Municipal Water Quality Investigations Program
2015-2016 Annual Work Plan Appendix 2

State of California
Natural Resources Agency
DEPARTMENT OF WATER RESOURCES

July 2015

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Chapter 1. Introduction

The purpose of this appendix is to provide additional information on studies that are described in the work plan. The descriptions provided in the work plan were kept to short summary descriptions and tables of deliverables and due dates. This was done in order to keep the document short and concise. This appendix contains detailed project management documentation and deliverable documents associated with the studies summarized in the work plan. The project management documentation in this appendix includes project management tools from the Project Management body of Knowledge (PMBOK) standard of developing projects.

The PMBOK standard of designing and implementing projects is the method used by DWR, and MWQI principal investigators are using these tools for developing and managing their projects. The PMBOK method includes processes for initiating, planning, executing, monitoring and controlling, and closing out a project. Each stage of project development incorporates the elements of project integration, management, scope, time, cost, quality, resources, communication, risk, procurement, and stakeholder management. Utilizing the PMBOK standard will enable staff to effectively manage projects while efficiently producing deliverables within scope, schedule, and budget. For budget information for each of the projects, see Table 1 of the work plan; it is not included in this appendix.

In addition to the PMBOK documents, this appendix also includes deliverable documents associated with the studies. When applicable, this includes project study plans, Quality Assurance Project Plans (QAPPs), Health and Safety Plans, and Pre-Work Safety Plans.

For continuity between this appendix and the work plan, the sections of this appendix are broken down by work plan section. The project management documents for this work plan fall into “Program Elements Water Quality Assessment” and “Science Support (Special Studies)”. The documents associated with each project are in the same order as those projects appear in the work plan.

Chapter 2. Program Elements Water Quality Assessment – Short Term Monitoring Projects

5.2.1 DSM2 Nutrient Monitoring

DSM2 Nutrients Project Charter

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PROJECT CHARTER

Version#: 2 **Date:** 7/14/2015

Project Name: Write out the entire, specific name.

DSM2 Nutrient Monitoring Study

Sponsor/Program Manager	Cindy Garcia
Project Manager	Steven San Julian

Project Objective Statement: What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).

By September 1, 2013, develop monitoring plan and commence monitoring for analytes of concern at key DSM2 nodes as required by computer modelers until sufficient data has been collected to improve the DSM2 model calibration.

Triple Constraint Trade-off:

Resources	S	Select a different flexibility letter for each constraint N= Not Flexible S= Somewhat Flexible M= Most Flexible
Schedule	M	
Scope	N	

Estimated Start Date:	9/1/13	**Estimated End Date:**	Depends on data needs

Project Deliverables: What is the project going to produce? Create a list of tangible products that will result from project.

Monitoring Plan, Data available on WDL, and a data analysis memorandum report that will determine need for continued montiroing.

Strategic Fit: What is the Strategic Initiative Identifier for this project?

Agreed to part of the MWQI 15/16 Workplan

Customer: Who are you doing the project for?

MWQI Contractors and DSM2 Nutrient modelers

PROJECT CHARTER

Customer Benefits: What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.

Water quality data for DSM2 nutrient model calibration. Make data available. The data is needed because the current DSM2 nutrient calibration has been determined to be lacking. The data provided will allow for refinement of the model and hopefully a more accurate output.

Success Determination Factors: How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.

Data will be available and when analyzed will accurately describe the DSM2 node locations which will allow for DSM2 model's calibration to be refined. A successful memorandum report will provide the data analysis in a way that allows DSM2 modelers to clearly determine if monitoring needs to continue or if it can stop.

Project Background: What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.

In the Delta Simulation Model 2 (DSM2), modeled nutrient concentrations and flux are inaccurate. Inaccuracies in the data input to the model have been defined as the shortcoming. To improve the DSM2 model response, additional field monitoring at key locations will be instituted for the 13/14 fiscal year. Certain nodes have been defined as locations where insufficient data exists. For this reason these nodes have been monitored. Monitoring has continued beyond the 13/14 fiscal year, and data analysis has yet to occur that answers affirmatively whether monitoring should continue or stop.

Project Scope:

In Scope: List areas and functionality included in project.	**Out of Scope**: List areas and functionality not included in project.
Collect WQ samples at DSM2 defined, key nodes or at acceptable nearby locations. Collect samples that will help calibrate the DSM2 Nutrient model. Make data available on WDL. Analyze data to determine if sufficient data has been collected.	Not WQ related. Not related to DSM2 Nutrient model calibration.

