spike duplicates is to demonstrate the performance of the analytical method in a particular sample matrix. Matrix spikes and matrix spike duplicates are typically analyzed at the rate of one pair per sample batch. Each matrix spike and matrix spike duplicate will consist of an aliquot of laboratory-fortified environmental sample. Spike concentrations should be added at between 2 to 10 times the expected sample value.

If matrix spike recovery of any analyte is outside the acceptable range, the results for that analyte have failed the acceptance criteria. If recovery of laboratory control samples is acceptable, the analytical process is being performed adequately for that analyte, and the problem is attributable to the sample matrix. Attempt to correct the problem (by dilution, concentration, etc.) and re-analyze the samples and the matrix spikes. If matrix spike duplicate RPD for any analyte is greater than the precision criterion, the results for that analyte have failed the acceptance criteria. If the RPD for laboratory duplicates is acceptable, the analytical process is being performed adequately for that analyte, and the problem is attributable to the sample matrix. Attempt to correct the problem (by dilution, concentration, etc.) and re-analyze the samples and the matrix spike duplicates.

8. Field Quality Assurance/Quality Control requirements:

A. Definition of Field QA/QC Procedures

For basic water quality analyses, quality control samples to be prepared in the field will consist of field blanks and field duplicates. Field Blank data is included in Table 3.

7. Field Blanks

The purpose of analyzing field blanks is to demonstrate that sampling procedures do not result in contamination of the environmental samples. Field blanks will consist of laboratory-prepared blank water processed through the sampling equipment using the same procedures used for environmental samples. If any analytes of interest are detected at levels greater than the Reporting Limit (RL) for the parameter, the sampling crew should be notified so that the source of contamination can be identified (if possible) and corrective measures taken prior to the next sampling event.

8. Field Duplicates

The purpose of analyzing field duplicates is to demonstrate the precision of sampling and analytical processes. Field duplicates will consist of two grab samples collected in rapid succession. If field duplicate results have a relative percent difference of greater than 25%, the sampling crew should be notified so that the source of sampling variability can be identified (if possible) and corrective measures taken prior to the next sampling event.

2. Frequency of Field Blanks

Field blank samples are analyzed periodically as part of the study. Field blanks were analyzed monthly from 1998- June 2000, and 2-4 times per year thereafter. Field blank data is summarized in a separate spreadsheet, attached.

3. Frequency of Field Duplicates

Field duplicate samples are analyzed periodically as part of the study. Field duplicates were analyzed monthly from 1998 – Jan 2005. Field duplicates yielded consistent results for seven years of sampling during 1998- Jan 2005 and analysis of field duplicates was cancelled in 2005.

4. Metals “ultra clean” sample collection

EPA method 1669, “Sampling Ambient Water for Determination of Metals at EPA Water Quality Criteria Levels” was used for all Sacramento River water sampling from 1998 to the present.

Sample collection bottles used during the study were pre-cleaned at Frontier GeoSciences, Inc. Pre-cleaned bottles were double-bagged at Frontier GeoSciences, opened in the field using class 100 clean room gloves, and double-bagged following sample collection in the field prior to preparation for shipment. A “clean hands – dirty hands” method of sample collection is utilized. The “dirty hands” person opens the outer bag of the double-bagged sample bottles. The “clean hands” person opens only the inner bag, removes the sample bottle, rinses the bottle three times with the sample source, collects the sample, caps the bottle, places the bottle back in the inner bag, and seals the inner bag. The “dirty hands” person then seals the outer bag and prepares the sample for shipping. Gloves are changed after touching anything other than the sample bag or bottle.

Samples are shipped on ice via overnight service from Federal Express to Frontier GeoSciences. Ice chests used for shipping are sealed with custody tape.

9. Personnel Training:

Personnel are trained on sample collection procedures both in the City of Redding's Industrial Waste Laboratory and in the field. All personnel performing the sampling are required to be certified as Environmental Compliance Inspector, Grade 2, through the California Water Environment Association. Training includes the following elements:

(1) Proper use of class 100 laboratory "clean room" gloves
(2) Proper use of river waders
(3) Personal safety procedures for sampling in the Sacramento River
(4) Proper handling of "ultra-clean" samples
(5) Proper Chain of Custody procedures for samples
(6) Proper sample preparation for Priority Overnight shipping via Fed-Ex
(7) Proper calibration and use of field pH, temperature and conductivity meters

Project Specific sampling and analysis plan:

A. Summary

This sampling project began as an effort to more accurately characterize Sacramento River water quality and to allow the City of Redding to be proactive with respect to future regulatory issues and their potential impact to our municipality. The City=s efforts to develop a defensible low level trace metals data-base shows marked improvement in Sacramento River water quality following the remediation efforts at Iron Mountain Mine, the most recent of which being the completion of the Slickrock Creek Retention Reservoir in May 2004.

