

**Evaluation of Municipal and Domestic Supply (MUN)
Beneficial Use in Agricultural Drains**

**Sacramento Valley Archetypes
Quality Assurance Project Plan**

December 2014

Please note: Since the release of the Evaluation of MUN Beneficial Use in Ag Drains QAPP Version 1 (June 2012), updates to project schedule, budget, and other elements of this QAPP is provided in Appendix 18.

A1, Element 1. Title and Approval Sheet

Program Title Evaluation of MUN Beneficial Use in Agricultural Drains

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A2, Element 2. Table of Contents

A1, Element 1. Title and Approval Sheet	2
A2, Element 2. Table of Contents	3
A3, Element 3. Distribution List	8
A4, Element 4. Project/Task Organization	8
Involved Parties and Roles	10
Laboratory Director.....	11
Quality Assurance Officer – Central Valley Water Board	11
Fresno Lab Contract – Central Valley Water Board	11
Field and Lab Personnel.....	11
Monitoring Lead – Central Valley Water Board	11
A5, Element 5. Problem Statement/Background	13
Problem Statement.....	13
Decisions or Outcomes	15
Water Quality or Regulatory Criteria	15
A6, Element 6. Project/Task Description	32
Work statement and produced products	32
Constituents to be monitored and measurement techniques	32
Project Schedule	35
Geographical Setting	35
Constraints	36
A7, Element 7. Quality Objectives and Criteria for Measurement Data	36
Accuracy	38
Precision	38
Contamination	38
Comparability	38
Completeness	39
Representativeness.....	39
Method Detection Limit and Sensitivity	39
A8, Element 8. Special Training Needs/Certification	51
Specialized Training or Certifications.....	51
Training Personnel	51
A9, Element 9. Documents and Records	52

QAPP updates and distribution.....	52
Records to be included in data reports	52
Persons responsible for maintaining records.....	52
Electronic records.....	52
B1, Element 10. Sampling Process Design	53
Description and Justification for Design Strategy.....	53
Type and Total Number of Samples	56
Sampling Location.....	58
Inaccessible Sampling Locations.....	58
Project Activity Schedule	58
Critical vs. Non-critical Information	58
Variability – Sources and Reconciliation	58
Bias – Sources and Minimization.....	58
B2, Element 11. Sampling Methods	59
Field Preparation.....	60
Sample Volume and Bottle Type	61
Sample Preservation and Holding Times.....	61
Sample Equipment.....	62
Sample collection procedures.....	66
Responsible person.....	66
B3, Element 12. Sample Handling Custody.....	67
Maximum Holding Times	67
Sampling Handling	67
Transport.....	67
Sample Transfer.....	68
Sample Handling and Custody Documentation.....	68
Responsible Individuals	68
Sample Identification	68
Chain of Custody Procedures.....	68
B4, Element 13. Analytical Methods and Field Measurements	69
Field and Lab Analytical Procedures	69
Instruments to be used in Field.....	72
Equipment to be used for laboratory analysis	72
Method Performance Criteria.....	74

Corrective Actions	76
Sample Disposal Procedures	76
Laboratory Turnaround Times	76
B5, Element 14. Quality Control	76
Quality Control Samples	77
Laboratory Blank	77
Matrix Spike and Matrix Spike Duplicate.....	77
Laboratory Control Spike and Laboratory Control Spike Duplicate	77
Surrogates.....	77
Calibration Check Samples	78
Travel Blank	78
Field Duplicates.....	78
Laboratory Duplicates.....	78
Quality Assurance Frequency of Analysis and Measurements Quality Objectives	78
Corrective Actions	79
B6, Element 15. Instrument/Equipment Testing, Inspection, and Maintenance	81
Periodic Maintenance	81
Testing Criteria	81
Persons Responsible for Testing, Inspection, and Maintenance	81
Spare Parts	81
Deficiencies.....	82
B7, Element 16. Instrument/Equipment Calibration and Frequency.....	84
B8, Element 17. Inspection/Acceptance of Supplies and Consumables.....	85
B9, Element 18. Non-Direct Measurements (Existing Data)	86
Existing Data	86
Usage Limits.....	86
B10, Element 19. Data Management	86
Data/Information Handling and Storage.....	87
Recording, transcribing, digitizing, and downloading data.....	87
Transmittal.....	87
Storage.....	87
Retrieval.....	87
Computerized Information System Maintenance	87
SWAMP Information Management Systems	88
C1, Element 20. Assessments and Response Actions.....	88

Project Assessments	88
Assessment Reports	89
Corrective Actions	90
C2, Element 21. Reports to Management	90
Interim and Final Reports	90
Quality Assurance Reports.....	90
D1, Element 22. Data Review, Verification, and Validation Requirements	91
Responsibility for Data Review	91
Checking for Typical Errors	91
Checking Against MQOs	91
Checking Against QA/QC	91
Checking Lab Data.....	91
Data Verification	92
Data Validation	92
Responsibility for Data Validation	92
Data Separation	92
D2, Element 23. Verification and Validation Methods.....	93
D3, Element 24. Reconciliation with User Requirements	94
APPENDICES.....	95
Appendix 1. List of Sampling Sites	96
Appendix 2. Map of Sampling Sites	98
Appendix 3. Monitoring Plan.....	xcix
Appendix 4. Sampling Event Preparation	145
Appendix 5. Field Protocols	146
Appendix 6. Sample Collection.....	147
Appendix 7. Field Sheet (SWAMP).....	150
Appendix 8. Bacteria Processing Laboratory Sheet (SWAMP)	151
Appendix 9. Excelchem Environmental Labs (Chain of Custody).....	152
Appendix 10. Moore Twining Associates (Chain of Custody).....	153
Appendix 11. BSK Associates (Chain of Custody).....	154
Appendix 12. Excelchem Environmental Laboratories QA/QC Manual	155
Appendix 13. Moore Twining Associates QA Manual.....	156
Appendix 14. BSK Associates QA Manual.....	157
Appendix 15. SWAMP QAPP	158

Appendix 16. ASWA Procedures Manual	159
Appendix 17. References	160
Appendix 18. Updates to QAPP Version 1	161

LIST OF TABLES

Table 1 Distribution List.....	8
Table 2 Personnel Responsibilities	10
Table 3 List of Potential Parameters of Concern.....	16
Table 4 Field Sampling Project Schedule Timeline	35
Table 5 Measurement Quality Objectives.....	40
Table 6 List of Constituents within Each Scan	57
Table 7 Field and Laboratory Analytical Methods	69
Table 8 Quality Control Checks.....	76
Table 9 Quality Assurance Frequency of Analysis and Measurement Quality Objectives	79
Table 10 Corrective Actions	80
Table 11 Testing, Inspection, Maintenance of Sampling Equipment.....	83
Table 12 Calibration of Sampling Equipment	84
Table 13 Inspection/Acceptance Testing Requirements for Consumables and Supplies	85
Table 14 QA Management Reports.....	90

TABLE OF FIGURES

Figure 1 Organizational Chart	12
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A3, Element 3. Distribution List

Central Valley Regional Water Quality Control Board (Central Valley Water Board) staff listed in Table 1 below will receive copies of this Quality Assurance Project Plan (QAPP) and any approved revisions of this plan. The QAPP plan will be available on the project website and to any interested party by requesting a copy from Calvin Yang.

Table 1 Distribution List

Title:	Name (Affiliation):	E-Mail.:	No. of copies
Project Lead, Senior Environmental Scientist	Jeanne Chilcott (Central Valley Water Board)	jchilcott@waterboards.ca.gov	1
QA Officer, Staff Chemist	Leticia Valadez (Central Valley Water Board)	lvaladez@waterboards.ca.gov	1
Monitoring Lead, Environmental Scientist	Calvin Yang (Central Valley Water Board)	ccyang@waterboards.ca.gov	1
Project Coordinator, Environmental Scientist	Anne Littlejohn (Central Valley Water Board)	alittlejohn@waterboards.ca.gov	1
Field Staff, Engineering Geologist	Alisha Wenzel (Central Valley Water Board)	awenzel@waterboards.ca.gov	1
Field Staff, Environmental Scientist	TJ Ditto (Central Valley Water Board)	tditto@waterboards.ca.gov	1
City of Colusa, Public Works Director	Dale Klever (City of Colusa POTW)	publicworks@cityofcolusa.com	1

A4, Element 4. Project/Task Organization

The MUN Beneficial Use Evaluation in Agricultural Drains 2012 study is being sponsored by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) in conjunction with the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) initiative. The Municipal and Domestic Supply (MUN) Beneficial Use is defined as uses of water are for community, military, or individual water supply systems including, but not limited to, drinking water supply. The purpose of this study is to evaluate appropriate application of MUN Beneficial Use designations within agriculturally dominated water bodies downstream of Publicly Owned Treatment Works (POTW) discharges in a sub-area of the Sacramento River Basin. Part of the study is to determine background water quality and any influence the POTW discharges may have on the downstream water bodies (water quality and/or quantity).

Sampling sites consist of:

- Sites utilized by POTWs for compliance for the National Pollutant Discharge Elimination System (NPDES) program (specifically, sites upstream and downstream of effluent discharge, defined as treated wastewater); and
- Downstream locations that evaluate progressive water quality at confluences with additional agriculturally dominated water bodies.

Water quality monitoring will be conducted for a minimum of 1-year with the potential for quarterly revisions based on evaluated results. Parameters monitored for the first three months (April – June) will include specific conductivity, pH, temperature, dissolved oxygen, turbidity, and key constituents (boron, sodium, Nitrate as Nitrogen, Nitrite as Nitrogen, total Arsenic, Volatile Organic Compounds, total aluminum, total iron, total manganese, and Methylene Blue Active Substance). The key constituents sampled will be compared against Maximum Contaminant Levels (MCLs) specified in provisions of Title 22 of the California Code of Regulations and other limits more stringent than the MCLs as documented in the Central Valley Basin Plans. Additional constituents will be analyzed against human health-based standards in the California Toxics Rule (CTR) and other drinking water criteria as funding permits.

Table 2 identifies all personnel involved with this study. Descriptions of each person's responsibilities follow the table.

Figure 1 shows relationships between personnel.

Involved Parties and Roles

Table 2 Personnel Responsibilities

Name	Organizational Affiliation	Title	Project Title/ Responsibility	Contact Information (Telephone number, fax number, email address.)
Jeanne Chilcott	Central Valley Water Board	Senior Environmental Scientist	Project Lead	Tel: 916 464 4788 Email: jchilcott@waterboards.ca.gov
Anne Littlejohn	Central Valley Water Board	Environmental Scientist	Project Coordinator	Tel: 916 464 4840 Email: alittlejohn@waterboards.ca.gov
Calvin Yang	Central Valley Water Board	Environmental Scientist	Monitoring Lead	Tel: 916 464 4730 Email: ccyang@waterboards.ca.gov
Leticia Valadez	Central Valley Water Board	Staff Chemist	QA Officer, Central Valley Water Board Lab	Tel: 916 464 4634 Email: lvaladez@waterboards.ca.gov
Anthony Toto	Central Valley Water Board	Water Resource Control Engineer	Fresno Lab Contract	Tel: 559 445 6278 Email: atoto@waterboards.ca.gov
Field Staff	Central Valley Water Board	Various	Monitoring Support	Tel: 916 464 3291
Field Staff	City of Colusa	Various	Monitoring Support	Email: publicworks@cityofcolusa.com
Lab Staff	Excelchem Environmental Labs	Various	Sample Analysis	Tel: 916 543 4445
Lab Staff	Moore Twining Associates	Various	Sample Analysis	Tel: 559 268 7021

Laboratory Director

The Laboratory Director for the Central Valley Water Board is Leticia Valadez, who will ensure facility needs are met.

Quality Assurance Officer – Central Valley Water Board

The Quality Assurance Officer for the Central Valley Water Board is Leticia Valadez, who works independently from the Monitoring Lead, field staff, and laboratory staff, and is responsible for ensuring the data meets all quality objectives.

Fresno Lab Contract – Central Valley Water Board

The Fresno Lab Contract staff from the Fresno Water Board office will ensure all analysis conducted for June 2012 samples are within budget.

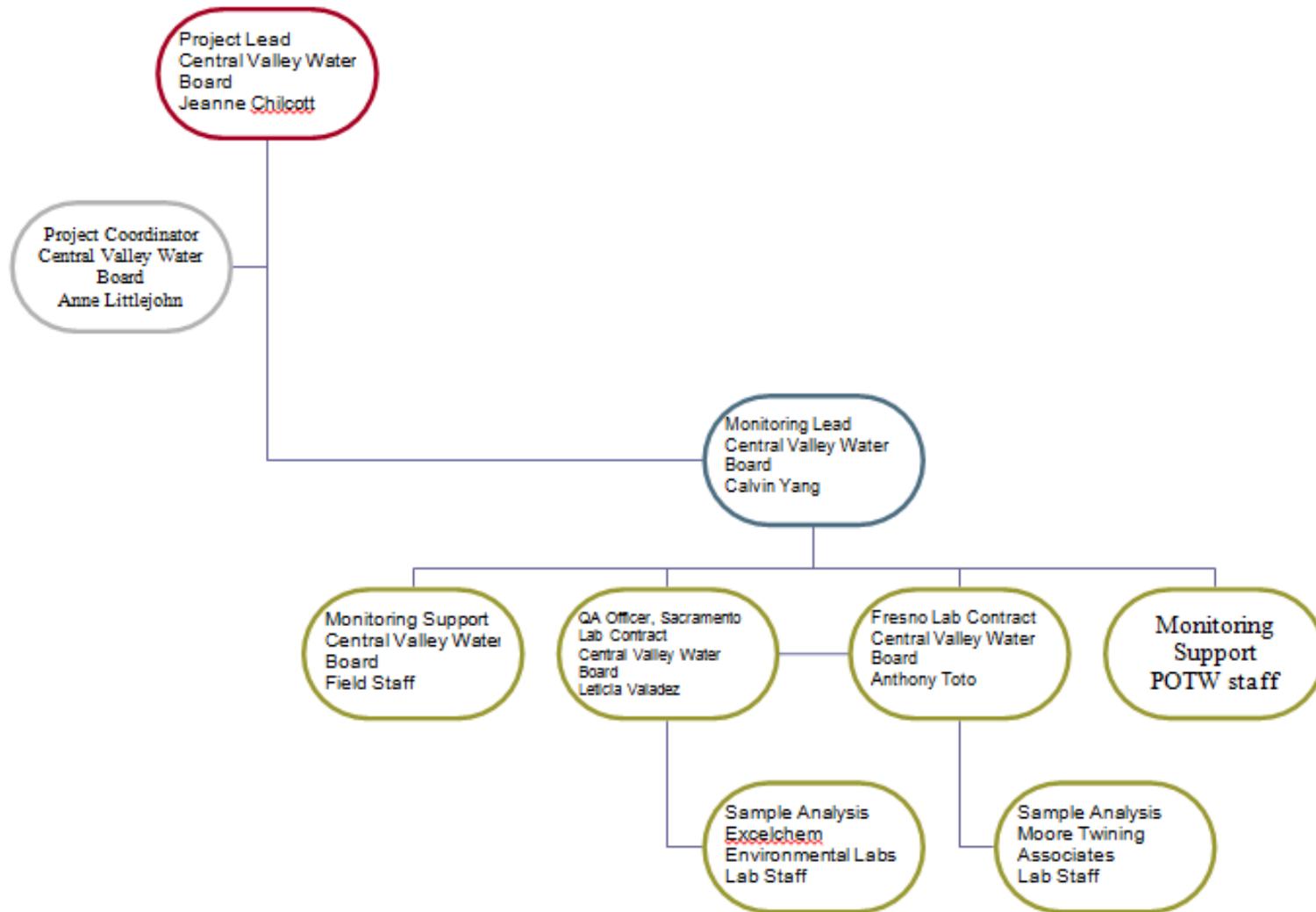
Field and Lab Personnel

Central Valley Water Board staff trained in sample collection will coordinate all field collection activities and collect the majority of water samples. City of Colusa staff will collect field measurements (pH, EC, temperature, and DO) at their receiving water sites and effluent site. Excelchem Environmental Labs and Moore Twining Associates personnel will conduct laboratory analyses.

Monitoring Lead – Central Valley Water Board

The Monitoring Lead will be responsible for maintaining the official and approved QA Project Plan.

Figure 1 Organizational Chart



A5, Element 5. Problem Statement/Background

Problem Statement

Please see Monitoring Plan in Appendix 3.

The Central Valley Regional Board and CV-SALTS are evaluating the appropriate application of the Sources of Drinking Water Policy (#88-63) and Antidegradation Policy (#68-16) in agriculturally dominated water bodies within a sub-area of the Sacramento River Basin that receives discharges from POTWs. This project attempts to combine and leverage the work desired by four POTWs (the cities of Willows, Colusa, Live Oak, and Biggs) and the archetypes identified by CV-SALTS. The findings from this study may change how compliance for MUN will be enforced in new NPDES permits. Questions being asked of the monitoring are:

Key Factors

- Is the designated use occurring? (Perform physical survey of the area)
- Is the water source predominantly recycled water, urban storm drainage, treated or untreated wastewater or agricultural return water? (California Department of Public Health policy memorandum 97-005: Recommends against the use of drinking water supplies from “Water that is predominantly recycled water, urban storm drainage, treated or untreated wastewater, or is agricultural return water”)
- Is there a significant change in hydrology due to seasonality and/or water management?

88-63: Sources of Drinking Water

- Do the exceptions of the Drinking Water policy apply?
 - Does water source provide an average sustained yield of 200 gallons per day?
 - Is the water source in a system designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff?
 - Is the water source in a system designed or modified for the primary purpose of conveying or holding agricultural drainage waters?
 - Does the water body have a contamination, either by natural processes or by human activity that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices?
- If an exception is applicable, will the discharge (from the system designed to treat wastewater or conveying agricultural water) be monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?

68-16: Maintaining High Quality of Waters in California

- *Is the anti-degradation analysis for NPDES permit complete?*
 - *If not, what additional information is needed?*
- Is water quality sufficient to attaining the beneficial use? (What is the quality of the background water?)
 - If not:
 - At what point downstream is MUN achievable?
 - Do any of the 40CFR131.10(g) Factors occur?
 - Naturally occurring pollutant concentrations prevent attainment of use
 - Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met
 - Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place
 - Dams, diversions or other types of hydrologic modification preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use
 - Controls more stringent than those required by sections 301 (b) and 306 of the Act would result in substantial and widespread economic and social impact
- What are the appropriate constituents to monitor?

Decisions or Outcomes

The primary objectives of this monitoring project are:

- Characterize Receiving Waters
- Determine spatial and temporal extent of potential degradation and/or impairment

This monitoring effort will collect water quality data within the POTW study areas in order to evaluate the appropriateness of the MUN beneficial use. The monitoring design allows for adaptive review and changes on a quarterly schedule. If it is determined that the MUN designated use is not existing and the water body meets the exceptions in the Drinking Water policy, adjustments to the monitoring design will be discussed at quarterly reviews.

Water Quality or Regulatory Criteria

To evaluate whether water quality may be suitable for the MUN beneficial use, data will be compared to Maximum Contaminant Levels (MCLs) specified in provisions of Title 22 of the California Code of Regulations, California Toxics Rule (CTR) criteria, and other numeric water quality criteria listed in Table 3 for constituents without a MCL or CTR criteria. For constituents with both a MCL and CTR criteria, the most conservative numeric threshold will be selected for water quality evaluation. For constituents without a MCL and CTR criteria, the most appropriate numeric water quality criteria for protecting MUN beneficial use will be selected for water quality evaluation.

In addition, *E. coli* will be added to the monitoring effort and will be compared to the USEPA Recreational Guideline for Designated Beach Area at 235 MPN/100mL (USEPA, 1986). This numeric water quality criterion will be strictly used as a tool for evaluation to put values into context in terms of spatial and temporal trends.

Table 3 List of Potential Parameters of Concern

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
1,1,1-Trichloroethane	0.200 mg/L			1.0 mg/L [California Public Health Goal for Drinking Water]
1,1,2,2-Tetrachloroethane	0.001 mg/L		0.00017 mg/L	0.0001 mg/L [California Public Health Goal for Drinking Water]
1,1,2,Trichloro-1,2,2-Trifluoroethane (Freon 113)	1.2 mg/L			4.0 mg/L [California Public Health Goal for Drinking Water]
1,1,2-Trichloroethane	0.005 mg/L		0.0006 mg/L	0.0003 mg/L [California Public Health Goal for Drinking Water]
1,1-Dichloroethane	0.005 mg/L			0.003 mg/L [California Public Health Goal for Drinking Water]
1,1-Dichloroethylene	0.006 mg/L		0.000057 mg/L	0.010 mg/L [California Public Health Goal for Drinking Water]
1,2,4-Trichlorobenzene	0.005 mg/L			0.005 mg/L [California Public Health Goal for Drinking Water]
1,2,4-Trimethylbenzene				0.330 mg/L [California DPH Notification Level for drinking water]
1,2-Dibromo-3chloropropane (DBCP)	0.0002 mg/L			0.0000017 mg/L [California Public Health Goal for Drinking Water]
1,2-Dibromoethane (Ethylene Dibromide) (EDB)	0.00005 mg/L			0.00001 [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
1,2-Dichlorobenzene	0.6 mg/L		2.7 mg/L	0.6 mg/L [California Public Health Goal for Drinking Water]
1,2-Dichloroethane (Ethylene dichloride)	0.0005 mg/L		0.00038 mg/L	0.0004 mg/L [California Public Health Goal for Drinking Water]
1,2-Dichloropropane	0.005 mg/L		0.00052 mg/L	0.00050 mg/L [California Public Health Goal for Drinking Water]
1,2-Diphenylhydrazine			0.000040 mg/L	
1,3 Dichlorobenzene			0.400 mg/L	0.600 mg/L [California DPH Notification Level for drinking water]
1,3,5-Trimethylbenzene				0.330 [California DPH Notification Level for drinking water]
1,3-Dichloropropene	0.0005 mg/L		0.01 mg/L	0.0002 mg/L [California Public Health Goal for Drinking Water]
1,4-Dichlorobenzene	0.005 mg/L		0.400 mg/L	0.006 mg/L [California Public Health Goal for Drinking Water]
2,3,7,8-TCDD (Dioxin)	3 x 10 ⁻⁸ mg/L		1.3 x 10 ⁻¹¹ mg/L	5 x 10 ⁻¹¹ mg/L [California Public Health Goal for Drinking Water]
2,4,5-TP (Silvex)	0.05 mg/L			0.002 mg/L [California Public Health Goal for Drinking Water]
2,4,6-Trichlorophenol			0.0021 mg/L	
2,4-Dichlorophenol			0.093 mg/L	

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.07 mg/L			0.02 mg/L [California Public Health Goal for Drinking Water]
2,4-Dichlorophenoxybutyric acid (2,4-DB)				0.056 mg/L [USEPA IRIS Reference Dose]
2,4-Dimethylphenol			0.540 mg/L	
2,4-Dinitrophenol			0.070 mg/L	
2,4-Dinitrotoluene			0.00011 mg/L	
2-Chloronaphthalene			1.7 mg/L	
2-Chlorophenol			0.120 mg/L	
2-Methyl-4,6-Dinitrophenol			0.0134 mg/L	
3,3'-Dichlorobenzidine			0.00004 mg/L	
4,4'-DDD			0.00000083 mg/L	0.00015 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
4,4'-DDE			0.00000059 mg/L	0.0001 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
4,4'-DDT			0.00000059 mg/L	0.0001 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Acenaphthene			1.2 mg/L	0.020 mg/L [USEPA National Recomm. WQ Criteria, taste & odor]
Acrolein			0.320 mg/L	0.110 mg/L [Odor threshold (Amoore and Hautala)]
Acrylonitrile			0.000059 mg/L	
Alachlor	0.002 mg/L			0.004 mg/L [California Public Health Goal for Drinking Water]
Aldrin			0.00000013 mg/L	0.0000021 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Alpha-BHC (alpha-Benzene hexachloride)			0.00000039 mg/L	0.000013 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Aluminum	1.0 mg/L	0.2 mg/L		0.600 mg/L [California Public Health Goal for Drinking Water]
Ammonia				1.5 mg/L [Odor threshold (Amoore and Hautala)]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Anthracene			9.6 mg/L	
Antimony	0.006 mg/L		.0014 mg/L	0.020 mg/L [California Public Health Goal for Drinking Water]
Arsenic	0.010 mg/L			0.000004 mg/L [California Public Health Goal for Drinking Water]
Asbestos	7 Million Fibers per Liter		7 Million Fibers/Liter	
Atrazine	0.001 mg/L			0.00015 mg/L [California Public Health Goal for Drinking Water]
Barium	1.0 mg/L			2.0 mg/L [California Public Goal for Drinking Water]
Bentazon	0.018 mg/L			
Benzene	0.001 mg/L		0.0012 mg/L	0.00015 mg/L [California Public Health Goal for Drinking Water]
Benzidine			0.00000012 mg/L	
Benzo(a)Anthracene [1,2-Benzanthracene]			0.0000044 mg/L	0.000029mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Benzo(a)pyrene	0.0002 mg/L		0.0000044 mg/L	0.000007mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Benzo(b)Fluoranthene [3,4-Benzofluoranthene]			0.0000044 mg/L	0.000029mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Benzo(k)Fluoranthene			0.0000044 mg/L	0.000029mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Beryllium	0.004 mg/L			0.001 mg/L [California Public Health Goal for Drinking Water]
Beta/photon emitters	4 millirem/year annual dose equivalent to the total body or any internal organ			
Beta-BHC (beta-Benzene hexachloride)			0.000014 mg/L	0.000023 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Bis(2-Chloroethyl)Ether			0.000031 mg/L	

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Bis(2-Chloroisopropyl)Ether			1.400 mg/L	
Boron				1 mg/L [California Public Health Goal for Drinking Water]
Bromoform			0.0043 mg/L	0.004 mg/L USEPA IRIS Cancer Risk Level
Butylbenzyl Phthalate			3.0 mg/L	
Cadmium	0.005 mg/L			0.00004 mg/L [California Public Health Goal for Drinking Water]
Carbofuran	0.04 mg/L			
Carbon Tetrachloride	0.0005 mg/L			0.00025 mg/L [National Toxics Rule (NTR) for sources of drinking water]
Chlordane	0.0001 mg/L		0.00000057 mg/L	0.00003 mg/L [California Public Health Goal for Drinking Water]
Chloride		250 mg/L		
Chlorobenzene	0.070 mg/L		0.680 mg/L	
Chlorodibromomethane			0.00041 mg/L	
Chloroform				0.0018 mg/L [Ca/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Chlorpyrifos				0.002 mg/L [USEPA, OPP Drinking Water Health Advisory - non-cancer]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Chromium	0.05 mg/L			
Chrysene			0.0000044 mg/L	0.00029 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Cis1,2-Dichloroethylene	0.006 mg/L			0.100 mg/L [California Public Health Goal for Drinking Water]
Color		15 Units		
Copper		1.0 mg/L	1.3 mg/L	0.300 mg/L [California Public Health Goal for Drinking Water]
Cyanide	0.15 mg/L		0.700 mg/L	0.150 mg/L [California Public Health Goal for Drinking Water]
Dalapon	0.2 mg/L			0.790 mg/L [California Public Health Goal for Drinking Water]
Di(2-ethylhexyl)adipate	0.4 mg/L			
Di(2-ethylhexyl)phthalate (DEHP) (Bis(2-ethylhexyl) phthalate)	0.004 mg/L			0.0018 mg/L [National Toxics Rule (NTR) for sources of drinking water]
Diazinon				0.0012 mg/L [CDPH Notification Level for drinking water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Dibenzo(ah)Anthracene			0.0000044 mg/L	0.0000085 [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Dichlorobromomethane			0.00056 mg/L	0.00027 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Dichloromethane (Methylene Chloride)	0.005 mg/L		0.0047 mg/L	0.0004 mg/L [California Public Health Goal for Drinking Water]
Dieldrin			0.00000014 mg/L	0.0000022 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Diethyl Phthalate			23 mg/L	
Di-isopropyl ether (Isopropyl ether) (DIPE)				0.0008 mg/L [Odor threshold (Amoore and Hautala)]
Dimethyl Phthalate			313 mg/L	
Di-n-Butyl Phthalate			2.7 mg/L	
Dinoseb	0.007 mg/L			0.014 mg/L [California Public Health Goal for Drinking Water]
Diquat	0.02 mg/L			