Dependent Projects: What projects must be underway or completed before this project can be successful?

Data collected in this project will be not be used to its full potential until the data has been incorporated into the DSM2 Nutrient model. The lack of feedback from DSM2 modelers has resulted in monitoring continuing to present. In order to help DSM2 modelers provide the needed feedback about continuing or stopping monitoring, a MWQI created memorandum report will be created to help determine if additional data collection is needed.

Risks: What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.

Contractors cut funding to this monitoring program. Access issues arise. Monitoring vehicles become unavailable. Contract lab changes. Bryte can't handle the increase in samples. DSM2 modelers do not provide feedback needed to halt or improve monitoring.

Assumptions and Constraints: What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.

The DSM2 Nutrient model does not currently reflect the actual conditions in the Delta. Data can be collected that will accurately represent nutrient water quality at DSM2 nodes. Calibration of DSM2 will use this data. Sites will be accessible for the life of the study. DSM2 modelers will provide needed feedback.

PROJECT CHARTER

Environmental Stewardship and Sustainability Considerations: What is the process that will be used to ensure compliance with the Environmental Stewardship Policy? Include the Environmental Stewardship Coordinator and team members (this can be roles instead of specific names)

No impact to the environment from this activity, so no environmental coordinator necessary. No waste material will be disposed of during monitoring other than unused sample water and small amounts of deionized (clean) water. All solid waste will be disposed of in the proper receptacles. This monitoring project will provide data that can be used determining environmental effects in the delta region.	
Environmental Stewardship Coordinator:	n/a

Major High-Level Milestone Targets: What events measure progress? E.g. Initiation Approved, Analysis Complete.

Milestone	Target
Create Draft Monitoring Plan	7/13
Complete Final Monitoring Plan	9/13
Begin Monitoring Activities	9/13
Make Data Available on the WDL	10/13
Create Memorandum report	9/15
Present findings to DSM2 modelers	10/15
End of Monitoring	Based on memo findings

Project Core Team Members:

Team Member	Phone/E-mail	Role
Steven San Julian	916-371-2284	Project lead
Rachel Pisor	916-376-9711	Data Analysis oversight
Elaine Archibald	916-736-3713	Study design
Hari Raibhandari	(916) 657-5171	Study design
Jason Moore	(916)376-9713	Data Analysis Report Lead
Siqing Liu	(916) 653-3522	Study design/DSM2 Calibration
MWQI Field Staff	916-322-5786	monitoring

Charter Version Number: 2	
Updated By:	**Date:**
Approved By:	**Date:**

Funding Information:

Project Budget:	
Fund Center Title	Water Quality Assessment
Fund Center Number	VWQASSMENT13
Organization	DWR-Municipal Water Quality Investigations
Contact Person	Steven San Julian
Phone/E-mail	916-371-2284; sjulian@water.ca.gov

PROJECT CHARTER

This Project Should Have: Check all that apply

Project Management Plan ☐	Environmental Stewardship Plan[1] ☐	Work Breakdown Structure ☐	Communications Plan ☐	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ☐	Risk Register ☐	Project Budget ☐	Project Schedule ☐	DWR Form 1498 ☐
Project Safety Plan[2] ☐					

[1] See WREM 58b for more information about creating an Environmental Stewardship Plan.

[2] All project Managers must take into account safety policies and procedures for projects. A safety plan should be created if needed. For more information visit the Workplace Safety Project web site.

5.2.2 Cache Slough Complex Pre-Restoration Baseline Monitoring

Cache Slough Complex Project Charter

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PROJECT CHARTER

Version#: 2 **Date:** 7/15/2015

Project Name: Write out the entire, specific name.

Cache Slough Complex Pre-Restoration Baseline Monitoring

Sponsor/Program Manager	Cindy Garcia
Project Manager	Steven San Julia

Project Objective Statement: What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).

By September 1, 2013, develop monitoring plan and commence monitoring of analytes of concern to municipal water agencies at sites upstream and downstream from proposed Cache/Yolo Complex restoration in a manner that will allow for restoration drinking water quality impacts to be measured, and conduct analysis of that data after 2 years to assess if the monitoring plan should be refined.