In 1998, the RWQCB approved this study as a means to establish an accurate ambient water quality database for the Sacramento River. The sampling site at Caldwell Park was chosen due to the low hardness values expected at this relatively pristine sampling site. Monthly samples are collected to provide adequate data during times of both high and low seasonal river flows.

The use of EPA method 1669 low level Aultra-clean@ metals sampling and analytical techniques are necessary to determine ambient water quality at the concentrations required by the California Toxics Rule (CTR) and the California Central Valley Basin Plan. The Sacramento River between Keswick Dam and Cottonwood Creek was previously listed as an Impaired Water body on the CWA 303(d) list for cadmium, copper, and zinc but was removed from listing following the TMDL development in 2002. It is scheduled for re-listing on the 2006 303(d) list in the Water Quality Limits Being Addressed section. This re-listing further necessitates the use of ultra-clean techniques to characterize background metals concentrations in the Sacramento River.

Although we are documenting decreasing concentrations of trace metals in the Sacramento River, we have additional concerns due to background receiving water metal concentrations from historic mining activities. High ambient metal levels in our domestic water supply leave little or no room for residential, commercial, or industrial metal contributions to wastewater. The City will continue its monitoring study of the Sacramento River through the use of ultra-clean sampling and low-level analytical techniques. Continued diligence in cleaning up pollution from abandoned mines on the part of EPA, the California SWRCB and the Central Valley RWQCB is imperative to ensure the economic and social vitality of our area and the Central Valley as a whole.

B. Data quality objectives

The standard data validation procedures documented in the contract laboratory's Quality Assurance Manuals will be used to accept, reject, or qualify the data generated by the laboratory. Each laboratory's QA officer will be responsible for validating data generated by the laboratory. The project manager will be responsible for final validation and for qualifying all data based on the evaluation of field and laboratory quality control samples.

Data quality objectives for sample holding times conform to recommendations documented in the analytical methods for individual parameters. All samples will be analyzed by the contract laboratory before the maximum allowable holding time for any sample is exceeded.

Laboratory personnel will verify the measurement process was "in control" (i.e., all specified data quality objectives were met or acceptable deviations explained) for each batch of samples before proceeding with the analysis of a subsequent batch. In addition, each laboratory will establish a system for detecting and reducing transcription and/or calculation errors prior to reporting data.

Only data which have met data quality objectives, or data which have acceptable deviations explained, will be submitted by the laboratory. When QA requirements have not been met, the samples will be reanalyzed when possible and only the results of the reanalysis will be submitted, provided they are acceptable.

Project Quality Control Requirements for Analysis of Water Quality Samples Trace Metals, and General Water Quality Constituents				
QA Procedure	**QA Parameter**	**Frequency[1]**	**Criterion**	**Corrective Action**
ld Blanks	Contamination	Various	< RL *or* < sample ÷ 5	Examine field log. Identify contamination source. Qualify data as needed.
Field Duplicate	Precision	Various	RPD ≤ 25% if |Difference| ≥ RL	Reanalyze both samples. Identify variability source. Qualify data as needed.
Method Blank	Contamination	≥1 per batch	< MDL *or*, if n≥3, avg ± 2 s.d. < RL	Identify contamination source. Reanalyze method blank and all samples in batch.
LCS	Accuracy	1 per batch	80-120% REC	Recalibrate and reanalyze LCS and samples. Qualify data as needed.
Lab Duplicate	Precision	1 per batch	RPD ≤ 20% if |Difference| ≥ RL	Recalibrate and reanalyze. Qualify data as needed.
Matrix Spike	Accuracy	1 per batch	80-120% REC	Attempt to correct matrix problem and reanalyze sample. Qualify data as needed.
Matrix Spike Duplicate	Precision	1 per batch	RPD ≤ 20%	Attempt to correct matrix problem and reanalyze samples. Qualify data as needed.

Notes: MDL = Method Detection Limit; RL = Reporting Limit; RPD = Relative Percent Difference; REC = Recovery; LCS = Laboratory Control Sample;

(1) The term “lot” refers to a set of bottles or reagents identifiable by a common production lot number, or to sampling equipment subjected to the same cleaning procedures as a set.The term “batch”, as used in this document, refers to an uninterrupted series of analyses.

C. Achievement of data quality objectives

Data quality objectives are summarized on the spreadsheet titled "QA Summary". Data quality objectives were either met or were sufficiently explained and qualified by the analytical laboratory. The City of Redding certifies the data set is an accurate representation of ongoing river water concentrations at the Caldwell Park sampling site for the following parameters: Total Recoverable and Dissolved metals including Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, and Zinc, Total recoverable Methyl Mercury, Hardness, TOC, TKN, NH3-N, NO3-N, Turbidity, Conductivity, TDS, TSS, pH, temperature, and river flow (cfs).