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
<i>E. coli</i>				235 MPN/100 mL [USEPA Recreational Guideline for Designated Beach Area (Upper 75% confidence level)]
Endosulfan I (Alpha-Endosulfan)			0.110 mg/L	0.042 mg/L [USEPA IRIS Reference Dose]
Endosulfan II (Beta-Endosulfan)			0.110 mg/L	0.042 mg/L [USEPA IRIS Reference Dose]
Endosulfan Sulfate	0.002 mg/L		0.110 mg/L	
Endothall	0.1 mg/L			
Endrin	0.002 mg/L		0.00076 mg/L	0.0018 mg/L [California Public Health Goal for Drinking Water]
Endrin Aldehyde			0.00076 mg/L	
Ethylbenzene	0.3 mg/L		3.1 mg/L	0.0032 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Fluoranthene			0.3 mg/L	0.280 mg/L [USEPA IRIS Reference Dose]
Fluorene			1.3 mg/L	0.280 mg/L [USEPA IRIS Reference Dose]
Fluoride		2.0 mg/L		1.0 mg/L [California Public Health Goal for Drinking Water]
Foaming Agents (MBAS)		0.5 mg/L		

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Gamma-BHC (gamma-Benzene hexachloride) (Lindane)	0.0002 mg/L		0.000019 mg/L	0.000032 mg/L [California Public Health Goal for Drinking Water]
Glyphosate	0.7 mg/L			
Gross Alpha particle activity (excluding radon and uranium)	15 pCi/L			
Heptachlor	0.0004 mg/L		0.00000021 mg/L	0.000008 mg/L [California Public Health Goal for Drinking Water]
Heptachlor Epoxide	0.0002 mg/L		0.00000010 mg/L	
Hexachlorobenzene	0.001 mg/L		0.00000075 mg/L	
Hexachlorobutadiene			0.00044 mg/L	
Hexachlorocyclopentadiene	0.05 mg/L		0.240 mg/L	
Hexachloroethane			0.0019 mg/L	
Indeno(1,2,3-cd) Pyrene			0.0000044 mg/L	0.000029 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Iron		0.3 mg/L		
Isophorone			0.0084 mg/L	

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Lead	0.015 mg/L			0.0002 mg/L [California Public Health Goal for Drinking Water]
Manganese		0.05 mg/L		0.500 mg/L [California DPH Notification Level for drinking water]
Mercury	0.002 mg/L		0.000050 mg/L	0.0012 mg/L [California Public Health Goal for Drinking Water]
Methoxychlor	0.03 mg/L			0.00009 mg/L [California Public Health Goal for Drinking Water]
Methyl Bromide (Bromomethane)			0.048 mg/L	
Methyl-tert-butyl ether (MTBE)	0.013 mg/L	0.005 mg/L		0.013 mg/L [California Public Health Goal for Drinking Water]
Molinate	0.02 mg/L			
Monochlorobenzene	0.1 mg/L			
Nickel	0.100 mg/L		0.61 mg/L	0.012 mg/L [California Public Health Goal for Drinking Water]
Nickel	0.1 mg/L		0.610 mg/L	0.012 mg/L [California Public Health Goal for Drinking Water]
Nitrate (as NO ₃)	45 mg/L			
Nitrate+Nitrite (sum as nitrogen)	10 mg/L			
Nitrite (as Nitrogen)	1.0 mg/L			

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Nitrobenzene			0.017 mg/L	
N-Nitrosodimethylamine (NDMA)			0.00000069 mg/L	0.000003 mg/L [California Public Health Goal for Drinking Water]
N-Nitrosodi-n-Propylamine			0.000005 mg/L	
N-Nitrosodiphenylamine			0.005 mg/L	
Odor		3 TON (Threshold Odor Number)		
Oxamyl	0.2 mg/L			
Pentachlorophenol	0.001 mg/L		0.00028 mg/L	0.0003 mg/L [California Public Health Goal for Drinking Water]
Perchlorate	0.006 mg/L			0.006 mg/L [California Public Health Goal for Drinking Water]
pH		6.5 - 8.5		
Phenol			21.0 mg/L	
Picloram	0.5 mg/L			
Polychlorinated Biphenyls (PCBs)	0.0005 mg/L		0.00000017 mg/L	0.00009 mg/L California Public Health Goal for Drinking Water]
Pyrene			0.960 mg/L	0.210 mg/L [USEPA IRIS Reference Dose]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Radium-226	5 pCi/L (combined radium-226 & -228)			
Radium-228	5 pCi/L (combined radium-226 & -228)			
Selenium	0.05 mg/L			0.03 mg/L [California Public Health Goal for Drinking Water]
Silver		0.1 mg/L		0.035 mg/L [USEPA IRIS Reference Dose]
Simazine	0.004 mg/L			
Sodium				20 mg/L [USEPA Drinking Water Advisory (for persons on restricted sodium diet)]
Specific Conductance		900 μ S/cm		
Strontium-90	8 pCi/L (=4 millirem/yr. dose to bone marrow)			
Styrene	0.1 mg/L			
Sulfate		250 mg/L		
Tetrachloroethylene (Tetrachloroethene) (PCE)	0.005 mg/L		0.0008 mg/L	0.0006 mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Thallium	0.002 mg/L		0.0017 mg/L	0.0001 mg/L [California Public Health Goal for Drinking Water]
Thiobencarb	0.07 mg/L	0.001 mg/L		
Toluene	0.15 mg/L		6.800 mg/L	0.150 [California Public Health Goal for Drinking Water]
Total Dissolved Solids		500 mg/L		
Total Triahalomethanes	0.080 mg/L			
Toxaphene	0.003 mg/L		0.00000073 mg/L	0.00003 mg/L [California Public Health Goal for Drinking Water]
Trans-1,2-Dichloroethylene	0.01 mg/L		0.700 mg/L	0.00060 mg/L [California Public Health Goal for Drinking Water]
Trichloroethylene (TCE)	0.005 mg/L		0.0027 mg/L	0.0017 mg/L [California Public Health Goal for Drinking Water]
Trichlorofluoromethane (Freon 11)	0.15 mg/L			1.3 mg/L [California Public Health Goal for Drinking Water]
Tritium	20000 pCi/L (=4 millirem/yr. dose to total body)			
Turbidity		5 NTU		
Uranium	20 pCi/L			
Vanadium				0.050 mg/L [California DPH Notification Level for drinking water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Vinyl Chloride	0.0005 mg/L		0.002 mg/L	0.00005 mg/L [California Public Health Goal for Drinking Water]
Xylenes	1.750 mg/L			1.80 mg/L [California Public Health Goal for Drinking Water]
Zinc		5.0 mg/L		2.1 mg/L [USEPA IRIS Reference Dose]

A6, Element 6. Project/Task Description

Work statement and produced products

This project will provide background water quality information on agriculturally dominated water bodies by collecting water quality data for up to 18 months in order to account for seasonal changes and water management. The water quality data will be compared to all drinking water criteria as part of an evaluation of potential MUN beneficial use.

Constituents to be monitored and measurement techniques

Field measurements for DO, SC, pH, and temperature will be collected using a YSI 600XLM Sonde (Sonde) and 650MDS. Turbidity measurements will be collected using a portable Hach 2100P turbidimeter. Photo documentation at all monitoring sites will be conducted when collecting field measurements.

Laboratory measurements for the first three months will include: boron, sodium, nitrate as nitrogen, nitrite as nitrogen, total arsenic, volatile organic compounds, total aluminum, total iron, total manganese, and methylene blue active substances (MBAs). In June, selected scans will be measured at effluent sites of POTWs for organo-chlorinated pesticides, Semi-volatiles, chlorinated herbicides, organo-phosphorus pesticides, PCB's, Dioxin, carbamate pesticides, total metals and minerals, ammonia as nitrogen, and total dissolved solids. Analyses will be conducted at Excelchem in Rocklin, CA and Moore Twining Associates in Fresno, CA utilizing the following methods:

EPA method 200.7:

This method will be used to analyzed hardness, barium, antimony, beryllium, cadmium, chromium, nickel, copper, silver, zinc, selenium, boron, sodium, total aluminum, total iron, and total manganese by inductively coupled plasma – mass spectrometry (ICP MS). This method is used for determination of dissolved elements and total recoverable element concentrations in surface waters, drinking water, and wastewaters.

EPA method 200.9:

This method will be used to analyze total lead and thallium by stabilized temperature graphite furnace atomic absorption. This method is used for determination of total recoverable elements in surface water, drinking water, storm runoff, industrial and domestic wastewater.

EPA method 300:

This method will be used to analyze sulfate, chloride, total fluoride, nitrate as nitrogen and nitrite as nitrogen by ion chromatography. This method is used on drinking water, surface water, mixed domestic and industrial wastewaters.

EPA method 5540C:

This method will be used to analyze MBAs or foaming agents by observing the intensity of the cationic dye through ion pair formation. This method is used for drinking water samples.

EPA method 8260B:

This method will be used to analyze volatile organic compounds by gas chromatography/mass spectrometry (GC/MS) in surface water. Organohalides, particularly the trihalomethanes, are present in most chlorinated water systems, especially those using surface waters as a source of supply.

EPA method 8151A:

This method will be used to analyze chlorinated herbicides by capillary gas chromatography (GC) in surface water.

EPA method 8141A:

This method will be used to analyze organo-phosphorus pesticides by capillary gas chromatography (GC) in surface water.

EPA method 8082A:

This method will be used to analyze polychlorinated biphenyls by capillary gas chromatography (GC) in surface water.

EPA method 8290:

This method will be used to analyze polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans by high-resolution gas chromatography and high-resolution mass spectrometry (HRGC/HRMS) on purified sample extracts of surface water.

EPA method 8318:

This method will be used to analyze carbamate pesticides by high performance liquid chromatography (HPLC) in surface water.

EPA method 8081A:

This method will be used to analyze organo-chlorinated herbicides by capillary gas chromatography (GC) in surface water.

EPA method 8270C:

This method will be used to analyze semivolatile organic compounds by gas chromatography/mass spectrometry (GC/MS) on purified sample extracts of surface water.

EPA method 2540:

This method will be used to analyze total dissolved solids by drying in an oven at a defined temperature using a filter on surface water samples.

EPA method 350.2:

This method will be used to analyze ammonia as nitrogen by distillation method on surface water.

EPA method 206.3

This method will be used to analyze total arsenic by gaseous hydride generation – atomic absorption in drinking water.

Project Schedule

The project schedule for the first three months is outlined in Table 4. The quarterly review will determine the next three months (July – September) of monitoring.

Table 4 Field Sampling Project Schedule Timeline

Date	Activity
April 16 – April 18 2012	Field Sampling
April 17 – April 20 2012	Lab Analysis (Excelchem)
April 27 – May 4 2012	Review April data, as available from lab
May 9, 10, 22, 24 2012	Field Sampling
May 23, 25, 30 2012	Lab Analysis (Excelchem)
May 29 – June 1 2012	Review May data, as available from lab
June 5, 7, 19, 21 2012	Field Sampling
June 27, 29 2012	Lab Analysis (Moore Twining)
June 25 – 29 2012	Review June data, as available from lab
July 2 – 13 2012	Quarterly review

Geographical Setting

The Central Valley Region Water Quality Control Plan (Basin Plan) covers the entire area included in the Sacramento and San Joaquin River drainage basins. The basins are bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. The Sacramento River and San Joaquin River Basins cover about one fourth of the total area of the State and over 30% of the State's irrigable land. The Sacramento and San Joaquin Rivers furnish roughly 51% of the State's water supply. Surface water from the two drainage basins meet and form the Delta, which ultimately drains to San Francisco Bay.

The Sacramento River Basin covers 27, 210 square miles and includes the entire area drained by the Sacramento River. All watersheds tributary to the Sacramento River north of the Cosumnes River watershed and the closed basin of Goose Lake and drainage sub-basins of Cache and Putah Creeks are included in the Sacramento River Basin.

The study area of this monitoring is located within the Sacramento River Basin. The POTWs in this project are small communities that discharge into agriculturally dominated water bodies that eventually drain into larger agricultural drains that specifically do not have the MUN beneficial use. The Colusa Basin Drain, Sutter Bypass, and Butte Creek below Chico are all listed in Table II-1 in the Basin Plan as not designated MUN. The Colusa Basin Drain and Sutter Bypass both flow into the Sacramento River, which does have the MUN beneficial use. A map of the study area can be found on Figure 2 of the Monitoring Plan.

Further description of the study area can be found in the monitoring plan located at: http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr.pdf,

Constraints

The primary constraints for this project are personnel, funding, and logistics. Other constraints may be identified throughout the course of the study.

Personnel: Only two Central Valley Water Board staff are currently available for monitoring. Live Oak, Willows, and Biggs wastewater treatment plants are also short-staffed. The limited availability of staff also limits the amount of sites and frequency that can be monitored. City of Colusa staff can take field measurements at a higher frequency at their receiving water sites and effluent site.

Funding: The current budget for contracted analytical work for this study is \$20,000 for the first three months of monitoring (April – June 2012). For monitoring during July 2012 – June 2013 the budget will be \$30,000. Although it is anticipated that the budget will be augmented through the CV-SALTS initiative, until the augmentation, current funding limits the number of sites and constituents that can be analyzed and compared to all drinking water criteria. Sites were chosen in order to characterize receiving waters and based on site accessibility. The key constituents being analyzed are those identified in new NPDES permits for protecting the MUN beneficial use and are based on POTW Reasonable Potential Analysis Reports. Boron and sodium were included as part of the CV-SALTS initiative. In addition, a notification level for drinking water from the Department of Public Health will be used to evaluate boron data. The US EPA drinking water advisory criteria will be used to evaluate sodium data.

Logistics: Logistical constraints include hold times. The sampling sites are 2 to 3 hours from the Central Valley Water Board's closest contracted laboratory. The shortest hold time is 48 hours for Nitrate as Nitrogen, Nitrite as Nitrogen, and MBAs. The Volatile Organic Compound scan has a hold time of 14 days. Boron, total iron, sodium, total aluminum, total arsenic, and total manganese have hold times of 6 months. Once sampling concludes for the day, the samples will be transported to Excelchem Environmental Labs.

A7, Element 7. Quality Objectives and Criteria for Measurement Data

This section contains the measurement quality objectives of this study and includes analyses in the field. Data quality indicators for this study will consist of the following:

Measurement or Analysis Type

Applicable Data Quality Objective

Field Measurements (DO, SC, pH, Temp, turbidity)

Accuracy, Precision, Completeness

Boron, sodium, nitrate as nitrogen, nitrite as nitrogen, volatile organic compounds, MBAs, total: iron, aluminum, fluoride, arsenic, manganese, barium, lead, antimony, beryllium, cadmium, nickel, thallium, copper, silver, zinc, selenium, *E. coli*, total dissolved solids, ammonia as nitrogen, hardness, sulfate, chloride, chlorinated herbicides, organo-phosphorus pesticides, PCB's, dioxin, carbamate pesticides, organochlorine pesticides, and semi-volatiles.

Accuracy, Precision, Contamination, Completeness

There are two types of quality objectives. Measurement Quality Objectives (MQOs) relate to the quality of the measurement itself (e.g. accuracy or precision). The Data Quality Objectives (DQOs) relate to the entire data set its ability to answer a study question (e.g. completeness or representativeness).

DQOs for the proposed project will be based on MQOs for the analytes listed in Table 5. All monitoring data obtained will be kept in Excel files in order to make quarterly reviews easier. The data will eventually be loaded into the California Environmental Data Exchange Network (CEDEN) as resources become available.

The MQOs for field measurements are listed in Table 5.

Additional MQOs for data acceptability, test conditions, water chemistry, and sample handling are listed in Appendix A of the SWAMP QAPP.

MQOs for the equipment used to measure water temperature, dissolved oxygen, specific conductivity, pH, and turbidity in this project are detailed in Table 5. With proper calibration, the range, accuracy, and resolution of each instrument will meet the manufacturer's specifications and meet the MQOs for individual parameters. These parameters are detailed in 7.1 through 7.6.

Accuracy

Accuracy is the measurement of a sample of known concentration and comparing the known value against the measured value. Accuracy is measured by determining the percent recovery of known concentrations of analytes spiked into field sample or reagent water before extraction. This is a laboratory quality assurance that Excelchem Environmental Labs will perform while analyzing water samples.

Precision

Precision is a Data Quality Indicator (DQI) that measures the variability of repeated measurements of the same parameter in the same sample under the same analytical condition. Precision measurements are determined by field and laboratory duplicate samples, and will be evaluated by having the same analyst complete the procedure for duplicate field samples or laboratory duplicates. Our expectation is that duplicate samples will be $\geq 80\%$ concordant (i.e., $\geq 80\%$ agreement between pairs of samples).

YSIs will be used in this study, which automatically take multiple measurements and display an average of the results. Where these types of instruments are used, replicate readings are not necessary. For turbidity, samples will be collected and results recorded in triplicate.

The number of sites where replicates will be collected for field measurements will be 1 for every 10 sites (note that if there are 11 sites there will be 2 sites selected). Analytical precision for key constituent analysis will be evaluated at a frequency of 5% of the total samples for the project for field duplicates for each key constituent.

Contamination

Contamination is the unintentional addition of analytical constituents to a sample or system. To test for contamination during sample transport, a travel blank for each key constituent will be transported with field samples. Travel blanks for each key constituent will be analyzed at a frequency of 5% of the total samples for the project. Laboratory blanks are analyzed per analytical batch

Comparability

Comparability is the degree to which data can be compared directly to similar studies. Methods for field parameters and key constituents are either EPA approved methods or found in Standard Methods.

Completeness

Completeness is the fraction of planned data that must be collected in order to fulfill the statistical criteria of the project. It is expected that 90% of field measurements and analysis of key constituents could be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems. We will determine completeness by comparing the number of measurements we planned to collect compared to the number of measurements we actually collected that were also deemed valid. No analysis at a “dry” site would still be considered a “sample” since part of the effort is to characterize the hydrology of the water bodies. An invalid measurement would be one that does not meet the sampling method requirements and the data quality objectives. Completeness results will be checked for each sampling season. This will allow us to identify and correct problems.

Representativeness

Representativeness describes how relevant the data are to the actual environmental condition. Bias or lack of representativeness can occur if:

- Samples are taken in a stream reach that fails to describe the area of interest,
- Samples are collected in an unusual location, for example: a stagnant pool instead of the flowing portion of the water body,
- Samples are not preserved, stored, or analyzed appropriately, causing conditions in the sample to change

Representativeness and resulting bias are addressed through the overall sampling design. Sites were selected to characterize receiving waters and where hold times could be met. Sample collection specifications are described in Appendix 5.

Method Detection Limit and Sensitivity

The Method Detection Limit is the lowest possible concentration the instrument or equipment can detect. This is important to record because we can never determine that a pollutant was not present, only that we could not detect it. Sensitivity is the ability of the instrument to detect one concentration from the next. Sensitivities (Target Reporting Limits) for field data and lab data are noted in Table 5.

Table 5 Measurement Quality Objectives

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Field Testing (YSI 600XLM)	Dissolved Oxygen	±0.5 mg/L	0.01 mg/L	NA	0.01 mg/L	Saturated air	Each sampling event	90%
Field Testing (YSI 600XLM)	pH	±0.2 unit	0.01 unit	NA	NA	Buffer solutions pH 4, 7, and 10	Each sampling event	90%
Field Testing (YSI 600XLM)	Specific Conductance	±0.5% of reading + 0.001 mS/cm	0.001 to 0.1 mS/cm (range dependent)	NA	0.001 µS/cm	1000 uS/cm standard	Each sampling event	90%
Field Testing (YSI 600XLM)	Water temperature	± 0.15°C	0.01°C	NA	NA	Not required	Not required	90%
Field Testing (Hach 2100P)	Turbidity	±2% of reading or 0.3 NTU, whichever is greater	0.1 NTU	NA	0 to 1,000NTU	StabiCal 2100P	Each sampling event	90%
Laboratory Analysis (Central Valley Regional Board)	Total Coliform and E. coli	P/A	Lab and Field duplicate samples, per SM	Field blank <1	1	NA	NA	90%
Laboratory Analysis	Chloroform	Laboratory Control Spike	Matrix Spike (MS) and Matrix Spike	Lab Blank <RL	0.5 µg/L	NA	NA	95%

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
(ExcelChem Lab)		70-130% REC	Duplicate (MSD) RPD <15					
Laboratory Analysis (ExcelChem Lab)	Bromodichlorom ethane	Laboratory Control Spike 70-130% REC	MS and MSD RPD <15	Lab Blank <RL	0.5 µg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	Dibromochlorom ethane	Laboratory Control Spike 70-130% REC	MS and MSD RPD <15	Lab Blank <RL	0.5 µg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	Bromoform	Laboratory Control Spike 70-130% REC	MS and MSD RPD <15	Lab Blank <RL	0.5 µg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	MBA's	Laboratory Control Spike 90-110% REC	Laboratory Control Spike (LCS) and LCS Dup RPD < 15	Lab Blank <RL	0.100 mg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	Nitrate as Nitrogen	Laboratory Control Spike 80-120% REC	Lab Duplicate RPD < 20	Lab Blank <RL	0.11 mg/L	NA	NA	95%
Laboratory Analysis	Nitrite as Nitrogen	Laboratory Control Spike	Lab Duplicate RPD < 20	Lab Blank <RL	0.15 mg/L	NA	NA	95%

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
(ExcelChem Lab)		80-120% REC						
Laboratory Analysis (ExcelChem Lab)	Total Aluminum	Laboratory Control Spike 85-115% REC	LCS and LCS Dup RPD < 20	Lab Blank <RL	10.0 µg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	Total Arsenic	Laboratory Control Spike 85-115% REC	LCS and LCS Dup RPD < 20	Lab Blank <RL	2.0 µg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	Total Iron	Laboratory Control Spike 85-115% REC	MS and MSD RPD < 25	Lab Blank <RL	20.0 µg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	Total Manganese	Laboratory Control Spike 85-115% REC	MS and MSD RPD < 25	Lab Blank <RL	10.0 µg/L	NA	NA	95%
Laboratory Analysis (ExcelChem Lab)	Sodium	Laboratory Control Spike 85-115% REC	MS and MSD RPD < 25	Lab Blank <RL	200 µg/L	NA	NA	95%

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Lab)								
Laboratory Analysis (ExcelChem Lab)	Boron	Laboratory Control Spike 85-115% REC	MS and MSD RPD < 25	Lab Blank <RL	200 µg/L	NA	NA	95%
Laboratory Analysis (Moore Twining Lab)	Chloroform	Laboratory Control Spike 80-120% REC	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) RPD <20	Lab Blank <RL	0.5 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Bromodichlorom ethane	Laboratory Control Spike 80-120% REC	MS and MSD RPD <20	Lab Blank <RL	0.5 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Dibromochlorom ethane	Laboratory Control Spike 80-120% REC	MS and MSD RPD <20	Lab Blank <RL	0.5 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Bromoform	Laboratory Control Spike 80-120% REC	MS and MSD RPD <20	Lab Blank <RL	0.5 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	MBAAs	Laboratory Control Spike 80-120% REC	Laboratory Control Spike (LCS) and LCS	Lab Blank <RL	0.100 mg/L	NA	NA	90%

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Lab)			Dup RPD < 20					
Laboratory Analysis (ExcelChem Lab)	Nitrate as Nitrogen	Laboratory Control Spike 80-120% REC	Lab Duplicate RPD < 20	Lab Blank <RL	0.11 mg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Nitrite as Nitrogen	Laboratory Control Spike 80-120% REC	Lab Duplicate RPD < 20	Lab Blank <RL	0.15 mg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Total Aluminum	Laboratory Control Spike 80-120% REC	LCS and LCS Dup RPD < 20	Lab Blank <RL	10.0 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Total Arsenic	Laboratory Control Spike 80-120% REC	LCS and LCS Dup RPD < 20	Lab Blank <RL	2.0 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Total Iron	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 20	Lab Blank <RL	20.0 µg/L	NA	NA	90%
	Polychlorinated							

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Laboratory Analysis (Moore Twining)	Biphenyls (PCBs)	Laboratory Control Spike 50-150% REC	MS and MSD RPD < 25	Lab Blank <RL	0.5 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Chlorinated Herbicide	Laboratory Control Spike 50-150% REC	MS and MSD RPD < 25	Lab Blank <RL	0.5 to 2.0 µg/L	NA	NA	90%
Laboratory Analysis (Moore Twining)	Organo- phosphorus pesticide	Laboratory Control Spike 50-150% REC	MS and MSD RPD < 25	Lab Blank <RL	0.05 to 0.20 µg/L	NA	NA	90%
Laboratory Analysis (Moore Twining)	Dioxin/Furan by HRMS	Laboratory Control Spike 50-150% REC	MS and MSD RPD < 25	Lab Blank <RL		NA	NA	90%
Laboratory Analysis (Moore Twining)	Carbamate Pesticide	Laboratory Control Spike 50-150% REC	MS and MSD RPD < 25	Lab Blank <RL	0.005 to 0.250 µg/L	NA	NA	90%
	Organochlorine							

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Laboratory Analysis (Moore Twining)	Pesticide	Laboratory Control Spike 50-150% REC	MS and MSD RPD < 25	Lab Blank <RL		NA	NA	90%
Laboratory Analysis (Moore Twining)	Semi-volatiles by GC/MS	Laboratory Control Spike 50-150% REC	MS and MSD RPD < 25	Lab Blank <RL	0.1 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Dissolved Solids	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	10mg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Ammonia as Nitrogen	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	1mg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Hardness	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	660 µg/L (detection limit)	NA	NA	90%
	Sulfate				2000 µg/L			

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Laboratory Analysis (Moore Twining)		Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	(detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Chloride	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	2000 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Fluoride	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	100 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Barium	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	10 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Lead	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	2 µg/L (detection limit)	NA	NA	90%
	Total Antimony				5 µg/L			

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Laboratory Analysis (Moore Twining)		Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	(detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Beryllium	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	1 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Cadmium	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	1 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Chromium	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	5 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Nickel	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	5 µg/L (detection limit)	NA	NA	90%
	Total Thallium				1 µg/L			

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Laboratory Analysis (Moore Twining)		Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	(detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Copper	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	5 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Silver	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	5 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Zinc	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	5 µg/L (detection limit)	NA	NA	90%
Laboratory Analysis (Moore Twining)	Total Selenium	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 25	Lab Blank <RL	1 µg/L (detection limit)	NA	NA	90%

Group	Parameter	Accuracy	Precision	Recovery/ Sensitivity	Target Reporting Limit	Calibration	Calibration Interval	Complete -ness
Laboratory Analysis (ExcelChem Lab)	Total Manganese	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 20	Lab Blank <RL	10.0 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Sodium	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 20	Lab Blank <RL	200 µg/L	NA	NA	90%
Laboratory Analysis (ExcelChem Lab)	Boron	Laboratory Control Spike 80-120% REC	MS and MSD RPD < 20	Lab Blank <RL	200 µg/L	NA	NA	90%

A8, Element 8. Special Training Needs/Certification

Specialized Training or Certifications

No specialized training or certifications are required for field staff for this project. The California Department of Public Health has certified Excelchem Environmental Labs and Moore Twining Associates, Inc. The QA officers for Excelchem and Moore Twining labs are responsible for overseeing training of lab staff to achieve and maintain high standards of quality.