Triple Constraint Trade-off:

Resources	S	Select a different flexibility letter for each constraint N= Not Flexible S= Somewhat Flexible M= Most Flexible
Schedule	N	
Scope	M	

Estimated Start Date:	9/1/13	**Estimated End Date:**	At finish of restoration

Project Deliverables: What is the project going to produce? Create a list of tangible products that will result from project.

Monitoring Plan, Data available on WDL, and a 2-year data analysis report that will help redirect the monitoring program.

Strategic Fit: What is the Strategic Initiative Identifier for this project?

Agreed to part of the MWQI 13/14 thru 15/16 Workplan

Customer: Who are you doing the project for?

MWQI Contractors, SCWA, and other Cache Slough Monitoring interests (FRPA, Aquatic Ecology, Methyl-Mercury Group)

PROJECT CHARTER

Customer Benefits: What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.

Water Quality data for Cache Slough Complex pre-restoration. Make data available. This data will be useful in the future to show the water quality change that can be attributed to ecological restoration projects completed in the cache slough complex.

Success Determination Factors: How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.

Data will be available and when analyzed will accurately describe the pre-restoration water quality of the cache slough complex. To ensure this, after two years of data collection, the data will be analyzed to ensure the monitoring is sufficiently scoped and recommend adjustments if necessary.

Project Background: What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.

Planned habitat restoration activities in the Cache/Yolo Complex will have unknown impacts to in-stream water quality and therefore, restoration efforts may result in additional costs to drinking water municipalities treating thru-Delta water. The development of a planned FRPA monitoring program, which was addressed in Phase 1 (Cache/Yolo Complex Baseline WQ Monitoring Project-Phase 1, dated 2/26/13), has either not developed quickly enough or has neglected to meet drinking water quality concerns brought forward by the MWQI program.

The MWQI program will develop its own monitoring program to answer questions and concerns of drinking water contractors funding the MWQI program. Based on the selected monitoring program, MWQI will collect baseline drinking WQ data near the proposed restoration sites with the goal of creating a data set that will define pre-restoration water quality in the Cache Slough Complex. Once restoration efforts are complete a comparison between pre and post restoration water quality will be possible allowing drinking water contractors to see how restoration efforts have affected the water quality at municipal intakes.

Project Scope:

In Scope: List areas and functionality included in project.	**Out of Scope**: List areas and functionality not included in project.
Collect WQ samples in and below the Cache Slough Complex. Collect samples that will benefit WQ questions in the complex. Make data available on WDL. Create documents that	Not WQ related. Not related to the 8000 acre restoration requirement. Anything occurring after restoration is complete.

Dependent Projects: What projects must be underway or completed before this project can be successful?

This project cannot reach it natural endpoint until the complete 8000 acre restoration requirement has been met, unless enough data is collected to statistically describe baseline conditions.

Risks: What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.

Contractors cut funding to this monitoring program. Access issues arise. Monitoring boats become unavailable. Contract lab changes. Bryte can't handle the increase in samples. Change in ability for collaborating groups to collect samples.

Assumptions and Constraints: What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.

Water Quality will be affected by changes in the land use in the Cache Slough Complex. Data can be collected that will accurately reflect the water quality in the Cache Slough Complex. Restoration projects will be complete. FRPA monitoring will not occur fast enough for MWQI's funding contractors.

PROJECT CHARTER

Environmental Stewardship and Sustainability Considerations: What is the process that will be used to ensure compliance with the Environmental Stewardship Policy? Include the Environmental Stewardship Coordinator and team members (this can be roles instead of specific names)

No impact to the environment from this activity, so no environmental coordinator necessary. No waste material will be thrown overboard during monitoring other than unused sample water and small amounts of deionized (clean) water. All solid waste will be disposed of in the proper receptacles. This monitoring project will provide data that can be used determining environmental effects of restoration.	
Environmental Stewardship Coordinator:	n/a

Major High-Level Milestone Targets: What events measure progress? E.g. Initiation Approved, Analysis Complete.