D. Sample site selection

The sampling site at Caldwell Park was chosen for several reasons. This site is between Keswick Dam and Cottonwood Creek on the Sacramento River. The site is approximately 10 river miles upstream of several NPDES permitted "point source" discharges including the City of Redding Clear Creek Wastewater Treatment Plant (WWTP), Sierra Pacific Industries, City of Redding Stillwater WWTP, and the City of Anderson WWTP. The sampling site is relatively pristine and the river water at this location is expected to have a low hardness value. The City of Redding maintains a cement boat launch ramp at Caldwell Park. The boat launch ramp allows City sampling staff easy access to enter the river and walk out into the flow of the river to collect representative samples.

E. Water Quality Parameters

The following water quality parameters were analyzed during the study: Total Recoverable and Dissolved metals including Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Molybdenum, Nickel , Selenium, Silver, and Zinc, Total Recoverable Methyl Mercury, Hardness, TOC, TKN, NH3-N, NO3-N, Turbidity, Conductivity, TDS, TSS, pH, temperature, and river flow (cfs). These water quality parameters were selected based on the NPDES requirements for effluent and biosolids monitoring at the City of Redding's two wastewater treatment plants, the biosolids monitoring requirements in 40 CFR part 503, and constituents of concern for the City of Redding Industrial Pretreatment Program industrial wastewater discharge local limits study.

F. Sampling Frequency

The sampling frequency has changed throughout the nine years of this study. The current sampling frequency is monthly. The following table details the various sampling frequencies used throughout the study:

Frequency	Dates	Rationale
Monthly	Jan 1998 – June 2000	At the start of the study, monthly samples were collected to ensure representative data throughout the seasonal variations in river flow.
Quarterly	Sept 2000 – May 2003	After a large data set was collected, the sampling was scaled back to quarterly to continue monitoring the river at least once per season.
Monthly	Sept 2003 – Dec 2006	Approval of the City of Redding Clear Creek WWTP NPDES permit required monthly sampling of the river to resume.

G. Representative Sample Assurance

Representativeness can be defined as the degree to which the environmental data generated by the monitoring program accurately and precisely represent actual environmental conditions. This objective is addressed by the overall design of the monitoring program. Specifically, assuring the representativeness of the data is addressed primarily by selecting appropriate locations, methods, times, and frequencies of sampling for each environmental parameter, and by maintaining the integrity of the sample after collection. Each of these elements of the quality assurance program is addressed elsewhere in this document.

Collection, handling, and storage of samples will be performed in a manner consistent with EPA Method 1669 to assure the collection of representative, uncontaminated water samples. Briefly, the key aspects of quality control associated with sample collection are as follows:

- Field personnel will be thoroughly trained in the proper use of sample collection gear and will be able to distinguish acceptable versus unacceptable samples in accordance with pre-established criteria.

- Field personnel will be thoroughly trained to recognize and avoid potential sources of sample contamination (e.g., engine exhaust, winch wires, deck surfaces, ice used for cooling, people smoking cigarettes, etc.).

- Samplers and utensils which come in direct contact with the sample will be made of non-contaminating materials and will be thoroughly cleaned and rinsed with sample prior to use.
- Sample containers will be pre-cleaned and of the recommended type.

H. Documentation to support the conclusion that results are reproducible

During the first seven years of the study, water samples were collected in duplicate and analyzed separately. An analysis of the relative percent difference (RPD) of the sample duplicate results showed 88.7% of the field duplicates had a RPD of less than or equal to 25%. Out of a total of 1117 field duplicate RPD's analyzed, only 126 (11.3%) had a RPD of greater than 25%.

The results of the duplicate sample analyses indicate the sample data is substantially reproducible. Duplicate sampling concluded in 2004 based on the continuing stability of the data and the significant cost of analyzing two individual samples from each sampling event. Single monthly samples have been collected from 2005 until present.

I. Conclusion

The City of Redding has been monitoring the water quality in the Sacramento River at the Caldwell Park sampling site for nine years. The State Water Resources Control Board is reviewing this section of the river for potential contamination of dissolved cadmium, copper and zinc. The City of Redding's results were below the water quality objectives in 100% of samples analyzed for both dissolved cadmium and zinc and were below the water quality objectives in 95.9% of the samples analyzed for dissolved copper during this study. (The only dissolved copper results above the water quality objectives were for duplicate samples in April 1998, April 1999, and December 2002 out of a total of 146 samples analyzed.) Therefore, the City of Redding concludes that re-listing the Sacramento River between Keswick Dam and Cottonwood Creek as an impaired water body is not justified or supported by the scientific data at this time.