All staff involved will be familiar with the field guidelines, fully trained in the Rinsing Technique and Sample Collection method of water sample collection and procedures as outlined in the Sample Procedures Manual (Appendix 16). If necessary, additional training will be provided by Central Valley Water Board staff.

Field staff will be required to review the SWAMP training manuals on field measurements and water sampling techniques, sample processing procedures, and the procedures outlined in Appendices 4-8, 15, and 16 of this QAPP, as needed.

Training Personnel

Central Valley Water Board staffs are trained annually on field procedures. Training is overseen by program managers who are responsible for their area of expertise. City of Colusa staff will be trained on how to collect water for turbidity analysis using the Rinsing Technique and Sample Collection method by the monitoring lead.

Training records for the Central Valley Water Board staff are maintained at the Central Valley Water Board office. Laboratory safety manual and safety training records are maintained in the Central Valley Water Board's main lab.

A9, Element 9. Documents and Records

Documents and records generated from this project will be organized and stored in compliance with this QAPP. This will allow for future retrieval, and to specify the location and holding times of all records.

QAPP updates and distribution

All originals of the first and subsequent amended QAPPs will be held at the Central Valley Water Board office by the Monitoring Lead. The Monitoring Lead will be responsible for the distribution of the QAPP and posting to the project website. Any future amended QAPPs will be held and distributed.

Records to be included in data reports

Data reports for each sampling event will include field data, laboratory data, chain of custody forms, and associated QA reports.

All field data will be recorded at the time of completion, using the field data sheets (see Appendix 7).

Samples being sent to the Excelchem Environmental Labs in Rocklin, CA and Moore Twining in Fresno, CA will include a Chain of Custody (CoC) form (Appendices 9 and 10, respectively). Laboratories will generate records for sample receipt and storage, analyses and reporting. All records will be delivered to the Regional Water Board Monitoring Lead, Calvin Yang within 45 days of sample submission.

Persons responsible for maintaining records

The Monitoring Lead will maintain the project file, to include the original QAPP and Monitoring Plan, and subsequent revisions. The project file will also contain correspondence regarding decisions made, data reports, draft project report and final project report.

Electronic records

All data verified by the Monitoring Lead (field measurements) will be entered and stored in Excel spreadsheets. Key constituents data will be verified first by the Laboratory Director for Excelchem or Moore Twining labs. After verification, key constituents data and laboratory QA will be forwarded electronically in PDF format to the Monitoring Lead. All key constituents data will be stored in Excel spreadsheets in order to more readily review the data. The Monitoring

Lead will store the data reports on the Central Valley Water Board network drive, which is backed up nightly.

B1, Element 10. Sampling Process Design

The monitoring will be conducted for up to eighteen months (April 2012 – September 2013) in order to span anticipated hydrologic changes due to seasons (irrigation, non-irrigation, dry, etc.) with the option to review and adapt the effort at quarterly intervals. The first quarterly review in July will determine the monitoring for the final 15 months of sampling. Final design was reviewed by the CV-SALTS Technical Committee.

For all sites, safety and all-weather access are priorities for sampling activities. Based on field and weather conditions, the sampling plan may be modified by the project team during the sampling event to provide for field safety and make the collection accurate and thorough. Any changes will be documented on SWAMP field sheets.

To address the problem statement in A5. Element 5, a sampling design was developed to generate data that would provide input for the decisions and outcomes listed in A5 Element 5. The plan below outlines the proposed approach and is subject to modification as circumstances arise. The project will measure field parameter and key constituents.

Description and Justification for Design Strategy

Answering Key Factors

- *Is the designated use occurring?*
- *Is the water source predominantly wastewater or agricultural return water?*

Review existing water rights permits and conduct a physical survey of the water bodies surrounding the effluent discharges from the POTWs. The physical survey would include evaluation of discharge points and diversions and associated use. .

Interview the POTWs and Irrigation Districts to characterize the water source. Confirm with physical survey.

- *Is there a significant change in hydrology due to seasonality and/or water management?*

Interview irrigation districts and POTWs to document hydrologic changes due to seasonality and/or water management. Identify any continuous flow data within the study area and compile

information. Collect flow information for a minimum of 1-year with the option to extend 6-months depending on initial findings. Flow measurements should be conducted weekly with photographs to complement the findings. Locations for flow measurements should be upstream and downstream of the effluent discharge, the effluent discharge, as well as upstream and downstream of the last water body that receive the effluent discharge and are tributary to the Sutter Bypass or Colusa Basin Drain which are both designated as non-MUN.

Answering the Sources of Drinking Water Policy

- *Do the exceptions of the Drinking Water policy apply?*
 - *Does water source provide an average sustained yield of 200 gallons per day?*

Conduct weekly flow measurements at key monitoring locations. Include photo documentation.

- *Is the water source in a system designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff?*
- *Is the water source in a system designed or modified for the primary purpose of conveying or holding agricultural drainage waters?*

Utilize a combination of physical surveys and interviews with POTWs, Irrigation Districts and local water users/purveyors to determine origin of the water body and dominant use.

- *Does the water body have a contamination, either by natural processes or by human activity that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices?*

Evaluate the water quality data collected for the antidegradation analyses to determine if the water body has a contamination. If a contamination is found in the water body, then interview the POTWs, the agricultural community, and other interested stakeholders to evaluate whether reasonable treatment can be economically achieved.

- *If an exception is applicable, will the discharge (from the system designed to treat wastewater or conveying agricultural water) be monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?*

Sites downstream of the effluent discharge will be monitored to evaluate progressive water quality at confluences with additional agriculturally dominated water bodies. Current long-term monitoring efforts, primarily the Irrigated Lands Regulatory Program, Surface Water Ambient Monitoring Program and Department of Water Resources Water Quality Investigations, will be evaluated to determine whether appropriate compliance points and adequate monitoring are established.

Answering the Anti-degradation Policy

- *Is the anti-degradation analysis for NPDES permit complete?*
 - *If not, what additional information is needed?*

Antidegradation analyses were conducted on all of the permitted discharges when they were re-adopted with a provision to protect the MUN beneficial use. Analysis of the results would provide valuable background information including identifying key constituents of concern and data gaps.

- *Is water quality sufficient to attaining the beneficial use?*
 - *What is the quality of the background water?*
 - *At what point downstream is MUN achievable?*
 - *What are the appropriate constituents to monitor?*

The Basin Plans specify using the Maximum Contaminant Levels (MCLs) specified in provisions of Title 22 of the California Code of Regulations to evaluate protection of MUN. In addition, the California Toxics Rule (CTR) provides human health-based standards for additional constituents. The constituents identified by the regulations are listed in Appendix A. To determine background concentrations and changing water quality moving through the system, water quality analyses will be conducted upstream and downstream of each major inflow. To account for anticipated seasonality, full scans of all constituents will be conducted during 4-key seasons: storm runoff; spring snowmelt; irrigation; and dry season. Monthly scans will be conducted for key constituents identified in previous NPDES evaluations: nitrate; arsenic; total trihalomethanes (THMs); aluminum; iron; manganese; methylene blue active substances (MBAS). Continuation of monthly analyses will be re-evaluated after each seasonal full scan.

- *Do any of the 40CFR131.10(g) Factors occur?*

The 40CFR131.10(G) Factors include naturally occurring pollutant contamination; natural, ephemeral, intermittent or low flow conditions or water levels; irreparable human caused conditions; hydrologic modifications and/or widespread economic impact that would prevent attainment of use. A combination of physical surveys, interviews with POTWs and Irrigation Districts, analysis of past and current water quality data would determine if any of the 40CFR131.10(G) Factors occur. The appropriate constituents to monitor have numerical criteria related to MUN. This includes constituents in the California Maximum Contaminant Levels, human-health based standards in the California Toxics Rule, and flow. The spatial and temporal aspects of the flow and water quality sampling have been described above and are linked to key inflows and seasonal periods where natural and managed hydrology are anticipated to have distinct patterns.

Type and Total Number of Samples

For the first three months, each site will be visited twice per month. For the first instance, field measurements (DO, SC, pH, temperature, and turbidity) and key constituents will be collected. For the second instance, only field measurements will be collected.

A total of 990 samples will be collected for key constituents for the first three months, this includes travel blanks and field duplicates at a frequency of 5% of the total project sample count.

Table 6 List of Constituents within Each Scan

Location	Sites	Constituents	
		Photographs and Field Parameters	Key Constituents of Concern
City of Colusa	Unnamed tributary to Powell Slough, below the first upstream agricultural discharge (up to 50 feet upstream)	2/month	1/month
	Unnamed tributary to Powell Slough, above the first downstream agricultural discharge (up to 200 feet downstream)	2/month	1/month
	Powell Slough, 250 feet upstream from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	2/month	1/month
	Powell Slough, 400 feet downstream from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	2/month	1/month
	New Ditch, upstream of effluent pump station	2/month	1/month
	Colusa Basin Drain, upstream of effluent discharge at Highway 20	2/month	1/month
	Colusa Basin Drain, downstream of effluent discharge at Abel Road	2/month	1/month
	Effluent Pump Station	2/month	1/month
	Powell Slough, upstream of effluent discharge at Highway 20	2/month	1/month
City of Willows	Ag Drain C, Upstream Receiving Water – 1500 feet upstream from D-001	2/month	1/month
	Ag Drain C, Downstream Receiving Water – 100 feet downstream from D-001	2/month	1/month
	Ag Drain C, downstream of effluent discharge before effluent enters Wildlife Refuge at Road 60	2/month	1/month
	Willow Creek, upstream of effluent discharge into Colusa Basin Drain at Road 61	2/month	1/month
	Hunters Creek, upstream of effluent discharge	2/month	1/month
	Logan Creek, downstream of effluent discharge	2/month	1/month
	Colusa Basin Drain, upstream of effluent discharge at Road 61	2/month	1/month
	Effluent - Downstream of the last connection through which wastes can be admitted to the outfall	2/month	1/month
City of Live Oak	Lateral Drain #2, Approximately 50 feet upstream of Discharge Point No. 001 to the receiving water	2/month	1/month
	Lateral Drain #2, Approximately 200 feet downstream of Discharge Point No. 001 to the receiving water or upstream of the next ag drain	2/month	1/month
	Effluent - Location where a representative sample of the facility's effluent can be obtained prior to discharge into the receiving water	2/month	1/month
	Wadsworth Canal, downstream of effluent discharge	2/month	1/month
	Sutter Bypass, upstream of effluent discharge	2/month	1/month
	Sutter Bypass, downstream of effluent discharge	2/month	1/month
City of Biggs	Lateral K – Upstream receiving water sample – 100 feet upstream of Discharge Point D-001	2/month	1/month
	Lateral K – Downstream receiving water sample – 100 feet downstream of Discharge Point D-001	2/month	1/month
	Effluent sample point – pipe	2/month	1/month
	C Main Drain, upstream of effluent discharge at dam before Cherokee Canal	2/month	1/month
	Cherokee Canal, upstream of effluent discharge	2/month	1/month
	Butte Creek, upstream of effluent discharge at Nelson Road	2/month	1/month
	Butte Slough, downstream of effluent discharge at Farman	2/month	1/month

Sampling Location

Sampling sites were chosen in order to characterize receiving waters and be able to determine spatial and temporal extent of potential degradation and/or impairment.

GPS coordinates have been obtained from site reconnaissance done by Central Valley Water Board staff in March 2012.

A description of each sampling site is included in Appendix 1.

Inaccessible Sampling Locations

If sampling locations become inaccessible, field crews will look for an alternate site within 100 yards of the original sampling site. If no alternative site can be located, no sample will be collected.

Project Activity Schedule

Sampling events will take place within the sample collection periods listed in the project schedule in A6 Element 6. Field parameters will be measured on site. Samples to be analyzed in labs will be transported to the respective labs at the end of the field run.

Critical vs. Non-critical Information

All data results for boron, sodium, nitrate as nitrogen, nitrite as nitrogen, MBAs, iron, manganese, aluminum, arsenic, and total trihalomethanes are critical to reaching conclusions that will answer the objectives presented in A5, Element 5. Field constituents (temperature, dissolved oxygen, pH, specific conductance, and turbidity) may prove useful in determining overall conditions. Other information may also prove to be critical, such as photographs documenting dry channels.

Variability – Sources and Reconciliation

Natural variability and water management occurs in this study area. One of the objectives of this study is to evaluate the seasonal and hydrology changes effects on water quality. In order to meet this objective, monitoring will be conducted monthly for a maximum of 18 months.

Bias – Sources and Minimization

Sample misrepresentation happens at the level of an individual sample or field measurement

(e.g., collecting a water sample at a backwater pool that does not represent the bulk of the flow) and will be minimized by using SWAMP compliant training and sampling methods. Representativeness and bias are addressed in more detail in A7, Element 7.

B2, Element 11. Sampling Methods

Grab samples are to be collected at stream banks at the location of greatest flow (at least one inch below the surface) by direct submersion of the sample bottle. Stagnant water will not be sampled and photographs will be taken of the stagnant pool.

Samples will be collected using the Rinsing Technique and Sample Collection located in the Procedures Manual for Water Quality Monitoring (Appendix 6).

Rinsing Technique and Sample Collection:

When rinsing, rinse and discard sample water down-stream of where the sample is to be taken. Try not to disturb sediment or any other debris that could alter the sample. Avoid floating impurities, sediment disturbed by sampling, and organic material.

Stream Bank Grab Sample Collection

1. Remove lid.
2. Submerge bottle into sample water area filling about $\frac{1}{4}$ of the way.
3. Lift sample out of water and move away/downstream from sampling spot.
4. Agitate sample thoroughly, to rinse the inside of the container, and pour out.
5. Repeat Steps 2-4 two more times.
6. Collect the sample by submerging the bottle below the surface of the water and facing it up stream. Be sure to collect a full bottle and not disturb the bottom sediment.
7. Pour a small amount of the sample into the cap for rinsing, discard rinse water, and cap the sample.

The Rinsing Technique and Sample Collection method will be used to fill the 500 mL polyethylene bottles. The 500 mL bottles will be analyzed for MBAs, Total Dissolved Solids, Nitrate as Nitrogen, and Nitrite as Nitrogen.

The 250 mL polyethylene bottles contain nitric acid (HNO₃) and can't be rinsed. A separate 500 mL bottle will be filled using the Rinsing Technique and Sample Collection method. Once the 500 mL bottle is filled, it will then be transferred to the 250 mL bottle. The 250 mL bottles with nitric acid preservative will be analyzed for boron, total iron, sodium, total aluminum, total arsenic, and total manganese.

Three 40 mL VOA vials contain hydrochloric acid (HCL) and also can't be rinsed. The three VOA vials will be used to analyze the full list for volatile organic compounds. A stainless steel cup attached to a metal pole to perform steps 2-6 of the Rinsing Technique and Sample Collection method. The stainless steel cup will then be used to transfer sample water into all three VOA vial until the surface tension builds a meniscus and then capped tightly to avoid bubbles.

Organochlorine pesticides, PCBs, Carbamate pesticides, Organophosphates, Chlorinated Herbicides, Semi-Volatile Organics, and Dioxin analysis will all need to be collected in amber glass containers. The amber glass containers will all contain preservatives, thus the amber glass containers will not be rinsed with sample water. A stainless steel cup attached to a metal pole to perform steps 2-6 of the Rinsing Technique and Sample Collection method. The stainless steel cup will then be used to transfer sample water into the appropriate amber glass container. Carbamate pesticides analysis requires a 120mL amber glass bottle. Dioxin analysis will require two 1 Liter glass amber containers. Chlorinated herbicides, organophosphates, PCBs, organochlorine pesticides, and semi-volatiles analysis each require 1 Liter glass amber containers

Field Preparation

Field run preparation will consist of preparing field sheets (Appendix 7), chain of custody forms (Appendices 9-11), bacteria processing laboratory sheets (Appendix 8), sample labels, sample collection bottles, and verifying equipment functionality and availability.

Central Valley Water Board staff will be responsible for preparing all forms and obtaining sample bottles from Excelchem environmental labs.

On the day of the field run, prior to leaving the office, CVWB field personnel must sign out on the Ag and Surface Water Assessment Unit/Ag Regulatory Planning (ASWAU/ARP) sign out board located in the ASWAU/ARP section. Noting a mobile phone number and providing a map and anticipated schedule for sample collection.

Additionally, prior to leaving the office, CVWB samplers will need to complete the vehicle travel log and check the vehicle's tire pressure, oil, coolant, lights, etc. in order to avoid problems and/or delays while in the field. Report any major maintenance needed to the appropriate personnel and if needed retrieve an alternate truck.

Sample Volume and Bottle Type

Specific conductivity, temperature, pH, and dissolved oxygen will be taken on site and do not require a sample volume or collection bottle.

Turbidity will be analyzed three times using the portable turbidimeter model 2100P from Hach. Sample water will be collected using a stainless steel cup on a metal pole using the Rinsing Technique and Sample Collection method. The sample water will then be transferred from the stainless steel cup to a 15 mL sample cell. The 15 mL sample cell will then be placed into the turbidimeter to analyze for turbidity.

Samples collected for boron, total iron, sodium, total aluminum, total arsenic, and total manganese will be collected in 250 mL plastic bottles that come from Excelchem environmental labs.

Samples collected for nitrate as nitrogen, nitrite as nitrogen, and MBAs will be collected in 500 mL plastic bottles that will come from Excelchem environmental labs.

Samples collected for the volatile organic compound scan will be collected in three 40 mL pre-acidified VOA vials that will be supplied by Excelchem environmental labs. There will be emphasis on no headspace on filling the VOA vials.

Sample Preservation and Holding Times

Samples collected for volatile organic compounds will be collected using containers pre-preserved with hydrochloric acid from Excelchem environmental labs. Water samples analyzed for boron, sodium, iron, aluminum, arsenic, and manganese will be preserved by using Excelchem environmental labs sample bottles containing nitric acid.

All samples to be analyzed in the lab will be preserved on ice at <10°C and transported in coolers (darkness) to the analytical labs.

Sample Equipment

All sample collection items are located in the Central Valley Water Board office. City of Colusa staff will utilize their own equipment when they monitor. Most items are stored in areas specifically designated for the Ag Surface Water and Assessment Unit (ASWAU). The Calibration Room is a laboratory prep room located adjacent to the ASWAU lab, which is separate from the Central Valley Water Board's main lab. Sample collection equipment will consist of the following items:

Safety:

Equipment	Location
Roadside Emergency Kit	Garage ASWAU Locker
Toolbox	Garage ASWAU Locker
First Aid Kit	Garage ASWAU Locker
Jumper Cables	Garage ASWAU Locker
Rain Gear (as needed)	Garage ASWAU Locker
Floatation Vests (1 per sampler)	Garage ASWAU Locker

Field run requirements:

Equipment	Location
Ag/RB/SWAMP Field Books	Calibration Room
Clipboards w/field sheets	Calibration Room
pH/SC Kit (Includes Myron L)	Calibration Room
Bucket (w/ Rope and Insect Repellant)	Garage ASWAU Locker
Potable Water	Garage ASWAU Shelf
Map Books (North + South)	Calibration Room
Shovel	Garage ASWAU Locker
SC Box	Garage ASWAU Shelf
Polyethylene 5-gal Bucket	Garage ASWAU Shelf
Back-up Bottles	Garage ASWAU Shelf
Vehicle Travel Pouch	Admin office (Reserved vehicle)

Sample collection:

Equipment	Location
Camera (charge battery)	Calibration Room
Sample Poles	Garage ASWAU Locker
Sample Coolers (sample containers)	Calibration Room
Ice	Garage Ice Machine
YSI MDS + Sonde	Calibration Room

All field equipment should be checked prior to each field event to verify functionality. In addition, the following procedures apply to selected equipment:

Field monitoring books: The field monitoring books contain summarized monitoring information (e.g. site location maps, contact information, etc.), access keys and emergency information for field personnel and provide directions to and contact information for the analytical laboratories. Should there be any changes made to the monitoring schedules, the field monitoring books will be updated as well.

Field Sheets: Attach the field data sheet to the clipboard with a pencil, extra blank labels, and a photograph sheet of the monitoring sites.

Multipurpose meter/sonde: Retrieve the YSI multi-meter from the calibration room shelf. Record the identification number of the meter/sonde in the space provided on the field data sheet. Make sure the battery is fully charged and the DO membrane is good (i.e. with no bubbles) for the next day's use. Also include in the YSI bag a full service kit and a screwdriver. Included in the full service kit are:

- DO membranes
- Fine sanding disks
- O rings
- KCL Solution
- Grease
- Probe installation tool
- Tube brush
- Q tips
- Batteries

Tracking the YSI meters/sondes used in the field is important for proper maintenance. Calibration of the meter will be conducted the morning of sampling before leaving the office according to the instructions/cheat sheets (as detailed in the Procedures Manual for the San Joaquin River Water Quality Monitoring Program (Draft), July 2008) located in the calibration room cabinets. The YSI will also be checked or recalibrated at the end of the run and any time during the run if values seem not "normal." These results are then recorded on the field data sheet in the space provided (Appendix 7).

A Myron L SC/pH meter should be included as a back-up for the field runs and stored in the pH/SC kit. Calibration of the meter should be conducted prior to use as a back-up. Calibration instructions for the Myron are on the back of the meter

pH/SC kit: The pH/SC kit is an ice chest containing items used for QA/QC during field sampling runs. Reorganize this cooler and augment any supplies as needed. The supplies include:

- SC calibration solution (1417 μ mhos) (1000 ml bottle)
- pH calibration solutions (4, 7, and 10) (1000 ml bottles)
- DI water (1000 ml bottle)
- Tap water (1000 ml bottle)
- Disposable nitrile gloves (in all sizes)
- Waterproof marker, ball-point pen, pencil, safety glasses, paper towels
- Myron L SC/pH meter
- Liquid soap
- Alcohol spray bottle w/extra alcohol
- Stainless steel cup

Sampling poles: Sampling poles are used to retrieve a sample up to six feet from the bank. Extensions are available and should be used as necessary. Additionally, a stainless steel cup attached to a pole by a clamp attachment will be used to collect volatile organic compound samples.

Bucket and rope: A stainless steel bucket (triple rinse) and rope can be used for sampling off a bridge when there is no safe access to the bank or the distance is too great for the extensions. Additionally, the bucket can be used to carry sampling bottles to and from the site.

Cellular telephone: The field crew must have one cellular phone with them in case for emergencies.

Life vests: **Even the best swimmers can succumb to hypothermia.** The ASWAU/ARP has three life vests and additional life vests are available in the office. Life vests should be worn when sampling from bridges, boats, unstable banks, or during periods of extremely high flow.

Toolbox (blue) and road emergency box (red): Periodically inspect the toolbox and road emergency box to ensure that the appropriate contents are present and in working order. Contents are listed below:

Tool Box

Screwdriver, pliers
Flashlight

Graduated cylinder
Duct tape

Utility knife

Chain w/ locks

W-D 40

Sigma tubing

Toilet paper

Spare field keys

Spare C Batteries w/ YSI Cover

Utility Saw

Desiccant

Road Emergency Box

Flares
Reflector triangles

Fire extinguisher

First aid kit

Shovel/spades: Carry a shovel or spade in the truck in case the truck gets stuck and must be dug out.

Boots: Each sampler is responsible for being fit for their own rubber boots. If no boots fit the sampler, it will be necessary to have boots ordered. Hip waders can also be ordered as needed.

Ice: Prepare bags of ice the day prior to sampling and leave these bags inside the ice machine to be pulled by the sampling crew.

Water and food: Drinking water is necessary to maintain normal bodily functions. Bring plenty of water for a day. During the summer, double the amount of water you bring to avoid dehydration. While in the field, convenience food stores are not always available, therefore, pack a lunch and some snacks for the day. **Wash your hands prior to eating as we are**

sampling waterways that may contain unknown contaminants. There are extra water coolers available to carry water for washing hands.

Personal protective gear: It is the responsibility of each sampler to think ahead and watch the weather forecast in order to dress appropriately for field monitoring. Rain gear is available in the ASWAU/ARP locker located in the garage area. Items that you may want to consider bringing from home are:

- Hiking boots
- Heavy coat/sweater/sweatshirt
- Hat
- Warm gloves
- Sunglasses
- Sunscreen

Other personal items: All field personnel will need a CRWQCB identification card that can be obtained from Scott Mills, 916-464-4688. Carry this card in case you are asked to identify yourself by other agencies or the local growers. Money is also helpful for those unexpected necessities.

Double Check: After coolers with samples are placed out in the garage with the appropriate equipment, check all equipment off the checklist. The checklist is located in the garage on the ASWAU shelf.

Sample collection procedures

Sample collection procedures are summarized in Appendix 5.

Responsible person

The Monitoring Lead is ultimately responsible for coordinating field activities. However, staff may be delegated responsibilities for conducting the work to ensure all activities are completed. For instance, Central Valley Water Board staff and/or students may be tasked to prepare field sheets, label sample bottles, and conduct sample collection on field runs.

Any issues that cannot be readily corrected should be brought to the attention of the Monitoring Lead and noted on the field sheet. The Monitoring Lead will be responsible for investigating and resolving the issue.

B3, Element 12. Sample Handling Custody

Maximum Holding Times

Field parameters do not have a holding time since the results will be determined on site. For all key constituent samples, the samples will be immediately placed on ice in a cooler for transport to the laboratories. All samples collected will be directly delivered to Excelchem and BSK Laboratories at the end of the field run, whereas samples will be delivered to Moore Twining Associates via FedEx.

Maximum holding time stated in the Surface Water Ambient Monitoring Program Quality Assurance Program Plan (QAPrP) is 6 months after preservation for boron, iron, sodium, aluminum, arsenic, and manganese. The maximum hold time for volatile organic compounds scan is 14 days. Nitrate as Nitrogen, Nitrite as Nitrogen, and MBAs have a maximum hold time of 48 hours. The data generated from the samples collected are intended to characterize ag dominated water bodies and support evaluating the appropriateness of the MUN beneficial use in agricultural drains.

Sampling Handling

Identification information for each sample will be recorded on the label on the plastic sample bottles when the sample is collected. The same identification information on the bottles utilized for collecting the sample will also be on the field sheet and chain of custody (COC) forms.

Transport

Samples will be stored in coolers with ice, at a temperature of <10°C.

Samples to be analyzed for key constituents will be delivered to:

(April – May Samples)

Excelchem Environmental Labs
1135 W. Sunset Blvd, Suite A
Rocklin, CA 95765
Tel: 916-543-4445

(June Samples)

Moore Twining Associates
2527 Fresno Street
Fresno, CA 93721
Tel: 559-268-7021

Maps to the appropriate laboratories are located within the field monitoring books.