Milestone	Target
Create Draft Monitoring Plan	7/13
Complete Final Monitoring Plan	9/13
Begin Monitoring Activities	9/13
Make Data Available on the WDL	10/13
Analyze Data and create interim data report that further directs monitoring	10/15
Changes made to monitoring based on findings	11/15
End of Monitoring	n/a

Project Core Team Members:

Team Member	Phone/E-mail	Role
Steven San Julian	916-371-2284	Project lead
Alex Rabidoux	707-455-1106	Study design
Elaine Archibald	916-736-3713	Study design
Gina Benigno	916-376-9767	Study design/monitoring
Jared Frantzich	916-376-9823	Study design/monitoring
Otome Lindsey	916-376-9716	Interim data report lead
MWQI Field Staff	916-322-5786	monitoring

Charter Version Number: 2	
Updated By:	**Date:**
Approved By:	**Date:**

Funding Information:

Project Budget:	
Fund Center Title	Water Quality Assessment
Fund Center Number	VWQASSMENT13
Organization	DWR-Municipal Water Quality Investigations
Contact Person	Steven San Julian
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Project Management Plan ☐	Environmental Stewardship Plan[1] ☐	Work Breakdown Structure ☐	Communications Plan ☐	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ☐	Risk Register ☐	Project Budget ☐	Project Schedule ☐	DWR Form 1498 ☐
Project Safety Plan[2] ☐					

[1] See WREM 58b for more information about creating an Environmental Stewardship Plan.

[2] All project Managers must take into account safety policies and procedures for projects. A safety plan should be created if needed. For more information visit the Workplace Safety Project web site.

Cache Slough Complex Monitoring Plan

Cache Slough Complex Pre-Restoration Baseline Monitoring Draft Quality Assurance & Monitoring Plan V.2

For *Phase 2* project described in the MWQI 15/16 Workplan

MWQI Program

July 14, 2015

Steven San Julian

steven.sanjulian@water.ca.gov

916-371-2284

Section 1. Purpose of Monitoring

In the coming years, numerous ecologically driven restoration projects are planned for construction in the Cache Slough Complex. The Cache Slough Complex includes the Yolo Bypass, North Bay tributaries draining into the Delta, and in-Delta, Sacramento River connected sloughs. Tied to the Delta Smelt Biological Opinions, numerous restoration projects of various sizes are planned, and a total of over 8000 acres could eventually be restored. These planned habitat restoration activities will have unknown impacts to in-stream water quality and therefore, may result in additional costs to drinking water municipalities treating thru-Delta water. Currently, other DWR groups and sister agencies are looking to initiate baseline monitoring efforts as required by the FRPA agreement. The proposed FRPA monitoring program is still in the initial phase of development. It is unclear if drinking water quality concerns will be covered by the FRPA monitoring plan and when such monitoring might commence. For this reason, MWQI will commence its own monitoring program to ensure pre-restoration water quality data is available to compare against post restoration water quality. Phase 1 part of this project, which is not covered in this monitoring plan, is for MWQI to work with FRPA to get drinking water quality concerns addressed in the FRPA monitoring plan. Both phases will run concurrently.

Section 2. Sample Design and Rational

In this plan, all major inputs and outflows, from the area commonly referred to as the Cache Slough Complex, will be monitored. Samples sites were initially selected to be monitored from shore, but due to issues related to access and representativeness, monitoring will be conducted by boat. When possible, station locations were positioned near existing flow gaging stations. See Section 3.4 for specific monitoring location overview.

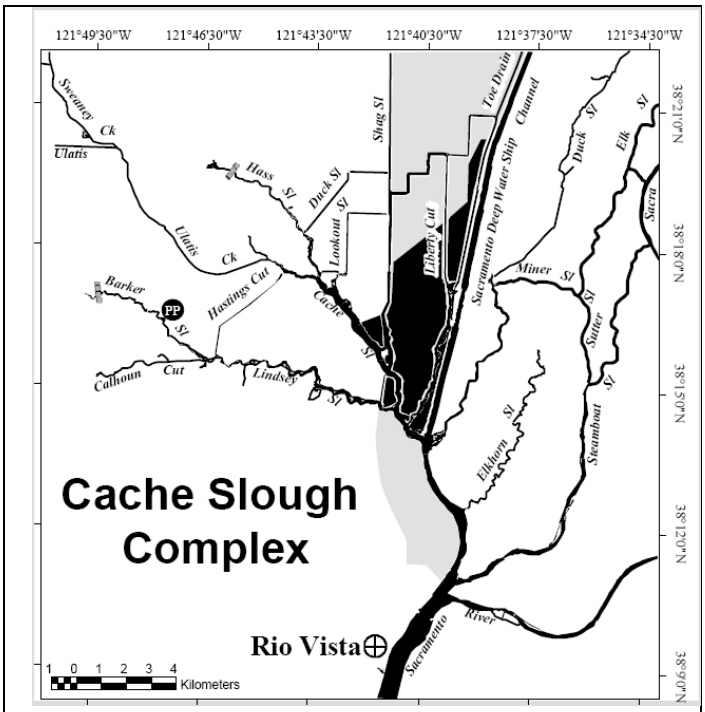


Figure 1. Map of Cache Slough Complex

Since the goal of this study is to describe pre-restoration water quality conditions, sites have been selected in each of the main tributaries to the lower Cache Slough. Sampling will occur in Lindsey Slough at Hastings Bridge, upper Cache Slough (below Ulatis Creek), Shag Slough (west Yolo bypass toe-drain), south tip of Liberty Island, Lisbon Weir (east Yolo bypass toe-drain), Sacramento Deep Water Channel (about mid-Prospect Island), Miner Slough above Prospect Island, Miner slough near the bottom of Prospect island, and finally, downstream, where all of these waters combine, in the lower Cache Slough above Elkhorn Slough.

Monitoring on a tidally consistent basis has benefit, but due to logistical concerns will not take place. The amount of time required to collect samples from all sites cannot occur at the same phase of the tidal cycle (sampling all sites takes about 3.5 hours), and using multiple boats and crews is not feasible at this point. Additionally, short hold time analyses, such as BOD and CBOD, need to be shipped immediately and tidally based sampling might result in key shipping times with our preferred shipper, Golden State Overnight (GSO), being missed. Therefore, monitoring runs will start at relatively consistent times (6-7am), and will occur roughly every two weeks with all samples being collected on the same day but not necessarily at the same time in the tidal cycle. In-situ instruments, such as YSI sondes, are planned to be installed in the near future and may aid in analysis of the non-tidally driven monitoring data.

The monitoring sites have been selected based on the assumption that the data will describe pre-restoration water quality in the Cache Slough Complex. To ensure that the data meeting this end, MWQI, the MWQI Technical Advisory Committee (TAC), FRPA staff, and other DES interests will continually assess the results and make adjustments to the monitoring design as necessary. Adjustments made will result in edits to this monitoring plan, and each successive *accepted* edit will be given a version number as in *V.1*. Completed revisions will be distributed to those listed in Table 1.

2.1 Sampling Timeframe

As first described in the MWQI FY13/14 Work plan, monitoring activities are planned to commence Aug 1, 2013 (actual first sampling event occurred September 2013). In successive work plans, the timeframe for this study may be extended, and changes may be made to the sampling locations and constituents. During initial discussions, project sponsors showed interest in this study continuing until all restoration projects were complete. This project may go on that long, but continued monitoring will be decided each year during MWQI work plan development.

2.2 Funding Considerations

THMFP/HAAFP samples need to be sent to a contract lab for analysis. Bryte Lab analyses are charged on overhead so there is no direct charge for these samples to the MWQI program, but the contract lab samples need to be paid directly out of MWQI funds. For informational purposes, the value of Bryte Lab analytical support for this study would cost roughly $60,000/year if the MWQI program was charged directly. The contract lab charges, per sample, $330 for HAAFP and $75 for THMFP. Therefore, outside of labor costs, the estimated cost of conducting the contract lab part of this study for the 13/14 fiscal year was $90,000. Due to budget constraints, beginning in July 2014, these contract lab samples were collected only one time per month, during the first run of the month. This resulted in roughly $45,000 in savings to the MWQI budget. Starting in May 2015, the once monthly collection of contract labs samples was shifted to the second run of the month to make room for pathogen monitoring scheduled for the 1st run of the month.

All contract lab charges will be paid for by the MWQI program under the VWQASSMENT13 internal order code. Staff resources will be used preparing these samples for shipment,

coordination with contract lab, and inputting contract lab results into DWR's WDL database. These costs are accounted for in MWQI's FY15/16 budget.

For this study, MWQI will be borrowing a boat from the DWR's Environmental Water Quality and Estuarine Studies Branch (EWQES). A resource agreement has been developed to supply EWQES reimbursement for MWQI's use of their equipment. This additional cost is unknown at this time, so has not been added onto the studies total cost.

It is estimated that 6 full staff days (including overtime) will be needed each week that monitoring is conducted. This is equal to 12 staff days per month. The average hourly rate for employees is assumed to be $100. Therefore the annualized labor cost will be approximately $15,000.

Total annual estimated costs for this study including contract lab costs (not including Bryte Lab), and labor is $60,000.