Sample Transfer

Field crews will deliver April and May samples and Chain of Custody (COC) forms to Excelchem staff designated to receive samples. Field crews will deliver June samples and Chain of Custody (COC) forms to Moore Twining staff via FedEx. Samples collected will be verified against field sheets and chain of custody forms. Discrepancies and any additional notes, such as holding time exceedances, incorrect sample identification information, inappropriate sample handling, or missing/inadequate field equipment calibration information, will be noted on the field sheets and chain of custody forms, as needed by the staff receiving the samples.

Sample Handling and Custody Documentation

All samples will be handled so as to minimize contamination. Sample containers will be clearly labeled. All caps and lids will be checked for tightness prior to transport. Samples will be placed in the ice chests with enough ice, or other packing, to include empty sample collection bottles, to completely fill the ice chest. Chain of custody forms will be placed in an envelope and taped to the top of the ice chest or they may be placed in a plastic bag and taped to the inside of the ice chest lid. Samples will be handled using aseptic technique so as to minimize chance for contamination.

Responsible Individuals

The Monitoring Lead and Lab Director will have ultimate responsibility for ensuring samples are properly handled and transferred. However, it is also the responsibility of the persons collecting, relinquishing, and receiving samples to initially verify correct sample handling and transfer.

Sample Identification

Appendix 3 details the sample ID conventions, information that will be included on each bottle, and how samples will be labeled.

Chain of Custody Procedures

Field measurements do not require specific custody procedures since they will be conducted on site at the sample collection location.

Copies of chain of custody forms and all field sheets will be kept in a MUN project binder in the Monitoring Lead's office.

B4, Element 13. Analytical Methods and Field Measurements

Field and Lab Analytical Procedures

Table 7 Field and Laboratory Analytical Methods

Analyte	Project Action Limit (units, wet or dry weight)	Project Reporting Limit (units, wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
			Analytical Method/ SOP	Modified for Method yes/no	MDLs (1)	Method (1)
Central Valley Regional Board						
DO	NA	NA	360.1	No	NA	NA
SC	NA	NA	b/120.1	No	NA	NA
pH	NA	NA	a/150.1	No	NA	NA
Temp	NA	NA	Temperature	No	NA	NA
Turbidity	NA	NA	*SM 2130B / EPA 180.1	No	NA	NA
ExcelChem Environmental Labs						
Boron	NA	50.0 µg/L	ICP or MS	No	0.8 µg/L	EPA 200.7
Sodium	NA	200 µg/L	ICP or MS	No	120 µg/L	EPA 200.7
Aluminum	NA	50.0 µg/L	ICP or MS	No	24.5 µg/L	EPA 200.7
Arsenic	NA	10.0 µg/L	ICP or MS	No	1.0 µg/L	EPA 200.7
Iron	NA	20.0 µg/L	ICP or MS	No	11.5 µg/L	EPA 200.7
Manganese	NA	10.0 µg/L	ICP or MS	No	0.6 µg/L	EPA 200.7
Chloroform	NA	0.5 µg/L	GC/MS	No	0.1 µg/L	EPA 8260B
Bromodichloromethane	NA	0.5 µg/L	GC/MS	No	0.1 µg/L	EPA 8260B
Dibromochloromethane	NA	0.5 µg/L	GC/MS	No	0.08 µg/L	EPA 8260B
Bromoform	NA	0.5 µg/L	GC/MS	No	0.1 µg/L	EPA 8260B

Analyte	Project Action Limit (units, wet or dry weight)	Project Reporting Limit (units, wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
			Analytical Method/SOP	Modified for Method yes/no	MDLs (1)	Method (1)
MBAAs	NA	0.100 mg/L	Wet Chemistry	No	0.0600 mg/L	SM5540C
Nitrate as Nitrogen	NA	0.11 mg/L	Ion Chromatography	No	0.02 mg/L	EPA 300.0
Nitrite as Nitrogen	NA	0.15 mg/L	Ion Chromatography	No	0.02 mg/L	EPA 300.0
Moore Twining Associates						
Boron	NA		ICP or MS	No	50 µg/L	EPA 200.7
Sodium	NA		ICP or MS	No	1000 µg/L	EPA 200.7
Total Dissolved Solids	NA		Dried at 180°C	No	10000 µg/L	EPA 2540
Ammonia as Nitrogen	NA		Ion Chromatography	No	1 µg/L	EPA 350.2
Hardness	NA		ICP or MS	No	660 µg/L	EPA 200.7
Sulfate	NA		Ion Chromatography	No	2000 µg/L	EPA 300
Chloride	NA		Ion Chromatography	No	2000 µg/L	EPA 300
Fluoride	NA		Ion Chromatography	No	100 µg/L	EPA 300
Barium	NA		ICP or MS	No	10 µg/L	EPA 200.7
Lead	NA		ICP or MS	No	2 µg/L	EPA 200.9
Antimony	NA		ICP or MS	No	5 µg/L	EPA 200.7

Analyte	Project Action Limit (units, wet or dry weight)	Project Reporting Limit (units, wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
			Analytical Method/SOP	Modified for Method yes/no	MDLs (1)	Method (1)
Beryllium	NA		ICP or MS	No	1 µg/L	EPA 200.7
Cadmium	NA		ICP or MS	No	1 µg/L	EPA 200.7
Chromium	NA		ICP or MS	No	5 µg/L	EPA 200.7
Nickel	NA		ICP or MS	No	5 µg/L	EPA 200.7
Thallium	NA		ICP or MS	No	1 µg/L	EPA 200.9
Copper	NA		ICP or MS	No	5 µg/L	EPA 200.7
Silver	NA		ICP or MS	No	5 µg/L	EPA 200.7
Zinc	NA		ICP or MS	No	5 µg/L	EPA 200.7
Selenium	NA		ICP or MS	No	1 µg/L	EPA 200.7
Aluminum	NA		ICP or MS	No	50 µg/L	EPA 200.7
Arsenic	NA		ICP or MS	No	2 µg/L	EPA 206.3
Iron	NA		ICP or MS	No	100 µg/L	EPA 200.7
Manganese	NA		ICP or MS	No	5 µg/L	EPA 200.7
Chloroform	NA		GC/MS	No	0.1 µg/L	EPA 8260B
Bromodichloromethane	NA		GC/MS	No	0.1 µg/L	EPA 8260B
Dibromochloromethane	NA		GC/MS	No	0.1 µg/L	EPA 8260B
Bromoform	NA		GC/MS	No	0.1 µg/L	EPA 8260B
Chlorinated Herbicide	NA		GC	No		EPA 8151A
Organo-phosphorus Pesticide	NA		GC	No		EPA 8141A
PCB's	NA		GC	No	0.5 µg/L	EPA 8082A

Analyte	Project Action Limit (units, wet or dry weight)	Project Reporting Limit (units, wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
			Analytical Method/SOP	Modified for Method yes/no	MDLs (1)	Method (1)
Dioxin/Furan	NA		HRMS	No		EPA 8290
Carbamate Pesticide	NA		HPLC	No		EPA 8318
Organo-chlorine Pesticides	NA		GC	No		EPA 8081A
Semi-volatiles	NA		GC/MS	No	5 µg/L	EPA 8270C

(*) Standard Methods for the Examination of Water and Wastewater, 20th edition.

Instruments to be used in Field

Field measurements for DO, EC, pH, and temperature will be collected using the YSI 600XLM Sonde and 650 MDS or the YSI Professional Plus Multiparameter Meter with the Quatro Cable Assembly. A probe guard will be attached at the end of the YSI to avoid fouling and protect the probes. If using the probe guard is not sufficient, the YSI may be hung by the bail from a sampling pole while the probe readings stabilize and are recorded.

Turbidity measurements will be collected using the Hach 2100P turbidimeter. Samples will be collected by using a stainless steel cup that is attached to a sampling pole and then poured into the glass vial. Care will be taken to minimize disturbance of the bottom of the stream bed. Should sediment be disturbed as a result of sample collection activities, the sampler will wait for the sediment to wash downstream before collecting the sample.

Equipment to be used for laboratory analysis

Equipment to be used for analysis of total metals and minerals:

- Inductively Coupled Plasma (ICP)/Mass Spectrophotometer (MS)
- Laboratory ware
- Air displacement pipets
- Analytical balance
- Sample preparation apparatus
- Clean hood

Equipment to be used for analysis of poly-chlorinated-dibenzo-p-Dioxin/Furan (HRMS):

High Resolution Gas Chromatograph/High-Resolution Mass Spectrometer/Data System
(HRMS)

GC Injection Port

Gas Chromatography/Mass Spectrometer

Mass Spectrometer

Data System

GC Columns

Equipment to be used for analysis of Carbamate Pesticides:

High Performance Liquid Chromatography (HPLC)

HPLC system

C-18 reverse phase HPLC column

Post Column Reactor with two solvent delivery systems

Fluorescence detector

Equipment to be used for analysis of volatile organic compounds, pesticides, herbicides:

Purge and trap system

Purging device

Trap

Gas chromatograph (GC)

Capillary GC columns

Column 1, 2, 3, 4

Mass spectrometer

Purge and trap – GC/MS interface

Data system

Syringes

Syringe valves

Microsyringes

Bottles

Equipment to be used for analysis of MBAs (Foaming Agents):

Colorimetric equipment

Spectrophotometer

Filter photometer

Separatory funnels

Equipment to be used for analysis of Nitrate and Nitrite as Nitrogen:

Spectrophotometer
Filter photometer (Nitrite as N analysis only)

Method Performance Criteria

Unless otherwise noted, SWAMP reporting limits do not exist for constituents to be monitored in this study.

YSI 600 XLM Probes

(https://www.yesi.com/DocumentServer/DocumentServer?docID=EMS_S_XO)

Temperature

Sensor Type	Thermistor
Range	-5 to 50°C
Accuracy	±0.15 °C
Resolution	0.01°C
Depth	200 meters

Rapid Pulse Dissolved Oxygen, mg/L (Calculated from %air saturation, temperature and salinity)

Sensor Type	Rapid Pulse – Clark type, polarographic
Range	0 to 50 mg/L
Accuracy	0 to 20 mg/l, ±2% of the reading or 0.2 mg/L, whichever is greater 20 to 50 mg/L, ±6% of the reading
Resolution	0.01mg/L
Depth	200 meters

pH

Sensor Type	Glass combination electrode
Range	0 to 14 units
Accuracy	±0.2 units
Resolution	0.01 units
Temperature range	-5 to 50°C
Depth	200 meters

Conductivity

Sensor Type	4 electrode cell with autoranging
Range	0 to 100 mS/cm
SWAMP RL	2.5mS/cm

Accuracy	±0.5% of reading +0.001 mS/cm
Resolution	0.001 mS/cm to 0.1 mS/cm (range dependent)
Temperature Range	-5 to 60°C
Depth	200 meters

YSI Professional Plus Probes

<http://www.ysi.com/media/pdfs/W14-ProPlus.pdf>

Temperature

Sensor Type	Field Rugged Cables
Range	-5 to 70°C
Accuracy	±0.2°C
Resolution	0.1°C

Dissolved Oxygen, mg/L (temp comp range -5 to 45°C)

Sensor Type	Polarographic or Galvanic
Range	0 to 50 mg/L
Accuracy	0 to 20 mg/L (±2% of the reading or 0.2 mg/L, whichever is greater)
Resolution	0.1 or 0.01 mg/L (user selectable)

Conductivity

Sensor Type	Four electrode cell
Range	0 to 200 mS/cm (auto range)
Accuracy	±0.5% of reading or 0.001 mS/cm, whichever is greater
Resolution	0.001 mS/cm to 0.1 mS/cm (range dependent)

pH

Sensor Type	Glass Combination Electrode
Range	0 to 14 units
Accuracy	±0.2 units
Resolution	0.01 units

Hach 2100P Turbidimeter

http://www.hach.com/fmmimghach?/CODE%3AL1619_09-0713836%7C1

Method	EPA Method 180.1 (Nephelometric Ratio)
Range	0 to 1000 NTU
SWAMP RL	0.5 NTU
Accuracy	±2% of reading plus stray light
Precision	±1% of reading, or 0.01 NTU, whichever is greater
Resolution	0.01 on lowest range
Temperature Range	0 to 50°C

Depth	200 meters
Sample Required	15 mL
Sample Cells	60X25 mm borosilicate glass with screw caps

Corrective Actions

When failures in the laboratory occur, the Monitoring Lead, QA officer, and Lab Director will each be responsible for corrections in their respective laboratories. All failures will be documented on the field sheet and with the data report, along with the corrective action that was made. Additionally, corrections will be annotated in any applicable maintenance logs.

Sample Disposal Procedures

All samples collected will be transferred to the appropriate lab. The laboratories will properly dispose of water samples after three months upon receipt of samples.

Laboratory Turnaround Times

Laboratory test results will be available within 2 weeks of sample receipt by the laboratory.

B5, Element 14. Quality Control

This section describes the field quality control samples to be used in this study.

Table 8 Quality Control Checks

QC Check	Information Provided
BLANKS	
Travel blank	Transport bias
Laboratory blank	Assessment of background level of target analyte resulting from sample preparation and analysis
CALIBRATION CHECK SAMPLES	
Zero check	Calibration drift and memory effect
Span check	Calibration drift and memory effect
Mid-range check	Calibration drift and memory effect
REPLICATES	
Field replicates	Precision of all steps after acquisition
Laboratory replicates	Analytical precision

Quality Control Samples

Laboratory quality control samples (laboratory blank, laboratory control spike, laboratory control spike duplicate, matrix spike, matrix spike duplicate, laboratory duplicate, and surrogates) will be created by Excelchem Environmental Labs and Moore Twining Associates to be analyzed with field samples. Specific field quality control sample types are described below.

Laboratory Blank

Laboratory blanks (also known as method blanks) provide bias information on possible contaminants for the entire laboratory analytical system. These samples will be made from sterile purified water that is known to have no detectable levels of the target analytes. Laboratory blanks will be analyzed along with the project samples to document background contamination of the analytical measurement system. The lab results must be less than the Reporting Limit of the target analytes to be acceptable.

Matrix Spike and Matrix Spike Duplicate

Matrix spikes and matrix spike duplicates measure precision and accuracy by determining if the methodology is in control for the particular matrix being analyzed. Matrix spikes are client samples to which a known amount of analyte has been added prior to sample extraction/digestion and instrumental analysis. The lab results must have percent recoveries between 80-120% and the matrix spike duplicate must have a relative percent difference below 25% to be acceptable.

Laboratory Control Spike and Laboratory Control Spike Duplicate

Laboratory control spike and laboratory control spike duplicates measure accuracy by determining if the methodology has been performed to meet criteria established by regulation, method or laboratory control chart data. Laboratory control spikes (LCS) and LCS duplicates are generated by spiking the analyte into a relatively inert matrix. The lab results must have percent recoveries between 80-120% and the LCS duplicate must have a relative percent difference below 25% to be acceptable.

Surrogates

Surrogates are utilized in organic analytical methods in order to measure precision. Surrogates are organic compounds which behave similarly to the analytes of interest, but are not normally found in environmental samples. Lab results must have percent recoveries between 70-130%

Calibration Check Samples

Field measurement equipment will be checked for calibration against standards of known concentrations for pH and SC. Checks will be run at the beginning of the field run, after ten samples, and/or at the end of the field run.

Travel Blank

Travel blanks help isolate contamination associated with sample transport. Travel blanks are not opened during the sample collection. These blanks are created by using deionized water from the Central Valley Water Board Lab to fill sample containers. Travel blanks will be preserved, packaged, and sealed exactly like the surface water samples and will be submitted blind to the lab. The lab results must be less than the reporting limit of the target analytes to be acceptable.

Field Duplicates

Field duplicates shall be collected immediately following the collection of normal samples. In cases where multiple intermediate bottles are used for a single analysis, field duplicates and normal sample containers should be filled in an alternating sequence (i.e., normal-duplicate-normal-duplicate). Field duplicates should be submitted “blind” to the laboratories. Five percent of total project sample count will be managed for field duplicates.

Laboratory Duplicates

Laboratory duplicates provide precision information on the analytical methods with the target analytes. The laboratory will generate the duplicate samples by splitting one sample for duplicate analysis. Lab results must have a relative percent difference (RPD) less than 25.

Quality Assurance Frequency of Analysis and Measurements Quality Objectives

Quality control checks above will be conducted at the frequencies described below. Evaluation will be based on the measurement quality objectives listed in Table 9:

Table 9 Quality Assurance Frequency of Analysis and Measurement Quality Objectives

LABORATORY QUALITY CONTROL	FREQUENCY OF ANALYSIS	MEASUREMENT QUALITY OBJECTIVE
Matrix Spike and Matrix Spike Duplicate	10% of samples	75-125% Recovery RPD < 25
Laboratory Control Spike and Laboratory Control Spike Duplicate	10% of samples	75-125% Recovery RPD < 25
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Laboratory Duplicate	Per 10 samples	RPD < 25%
Surrogates (VOC analysis)	All samples and Lab QA	70-130% Recovery
FIELD QUALITY CONTROL	FREQUENCY OF ANALYSIS	MEASUREMENT QUALITY OBJECTIVE
Field Duplicate	5% of total project sample count	RPD < 25%
Travel Blank	Per method	Blanks <RL for target analyte

Corrective Actions

The Contract Manager/QA officer is ultimately responsible for ensuring samples meet QA requirements and that appropriate corrective actions are followed. However, this does not exclude the Excelchem Environmental Labs Lab Director and QA Officer from maintaining responsibility for following QA/QC procedures for analyses conducted by Excelchem personnel.

The following table identifies QC samples and the corresponding corrective actions to be taken should problems arise.

Table 10 Corrective Actions

Laboratory Quality Control	Corrective Action
Matrix Spike and Matrix Spike Duplicate	If it is determined that there is a matrix effect, analyses may be resumed. Otherwise, analyses are suspended while the issue is resolved.
Laboratory Control Spike and LCS Duplicate	If LCS or LCS Duplicate fail, the data can be reported with a qualifier (Moore Twining). If acceptable recoveries are not obtained, further analyses are halted until a cause can be identified and corrective action taken.
Surrogate Spikes	Analyses are suspended while the issue is resolved.
Laboratory Blank	The source of the contamination investigated and corrected if possible. Flag associated samples as determined by the Monitoring Lead.
Laboratory Duplicate	Investigate possibility of analyst error.
Field Quality Control (Bacteria)	Corrective Action
Field Duplicate	Investigate possibility of analyst error.
Travel Blank	If contamination of the travel blanks and associated samples is known or suspected, the laboratory should qualify the affected data, and notify the Project Lead and/or Monitoring Lead, who in turn will follow the process detailed in the method.
Field Quality Control (Field measurements)	Corrective Action
DO, SC, pH, Temperature, Turbidity	The instrument should be recalibrated following its manufacturer's cleaning and maintenance procedures. If measurements continue to fail measurement quality objectives, affected data should not be reported and the instrument should be returned to the manufacturer for maintenance. All troubleshooting and corrective actions should be recorded on the Central Valley Water Board field sheet (Appendix 7)

B6, Element 15. Instrument/Equipment Testing, Inspection, and Maintenance

Periodic Maintenance

Field measurement equipment will be checked in accordance with the manufacturer's specifications. This includes battery checks and cleaning. All equipment will be inspected when first handed out and when returned from use for damage. Equipment will be maintained in accordance with its SOPs, which include those specified by the manufacturer and those specified by the method used in this study.

Field equipment inspection is carried out prior to each trip in the field. Testing is not conducted if equipment appears visibly worn or if field technicians report problems with the equipment upon returning from the field.

Laboratory instruments at Excelchem are calibrated at specified frequency and within acceptance limits published by EPA. In cases in which specific guidelines are not available, Excelchem applies either the manufacturer's recommended guidelines or in-house guidelines.

Laboratory instruments at Moore Twining Associates are maintained and noted in logbooks. The logbook is used to document all routine maintenance and any repairs performed on the instrument. Many logbooks contain a maintenance schedule with suggestions as to when certain components should be cleaned and replaced.

Testing Criteria

See table 11 Testing, Inspection, and Maintenance of Sampling Equipment and Analytical Instruments. See Appendices 12-14 for equipment testing at each laboratory.

Persons Responsible for Testing, Inspection, and Maintenance

The Monitoring Lead is responsible for ensuring equipment relevant to their team is properly tested, inspected and maintained. Staff may be delegated the responsibilities of carrying out these tasks.

Spare Parts

Location of spare parts for each piece of equipment is listed in Table 11 Testing, Inspection, and Maintenance of Sampling Equipment and Analytical Instruments. See Appendices 12-14 for equipment testing at each laboratory.

Deficiencies

If deficiencies are found, the necessary maintenance will be performed and then the equipment will be re-calibrated and re-inspected. A pre- and post-calibration will be run to determine if the problem has been fixed. If this does not correct the problem, then the equipment will be taken out of use and sent to the manufacturer for servicing. Deficiencies that cannot be immediately corrected will be annotated on the field sheets, as applicable, and noted in the maintenance/calibration logs.

Table 11 Testing, Inspection, Maintenance of Sampling Equipment

Group	Equipment / Instrument	Maintenance Activity, Testing Activity or Inspection Activity	Responsible Person	Testing/ Inspection Frequency	Location of Spare Parts	SOP Reference
Central Valley Water Board	pH probe (YSI)	Calibration Check	Monitoring Lead	Per field run	Calibration Room	YSI User's Manual
	DO probe (YSI)	Calibration Check	Monitoring Lead	Per field run	Calibration Room	YSI User's Manual
	EC probe (YSI)	Calibration Check	Monitoring Lead	Per field run	Calibration Room	YSI User's Manual
	Temperature probe (YSI)	Inspection	Monitoring Lead	Per field run	Calibration Room	YSI User's Manual
	Hach 2100P turbidimeter	Calibration Check	Monitoring Lead	Per field run	Calibration Room	Hach User's Manual
	Incubator	Temperature check	Contract Manager	Per field run	Order as needed	Fisher Scientific, Binder User's Manuals
	UV Lamp	Inspection	Contract Manager	Per field run	Spare UV Lamp located in main Central Valley Water Board lab	Central Valley Water Board Bacteria Monitoring Procedures
	Sealer	Cleaning, Inspection	Contract Manager	Monthly	Order as needed	Idexx Sealer Manual

B7, Element 16. Instrument/Equipment Calibration and Frequency

All equipment and instruments are operated and calibrated according to the manufacturer's recommendations. Operation and calibration are performed by personnel properly trained in these procedures. Documentation of all calibration information is recorded in the appropriate logs. If equipment is not meeting the listed criteria (Table 11) it is the responsibility of the field crews to notify the Monitoring Lead, Project Lead, and QA Officer, who will be responsible for addressing the problem. Correction may include repair or replacement of equipment. All corrective actions are documented in the appropriate log.

Table 12 Calibration of Sampling Equipment

Group	Equipment / Instrument	SOP reference	Calibration Description and Criteria	Frequency of Calibration	Responsible Person
Central Valley Water Board	pH probe (YSI)	YSI User Manual	pH 7: ± 0.2 pH MV 4: +177 pH MV 7: ± 50 pH MV 10: -177	Per field run	Monitoring Lead
	DO probe (YSI)	YSI User Manual	Charge: 50 ± 25 Gain: -0.7 – 1.4	Per field run	Monitoring Lead
	EC probe (YSI)	YSI User Manual	Sp. Cond.: ± 20 Cal Const.: 5.0 ± 0.45	Per field run	Monitoring Lead
	Temperature probe (YSI)	YSI User Manual	YSI User manual	Per field run	Monitoring Lead
	Hach 2100P turbidimeter	Hach User Manual	$\pm 1\%$ of standard concentration	Per field run	Monitoring Lead

B8, Element 17. Inspection/Acceptance of Supplies and Consumables

Upon receipt and prior to use, all calibration standards will be inspected by the field staff for broken seals and to compare the age of each reagent to the manufacturer's designated shelf life.

The Monitoring Lead, Project Lead, and QA Officer are each responsible for inspection and acceptance of supplies and consumable used by their respective portions of this study.

Details for each consumable are included in Table 13.

Table 13 Inspection/Acceptance Testing Requirements for Consumables and Supplies

Project-Related Supplies / Consumables*	Inspection / Testing Specifications	Acceptance Criteria	Frequency	Responsible Individual
pH 7 Calibration Solution	Used to calibrate pH probe on YSI	Bottle tightly closed	Upon arrival and prior to use	Monitoring Lead
pH 4 Calibration Solution	Used to calibrate pH probe on YSI	Bottle tightly closed	Upon arrival and prior to use	Monitoring Lead
pH 10 Calibration Solution	Used to calibrate pH probe on YSI	Bottle tightly closed	Upon arrival and prior to use	Monitoring Lead
1417 Calibration Solution	Lowest solution used to calibrate conductivity probe on YSI	Bottle tightly closed	Upon arrival and prior to use	Monitoring Lead

B9, Element 18. Non-Direct Measurements (Existing Data)

Existing Data

Data Quality Indicators (DQIs) will be used to judge whether the external data meets acceptance criteria. These include, for example, precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity.

Measurement performance information such as method detection limits (MDLs), method quantification levels, and the selectivity of a method (or lack of sensitivity) for the target analytes will be used to judge whether the external data meets acceptance criteria.

Acceptance of external data for use will depend on the relevance of the matrix, location of the samples, and the methods that were used for collection and/or analysis (for example, field versus laboratory-based methods, the method of collection and analysis, etc.).

Water chemistry and field measurement data collected through this project will be stored in Excel spreadsheets until more resources become available. Additionally, data collection stations for parameters such as flow and precipitation can be accessed through the California Data Exchange Center (<http://cdec.water.ca.gov>). Where appropriate, this data may be assessed in this study in order to better characterize long term trends.

Usage Limits

If and when external data does not meet acceptance criteria, it will, at the very least, be flagged as such. Flagged data may possibly be used under some conditions, but its use will be limited and clearly designated.

B10, Element 19. Data Management

Data will be maintained as established in Element 9 above. All data from this study will be stored in excel files until resources are available to transfer the information to a statewide data base.

The Monitoring Lead maintains overall responsibility for proper data handling. Specific tasks may be delegated to other participants in this study. The Monitoring Lead will keep hard copies of monitoring related project documents in a dedicated binder. Monitoring related documents include: the Monitoring Plan (MP), the Quality Assurance Project Plan (QAPP), field logs, field data forms, COC forms and laboratory reports.

Data/Information Handling and Storage

Recording, transcribing, digitizing, and downloading data

Central Valley Water Board staff will prepare field sheets (Appendix 7) prior to the field run to include sample run and sample location identification information. The sheets will be printed on waterproof paper.

Field crews will record observations and field measurement data at the sampling locations, using pencil. Prior to leaving the field site, field data sheets will be checked for completeness and accuracy.

Transmittal

See A9, Element 9

Management

See A9, Element 9

Storage

See A9, Element 9.

Retrieval

The main contact for records will be through the Monitoring Lead, who will maintain the official project file. Contact information can be found in Table 2, A4, Element 4.

Computerized Information System Maintenance

Official electronic files will be maintained by the Monitoring Lead once the data reports are received. The file will be located on the Central Valley Water Board network at T:\R5S Sections\Irrigated Lands Assessment Planning\A Cross Section\Ag Dominated WBs\MUN POTWs\Monitoring Data_Info.

The Central Valley Water Board Information Technology unit performs backup nightly on all network drives.