Section 3. Field Sampling Plan

3.1 Project Organization and Responsibilities

The MWQI Field Section is taking the lead on this study, but many parties will be involved in various aspects of this study. See Table 1 for the listed responsibilities.

Table 1. Cache Slough Complex Study Responsibilities Matrix

Staff Member	Position	Responsibilities
Steven San Julian, MWQI Field	Study Lead/Project Manager	General coordination and management, field run scheduling, boat scheduling, boat operator, and field run staff
Arin Conner, MWQI Field	Field Staff	Boat operator, field run staff
Travis Brown, MWQI Field	Field Staff	Field run staff, contract lab shipping coordinator
Jeremy Del Cid, MWQI Field	Field Staff	Field run staff, THMFP/HAAFP Chem module data entry and coordination
Mark Bettencourt, MWQI	Field Staff	Boat operator, field run staff
Jared Frantzich, DWR, Aquatic Ecology	Aquatic Ecology Coordinator	Monitoring design support and calibration, and Lisbon Weir sample collection/coordinator.
Sid Fong, DWR, Bryte Lab	Bryte Lab Director	Receive/Analyze/Report lab samples associated with this study with the exception of THMFP/HAAFP samples
Brandon Gee, Weck Lab	Weck Lab Contact	Send specialized sampling and shipping containers, analysis of THMFP/HAAFP samples, and deliver analytical results to Sid Fong and Jeremy Del Cid
Carol DiGiorgio, DWR	Methyl Mercury Coordinator	Monitoring design support and calibration
Gina Benigno, DWR, FRP	FRPA Coordinator	Monitoring design support and calibration
Alex Rabidoux, SWCA	SWC Study Partner and SWCA Coordinator	Monitoring design support and calibration
Cindy Garcia, MWQI	Program Manager	Study funding and approval
Elaine Archibald, SWPCA Rep.	Project Sponsor	Study funding and design support

3.2 Field Activities Safety Considerations

Employee safety is a chief concern during all field work. Conditions in the field can change rapidly and it is important for field staff to be adequately prepared for such changes. For this study in particular, additional hazards will be present related to boat work. Prior to every field run, a safety tailgate meeting will be conducted by the boat operator with all run staff present. Topics discussed should related to the hazards described in the Job Hazard Analysis. Also, prior to departing the office for this field run, the boat operator needs to complete a boat pre-operation checklist and a float plan. The float plan describes information such as which boat is being used, who is on the boat, where the boat will be, and contact information for run staff. The float plan is to be entrusted to a responsible party at the office (not on the field run) who is in charge of ensuring that the run staff return to the office by the planned time.

The boat operator and field run staff must follow all boating and waterway rules. Field run staff need to do as directed by the boat operator as the boat operator has the ultimate responsibility for staff safety. Weather and water conditions may be hazardous. Prior to leaving the office in the morning, the boat operator needs to check weather and water conditions. If the conditions are deemed unsafe, the run will be cancelled. Again, once the crew arrives on site at the boat ramp conditions need to be assessed. If the operator or field run staff are uncomfortable with the conditions, they have the authority to cancel the run.

When onboard any vessel, staff are required to wear a personal floatation device (PFD).

On boat-based monitoring runs, MWQI staff need to bring the Boat Safety Bag on the vessel. The boat safety bag contains:

1. Field Safety Plan Binder
2. Type IV throw-able floatation device
3. Collapsible paddle
4. Beacon light
5. Signal horn
6. Eye wash
7. Flashlight
8. First aid kit
9. Throw rope
10. Paper towels
11. CPR mask
12. Emergency blankets
13. Waterproof chart book, bay/delta
14. gloves

Based on initial field reconnaissance and staff experience, a job hazard analysis was completed that describes all of the tasks and possible hazards associated with the field component of this study. The complete JHA is in Appendix H. Aside from the hazards and procedures described here and in the JHA, field run staff need to read and understand the MWQI Field Safety Plan (Appendix B). The Safety Plan contains additional safety related information of which all field employees need to be aware.

3.3 Field Sampling Schedule

Sampling at the sites will be bi-weekly (twice a month) at all sites. Sampling will occur during the first full week of the month at the same time as MWQI's routine monthly monitoring and current special study monitoring. Sampling will occur roughly every two weeks. Because sampling will occur from a boat, conditions may result in field runs being cancelled. Such occurrences will be noted. An attempt will be made to reschedule on another day during the early part of the same week, but if this is not feasible, the run will be cancelled. Because MWQI is borrowing a boat from another DWR group, MWQI is responsible for scheduling field runs as far in advance as possible. Because of the consistent schedule for this study, MWQI will try to schedule the boat for 6 months into the future.