SWAMP Information Management Systems

Field measurement and key constituents data will be verified as meeting QA/QC requirements by the Monitoring Lead. Once the data is verified acceptable, it will be entered into Excel spreadsheets by the Monitoring Lead.

C1, Element 20. Assessments and Response Actions

Assessment and oversight involves field activities to ensure that the QA Project Plan is being implemented as planned and that the project activities are on track. By implementing proper assessment and oversight, finding critical problems toward the end of the project is minimized, when it may be too late to apply corrections to remedy them.

Two types of assessments may be used in this project: field assessments and laboratory assessments.

Field assessments will include:

- Readiness reviews to verify field teams are properly prepared prior to starting field activities;
- Field activity audits to assess field team activities during their execution; and
- Post sampling event reviews to assess field sampling and measurement activities methodologies and documentation at the end of all events or a selected event.

Laboratory assessments may involve two types of activities:

- Data reviews of each data package submitted by a laboratory; and
- Audits of laboratory practices and methodologies.
 - Field duplicates and travel blanks will be submitted blind to the laboratories to assess precision and contamination.

Project Assessments

Readiness reviews will be conducted prior to each sampling run by the Monitoring Lead. All sampling personnel will be given a brief review of the goals and objectives of the sampling event and the sampling procedures and equipment that will be used to achieve them. Readiness reviews will consist of the following activities:

- Equipment checks – It is important that all field equipment be clean and ready to use when it is needed. Therefore, prior to using all sampling and/or field measurement equipment, each piece of equipment will be checked to make sure that it is in proper working order.
- Equipment maintenance records – Equipment maintenance records will be checked to

ensure that all field instruments have been properly maintained and that they are ready for use.

- Supply checks – Adequate supplies of all items in B2, Element 11 will be checked before each field event to make sure that there are sufficient supplies to successfully support each sampling event.
- Paperwork checks – It is important to make sure that all field activities and measurements are properly recorded in the field. Therefore, prior to starting each field event, necessary paperwork such as field sheets, chain of custody record forms, etc. will be checked to ensure that sufficient amounts are available during the field event.

Field activity audits are held per the Central Valley Water Board's Procedures Manual to assess the sample collection methodologies, field measurement procedures, and record keeping of the field crew in order to ensure that the activities are being conducted as planned and as documented in this QAPP.

Post sampling event reviews will be conducted by the Monitoring Lead following each sampling event in order to ensure that all information is complete and any deviations from planned methodologies are documented. Activities include reviewing field measurement documentation in order to help ensure that all information is complete.

Laboratory data review will be conducted by Excelchem's or Moore Twining's QA Officer (depending on where sample goes for analysis) upon receipt of data from each lab. Data will be checked for completeness, accuracy, specified methods were used, and that all related QC data was provided with the sample analytical results.

Laboratory audits will include blind sample submission to the labs by the monitoring lead for each sampling run. The results of the lab's analysis will be compared to the known analytes (e.g. lab blanks) or acceptable ranges (e.g. lab duplicates)

Assessment Reports

Separate assessment reports will not be generated for readiness reviews, field activity audits, or post sampling event reviews. Instead, problem areas such as sample collection or transport of samples will be notated on field sheets. The monitoring lead will be responsible for correcting or minimizing the problem for the next sampling event after reviewing the notes on the field sheets.

Laboratory assessment information (data review and audit) will be included in the laboratory data sets.

Corrective Actions

If a problem arises, prompt action to correct the immediate problem and identify its root causes is imperative. Any related systematic problems must also be identified.

Problems regarding field data quality that may require corrective action will be documented in the field data sheets. Deficiencies that cannot be immediately corrected will be noted on the Central Valley Water Board field sheet and brought to the attention of the Monitoring Lead. The Monitoring Lead will coordinate with the Central Valley Water Board staff to correct the deficiencies. The results of the resolution of the discrepancy will be documented in writing on the field sheet and on a separate log that will be kept in the project file.

Individual laboratory data quality will be reviewed by the Monitoring Lead and QA officer. Deficiencies and corrective actions taken will be noted on the Excelchem report and on the Excel spreadsheets to which the data will be transferred. Overall laboratory data quality will be reviewed by the QA Officer.

The Monitoring Lead, Project Lead, and QA Officer have the authority to issue stop work orders to stop all sampling and analysis activities until the discrepancy can be resolved.

C2, Element 21. Reports to Management

Interim and Final Reports

The Excelchem Lab Director will review draft reports to ensure the accuracy of data analysis and data interpretation.

Table 14 QA Management Reports

Type of Report	Frequency	Projected Delivery Dates(s)	Person(s) Responsible for Report Preparation	Report Recipients
Data report	Per field run	7 days after receipt of samples	Excelchem Lab Director	Monitoring Lead, QA Officer

Quality Assurance Reports

Separate quality assurance reports will not be generated. Quality assurance information annotated on field and lab sheets will be included with the Data reports.

D1, Element 22. Data Review, Verification, and Validation Requirements

Data review, verification, and validation procedures help to ensure that project data will be reviewed in an objective and consistent manner. Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly.

Responsibility for Data Review

The Monitoring Lead and QA Officer will be responsible for data review. This includes checking that all technical criteria have been met, documenting any problems that are observed and, if possible, insuring that deficiencies noted in the data are corrected.

Checking for Typical Errors

In-house examination of the data produced from the proposed project will be conducted to check for typical types of errors. This includes checking to make sure that the data have been recorded, transmitted, and processed correctly. The kind of checks that will be made will include checking for data entry errors, transcription errors, transformation errors, calculation errors, and errors of data omission.

Checking Against MQOs

Data generated by project activities will be reviewed against method quality objectives (MQOs). This will ensure that the data will be of acceptable quality and that it will be SWAMP-comparable with respect to minimum expected MQOs.

Checking Against QA/QC

QA/QC requirements were developed and documented in B3, Element 12; B4, Element 13; B5, Element 14; B7, Element 16; and B8, Element 17 and the data will be checked against this information. Checks will include evaluation of field and laboratory duplicate results; and field and laboratory blank data pertinent to each method and analytical data set. This will ensure that the data will be SWAMP-comparable with respect to quality assurance and quality control procedures.

Checking Lab Data

Lab data consists of all information obtained during sample analysis. Initial review of laboratory data will be performed by the laboratory QA/QC Officer in accordance with the lab's internal

data review procedures. However, once we receive the lab data then we will perform independent checks to ensure that it is complete, consistent, and meets the data management requirements of the data management section of this QAPP.

Data Verification

Data verification is the process of evaluating the completeness, correctness, and conformance / compliance of a specific data set against the method, procedural, or contractual specifications.

Data Validation

Data validation is an analyte- and sample-specific process that evaluates the information after the verification process (i.e., determination of method, procedural, or contractual compliance) to determine analytical quality and any limitations. We will conduct data validation in order to ensure that the data is able to be used in evaluating the MUN beneficial use.

Responsibility for Data Validation

The Monitoring Lead will be responsible for validation of data.

Data Separation

Data will be separated into three categories for use with making decisions based upon it. These categories are:

1. Data that meets all acceptance requirements
2. Data that has been determined to be unacceptable for use
3. Data that may be conditionally used and that is flagged as per SWAMP specification

D2, Element 23. Verification and Validation Methods

Defining the methods for data verification and validation helps to ensure that project data are evaluated objectively and consistently. Information on these methods is provided below.

All data records for the proposed project will be checked visually and will be recorded as checked by the checker's initials as well as with the dates on which the records were checked.

All of the laboratory's data will be checked as part of the verification methodology process.

Any data that is discovered to be incorrect or missing during the verification or validation process will immediately be reported to the Monitoring Lead. If errors involve laboratory data then this information will also be reported to the QA Officer.

If there are any data quality problems, the monitoring lead will try to identify whether the problem is a result of project design issues, sampling issues, analytical methodology issues, or QA/QC issues (from laboratory or non-laboratory sources). If the source of the problems can be traced to one or more of these basic activities then the person or people in charge of the areas where the issues lie will be contacted and efforts will be made to immediately resolve the problem. If the issues are too broad or severe to be easily corrected then appropriate people involved will be assembled to discuss and try to resolve the issue(s) as a group. The QA Officer has the final authority to resolve any issues that may be identified during the verification and validation process.

D3, Element 24. Reconciliation with User Requirements

Information from field data reports (including field activities, post sampling events, corrective actions, and audits), laboratory data reviews (including errors involving data entry, transcriptions, omissions, and calculations and laboratory audit reports), reviews of data versus MQOs, reviews against Quality Assurance and Quality Control (QA/QC) requirements, data verification reports, data validation reports, independent data checking reports, and error handling reports will be used to determine whether or not the project's objectives have been met.

Data from all monitoring measurements will be summarized in tables. During the quarterly review, data that show significant changes over time during the monitoring period will be plotted in graphs and charts. There are no known limitations that are inherent to the data to be collected for this study. Explanations will be provided for any data determined unacceptable for use or flagged for QA/QC concerns.

The proposed project will provide data for the selected analytes described in Element 6. All data will be readily available to all those involved in this project.

The above evaluations will provide a comprehensive assessment of how well the project meets its objectives. No other evaluations will be used.

The Project Lead and Monitoring Lead will be responsible for reporting project reconciliation. This will include measurements of how well the project objectives were met. When resources become available, the data will be entered into CEDEN templates in order to be loaded into the CEDEN database.

This section describes how validated data will be evaluated to see if it answers the project objectives outlined in A5, Element 5.

APPENDICES

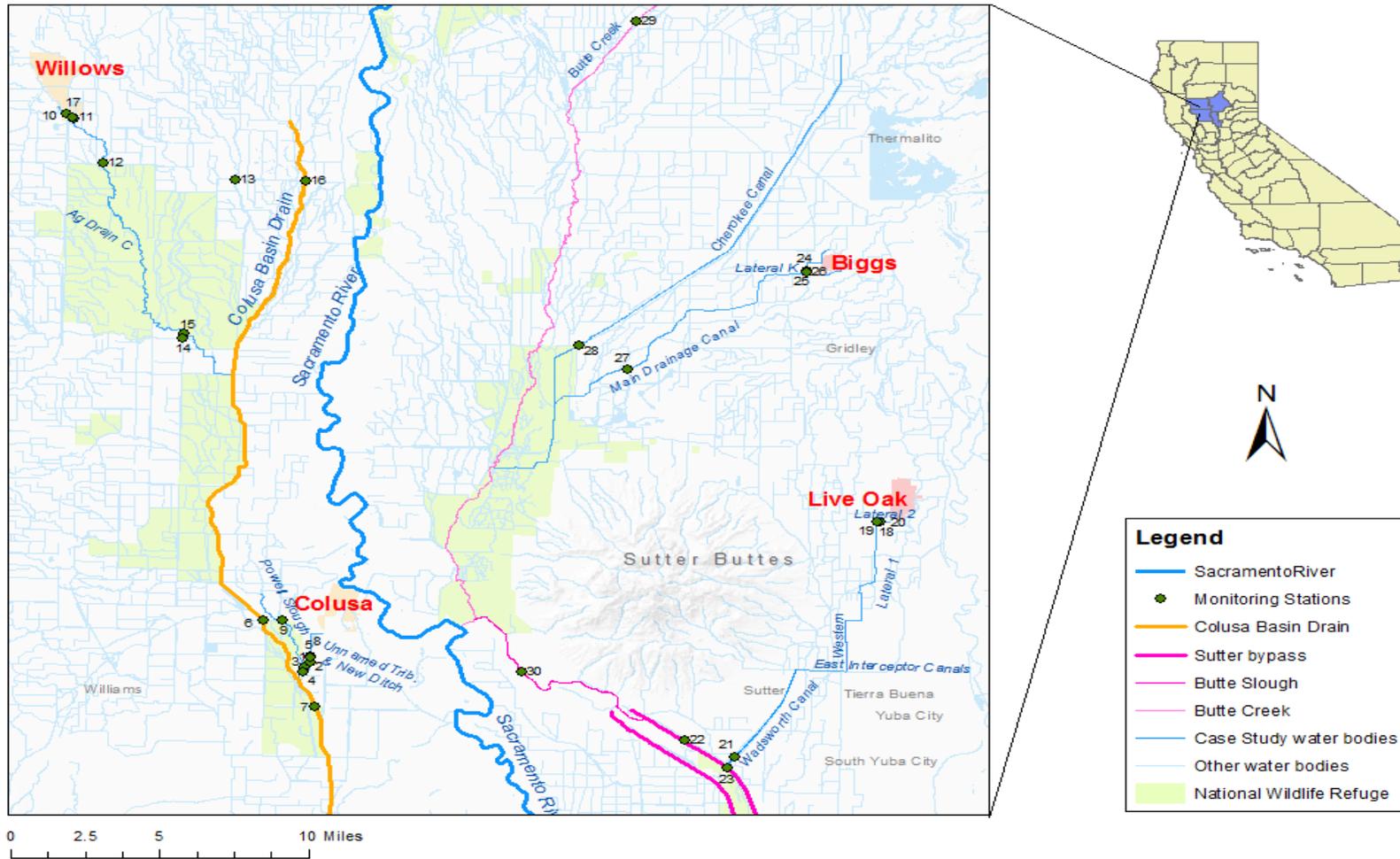
Appendix 1. List of Sampling Sites

Location	Map Label	Sites	Station Code	Latitude	Longitude
City of Colusa	1	Unnamed tributary to Powell Slough, upstream of the effluent discharge.	520COL106	39.17427	-122.03138
	2	Unnamed tributary to Powell Slough, downstream of the effluent discharge	520COL105	39.17138	-122.03132
	3	Powell Slough, upstream of the confluence of the unnamed tributary and Powell Slough	520COL003	39.16779	-122.03479
	4	Powell Slough, downstream from the confluence of the unnamed tributary and Powell Slough.	520COL102	39.1654	-122.03571
	5	New Ditch, upstream of the effluent discharge.	520COL107	39.17427	-122.03125
	6	Colusa Basin Drain at Highway 20 upstream of effluent discharge	520COL006	39.1955	-122.06083
	7	Colusa Basin Drain at Abel Road downstream of effluent discharge	520COL101	39.14463	-122.02734
	8	Effluent Monitoring Station	n/a	39.18763	-122.02941
	9	Powell Slough at Highway 20 upstream of effluent discharge	520COL005	39.19545	-122.04893
City of Willows	10	Ag Drain C, upstream ~1500 feet of the effluent discharge at Highway 99W.	520GLE005	39.49469	-122.19308
	11	Ag Drain C, downstream ~100 feet of the effluent discharge.	520GLE004	39.49233	-122.18903
	12	Ag Drain C, downstream of effluent discharge before entering the Wildlife Refuge at Road 60	520GLE003	39.46569	-122.16961
	13	Willow Creek at Road 61 upstream of effluent discharge	520GLE001	39.45747	-122.08609
	14	Hunter Creek at 4 Mile Road downstream of effluent	520COL108	39.3626	-122.11622
	15	Logan Creek at 4 Mile Road downstream of effluent	520COL109	39.3652	-122.11597
	16	Colusa Basin Drain at Road 61 upstream of effluent discharge	520GLE002	39.4575	-122.04198
	17	Effluent Monitoring Station	n/a	39.50187	-122.19133

Location	Map Label	Sites	Station Code	Latitude	Longitude
City of Live Oak	18	Lateral Drain #2, upstream ~50 feet of effluent discharge	520SUT008	39.2598	-121.67607
	19	Lateral Drain #2, downstream ~ 200 feet of effluent discharge	520SUT007	39.25976	-121.67794
	20	Effluent Monitoring Station	n/a	39.26029	-121.677975
	21	Wadsworth Canal, downstream of effluent discharge	520SUT005	39.11893	-121.76402
	22	Sutter Bypass, upstream of effluent discharge and the Wadsworth Canal confluence	520SUT006	39.12836	-121.79546
	23	Sutter Bypass, downstream of effluent discharge and the Wadsworth Canal confluence	520SUT004	39.1125	-121.76814
City of Biggs	24	Lateral K – Upstream ~100 feet of effluent discharge	520BUT004	39.40863	-121.72537
	25	Lateral K – Downstream ~ 100 feet of effluent discharge	520BUT003	39.40797	-121.7253
	26	Effluent Monitoring Station – pipe prior to entering Lateral K	n/a	39.40827	-121.72533
	27	C Main Drain, downstream of effluent discharge at dam before Cherokee Canal confluence	520BUT001	39.3488	-121.83657
	28	Cherokee Canal, upstream of effluent discharge at Colusa Highway.	520BUT002	39.36247	-121.86745
	29	Butte Creek, upstream of effluent discharge at Nelson Road	520BUT902	39.55569	-121.83652
	30	Butte Slough, downstream of effluent discharge at Farman	520COL104	39.1675	-121.89874

Appendix 2. Map of Sampling Sites

See Appendix 1 for map labels.



Appendix 3. Monitoring Plan

**Evaluation of Municipal and Domestic Supply (MUN)
Beneficial Use in Agricultural Drains**

**Sacramento Valley Archetypes
Final Monitoring Plan**

December 2014

Please note: Since the release of the Evaluation of MUN Beneficial Use in Ag Drains Draft Monitoring Plan (March 2012), updates to sampling frequency, constituents sampled, and other related information can be found in the final version of the QAPP or in the water quality final report.

TABLE OF CONTENTS

I. INTRODUCTION	101
II. BACKGROUND	102
III. STUDY DESIGN OVERVIEW	103
III.a Monitoring Design.....	104
III.a.1 Questions to be Answered.....	104
III.a.2 Answering Key Factors.....	106
III.a.3 Answering the Sources of Drinking Water Policy	106
III.a.4 Answering the Anti-degradation Policy.....	107
III.b. Sampling Locations	110
III.c. Parameters	114
III.c.1 Field Parameters.....	114
III.c.2 Key Constituents.....	114
III.d. Frequency of Sampling.....	117
III.e. Data Management	121
IV. Review Strategy	121
V. Quality Assurance	122
V.a. Field Equipment	122
V.b. Laboratory Methods and Costs	123
APPENDIX A: List of Potential Parameters of Concern	127
APPENDIX B: List of Stakeholders	144

LIST OF TABLES

Table 1. Summary of Methods Used to Evaluate MUN Beneficial Use	109
Table 2. Monitoring Sites (Water bodies are in Bold).....	111
Table 3. Water Quality Criteria for Key Constituents.....	115
Table 4. Sampling Frequency (W= Weekly, M=Monthly, S=Seasonally)	118
Table 5. Laboratory Costs for Key Constituents and All Scans.....	124
Table 6. Estimated Analytical Cost by POTW Study Area	125
Table 7. List of Constituents within Each Scan.....	126

LIST OF FIGURES

Figure 1: Study Area	103
Figure 2: MUN Beneficial Use Study – Site Map	113

I. INTRODUCTION

This plan documents the monitoring aspects of the MUN Beneficial Use Evaluation in Agricultural Drains 2012 study. This study is sponsored by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) in conjunction with the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) initiative. The purpose of this study is to evaluate appropriate application of MUN Beneficial Use designations within agriculturally dominated water bodies downstream of Publicly Owned Treatment Works (POTW) discharges in the Sacramento River Basin.

Sampling sites consist of:

- Sites utilized by POTWs for compliance for the National Pollutant Discharge Elimination System (NPDES) program (specifically, sites upstream and downstream of effluent discharge, defined as treated wastewater); and
- Downstream locations that evaluate progressive water quality at confluences with additional agriculturally dominated water bodies.

Parameters analyzed include flow, electrical conductivity and constituents encompassed by Maximum Contaminant Levels (MCLs) specified in provisions of Title 22 of the California Code of Regulations as documented in the Central Valley Basin Plans. Additional constituents will be analyzed against human health-based standards in the California Toxics Rule (CTR).

It is anticipated that an 18-month sampling period will be needed to ensure that seasonal changes in water quality and hydrology are documented. The design allows for adaptive review and changes on a quarterly schedule. If it is determined that the MUN designated use is not existing and the water body meets the exceptions in the Drinking Water policy, adjustments to the monitoring design will be discussed at quarterly reviews.

To leverage resources, provide access and insure transparency, the project has been coordinated with the CV-SALTS initiative, Irrigated Lands Regulatory Program coalitions, local POTWs and other local, state and federal stakeholders.

II. BACKGROUND

Via the Sources of Drinking Water Policy (88-63), the Central Valley Regional Water Quality Control Board Basin Plans (Basin Plans) designate MUN beneficial use to all water bodies unless they are specifically listed as water bodies that are not designated with MUN. The Basin Plan states that waters designated for MUN must not exceed MCLs for chemical constituents, pesticides, and radionuclides. While 88-63 does contain exceptions for the MUN designation, to utilize the exception, the Basin Plans require “. . . a formal Basin Plan amendment and public hearing, followed by approval of such an amendment by the State Water Board and the Office of Administrative Law.”

During permit adoptions for the National Pollution Discharge Elimination System (NPDES) program, there have been challenges to protecting the MUN beneficial use designation in agricultural drains due to the stated exception in 88-63. The cost for POTWs to comply with protecting the MUN beneficial use has been estimated at \$3 - \$7 million (City of Willows, case example). The POTWs have been provided the option of pursuing a basin plan amendment as part of their permit compliance.

Concurrently, the CV-SALTS initiative has identified the protection of MUN beneficial uses in agriculturally dominated water bodies as potentially over restrictive and in need of evaluation. CV-SALTS identified receiving waters of four POTWs as potential archetypes for evaluating appropriateness of a MUN designation. These same archetypes have challenged the MUN designation during NPDES permit renewals.

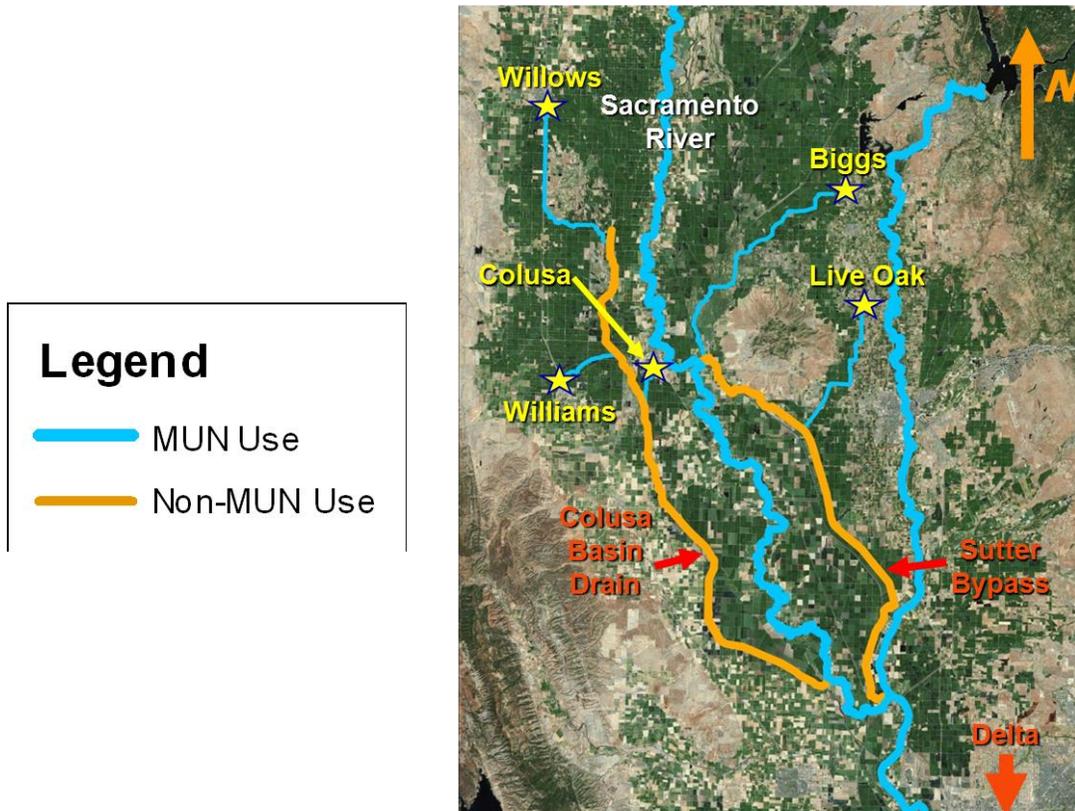
In May 2011, a draft Central Valley Water Board staff report evaluated the appropriateness of the MUN beneficial use in a water body (agricultural drain) receiving effluent. The report found that more data needs to be collected before determining if a basin plan amendment is needed. The data needs noted included: characterization of the receiving waters, water quality data for the effluent and all receiving waters, flow data for all of the receiving waters, an antidegradation analysis, and an environmental analysis.

This project attempts to combine and leverage the work desired by four POTWs (the cities of Willows, Colusa, Live Oak, and Biggs) and the archetypes identified by CV-SALTS. The findings from this study may change how compliance for MUN will be enforced in new NPDES permits.

III. STUDY DESIGN OVERVIEW

This Monitoring Plan has been formatted to reflect California's Surface Water Ambient Monitoring Program's (SWAMP) template. The following sections provide details of the plan, including questions to be answered, constituents to be analyzed, sampling sites and frequency. Figure 1 displays where the study area.

Figure 1 Study Area



III.a Monitoring Design

III.a.1 Questions to be Answered

This monitoring effort will provide information within the designated area of the Sacramento River Basin to evaluate appropriate implementation of the MUN beneficial use in agriculturally dominated water bodies (Figure 1). This project will primarily investigate appropriate application of the Sources of Drinking Water Policy (#88-63) and Antidegradation Policy (#68-16). Questions being asked by this study are:

Key Factors

- Is the designated use occurring? (Perform physical survey of the area)
- Is the water source predominantly recycled water, urban storm drainage, treated or untreated wastewater or agricultural return water? (California Department of Public Health policy memorandum 97-005: Recommends against the use of drinking water supplies from “Water that is predominantly recycled water, urban storm drainage, treated or untreated wastewater, or is agricultural return water”)
- Is there a significant change in hydrology due to seasonality and/or water management?

88-63: Sources of Drinking Water

- Do the exceptions of the Drinking Water policy apply?
 - Does water source provide an average sustained yield of 200 gallons per day?
 - Is the water source in a system designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff?
 - Is the water source in a system designed or modified for the primary purpose of conveying or holding agricultural drainage waters?
 - Does the water body have a contamination, either by natural processes or by human activity that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices?
- If an exception is applicable, will the discharge (from the system designed to treat wastewater or conveying agricultural water) be

monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?

68-16: Maintaining High Quality of Waters in California

- *Is the anti-degradation analysis for NPDES permit complete?*
 - *If not, what additional information is needed?*
- Is water quality sufficient to attaining the beneficial use? (What is the quality of the background water?)
 - If not:
 - At what point downstream is MUN achievable?
 - Do any of the 40CFR131.10(g) Factors occur?
 - Naturally occurring pollutant concentrations prevent attainment of use
 - Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met
 - Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place
 - Dams, diversions or other types of hydrologic modification preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use
 - Controls more stringent than those required by sections 301 (b) and 306 of the Act would result in substantial and widespread economic and social impact
- What are the appropriate constituents to monitor?

The primary objectives of this monitoring project are:

- Characterize Receiving Waters
- Determine spatial and temporal extent of potential degradation and/or impairment
-

III.a.2 Answering Key Factors

- *Is the designated use occurring?*
- *Is the water source predominantly wastewater or agricultural return water?*

Review existing water rights permits and conduct a physical survey of the water bodies surrounding the effluent discharges from the POTWs. The physical survey would include evaluation of discharge points and diversions and associated use. .