3.4 General Field Sampling Locations

Figure 2. Map of all sampling sites

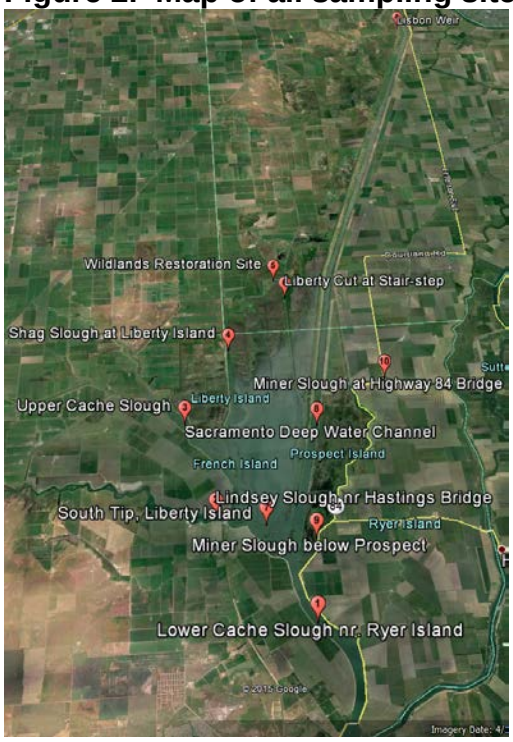


Table 3. Cache Slough Monitoring Locations

Station Name	Station ID#	Latitude	Longitude
Lindsey Slough at Hastings Bridge (Barker/Lindsey Slough)	B9D81481421	38°14'46.84"N	121°42'8.83"W
Upper Cache Slough	B9D81701460	38°16’44.81”N	121°42’41.24”W
Lisbon Weir (East Yolo Bypass Toe-drain)	B9D82851352	38°28’36.07" N	121°35’19.30" W
Shag Slough at Liberty Island (West Yolo Bypass Toe-drain)	B9S81841416	38°18'23.47"N	121°41'34.60"W
Miner Slough above Prospect Island (highway 84 bridge)	B9D81751379	38°17'29.89"N	121°37'51.06"W
Miner slough below Prospect Island	B9D814103910	38°14'6.18"N	121°39'57.55"W
Cache Slough nr. Ryer Island gaging station	B9D81281401	38°12.799’N	121°40.115’W
Sacramento Deep Water Channel	B9D81621397	38°16’31.39	121°39’37.81”W
Southern Tip of Liberty Island	B9D81461410	38°14’34.16”N	121°41’0.99”W
Wildlands Restoration Site	B9D82011403	38°20’6.93”N	121°40’16.79”W
Liberty Cut at Stairstep	B9D82011400	38°19’38.20”N	121°40’2.05”W

Duplicate Site (changes each run)	n/a	n/a	n/a

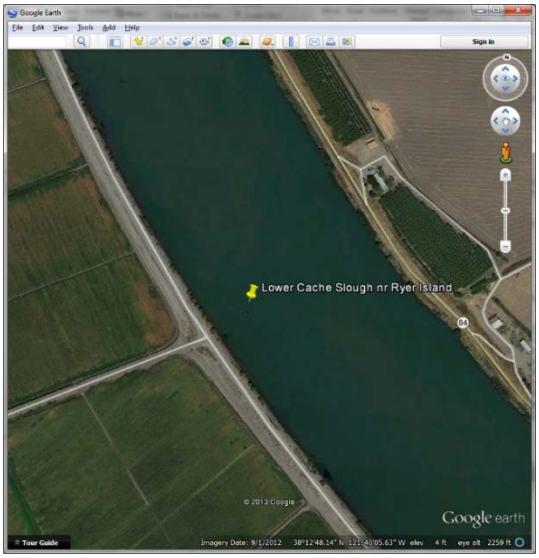
3.5 Field Monitoring and Sampling Methods

3.5.1 Sampling Vessels

Monitoring activities will take place aboard Department of Water Resources' vessels. We currently have the approval to use the EWQES Branch vessel commonly referred to as the *Stryker*. The boat will be trailered from West Sacramento and deployed at the Rio Vista Boat Ramp. Launch at this location is free to state agencies. The Stryker is appropriately sized for the monitoring task at hand, has sounding equipment for GPS location and depth measurements, and has mounting brackets for sampling equipment. Additionally, the Stryker has a Bimini Top to help protect run staff and collected samples from the elements. An additional vessel, commonly referred to as the *Whaler*, may be used at times. The Whaler will handle rough conditions better, but does not have a Bimini top to protect staff and samples from the elements.