Interview the POTWs and Irrigation Districts to characterize the water source. Confirm with physical survey.

- *Is there a significant change in hydrology due to seasonality and/or water management?*

Interview irrigation districts and POTWs to document hydrologic changes due to seasonality and/or water management. Identify any continuous flow data within the study area and compile information. Collect flow information for a minimum of 1-year with the option to extend 6-months depending on initial findings. Flow measurements should be conducted weekly with photographs to complement the findings. Locations for flow measurements should be upstream and downstream of the effluent discharge, the effluent discharge, as well as upstream and downstream of the last water body that receive the effluent discharge and are tributary to the Sutter Bypass or Colusa Basin Drain which are both designated as non-MUN.

III.a.3 Answering the Sources of Drinking Water Policy

- *Do the exceptions of the Drinking Water policy apply?*
 - *Does water source provide an average sustained yield of 200 gallons per day?*

Conduct weekly flow measurements at key monitoring locations. Include photo documentation.

- *Is the water source in a system designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff?*
- *Is the water source in a system designed or modified for the primary purpose of conveying or holding agricultural drainage waters?*

Utilize a combination of physical surveys and interviews with POTWs, Irrigation Districts and local water users/purveyors to determine origin of the water body and dominant use.

- *Does the water body have a contamination, either by natural processes or by human activity that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices?*

Evaluate the water quality data collected for the antidegradation analyses to determine if the water body has a contamination. If a contamination is found in the water body, then interview the POTWs, the agricultural community, and other interested stakeholders to evaluate whether reasonable treatment can be economically achieved.

- *If an exception is applicable, will the discharge (from the system designed to treat wastewater or conveying agricultural water) be monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?*

Sites downstream of the effluent discharge will be monitored to evaluate progressive water quality at confluences with additional agriculturally dominated water bodies. Current long-term monitoring efforts, primarily the Irrigated Lands Regulatory Program, Surface Water Ambient Monitoring Program and Department of Water Resources Water Quality Investigations, will be evaluated to determine whether appropriate compliance points and adequate monitoring are established.

III.a.4 Answering the Anti-degradation Policy

- *Is the anti-degradation analysis for NPDES permit complete?*
 - *If not, what additional information is needed?*

Antidegradation analyses were conducted on all of the permitted discharges when they were re-adopted with a provision to protect the MUN beneficial use. Analysis of the results would provide valuable background information including identifying key constituents of concern and data gaps.

- *Is water quality sufficient to attaining the beneficial use?*
 - *What is the quality of the background water?*
 - *At what point downstream is MUN achievable?*
 - *What are the appropriate constituents to monitor?*

The Basin Plans specify using the Maximum Contaminant Levels (MCLs) specified in provisions of Title 22 of the California Code of Regulations to evaluate protection of MUN. In addition, the California Toxics Rule (CTR) provides human health-based standards for additional constituents. The constituents identified by the regulations are listed in Appendix A. To determine background concentrations and changing water quality moving through the system, water quality analyses will be conducted upstream and downstream of each major inflow. To account for anticipated seasonality, full scans of all constituents will be conducted during 4-key seasons: storm runoff; spring snowmelt; irrigation; and dry season. Monthly scans will be conducted for key constituents identified in previous NPDES evaluations: nitrate; arsenic; total trihalomethanes (THMs); aluminum; iron; manganese; methylene blue active substances (MBAS). Continuation of monthly analyses will be re-evaluated after each seasonal full scan.

- *Do any of the 40CFR131.10(g) Factors occur?*

The 40CFR131.10(G) Factors include naturally occurring pollutant contamination; natural, ephemeral, intermittent or low flow conditions or water levels; irreparable human caused conditions; hydrologic modifications and/or widespread economic impact that would prevent attainment of use. A combination of physical surveys, interviews with POTWs and Irrigation Districts, analysis of past and current water quality data would determine if any of the 40CFR131.10(G) Factors occur. The appropriate constituents to monitor have numerical criteria related to MUN. This includes constituents in the California Maximum Contaminant Levels, human-health based standards in the California Toxics Rule, and flow. The spatial and temporal aspects of the flow and water quality sampling have been described above and are linked to key inflows and seasonal periods where natural and managed hydrology are anticipated to have distinct patterns.

Table 1 summarizes the general types of activities that will occur to answer the monitoring questions addressed by this study.

The monitoring will be conducted for eighteen months (April 2012 – September 2013) in order to span anticipated hydrologic changes due to seasons (irrigation, non-irrigation, dry, etc.) with the option to review and adapt the effort at quarterly intervals. Final design was reviewed by the CV-SALTS Technical Committee.

Table 1 Summary of Methods Used to Evaluate MUN Beneficial Use

Monitoring Questions	Method of Evaluation					
	Background Survey Watershed (Includes looking for intake pipes and interviews with POTWs and Irrigation Districts)	Site Selection			Parameter Selection	
		Monitor at Upstream Receiving Water Sites	Monitor at Downstream Receiving Water Sites	Monitor at Effluent Sites	Monitor Flow	Monitor MUN Constituents listed in: MCLs, CTR, Public Health Goal, Notification Level for drinking water, Odor Threshold
Key Factors						
Is the MUN use occurring?	X					
What is the characterization of the water source?	X					
Is there a change in Hydrology?	X	X	X		X	
68-16: Antidegradation Policy						
Is the Antidegradation analysis complete for NPDES permit?		X	X	X		X
Is water quality sufficient to attaining MUN?		X	X	X		X
If not, at what point downstream is MUN achievable?			X	X	X	X
Do any of the 40CFR131.10(G) Factors occur?	X	X	X	X	X	X
What are the appropriate constituents to monitor?					X	X
88-63: Sources of Drinking Water Policy						
Does the water source provide an average sustained yield of 200 gallons per day?	X	X	X	X	X	
Is the water source in a system designed to treat industrial wastewaters?	X					
Is the water source in a system modified for the primary purpose of holding or conveying agricultural drainage waters?	X					
If an exception is applicable, will the discharge be monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?			X			X

III.b. Sampling Locations

The sampling locations were selected to characterize the receiving waters and determine background quality as well as spatial and temporal extent of potential degradation and/or impairment.

Thirty-one sites have been selected to help characterize the water bodies (Table 2). Sites were selected after field reconnaissance and discussions with local stakeholders and water managers.

For all sites, safety and all-weather access are priorities for sampling activities. Based on field and weather conditions, the sampling plan may be modified by the project team during the sampling event to provide for field safety and make the collection accurate and thorough. Any changes will be documented on the field sheets. Figure 2 displays the monitoring sites on a map.

Table 2 Monitoring Sites

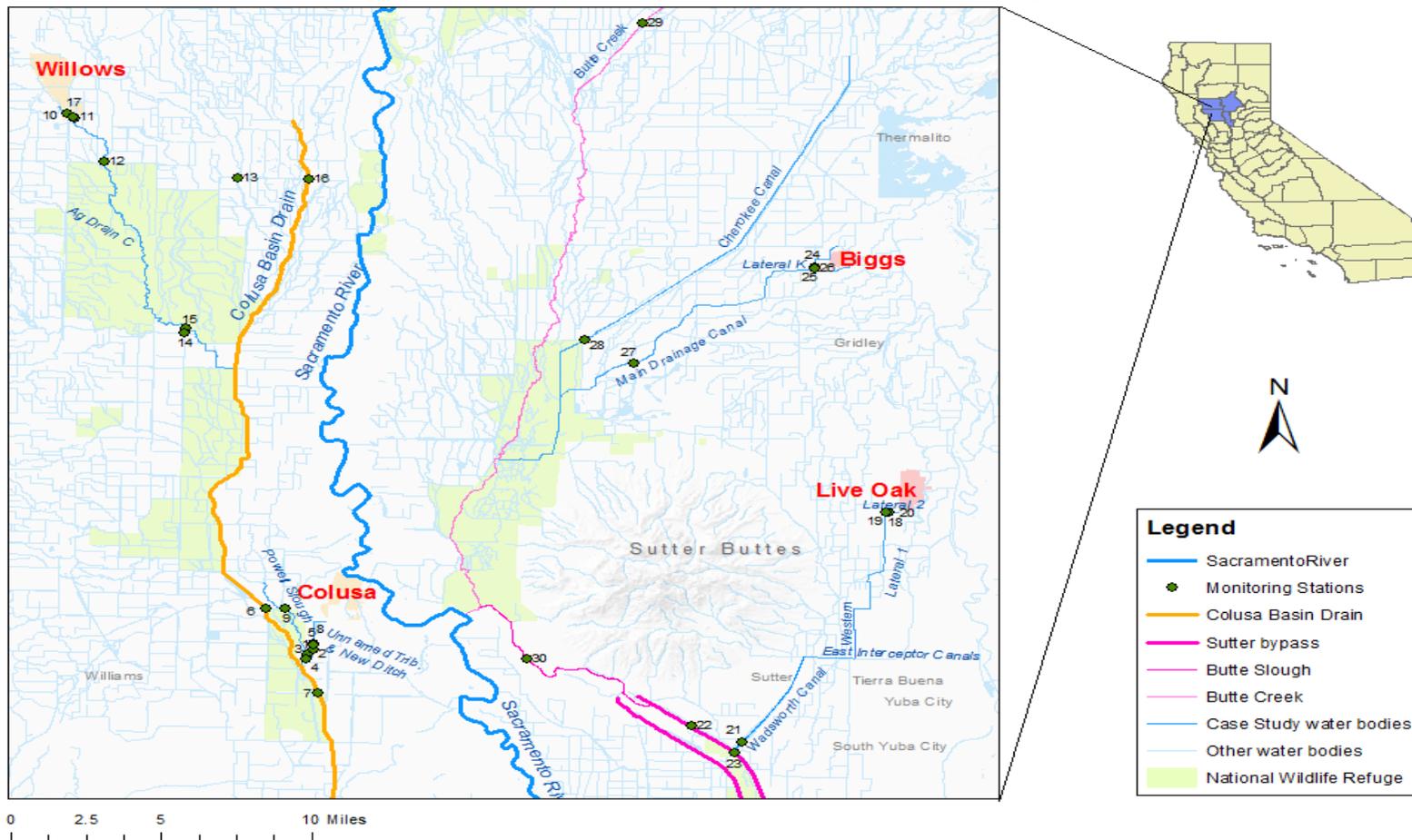
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	17	Effluent Monitoring Station	n/a	39.50187	-122.19133

Table 2 continued: Monitoring Sites

Location	Map Label	Sites	Station Code	Latitude	Longitude
City of Live Oak	18	Lateral Drain #2, upstream ~50 feet of effluent discharge	520SUT008	39.2598	-121.67607
	19	Lateral Drain #2, downstream ~ 200 feet of effluent discharge	520SUT007	39.25976	-121.67794
	20	Effluent Monitoring Station	n/a	39.26029	-121.677975
	21	Wadsworth Canal, downstream of effluent discharge	520SUT005	39.11893	-121.76402
	22	Sutter Bypass, upstream of effluent discharge and the Wadsworth Canal confluence	520SUT006	39.12836	-121.79546
	23	Sutter Bypass, downstream of effluent discharge and the Wadsworth Canal confluence	520SUT004	39.1125	-121.76814
City of Biggs	24	Lateral K – Upstream ~100 feet of effluent discharge	520BUT004	39.40863	-121.72537
	25	Lateral K – Downstream ~ 100 feet of effluent discharge	520BUT003	39.40797	-121.7253
	26	Effluent Monitoring Station – pipe prior to entering Lateral K	n/a	39.40827	-121.72533
	27	C Main Drain, downstream of effluent discharge at dam before Cherokee Canal confluence	520BUT001	39.3488	-121.83657
	28	Cherokee Canal, upstream of effluent discharge at Colusa Highway.	520BUT002	39.36247	-121.86745
	29	Butte Creek, upstream of effluent discharge at Nelson Road	520BUT902	39.55569	-121.83652
	30	Butte Slough, downstream of effluent discharge at Farman	520COL104	39.1675	-121.89874

Figure 2: MUN Beneficial Use Study – Site Map

See Figure 1 for map labels.



III.c. Parameters

Parameters for this study were selected based on the potential to address the primary objectives and questions listed in section III.a. Study parameters include: field parameters (including flow, EC, pH, temperature and dissolved oxygen); and chemical parameters (including those with MCLs and those contained within the CTR). A draft Central Valley Water Board staff report released in May 2011 indicated that seven constituents currently in POTW effluent may not meet the water quality based effluent limitations designed to protect the MUN beneficial use. The seven constituents are: nitrate, arsenic, total trihalomethanes, aluminum, iron, manganese, and methylene blue active substances (MBAs).

The draft staff report used the permit findings which referred to the use of Primary and Secondary MCLs to protect the MUN beneficial use. Primary MCLs are enforceable drinking water standards which are established to protect the public against consumption of drinking water contaminants that present a risk to human health. Secondary MCLs are non-mandatory water quality standards established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. While all the MCL and CTR constituents will be monitored seasonally, the seven constituents along with specific conductivity, dissolved boron and sodium will be monitored monthly in order to determine potential impact of the discharge to the water body and downstream. Specific constituents and assessment concentrations are listed in Appendix A.

III.c.1 Field Parameters

Field parameters will include flow, temperature, dissolved oxygen, pH, specific conductivity and turbidity. Field parameters will help characterize the water bodies because they provide general hydrology and water quality information.

III.c.2 Key Constituents

During the POTWs' NPDES permit renewal process, the following constituents were identified in the effluent at concentrations that may exceed guidelines and/or criteria for protecting drinking water supplies:

- Nitrate
- Arsenic
- Total Trihalomethanes (THMs)
- Aluminum
- Iron
- Manganese
- Methylene Blue Active Substances (MBAS)

Table 3. Water Quality Criteria for Key Constituents

Parameter	Drinking Water	Impact of exceeding criteria
Flow	"Sources of Drinking Water" Policy - exception if water source does not provide an average sustained yield of 200 gallons per day	
Specific Conductivity	California Secondary Maximum Contaminant Level – 900 µmhos/cm	
Turbidity	California Secondary Maximum Contaminant Level – 5 NTU	
pH	Basin Plan Objective -6.5 – 8.5	
Boron	CDPH Notification Level for drinking water – 1 mg/L	
Sodium	USEPA Drinking Water Advisory – 20 mg/L	
Nitrate	California Primary Maximum Contaminant Level - 10 mg/L	The concern with nitrate is for infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.
Arsenic	California Primary Maximum Contaminant Level - 0.01 mg/L	The concern with arsenic is skin damage or problems with circulatory systems, and may have increased risk of getting cancer. Arsenic is a priority pollutant covered by the CTR but no criteria to protect human health was promulgated.

Parameter	Drinking Water	Impact of exceeding criteria
Total Trihalomethanes	California Primary Maximum Contaminant Level - 80 µg/L	<p>THMs are made up of bromoform, chloroform, dibromochloromethane, and dichlorobromomethane. THM compounds are formed in the wastewater during the disinfection process with chlorine. The California Primary MCL for total THMs is 80 µg/L. The California Toxics Rule (CTR) includes a criterion of 4.3 µg/L for bromoform, 0.41 µg/L for dibromochloromethane, and 0.56 µg/L for dichlorobromomethane for the protection of human health for waters from which both water and organisms are consumed. Chloroform is a priority pollutant covered by the CTR but no criteria to protect human health was promulgated. Bromoform, dibromochloromethane and dichlorobromomethane are carcinogens. The CTR criteria for these constituents protect at the 10⁻⁶ risk level, which is the risk of up to one additional cancer in one million people based on an average water consumption level of 2.0 Liters/day and assuming lifetime exposure of 70 years.</p>
Aluminum	California Secondary Maximum Contaminant Level - 0.2 mg/L	<p>The concern with aluminum is chronic toxicity due to gastrointestinal effects. The California Secondary MCL is 0.2 mg/L. The Secondary MCL level protects against colored water. Effluent limitation that are causing compliance issues are based on the Secondary MCL.</p>

Parameter	Drinking Water	Impact of exceeding criteria
Iron	California Secondary Maximum Contaminant Level - 0.3 mg/L	The secondary MCL protects against colored water, staining and metallic taste.
Manganese	California Secondary Maximum Contaminant Level - 0.05 mg/L	The secondary MCL protects against colored water and metallic taste.
Methylene blue Active Substances (MBAs)	California Secondary Maximum Contaminant Level - 0.5 mg/L	The secondary MCL protects against froth, cloudy water, bitter taste and odor.

III.d. Frequency of Sampling

All chemical parameters listed under the MCLs and CTR will be monitored seasonally at all twenty-eight sites. Key constituents will be monitored monthly at all twenty-eight sites and will be re-evaluated after each seasonal full scan. Flow and field parameters will be monitored weekly.

Frequency of sampling is summarized in Table 4:

Table 4. Sampling Frequency (W= Weekly, M=Monthly, S=Seasonally)

Location	Sites	Flow and Field Parameters	Key Constituents of Concern	Inorganic Chemical Scan	Non-volatile Synthetic Organic Chemical Scan
City of Colusa	Unnamed tributary to Powell Slough , below the first upstream agricultural discharge (up to 50 feet upstream)	W	M	S	S
	Unnamed tributary to Powell Slough , above the first downstream agricultural discharge (up to 200 feet downstream)	W	M	S	S
	Powell Slough , 250 feet upstream from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	W	M	S	S
	Powell Slough , 400 feet downstream from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	W	M	S	S
	Powell Slough , Upstream of WWTP at Hwy 20	W	M	S	S
	Colusa Basin Drain , upstream of WWTP at Hwy 20	W	M	S	S
	Colusa Basin Drain , downstream of effluent discharge at Abel Rd	W	M	S	S
	New Ditch , upstream of effluent discharge	W	M	S	S
	Effluent Pump Station	W	M	S	S

Location	Sites	Flow and Field Parameters	Key Constituents of Concern	Inorganic Chemical Scan	Non-volatile Synthetic Organic Chemical Scan
City of Willows	Upstream Receiving Water – 1500 feet upstream from D-001 when discharging to Ag Drain C	W	M	S	S
	Downstream Receiving Water – 100 feet downstream from D-001 when discharging to Ag Drain C	W	M	S	S
	Willow Creek , upstream of effluent discharge into Colusa Basin Drain at Road 61	W	M	S	S
	Colusa Basin Drain , upstream of effluent discharge at Road 61	W	M	S	S
	Ag Drain C – Downstream , This site is the point before it enters the Sacramento Wildlife Refuge	W	M	S	S
	Logan Creek , Downstream of effluent discharge	W	M	S	S
	Hunters Creek , upstream of effluent discharge	W	M	S	S
	Effluent - Downstream of the last connection through which wastes can be admitted to the outfall	W	M	S	S
City of Live Oak	Reclamation District 777 Lateral Drain No. 2 , Approximately 50 feet upstream of Discharge Point to the receiving water	W	M	S	S
	Reclamation District 777 Lateral Drain No. 2 , Approximately 200 feet downstream of Discharge Point No. 001 to the receiving water or	W	M	S	S

Location	Sites	Flow and Field Parameters	Key Constituents of Concern	Inorganic Chemical Scan	Non-volatile Synthetic Organic Chemical Scan
	upstream of the next ag drain				
	Effluent	W	M	S	S
	Wadsworth Canal , Last point before effluent discharge from treatment plant flows into the Sutter Bypass	W	M	S	S
	Sutter Bypass , Upstream of effluent discharge from Live Oak	W	M	S	S
	Sutter Bypass , Downstream of effluent discharge from Live Oak	W	M	S	S
City of Biggs	Lateral K , Upstream receiving water sample – 100 feet upstream of Discharge Point D-001	W	M	S	S
	Lateral K , Downstream receiving water sample – 100 feet downstream of Discharge Point D-001	W	M	S	S
	Effluent , last connection through which wastes can be admitted into the outfall	W	M	S	S
	Cherokee Canal , upstream of effluent discharge	W	M	S	S
	C Main Drain , upstream before Cherokee Canal	W	M	S	S
	Butte Creek , Upstream of WWTP	W	M	S	S

Location	Sites	Flow and Field Parameters	Key Constituents of Concern	Inorganic Chemical Scan	Non-volatile Synthetic Organic Chemical Scan
	near Nelson Road				
	Butte Creek or Butte Slough , if accessible-will sample Butte Creek in Duck Club. Alternate is Butte Slough at Meridian	W	M	S	S

III.e. Data Management

All data from this study will be managed in accordance with the California Environmental Data Exchange Network (CEDEN) templates provided by the Central Valley Regional Data Center. The Central Valley Water Board will load field sheet, field parameters, flow, and chemical parameters data into the templates provided from the Regional Data Center. The time period to enter all data from this study into the templates will be determined when more resources become available.

When the data is entered into the CEDEN Database, the data can then be accessed by the public through the CEDEN website. Information on CEDEN is available at www.ceden.org.

IV. REVIEW STRATEGY

In addition to the review by SWAMP, ILRP and CV-SALTS program staff from the Central Valley Water Board, this document and the draft and final study reports will be provided to the CV-SALTS technical committee for review.

V. Quality Assurance

All aspects of this study will be conducted in accordance with the 2008 SWAMP Quality Assurance Program Plan (QAPrP) for the State of California's Surface Water Ambient Monitoring Program (State Water Board, 2008) and the Procedures Manual for the San Joaquin River Water Quality Monitoring Program (Central Valley Water Board, 2010).

All samples and field measurements collected will comply with the 2008 SWAMP Quality Assurance Program Plan (QAPrP) for the State of California's Surface Water Ambient Monitoring Program (State Water Board, 2008) and the Procedures Manual for the San Joaquin River Water Quality Monitoring Program (Central Valley Water Board, 2010).

Blind field and laboratory replicates will be collected at 5% of sites sampled. Sample bottles will be provided by Excel Chem Laboratories. Water samples will be bottled appropriately based on whether they come pre-preserved or need to be held at <10°C. Field and laboratory blanks will be used for each batch of bottles collected and processed. Chain-of-custody documentation will be maintained for all samples.

Sampling protocols will comply with the 2008 SWAMP Quality Assurance Management Plan (QAMP) for the State of California's Surface Water Ambient Monitoring Program (State Water Board, 2008) and the Procedures Manual for the San Joaquin River Water Quality Monitoring Program (Central Valley Water Board, 2010).

V.a. Field Equipment

A YSI multiparameter water quality monitor will be used to collect data for temperature, dissolved oxygen, pH and specific conductivity. Turbidity measurements will be collected with a Hach turbidimeter. The field equipment are calibrated using certified calibration standards and manufacturer specifications prior to each sampling event and the calibration is checked for accuracy following each sampling event. Calibration records are maintained at the Central Valley Water Board offices and are used to determine instrument accuracy. Specific model numbers and calibration dates for the field equipment will be noted on the field sheets and in the final report.

Photo documentation will be used to document when flows are dry. Stagnant flow will be notated on field sheets.

V.b. Laboratory Methods and Costs

Most lab analysis will be conducted by Excelchem Environmental Labs (Rocklin, CA) through June 2013 and estimated analytical costs are summarized in Table 5. Excelchem Environmental Labs will analyze all key constituents from April and May. June samples will be split between Excelchem Environmental Labs and Moore Twining Associates (Fresno, CA) in order to fit within laboratory contract budgets. Excelchem will analyze for Nitrate as Nitrogen, Nitrite as Nitrogen, and MBAs because these constituents have a very short holding time (48 hours). Moore Twining Associates will analyze for boron, sodium, total: iron, aluminum, arsenic, manganese, and volatile organic compounds. Table 6 is a summary of estimated analytical costs by POTW Study Area. Table 7 is a list of constituents that are contained within the scans. Radionuclides, Bentazon, Diquat, Endothall, Glyphosate, Molinate, Asbestos, and Thiobencarb costs are to be determined because they were not part of the Central Valley Water Board FY11/12 Analytical Contract. The Volatile Organic Compound & Oxygenated Additive Scan is being sampled monthly because analyzing for Total Trihalomethanes separately will still cost the same as the scan. Cost estimates include QA samples.

Table 5. Laboratory Costs for Key Constituents and All Scans (Excelchem Only)

Constituent	Test Method	Cost
Key Constituents (Monthly sampling)		
Boron	200.8	\$ 5.00
Sodium	200.8	\$ 5.00
Nitrate	300	\$ 7.00
Arsenic	1639	\$ 8.00
Volatile Organic Compound & Oxygenated Additive Scan (This scan includes Total Trihalomethanes)	8260B	\$ 60.00
Aluminum	200.8	\$ 5.00
Iron	200.8	\$ 5.00
Manganese	200.8	\$ 5.00
MBAs	5540C	\$ 20.00
Total per Site:		\$ 120.00
Total per Month (28 Sites):		\$ 3,360.00
QA Samples per Month (10%):		\$ 336.00
Total per Month (28 Sites + QA):		\$ 3,696.00
Total for 28 Sites for 18 months:		\$ 66,528.00
Inorganic Chemical Scan (Seasonal sampling - Once every 3 months)		
<i>Note: Asbestos Cost is being determined because it was not part of the Lab Contract</i>		
Antimony, Barium, Beryllium, Cadmium, Chromium, Nickel, Thallium, Copper, Silver, Zinc	200.8	\$ 50.00
Lead	1638	\$ 35.00
Total Dissolved Solids	2540C	\$ 7.00
Ammonia	4500-NH3	\$ 25.00
Nitrite	300	\$ 7.00
Chloride	300	\$ 7.00
Sulfate	300	\$ 10.00
Cyanide	335.4	\$ 22.00
Fluoride	300	\$ 10.00
Mercury	1669/1631	\$ 100.00
Perchlorate	314.1	\$ 50.00
Selenium	200.9/1639	\$ 8.00
Total per Site:		\$ 331.00
Total per Season (28 Sites):		\$ 9,268.00
QA Samples per Season (10%):		\$ 926.80
Total per Season (28 Sites + QA):		\$ 10,194.80
Total for 6 seasons:		\$ 61,168.80
Organic (Non-Volatile Synthetic Organic Chemicals) Chemical Scan		
(Seasonal sampling - Once every 3 months)		
<i>Note: Bentazon, Diquat, Endothall, Glyphosate, Molinate, and Thiobencarb Costs are being determined because they were not part of the Lab Contract</i>		
Organo-Chlorinated Pesticide	8081A	\$ 60.00
Gas Chromatography/Mass Spectrometer (GC/MS) Semivolatiles	8270C	\$ 95.00
Chlorinated Herbicide	8151A	\$ 60.00
Organo-Phosphorus Pesticide	8141A	\$ 60.00
Polychlorinated Biphenyls (PCB's)	8082A	\$ 60.00
Poly-Chlorinated-Dibenzo-p-Dioxin/Furan High Resolution Mass Spectrometer (HRMS)	8290	\$ 500.00
Carbamate Pesticide	8318	\$ 125.00
Total per Site:		\$ 960.00
Total per Season (28 Sites):		\$ 26,880.00
QA Samples per Month (10%):		\$ 2,688.00
Total per Season (28 Sites + QA):		\$ 29,568.00
Total for 6 seasons:		\$ 177,408.00
Grand Total for Key Constituents and All Scans:		\$ 305,104.80

Table 6. Estimated Analytical Cost by POTW Study Area

POTW	# Sites	Estimated Analytical Cost**			
		Each Month	Each Season	1-Year	18-Months
Willows	9	\$1,181	\$12,734.90	\$65,164	\$97,793
Colusa	8	\$961	\$11,005.80	\$56,668	\$85,043
Live Oak	6	\$714	\$8,201.60	\$42,650	\$63,466
Biggs	5	\$653	\$7,054.50	\$34,687	\$54,207
Total:	28	\$3,509	\$38,996.80	\$199,169.00	\$300,509.00

Monthly = \$132/site (Includes 10% for QA)

Seasonal = \$1420.10/site (Includes 10% for QA)

1-year = 12-monthly + 4-seasonal

18-months = 18-monthly + 6-seasonal

**Costs Based on Central Valley Water Board FY11/12 Analytical Contract

**When applicable, costs have been adjusted when POTW is monitoring the same constituent as part of their NPDES permit

Table 7. List of Constituents within Each Scan

Scan	Test Method	Constituent
Volatile Organic Compound & Oxygenated Additive	8260B	1,1-Dichloroethane, 1,1-Dichloroethene, 1,1,1-Trichloroethane, 1,1,2,2-Tetrachloroethane, 1,2-Dichlorobenzene, 1,2-Dichloroethane, cis-1,2-Dichloroethene, 1,2-Dichloropropane, 1,2,4-Trichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, Acrolein, Acrylonitrile, Benzene, Bromoform, Bromomethane, Carbon tetrachloride, Chlorobenzene (mono chlorobenzene), Chloroethane, Chloroform, Chloromethane, Dibromochloromethane, Dichloromethane, Ethylbenzene, Hexachlorobenzene, Hexachlorobutadiene, Hexachloroethane, Naphthalene, Tetrachloroethene, Toluene, trans-1,2-Dichloroethylene, Trichloroethene, Vinyl chloride, Methyl-tert-butyl ether (MTBE), Trichlorofluoromethane, 1,1,2-Trichloro-1,2,2-Trifluoroethane, Styrene, Xylenes, 1,2-Dibromo-3-chloropropane (DBCP), Ethylene Dibromide, 1,1,1,2-Tetrachloroethane, 1,1,2-Trichloroethane, 1,1-Dichloropropene, 1,2,3-Trichloropropane (123TCP), 1,2,4-Trimethylbenze, 1,2-Dibromoethane (EDB), 1,3,5-Trimethylbenze, 1,3-Dichloropropane, 2,2-Dichloropropane, 2-Hexanone, 4-Chlorotoluene, 4-Methyl-2-pentanone, Acetone, 4-Methyl-2-pentanone, Bromobenzene, Bromochloromethane, Carbon disulfide, cis-1,3-Dichloropropene, Dichlorodifluoromethane, Dichloromethane, Isopropylbenzene, m,p-Xylene, Methylene chloride, n-Butylbenzene, n-Propylbenzene, o-Xylene, p-Isopropyltoluene, tert-Butylbenzene
Organo-Chlorinated Pesticide	8081A	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-Hexachlorocyclohexane (BHC), Aldrin, beta-Hexachlorocyclohexane, Chlordane, Dieldrin, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, Lindane (gamma-Hexachlorocyclohexane), Toxaphene, alpha-Chlordane, delta-BHC, Endosulfan I, Endosulfan II, Endrin ketone, gamma-Chlordane, Methoxychlor, Trifluralin
Gas Chromatography/Mass Spectrometer (GC/MS) Semivolatiles	8270C	1,2-Diphenylhydrazine, 2-Chlorophenol, 2,4-Dichlorophenol, 2,4-Dimethylphenol, 2,4-Dinitrophenol, 2,4-Dinitrotoluene, 2,4,6-Trichlorophenol, 2,6-Dinitrotoluene, 2-Nitrophenol, 2-Chloronaphthalene, 3,3'-Dichlorobenzidine, 4-Chloro-3-methylphenol, 4,6-Dinitro-2-methylphenol, 4-Nitrophenol, 4-Bromophenyl phenyl ether, 4-Chlorophenyl phenyl ether, Acenaphthene, Acenaphthylene, Anthracene, Benzidine, Benzo(a)pyrene (3,4-benzopyrene), Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Bis(2-chloroethoxy) methane, Bis(2-chloroethyl) ether, Bis(2-chloroisopropyl) ether, Bis(2-ethylhexyl) phthalate, Butyl benzyl phthalate, Chrysene, Di-n-butylphthalate, Di-n-octylphthalate, Dibenzo(a,h)-anthracene, Diethyl phthalate, Dimethyl phthalate, Fluoranthene, Fluorene, Hexachlorocyclopentadiene, Indeno(1,2,3-c,d)pyrene, Isophorone, N-Nitrosodiphenylamine, N-Nitrosodimethylamine, N-Nitrosodi-n-propylamine, Nitrobenzene, Pentachlorophenol, Phenanthrene, Phenol, Pyrene, 2,4,5-Trichlorophenol, 2-Methylnaphthalene, 2-Methylphenol, 2-Nitroaniline, 3-Hydroxycarbofuan, 3-Methylphenol, 3-Nitroaniline, 4-Chloroaniline, 4-Methylphenol, 4-Nitroaniline, Benzo (a) anthracene, Benzo (b) fluoranthene, Dibenzofuran, Dibromochloropropane, Diphenylamine, Isophorone
Chlorinated Herbicide	8151A	2,4-D, Dalapon, Dinoseb, Picloram, 2,4,5-TP (Silvex), 2,4,5-T, 2,4-DB, Dicamba, Dichloroprop, MCPA, MCPP,
Organo-Phosphorus Pesticide	8141A	Atrazine, Simazine (Princep), Diazinon, Chlorpyrifos, Azinphos methyl, Bolstar, Coumaphos, Demeton O/S, Dichlorvos, Disulfoton, Ethoprop, Fensulfotion, Fenthion, Merphos, Methyl parathion, Mevinphos, Naled, Phorate, Stirophos (Tetrachlorvinphos), Trichloronate
Polychlorinated Biphenyls (PCB's)	8082A	PCB-1016, PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254, PCB-1260
Poly-Chlorinated-Dibenzo-p-Dioxin/Furan High Resolution Mass Spectrometer (HRMS)	8290	2,3,7,8-TCDD (Dioxin)
Carbamate Pesticide	8318	Carbofuran, Oxamyl, 3-Hydroxycarbofuran, Aldicarb, Aldicarb sulfone, Carbaryl, Dioxacarb, Methiocarb, Methomyl, Promecarb, Propoxur (Baygon)

APPENDIX A: List of Potential Parameters of Concern

The following list all of the constituents that have MUN water quality evaluation criteria. Please note that not all of these constituents were tested for due to scan variations provided by each laboratory.

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
1,1,1-Trichloroethane	0.200 mg/L			1.0 mg/L [California Public Health Goal for Drinking Water]
1,1,2,2-Tetrachloroethane	0.001 mg/L		0.00017 mg/L	0.0001 mg/L [California Public Health Goal for Drinking Water]
1,1,2,Trichloro-1,2,2-Trifluoroethane (Freon 113)	1.2 mg/L			4.0 mg/L [California Public Health Goal for Drinking Water]
1,1,2-Trichloroethane	0.005 mg/L		0.0006 mg/L	0.0003 mg/L [California Public Health Goal for Drinking Water]
1,1-Dichloroethane	0.005 mg/L			0.003 mg/L [California Public Health Goal for Drinking Water]
1,1-Dichloroethylene	0.006 mg/L		0.000057 mg/L	0.010 mg/L [California Public Health Goal for Drinking Water]
1,2,4-Trichlorobenzene	0.005 mg/L			0.005 mg/L [California Public Health Goal for Drinking Water]
1,2,4-Trimethylbenzene				0.330 mg/L [California DPH Notification Level for drinking water]
1,2-Dibromo-3chloropropane	0.0002 mg/L			0.0000017 mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
(DBCP)				
1,2-Dibromoethane (Ethylene Dibromide) (EDB)	0.00005 mg/L			0.00001 [California Public Health Goal for Drinking Water]
1,2-Dichlorobenzene	0.6 mg/L		2.7 mg/L	0.6 mg/L [California Public Health Goal for Drinking Water]
1,2-Dichloroethane (Ethylene dichloride)	0.0005 mg/L		0.00038 mg/L	0.0004 mg/L [California Public Health Goal for Drinking Water]
1,2-Dichloropropane	0.005 mg/L		0.00052 mg/L	0.00050 mg/L [California Public Health Goal for Drinking Water]
1,2-Diphenylhydrazine			0.000040 mg/L	
1,3 Dichlorobenzene			0.400 mg/L	0.600 mg/L [California DPH Notification Level for drinking water]
1,3,5-Trimethylbenzene				0.330 [California DPH Notification Level for drinking water]
1,3-Dichloropropene	0.0005 mg/L		0.01 mg/L	0.0002 mg/L [California Public Health Goal for Drinking Water]
1,4-Dichlorobenzene	0.005 mg/L		0.400 mg/L	0.006 mg/L [California Public Health Goal for Drinking Water]
2,3,7,8-TCDD (Dioxin)	3 x 10 ⁻⁸ mg/L		1.3 x 10 ⁻¹¹ mg/L	5 x 10 ⁻¹¹ mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
2,4,5-TP (Silvex)	0.05 mg/L			0.002 mg/L [California Public Health Goal for Drinking Water]
2,4,6-Trichlorophenol			0.0021 mg/L	
2,4-Dichlorophenol			0.093 mg/L	
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.07 mg/L			0.02 mg/L [California Public Health Goal for Drinking Water]
2,4-Dichlorophenoxybutyric acid (2,4-DB)				0.056 mg/L [USEPA IRIS Reference Dose]
2,4-Dimethylphenol			0.540 mg/L	
2,4-Dinitrophenol			0.070 mg/L	
2,4-Dinitrotoluene			0.00011 mg/L	
2-Chloronaphthalene			1.7 mg/L	
2-Chlorophenol			0.120 mg/L	
2-Methyl-4,6-Dinitrophenol			0.0134 mg/L	
3,3'-Dichlorobenzidine			0.00004 mg/L	

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
4,4'-DDD			0.00000083 mg/L	0.00015 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
4,4'-DDE			0.00000059 mg/L	0.0001 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
4,4'-DDT			0.00000059 mg/L	0.0001 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Acenaphthene			1.2 mg/L	0.020 mg/L [USEPA National Recomm. WQ Criteria, taste & odor]
Acrolein			0.320 mg/L	0.110 mg/L [Odor threshold (Amoore and Hautala)]
Acrylonitrile			0.000059 mg/L	
Alachlor	0.002 mg/L			0.004 mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Aldrin			0.00000013 mg/L	0.0000021 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Alpha-BHC (alpha-Benzene hexachloride)			0.0000039 mg/L	0.000013 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Aluminum	1.0 mg/L	0.2 mg/L		0.600 mg/L [California Public Health Goal for Drinking Water]
Ammonia				1.5 mg/L [Odor threshold (Amoore and Hautala)]
Anthracene			9.6 mg/L	
Antimony	0.006 mg/L		.0014 mg/L	0.020 mg/L [California Public Health Goal for Drinking Water]
Arsenic	0.010 mg/L			0.000004 mg/L [California Public Health Goal for Drinking Water]
Asbestos	7 Million Fibers per Liter		7 Million Fibers/Liter	
Atrazine	0.001 mg/L			0.00015 mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Barium	1.0 mg/L			2.0 mg/L [California Public Goal for Drinking Water]
Bentazon	0.018 mg/L			
Benzene	0.001 mg/L		0.0012 mg/L	0.00015 mg/L [California Public Health Goal for Drinking Water]
Benzidine			0.00000012 mg/L	
Benzo(a)Anthracene [1,2-Benzanthracene]			0.0000044 mg/L	0.000029mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Benzo(a)pyrene	0.0002 mg/L		0.0000044 mg/L	0.000007mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Benzo(b)Fluoranthene [3,4-Benzofluoranthene]			0.0000044 mg/L	0.000029mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Benzo(k)Fluoranthene			0.0000044 mg/L	0.000029mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Beryllium	0.004 mg/L			0.001 mg/L [California Public Health Goal for Drinking Water]
Beta/photon emitters	4 millirem/year annual dose equivalent to the total body or any internal organ			
Beta-BHC (beta-Benzene hexachloride)			0.000014 mg/L	0.000023 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Bis(2-Chloroethyl)Ether			0.000031 mg/L	
Bis(2-Chloroisopropyl)Ether			1.400 mg/L	
Boron				1 mg/L [California Public Health Goal for Drinking Water]
Bromoform			0.0043 mg/L	0.004 mg/L USEPA IRIS Cancer Risk Level

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Butylbenzyl Phthalate			3.0 mg/L	
Cadmium	0.005 mg/L			0.00004 mg/L [California Public Health Goal for Drinking Water]
Carbofuran	0.04 mg/L			
Carbon Tetrachloride	0.0005 mg/L			0.00025 mg/L [National Toxics Rule (NTR) for sources of drinking water]
Chlordane	0.0001 mg/L		0.00000057 mg/L	0.00003 mg/L [California Public Health Goal for Drinking Water]
Chloride		250 mg/L		
Chlorobenzene	0.070 mg/L		0.680 mg/L	
Chlorodibromomethane			0.00041 mg/L	
Chloroform				0.0018 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Chlorpyrifos				0.002 mg/L [USEPA, OPP Drinking Water Health Advisory - non-cancer]
Chromium	0.05 mg/L			

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Chrysene			0.0000044 mg/L	0.00029 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Cis1,2-Dichloroethylene	0.006 mg/L			0.100 mg/L [California Public Health Goal for Drinking Water]
Color		15 Units		
Copper		1.0 mg/L	1.3 mg/L	0.300 mg/L [California Public Health Goal for Drinking Water]
Cyanide	0.15 mg/L		0.700 mg/L	0.150 mg/L [California Public Health Goal for Drinking Water]
Dalapon	0.2 mg/L			0.790 mg/L [California Public Health Goal for Drinking Water]
Di(2-ethylhexyl)adipate	0.4 mg/L			
Di(2-ethylhexyl)phthalate (DEHP) (Bis(2-ethylhexyl) phthalate)	0.004 mg/L			0.0018 mg/L [National Toxics Rule (NTR) for sources of drinking water]
Diazinon				0.0012 mg/L [CDPH Notification Level for drinking water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Dibenzo(ah)Anthracene			0.0000044 mg/L	0.0000085 [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Dichlorobromomethane			0.00056 mg/L	0.00027 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Dichloromethane (Methylene Chloride)	0.005 mg/L		0.0047 mg/L	0.0004 mg/L [California Public Health Goal for Drinking Water]
Dieldrin			0.00000014 mg/L	0.0000022 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Diethyl Phthalate			23 mg/L	
Di-isopropyl ether (Isopropyl ether) (DIPE)				0.0008 mg/L [Odor threshold (Amoore and Hautala)]
Dimethyl Phthalate			313 mg/L	
Di-n-Butyl Phthalate			2.7 mg/L	
Dinoseb	0.007 mg/L			0.014 mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Diquat	0.02 mg/L			
<i>E. coli</i>				235 MPN/100 mL [USEPA Recreational Guideline for Designated Beach Areas (Upper 75% Confidence Level)]
Endosulfan I (Alpha-Endosulfan)			0.110 mg/L	0.042 mg/L [USEPA IRIS Reference Dose]
Endosulfan II (Beta-Endosulfan)			0.110 mg/L	0.042 mg/L [USEPA IRIS Reference Dose]
Endosulfan Sulfate	0.002 mg/L		0.110 mg/L	
Endothall	0.1 mg/L			
Endrin	0.002 mg/L		0.00076 mg/L	0.0018 mg/L [California Public Health Goal for Drinking Water]
Endrin Aldehyde			0.00076 mg/L	
Ethylbenzene	0.3 mg/L		3.1 mg/L	0.0032 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Fluoranthene			0.3 mg/L	0.280 mg/L [USEPA IRIS Reference Dose]
Fluorene			1.3 mg/L	0.280 mg/L [USEPA IRIS Reference Dose]
Fluoride		2.0 mg/L		1.0 mg/L [California Public Health Goal for

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
				Drinking Water]
Foaming Agents (MBAS)		0.5 mg/L		
Gamma-BHC (gamma-Benzene hexachloride) (Lindane)	0.0002 mg/L		0.000019 mg/L	0.000032 mg/L [California Public Health Goal for Drinking Water]
Glyphosate	0.7 mg/L			
Gross Alpha particle activity (excluding radon and uranium)	15 pCi/L			
Heptachlor	0.0004 mg/L		0.00000021 mg/L	0.000008 mg/L [California Public Health Goal for Drinking Water]
Heptachlor Epoxide	0.0002 mg/L		0.00000010 mg/L	
Hexachlorobenzene	0.001 mg/L		0.00000075 mg/L	
Hexachlorobutadiene			0.00044 mg/L	
Hexachlorocyclopentadiene	0.05 mg/L		0.240 mg/L	
Hexachloroethane			0.0019 mg/L	

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Indeno(1,2,3-cd) Pyrene			0.0000044 mg/L	0.000029 mg/L [Cal/EPA Cancer Potency Factor as a drinking water level (assume 70kg body weight & 2 liters per day drinking water consumption)]
Iron		0.3 mg/L		
Isophorone			0.0084 mg/L	
Lead	0.015 mg/L			0.0002 mg/L California Public Health Goal for Drinking Water]
Manganese		0.05 mg/L		0.500 mg/L [California DPH Notification Level for drinking water]
Mercury	0.002 mg/L		0.000050 mg/L	0.0012 mg/L [California Public Health Goal for Drinking Water]
Methoxychlor	0.03 mg/L			0.00009 mg/L [California Public Health Goal for Drinking Water]
Methyl Bromide (Bromomethane)			0.048 mg/L	
Methyl-tert-butyl ether (MTBE)	0.013 mg/L	0.005 mg/L		0.013 mg/L [California Public Health Goal for Drinking Water]
Molinate	0.02 mg/L			
Monochlorobenzene	0.1 mg/L			

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Nickel	0.100 mg/L		0.61 mg/L	0.012 mg/L [California Public Health Goal for Drinking Water]
Nickel	0.1 mg/L		0.610 mg/L	0.012 mg/L [California Public Health Goal for Drinking Water]
Nitrate (as NO ₃)	45 mg/L			
Nitrate+Nitrite (sum as nitrogen)	10 mg/L			
Nitrite (as Nitrogen)	1.0 mg/L			
Nitrobenzene			0.017 mg/L	
N-Nitrosodimethylamine (NDMA)			0.00000069 mg/L	0.000003 mg/L [California Public Health Goal for Drinking Water]
N-Nitrosodi-n-Propylamine			0.000005 mg/L	
N-Nitrosodiphenylamine			0.005 mg/L	
Odor		3 TON (Threshold Odor Number)		
Oxamyl	0.2 mg/L			
Pentachlorophenol	0.001 mg/L		0.00028 mg/L	0.0003 mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Perchlorate	0.006 mg/L			0.006 mg/L [California Public Health Goal for Drinking Water]
pH		6.5 - 8.5		
Phenol			21.0 mg/L	
Picloram	0.5 mg/L			
Polychlorinated Biphenyls (PCBs)	0.0005 mg/L		0.00000017 mg/L	0.00009 mg/L California Public Health Goal for Drinking Water]
Pyrene			0.960 mg/L	0.210 mg/L [USEPA IRIS Reference Dose]
Radium-226	5 pCi/L (combined radium-226 & -228)			
Radium-228	5 pCi/L (combined radium-226 & -228)			
Selenium	0.05 mg/L			0.03 mg/L [California Public Health Goal for Drinking Water]
Silver		0.1 mg/L		0.035 mg/L [USEPA IRIS Reference Dose]
Simazine	0.004 mg/L			

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Sodium				20 mg/L [USEPA Drinking Water Advisory (for persons on restricted sodium diet)]
Specific Conductance		900 µS/cm		
Strontium-90	8 pCi/L (=4 millirem/yr dose to bone marrow)			
Styrene	0.1 mg/L			
Sulfate		250 mg/L		
Tetrachloroethylene (Tetrachloroethene) (PCE)	0.005 mg/L		0.0008 mg/L	0.0006 mg/L [California Public Health Goal for Drinking Water]
Thallium	0.002 mg/L		0.0017 mg/L	0.0001 mg/L [California Public Health Goal for Drinking Water]
Thiobencarb	0.07 mg/L	0.001 mg/L		
Toluene	0.15 mg/L		6.800 mg/L	0.150 [California Public Health Goal for Drinking Water]
Total Dissolved Solids		500 mg/L		
Total Triahalomethanes	0.080 mg/L			
Toxaphene	0.003 mg/L		0.00000073 mg/L	0.00003 mg/L [California Public Health Goal for Drinking Water]

Analyte	Primary MCL	Secondary MCL	CTR	Other Evaluation Criteria/Guidelines
Trans-1,2-Dichloroethylene	0.01 mg/L		0.700 mg/L	0.00060 mg/L [California Public Health Goal for Drinking Water]
Trichloroethylene (TCE)	0.005 mg/L		0.0027 mg/L	0.0017 mg/L [California Public Health Goal for Drinking Water]
Trichlorofluoromethane (Freon 11)	0.15 mg/L			1.3 mg/L [California Public Health Goal for Drinking Water]
Tritium	20000 pCi/L (=4 millirem/yr dose to total body)			
Turbidity		5 NTU		
Uranium	20 pCi/L			
Vanadium				0.050 mg/L [California DPH Notification Level for drinking water]
Vinyl Chloride	0.0005 mg/L		0.002 mg/L	0.00005 mg/L [California Public Health Goal for Drinking Water]
Xylenes	1.750 mg/L			1.80 mg/L [California Public Health Goal for Drinking Water]
Zinc		5.0 mg/L		2.1 mg/L [USEPA IRIS Reference Dose]

APPENDIX B: List of Stakeholders

- CV-SALTS
- City of Willows
- City of Colusa
- City of Biggs
- City of Live Oak
- California Rice Commission
- Sacramento Valley Coalition
- Central Valley Regional Water Quality Control Board
- US EPA
- State Water Resources Control Board

Appendix 4. Sampling Event Preparation

Sample Bottle Labeling

All samples will be pre-labeled before each sampling event to the extent practicable. Sample id numbers will correspond with the field sheets. Pre-labeling sample bottles simplifies field activities. Custom labels will be produced using blank water-proof labels. Using this approach will allow the stations and analytical constituent information to be entered into the computer program in advance, and printed as needed prior to each sampling event.

Labels shall be placed on the appropriate bottles in a dry environment; attempting to apply labels to sample bottles after filling will cause problems, as labels usually do not adhere to wet bottles. The labels shall be applied to the bottles rather than to the caps. Field labels shall contain the following information:

Sampler initials, year, month, date – sample id, parameter identification.

Parameter identifications are as follows:

M	Metals
VOC	Volatile Organic Compounds
N_n	Nitrate as Nitrogen and Nitrite as Nitrogen
MBA	Methylene Blue Active Substances

Example:

CLG090505-10M

CLG090505-10VOC

CLG090505-10N_n

CLG090505-10MBA

Appendix 5. Field Protocols

Field crews (2 persons per crew, minimum) will only be mobilized for sampling when weather conditions and flow conditions are considered to be safe. For safety reasons, sampling will occur during daylight hours. A sampling event should proceed in the following manner:

1. Before leaving the sampling crew base of operations, notify laboratory, confirm number and type of sample bottles as well as the complete equipment list.
2. Proceed to the first sampling station.
3. Fill-out the general information on the field log sheets (Appendix 7).
4. Take field measurements and observations, and record on the field log sheet (Appendix 7).
5. Take the samples indicated on the field log sheet in the manner described in this plan. Place bottles in the coolers with ice. Double check against the log sheet that all appropriate bottles were filled.
6. Repeat the procedures in steps 3, 4, and 5 for each of the remaining sampling stations.
7. Complete the chain of custody forms (Appendices 9-11) using the field notes.
8. After collection is completed, samples will be delivered to laboratories.

Appendix 6. Sample Collection

Water Sample Collection

All water samples will be collected as grab samples, using aseptic technique. At most stations, grab samples will be collected at approximately six feet from the bank, using sampling poles, by direct submersion of the sample bottle depth. This is the preferred method for grab sample collection; however, due to sampling station configurations and safety concerns, direct filling of sample bottles is not always feasible. Sampling station configuration will dictate grab sample collection technique. Grab samples will be collected directly into the appropriate bottles (containing the required preservations). The grab sample technique that may be employed is described below.

Direct Submersion:

Where practical, all grab samples will be collected by direct submersion to mid-stream, mid-depth using the following procedures.

The collector will be careful to not touch the inside of the sample bottle at anytime. If the inside of the sample bottle is accidentally touched another sample bottle will be used. This is the preferred method for grab sample collection, and shall be adhered to as long as the safety of the sampling personnel is not jeopardized by doing so. Modifications are to be made only as necessary, and clean sampling techniques are always to be followed. After collection the samples will be immediately placed on ice in a cooler for transport to the analytical laboratories. All samples will be delivered to labs at the end of the field run (in the afternoon of each sampling day). Control samples will be collected at the same time and also immediately placed on ice. The proper COC form (See Appendices 9-11) will be filled out and signed by the appropriate lab personnel prior to releasing the samples to them.

Clean Sampling Techniques

Samples will be collected using “clean sampling techniques” to minimize the possibility of sample contamination. For this program, clean techniques must be employed whenever handling bottles, lids, or intermediate containers. Clean sampling techniques are summarized below:

- Samples are collected only into new, clean, laboratory provided sample bottles.
- Wearing clean powder-free nitrile gloves at all times are required on sampling crews.
- Clean, powder-free nitrile gloves are changed whenever something not known to be clean has been touched.
- Clean techniques must be employed whenever handling grab sample or

intermediate bottles.

- To reduce the potential for contamination, sample collection personnel must adhere to the following rules while collecting samples:
 - No smoking.
 - Never sample near a running vehicle. Do not park vehicles in immediate sample collection area, even non-running vehicles.
 - During wet weather events avoid allowing rainwater to drip from rain gear or any other surface into sample bottles.
 - Do not eat or drink during sample collection.
 - Do not breathe, sneeze or cough in the direction of an open sample bottle.
- Wear clean powder-free nitrile gloves when handling bottles and caps. Change gloves if soiled or if the potential for cross-contamination occurs from handling sampling materials or samples;
- Submerge bottle to mid-stream/mid-depth, remove lid, let bottle fill, and replace lid. Place sample on ice;
- Collect remaining samples including control samples, if needed, using the same protocols described above;
- Fill out COC form, note sample collection on field form, and deliver to analytical lab.

Field Measurements and Observations

Field measurements will be taken and observations made at each sampling station before a sample is collected. Field measurements will include pH, temperature, dissolved oxygen, specific conductance and turbidity. Field measurements will be taken at approximately six feet from the bank. All field measurement results and comments on field observations will be recorded in the field log in Appendices 6&7.

If at any time the collection of field measurements appears unsafe, an alternate site within 100 yards may be used, or the sample will not be collected. Sample site conditions will be noted on the field sheets, and photos will be taken of the site.

In addition to field measurements, observations will be made at each sampling station. Observations will include color, odor, floating materials, presence of wildlife, as well as observations of contact and non-contact recreation. All comments on field observations will be recorded in the field log presented in Appendices 6&7.

Chain-of-Custody

Chain-of-custody (COC) forms will be filled out for all samples submitted to the analytical laboratory. Sample data, sample location, sample collection crew names, and analysis requested shall be noted on each COC. See Appendices 8&9 for blank COC forms.

Transport to Lab

Samples will be stored in coolers with ice and delivered to ExcelChem (April & May) or Moore Twining (June) at the address provided in the field protocols section of this plan.

Appendix 7. Field Sheet (SWAMP)

SWAMP Field Observations Data Sheet		Event Type	WQ	Entered In	Database	(Initial/Date)	Page	1	of	1	Pages								
SAMPLE COLLECTION	Sample ID	XMP110101-10		Station Description	American R @ Discovery Park														
	Personnel:	IIIII		Station ID	519AMNDVY														
	Sample Time (first sample):			Agency:	Citizens Monitoring Group			Date:	5/2/2011	Funding:	10SWSS01								
	Purpose:	Water/Chem / Habitat / Field Measure		Project:	RBS_StS_05_FY1011			Group:	SJR	Protocol:	AGPRO_RSS_2010								
SAMPLE SITE DESCRIPTION	Occupation Method:	Walk-in	Bridge	Other															
	Collection Location:	Bank	Midchannel																
	Hydromodification Type	None	Bridge	Pipes	Concrete Channel	Grade Control	Culvert	Aerial Zipline	If there is an IMMEDIATE (within range, potentially affecting sample) hydromodification, is the hydromodification upstream/downstream/within area of sample; if there is no describe existing hydromodifications indicated above, such as a grade control, drainage pipes, bridge, culvert.										
GPS	GPS Device:	0		Actual Latitude:				Record Actual GPS coordinates	Target Latitude:	38.60094									
	Datum:	0		Actual Longitude:					Target Longitude:	-121.5055									
PHOTOS	1	RB / LB / BB / US / DS / ##																	
	2	RB / LB / BB / US / DS / ##																	
	3	RB / LB / BB / US / DS / ##																	
HABITAT OBSERVATIONS	Site Odor	None	Sulfides (e.g. rotten eggs)	Sewage	Manure	Petroleum	Smoke												
	Sky Code	Clear	Partly Cloudy	Overcast	Fog	Smoky	Hazy												
	Other Presence	None	Vascular	Nonvascular	Oily Sheen	Foam	Trash	Record presence of vegetation in the water at the immediate sampling area. Vascular refers to terrestrial or aquatic vegetation and Nonvascular refers to plankton, periphyton, if possible, describe the DOMINANT substrate type; use unknown if you cannot see the dominant substrate type											
	Dominant Substrate	Bedrock	Concrete	Cobble	Gravel	Sand	Mud	Unknown	This describes the clarity of the water while standing creek side.										
	Water Clarity	Clear (see bottom)	Cloudy (>4" visibility)	Murky (<4" visibility)					The color of the water from standing creek side										
	Water Odor	None	Sulfides (e.g. rotten eggs)	Sewage	Manure	Petroleum	Mixed		Visual estimates in cubic feet/second, if able to estimate										
	Water Color	Colorless	Green	Yellow	Brown				In general, is the water body being sampled accessible to the average person at the point of sample?										
	Observed Flow	NA	Dry	Isolated Pool	Low	Normal	High	Flood	What is happening right now?										
	Wadeability	Yes	No	Unknown					Record if there is evidence of rain or overland runoff at the site. Light refers to light rain with no overland runoff and Moderate/Heavy refers to rain resulting in overland runoff.										
	Precipitation	None	Fog	Drizzle	Rain	Snow			Record if there is evidence of rain or overland runoff at the site. Light refers to light rain with no overland runoff and Moderate/Heavy refers to rain resulting in overland runoff.										
WIND	Direction	N / S / E / W		Record the direction from which the wind is blowing															
	Beaufort Scale			Use scale 0-8; refer to the scales listed:															
	0	Calm; smoke rises vertically		3	Gentle Breeze: Leaves and small twigs in constant motion; wind extends light flag		6	Strong Breeze: Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty											
1	Light Air: Direction of wind shown by smoke drift, but not by wind vanes		4	Moderate Breeze: Raises dust and loose paper; small branches are moved		7	Near gale: Whole trees in motion; inconvenience felt when walking against the wind												
2	Light Breeze: Wind felt on face; leaves rustle; ordinary vanes moved by wind		5	Fresh Breeze: Small trees in leaf begin to sway; crested wavelets form on inland waters		8	Gale: Breaks twigs and generally impedes progress												
FIELD MEASUREMENTS	Measurements Collected:			Substrate															
	Water Temp (°C)	pH	DO (mg/L)	SC (µS/cm)	Turbidity (ntu)	Other:	Don't forget to fill in the calibration sheet	SAMPLES		Sample ID: XMP110101-20									
								Number Bottles:	2	Crypto 500ml	0	Glass 500ml	0	Sal 100ml	0	Other:			
								Field Duplicate		Y							Sample Type:	No Access	Dry
								Field Blank		N							Individual Bottles Collected By:	Flooded	Other (explain)
							Lab Duplicate		N							Field Hand			
																Field & beaker			
Light gray cells are for information purposes				Field Comments:															
Uncolored cells need to be populated																			

Appendix 8. Bacteria Processing Laboratory Sheet (SWAMP)

Run: Colusa Run													Sample Processing Date: 6/29/11						
Sample ID Number: ARW110629																			
Site Code:		40	41	42	43	44	45	52	51	50	60								
18H 22H		520COL006	520COL005	520COL001	520COL002	520COL003	520COL004	FieldBlank	520COL006 LD	520COL002 FD	LAB BLANK								
Yellow +	# Large Wells																		
	# Small Wells																		
	Empty Wells																		
	MPN																		
Yellow + Fluorescence (+)	# Large Wells																		
	# Small Wells																		
	False Positives																		
	MPN																		
Incubator Temperature Checks:													1st Check ~4 Hrs After Field Crew Leaves: Initials: Temp: Time:						
													2nd Check - Placed in Incubator: Initials: Temp: Time:						
													3rd Check ~4 Hrs Before Pull fr Incubator: Initials: Temp: Time:						
													4th Check - Pulled from Incubator: Initials: Temp: Time:						
Media Lot #	FIELD DUPLICATES								LAB DUPLICATES										
	Normal Sample #	43								Normal Sample #	40								
	Duplicate Sample #	50									Duplicate Sample #	51							
		MPN	Log MPN	ABS(Normal Log MPN-Dup Log MPN)						MPN	Log MPN	ABS(Normal Log MPN-Dup Log MPN)							
TOTAL COLIFORM	Normal								Normal										
	Duplicate								Duplicate										
	Mean of R_{log}	~0.24		Pass	Needs Review				Mean of R_{log}	~0.43		Pass	Needs Review						
E. COLI	Normal								Normal										
	Duplicate								Duplicate										
	Mean of R_{log}	0.29		Pass	Needs Review				Mean of R_{log}	0.36		Pass	Needs Review						
BLANK	Field Blank # 52							Pass	Needs Review	Lab Blank # 60							Pass		
Mean = Mean of Normal and Duplicate, which is then compared to the individual corresponding CFs to determine acceptability of data.													Light gray fields to be filled in during field run set up.						
Xave = Mean of Normal and Duplicate, which is used as part of RD% formula.													Unshaded fields to be filled in during sample processing, result analysis, and for incubator QA						
Pass ¹ = Lab Duplicates pass only when RD% < 2																			
Sampler Signature / Date / Time Arrived in Lab:				Placed in Incubator By / Date / Time:				Trays Read By:											
Processor / Date / Time:				Pulled from Incubator By / Date / Time:				Distribution:											
								Original: to CLG for QA Tracking and Originals Binder											
								Copy: to Data entry											
								Copy: to Project Managers, as needed											
NOTES:																			

Appendix 10. Moore Twining Associates (Chain of Custody)



CHAIN OF CUSTODY/ANALYSIS REQUEST
 2527 FRESNO STREET • FRESNO, CA 93721 • PHONE (559) 268-7021 • FAX: (559) 268-0740

ATTENTION: Anthony Medrano		ATTENTION: Anthony Toto		<input type="checkbox"/> STANDARD FORMAT <input type="checkbox"/> WRITE-ON (STATE FORM) <input type="checkbox"/> GEOTRACKER/COELT (LUF-1) <input type="checkbox"/> PDF <input type="checkbox"/> SPREADSHEET <input type="checkbox"/> County DHS : _____ <input type="checkbox"/> Environmental Health Agency : _____ <input type="checkbox"/> OTHER: _____														
NAME: Regional Water Board		NAME: Regional Water Board																
ADDRESS: 1685 E Street		ADDRESS: 1685 E Street																
Fresno, CA 93706		Fresno, CA 93706																
PHONE: 559-488-4395		PHONE: 559-445-6278																
FAX: 559-445-5910		FAX: 559-445-5910																
SAMPLE INFORMATION			PROJECT INFORMATION															
SAMPLED BY (PRINT):		SAMPLE TYPES: SOLID BS - BIOSOLID CR - CERAMIC SL - SOIL/SOLID LIQUID DW - DRINKING WATER GW - GROUND WATER OL - OIL SF - SURFACE WATER ST - STORM WATER WW - WASTE WATER	CONTRACT/P.O. NO.: 10-023-150		PROJECT: CALTRANS Grapevine Escape Ramp													
SIGNATURE:			PROJECT NUMBER:		PROJECT MANAGER:													
<input type="checkbox"/> PUBLIC SYSTEM <input type="checkbox"/> ROUTINE <input type="checkbox"/> PRIVATE WELL <input type="checkbox"/> REPEAT <input type="checkbox"/> OTHER REPLACEMENT <input type="checkbox"/>																		
TURN AROUND TIME: <input type="checkbox"/> RUSH, DUE ON: <input type="checkbox"/> STANDARD																		
NOTES ON RECEIVED CONDITION: <input type="checkbox"/> CUSTODY SEAL(S) BROKEN <input type="checkbox"/> SAMPLE(S) DAMAGED <input type="checkbox"/> ON ICE <input type="checkbox"/> AMBIENT TEMP. <input type="checkbox"/> INCORRECT PRESERVATION			ANALYSIS REQUESTED															
CLIENT SAMPLE ID DATE TIME TYPE																		
L A B U S E	AM100623-1	06/23/10	SW	X	X													
	AM100623-2	06/23/10	SW	X	X													

Appendix 11. BSK Associates (Chain of Custody)

BSK Associates

Engineering Laboratories

1414 Stanislaus St., Fresno, CA 93706
 (559) 497-2888 Fax (559) 497-2893
 www.bskassociates.com

A312049
 centr4730

09/25/2011
 10



Page 57 of 59

Temp: 63.0-8

Company/Client Name: Central Valley Regional Water Quality Control Board
Report Attendee: Anne Littlejohn
Invoice To: Joseph C. McGahan
Phone: 916-464-4840
Address: 11020 Sun Center Dr #200 Rancho Cordova CA 95670
City: Rancho Cordova **State:** CA **Zip:** 95670
Project: Eval WQ in Ag Dominated Water Bodies
Reporting Options: Trace (J-Flag) Swamp EDD Type: _____
Sampler Name (Printed/Signatures): Cindy A. Young *[Signature]*
Matrix Types: SW-Surface Water BW-Bottled Water GW-Ground Water WW-Waste Water STW-Stam Water DW-Drinking Water SO-Solid
Sample Description:

#	Sample Description	Sampled		Matrix	Comments / Station Code / WTRAX	Na, Nitrate, TDS, Perchlorate, Chloride	Sulfate, Hardness, Total: So, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se	Total: Ag, T, Fluoride, Zn, Hg	Total and Dissolved: Al, As, Fe, Mn	VOC: 8260	Boron
		Date	Time								
1	AWL130924 - 27	9/24/13	8:00	SW		X	X	X	X		X
2	AWL130924 - 28	9/24/13	8:30	SW		X	X	X	X		X
3	AWL130924 - 29	9/24/13	8:45	SW		X	X	X	X	X	X
4	AWL130924 - 30	9/24/13	8:00	SW		X	X	X	X		X
5	AWL130924 - 31	9/24/13	8:21	WW		X	X	X	X		X
6	AWL130924 - 32	9/24/13	8:47	SW		X	X	X	X		X
7	AWL130924 - 33	9/24/13	9:15	SW		X	X	X	X		X
8	AWL130924 - 34	9/24/13	9:25	SW		X	X	X	X		X
9	AWL130924 - 35	9/24/13	9:40	SW		X	X	X	X		X
10	AWL130924 - 36	9/24/13	9:55	SW		X	X	X	X		X
11	AWL130924 - 37	9/24/13	10:07	SW		X	X	X	X		X
12	AWL130924 - 38	9/24/13	10:30	SW		X	X	X	X		X
13	AWL130924 - 39	9/24/13	11:32	SW		X	X	X	X		X
14	AWL130924 - 40	9/24/13	11:50	SW		X	X	X	X		X

Shipping Method: DNTX UPS OBD WALK-IN FED EX Courier
Coating Method: White Blue None
Payment Received at Delivery: _____
Amount: _____ **PS&S:** _____
Check: _____ **Inst:** _____
Chilling Process Begun: *[Signature]*

Appendix 12. Excelchem Environmental Laboratories QA/QC Manual

Excelchem Environmental Laboratories

**Quality Assurance and Quality Control
Manual**

**Initial release date - 1990
Revision – June - 2011**

Appendix 13. Moore Twining Associates QA Manual



CONFIDENTIAL

California ELAP Certificate #1371

QUALITY ASSURANCE MANUAL

Document # QM-QA-0001-01

Effective Date: 3/16/11

Supersedes: QAP Manual 2009

Revised by: Maria Manuel, QA Manager

Approved by:

Andrew Adams
Andrew Adams
Laboratory Director

3/16/11
Date

Maria C. Manuel
Maria Manuel
Quality Assurance Officer

3/16/11
Date

Annual Review:

Name	Title	Date

08/ 8/29/11

Control # _____

Appendix 14. BSK Associates QA Manual



CONFIDENTIAL

QUALITY ASSURANCE MANUAL

Document # QA-QM-0001-04
Effective Date: 10/31/11
Supersedes: QA-QM-0001-03

BSK Associates
1414 Stanislaus Street
Fresno, California 93706
(559) 497-2888

Laboratory Director: Brad Meadows
Quality Assurance Officer: Kasanna Coulter

Review:

Name	Title	Date

Appendix 15. SWAMP QAPP



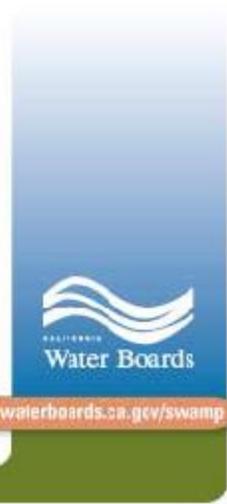
Final Technical Report 2008

Quality Assurance Program Plan

Version 1.0

September 1, 2008

Surface Water Ambient Monitoring Program



Appendix 16. ASWA Procedures Manual

**PROCEDURES MANUAL FOR WATER QUALITY
MONITORING BY THE
AG AND SURFACE WATER ASSESSMENT UNIT**



Updated April 2010

PREPARED BY:

CHAD DIBBLE
Environmental Scientist

VICTORIA BOWLES
Environmental Scientist

TJ Ditto
Environmental Scientist

Lee Xiong
Student Assistant

Appendix 17. References

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Appendix 18. Updates to QAPP Version 1

Appendix 19 details all updates made to QAPP Version 1 (June 2012). From December 2012 to September 2013, water samples were submitted to BSK Associates for analyses. A majority of the updates pertain to the addition of a new laboratory—BSK Associates.

Element	Section	Table/Figure	Update
A4, Element 4. Project/Task Organization	Involved Parties	Table 2	Name: <i>Lab Staff</i> Organizational Affiliation: <i>BSK Associates</i> Title: <i>Various</i> Project Title/Responsibility: <i>Sample Analysis</i> Contact info: <i>Tel: 559 497 2888</i>
		Figure 1	BSK Associates Lab Staff included under Monitoring Lead, Calvin Yang.
A6, Element 6. Project/Task Description	Project Schedule	Table 4	The project schedules for the 18-month study vary depending on quarterly reviews and funding. Water samples are analyzed at the lab on the same day as sample submission. Refer to Table A below for updated field sampling schedule.
	Constraints		Funding: The estimated budget for BSK Associates lab contract is \$50,000 for the monitoring period of December 2012 to September 2013. The funding limits the number of constituents that can be analyzed and compared to all drinking water criteria.
A7, Element 7. Quality Objectives and Criteria for Measurement Data	Method Detection Limit and Sensitivity	Table 5	Measurement Quality Objectives for BSK Associates is provided in their QA Manual (Appendix 14).
A8, Element 8. Special Training Needs/Certification	Specialized Training or Certification		The California Department of Public Health has certified Excelchem Environmental Labs, Moore Twining Associates Inc., and BSK Associates. The QA officers of all three labs are responsible for overseeing training of lab staff to achieve and maintain high standards of quality.
A9, Element 9. Documents and Records	Records to be included in data reports		Samples being sent to the Excelchem Environmental Labs, Moore Twining Associates Inc, and BSK Associates will include a Chain of Custody (CoC) form (Appendices 9-11).
	Electronic Records		Data will be verified first by the Laboratory Director for Excelchem Environmental Labs, Moore Twining Associates Inc, or BSK Associates.

Element	Section	Table/Figure	Update
B1, Element 10. Sampling Process Design	Type and Total Number of Samples		<p>Grab samples will be collected at all sites and included field measurements of specific conductance (SC), pH, turbidity, dissolved oxygen (DO), and temperature. In addition, photos will be taken during each site visit to visually document changing conditions including water levels. Depending on the site and constituent of interest, monitoring will be conducted once a month, twice a month, annually, or quarterly. Monitoring of constituents was also dependent on the quarterly reviews which were based on where and how frequent elevated concentrations were detected. Quarterly scans in 2012 will occur in June and September and quarterly scans in 2013 occurred in January, March, June, and September. Ammonia as nitrogen will be sampled once a month at the Biggs study area and annually at the effluent site of the Colusa, Willows, and Live Oak study area. <i>Escherichia coli</i> (<i>E. coli</i>) will be added and sampled once a month from August 2012 – September 2013. Key constituents consists of constituents that were identified in the effluent during the POTW’s NPDES permit renewal process at concentrations that may exceed the evaluation criteria for protecting drinking water supplies, constituents of potential concern through ILRP analyses, and constituents that had frequent elevated concentrations detected during monitoring. The following list shows the sampling frequency of key constituents for the period of April 2012 through September 2013 (Refer to List 1 below)</p> <p>Limited funding will allow for one full scan of all four POTW’s effluents in June 2012. In addition to the constituents listed, the full scan consisted of the following scans: Volatile Organic Compound and Oxygenated Additive; Organo-Chlorinated Pesticides; Gas Chromatograph/Mass Spectrometer Semivolatiles; Chlorinated Herbicides; Organo-Phosphorus Pesticides; Polychlorinated Biphenyls; Poly-Chlorinated-Dibenzo-p-Dioxin/Furan High Resolution Mass Spectrometer; and Carbamate Pesticides. Constituents within each scan are detailed in Table B. Not all of the constituents listed within each scan have MUN water quality evaluation criteria. (Refer to Table B below)</p>

Element	Section	Table/Figure	Update
B3, Element 12. Sample Handling and Custody	Maximum Holding Times		All samples collected in December 2012 to September 2013 will be delivered to BSK Associates Sacramento location at the end of each field run. BSK Associates Sacramento location will transfer all samples to Fresno location via ONTRAC.
	Transport		(December 2012—September 2013 Samples) BSK Associates 1414 Stanislaus Street Fresno, CA 93706 Tel: 559-497-2888
	Sample Transfer		Field crews will deliver December 2012—September 2013 samples and Chain of Custody (COC) forms to BSK Associates staff designated to receive samples.
B4, Element 13. Analytical Methods and Field Measurements	Field and Lab Analytical Procedures	Table 7	Lab Analytical Procedures for BSK Associates is provided in their QA Manual (Appendix 14).
B5, Element 14. Quality Control	Quality Control Samples		Laboratory quality control samples (laboratory blanks, laboratory control spike, laboratory control, spike duplicate, matrix spike, matrix spike duplicate, laboratory duplicate, and surrogates) will be created by Excelchem Environmental Labs, Moore Twining Associates Inc, and BSK Associates to be analyzed with field samples.
Appendices	Appendix 8		Added Bacteria Processing Laboratory Sheet (SWAMP)
	Appendix 11		Added BSK Associates (Chain of Custody)
	Appendix 14		Added BSK Associates QA Manual

Table A. Field Sampling Schedule

Site	Date
Colusa and Willows	2012
	April 16
	May 22, 29
	June 5, 29
	July 10, 24
	August 15, 28
	September 11, 25
	October 9, 25
	November 13, 29
	December 11, 26
	2013
	January 8, 29
	February 12, 28
	March 12, 27
	April 24
	May 20
	June 18
	July 24
	August 24
	September 24, 27
Live Oak and Biggs	2012
	April 18
	May 10, 24
	June 7, 26
	July 12, 26
	August 13, 29
	September 12, 26
	October 11, 30
	November 15, 27
	December 13, 27
	2013
	January 10, 30
	February 14, 26
	March 14, 28
	April 25
	May 21
	June 20
	July 25
	August 29
	September 26

List 1. Sampling Frequency of Key Constituents

Field (Two times/Month):

- Dissolved Oxygen
- pH
- Water Temperature
- Turbidity
- Specific Conductance
- Photos

Bacteria (Monthly):

- *E. coli*

Key (Monthly):

- Ammonia as N
- Nitrate as N
- Sulfate
- Total Dissolved Solids
- Boron
- Dissolved Arsenic
- Total Arsenic
- Sodium

General (Quarterly):

- Chloride
- Flouride
- Perchlorate
- Dissolved Aluminum
- Dissolved Iron
- Dissolved Manganese
- Total Aluminum
- Total Antimony
- Total Arsenic
- Total Barium
- Total Beryllium
- Total Cadmium
- Total Chromium

- Total Copper
- Total Iron
- Total Lead
- Total Manganese
- Total Mercury
- Total Nickel
- Total Selenium
- Total Silver
- Total Thallium
- Total Zinc

Trihalomethanes (Quarterly):

- Bromoform
- Chloroform
- Bromodichloromethane
- Dibromochloromethane

Table B. List of Constituents within Each Scan

Scan	Test Method	Constituent
Volatile Organic Compound & Oxygenated Additive	8260B	1,1-Dichloroethane, 1,1-Dichloroethene, 1,1,1-Trichloroethane, 1,1,2,2-Tetrachloroethane, 1,2-Dichlorobenzene, 1,2-Dichloroethane, cis-1,2-Dichloroethene, 1,2-Dichloropropane, 1,2,4-Trichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, Acrolein, Acrylonitrile, Benzene, Bromoform, Bromomethane, Carbon tetrachloride, Chlorobenzene (mono chlorobenzene), Chloroethane, Chloroform, Chloromethane, Dibromochloromethane, Dichloromethane, Ethylbenzene, Hexachlorobenzene, Hexachlorobutadiene, Hexachloroethane, Naphthalene, Tetrachloroethene, Toluene, trans-1,2-Dichloroethylene, Trichloroethene, Vinyl chloride, Methyl-tert-butyl ether (MTBE), Trichlorofluoromethane, 1,1,2-Trichloro-1,2,2-Trifluoroethane, Styrene, Xylenes, 1,2-Dibromo-3-chloropropane (DBCP), Ethylene Dibromide, 1,1,1,2-Tetrachloroethane, 1,1,2-Trichloroethane, 1,1-Dichloropropene, 1,2,3-Trichloropropane (123TCP), 1,2,4-Trimethylbenzene, 1,2-Dibromoethane (EDB), 1,3,5-Trimethylbenzene, 1,3-Dichloropropane, 2,2-Dichloropropane, 2-Hexanone, 4-Chlorotoluene, 4-Methyl-2-pentanone, Acetone, 4-Methyl-2-pentanone, Bromobenzene, Bromochloromethane, Carbon disulfide, cis-1,3-Dichloropropene, Dichlorodifluoromethane, Dichloromethane, Isopropylbenzene, m,p-Xylene, Methylene chloride, n-Butylbenzene, n-Propylbenzene, o-Xylene, p-Isopropyltoluene, tert-Butylbenzene
Organo-Chlorinated Pesticide	8081A	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-Hexachlorocyclohexane (BHC), Aldrin, beta-Hexachlorocyclohexane, Chlordane, Dieldrin, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, Lindane (gamma-Hexachlorocyclohexane), Toxaphene, alpha-Chlordane, delta-BHC, Endosulfan I, Endosulfan II, Endrin ketone, gamma-Chlordane, Methoxychlor, Trifluralin
Gas Chromatography/Mass Spectrometer (GC/MS) Semivolatiles	8270C	1,2-Diphenylhydrazine, 2-Chlorophenol, 2,4-Dichlorophenol, 2,4-Dimethylphenol, 2,4-Dinitrophenol, 2,4-Dinitrotoluene, 2,4,6-Trichlorophenol, 2,6-Dinitrotoluene, 2-Nitrophenol, 2-Chloronaphthalene, 3,3'-Dichlorobenzidine, 4-Chloro-3-methylphenol, 4,6-Dinitro-2-methylphenol, 4-Nitrophenol, 4-Bromophenyl phenyl ether, 4-Chlorophenyl phenyl ether, Acenaphthene, Acenaphthylene, Anthracene, Benzidine, Benzo(a)pyrene (3,4-benzopyrene), Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Bis(2-chloroethoxy) methane, Bis(2-chloroethyl) ether, Bis(2-chloroisopropyl) ether, Bis(2-ethylhexyl) phthalate, Butyl benzyl phthalate, Chrysene, Di-n-butylphthalate, Di-n-octylphthalate, Dibenzo(a,h)-anthracene, Diethyl phthalate, Dimethyl phthalate, Fluoranthene, Fluorene, Hexachlorocyclopentadiene, Indeno(1,2,3-c,d)pyrene, Isophorone, N-Nitrosodiphenylamine, N-Nitrosodimethylamine, N-Nitrosodipropylamine, Nitrobenzene, Pentachlorophenol, Phenanthrene, Phenol, Pyrene, 2,4,5-Trichlorophenol, 2-Methylnaphthalene, 2-Methylphenol, 2-Nitroaniline, 3-Hydroxycarbofuran, 3-Methylphenol, 3-Nitroaniline, 4-Chloroaniline, 4-Methylphenol, 4-Nitroaniline, Benzo (a) anthracene, Benzo (b) fluoranthene, Dibenzofuran, Dibromochloropropane, Diphenylamine, Isophorone
Chlorinated Herbicide	8151A	2,4-D, Dalapon, Dinoseb, Picloram, 2,4,5-TP (Silvex), 2,4,5-T, 2,4-DB, Dicamba, Dichloroprop, MCPA, MCPP,
Organo-Phosphorus Pesticide	8141A	Atrazine, Simazine (Princep), Diazinon, Chlorpyrifos, Azinphos methyl, Bolstar, Coumaphos, Demeton O/S, Dichlorvos, Disulfoton, Ethoprop, Fensulfothion, Fenthion, Merphos, Methyl parathion, Mevinphos, Naled, Phorate, Stirophos (Tetrachlorvinphos), Trichloronate
Polychlorinated Biphenyls (PCB's)	8082A	PCB-1016, PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254, PCB-1260
Poly-Chlorinated-Dibenzo-p-Dioxin/Furan High Resolution Mass Spectrometer (HRMS)	8290	2,3,7,8-TCDD (Dioxin)
Carbamate Pesticide	8318	Carbofuran, Oxamyl, 3-Hydroxycarbofuran, Aldicarb, Aldicarb sulfone, Carbaryl, Dioxacarb, Methiocarb, Methomyl, Promecarb, Propoxur (Baygon)