3.5.2 Station Positions

Below are the specific locations of all 11 sites. All sites are monitoring on the boat run with the exception of the Lisbon Weir site which is collected by the Aquatic Ecology section. At each site the location of sample collection should be mid-channel and approximately 3 feet below the surface of the water. If depth is less than 5 feet, sample form the middle of the water column. Sample within 50 feet of the positions listed, and closer if possible. On water travel time from Rio Vista to the 8 sites and back takes approximately 3 hours. Adding in time for processing, on water time will be roughly 6 hours. NOTE: The sites should be sampled in the following order!



Lower Cache Slough nr. Ryer Island @ 38°12.799'N 121°40.115'W

Representativeness: Mid-channel location near the USGS gaging station. At this location it is possible that the water body might not be adequately mixed. Such instances will be noted.

Access: No access issues by boat.

Lindsey Slough at Hastings Bridge@ 38°14'46.84"N 121°42'8.83"W

Representativeness: Good, mid-channel monitoring location (from bridge) that is intended to describe water quality in the Lindsey Slough drainage to Cache Slough.

Access: Private Bridge and levees. Selected because other groups (SCWA) already monitor at this location (add what is being monitored). Alex recommends monitoring from the SCWA monitoring shed on the northeast side of the bridge. If sampling by land, will use the SCWA's entry permit as we are sampling for SCWA. When boat sampling access is not an issue. Location of station is about 10 minutes off of highway 12.

(Current) Upper Cache Slough @ 38°16'44.81"N 121°42'41.24"W

(Old) Upper Cache Slough @ 38°16'59.03"N 121°42'57.70"W

Representativeness: Representative of the upper Cache Slough above Shag Slough connection**.** Site at Old location for first year but moved to current location because USGS has a sonde at this site.
Access: Not accessible by land without accessing private levees (RD 2060). Will need temporary entry permit (TEP) or similar to access by land, but since we are boat sampling this is not an issue.
Line of sight: (Current) Between 2 buoys marking a hazard. This is the USGS sonde location.
(Old)Positioned mid-channel, line up the bend in the river with the power poll for correct sampling position.

Shag Slough at Liberty Island (West Yolo Bypass Toe-drain) @ 38°18'23.47"N 121°41'34.60"W
Representativeness: This site has been monitored for a few years now. The bridge site is a good, mid-channel monitoring location for the west Yolo toe drain.
Access: Site is publicly accessible but is a long drive. Site will be sampled by boat for this study.

Wildlands Restoration Site @ 38°20’6.93”N 121°40’16.79”W
Representativeness: Located about 200 feet south of entrance onto island.
Access: No access issues by boat.
Caution: Sill at entrance is very high in water. Raise engine and float over sill or prop damage might occur.

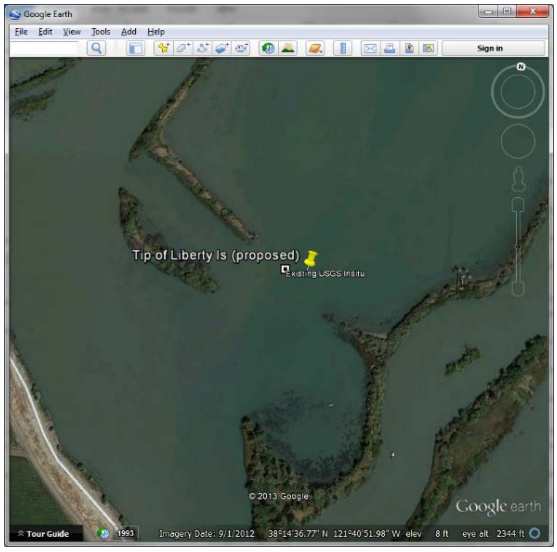
Liberty Cut at Stair Step @ 38°19’38.20”N 121°40’2.05”W

Representativeness: Located down liberty cut from stair step, at USGS instrument buoy.

Access: No access issues by boat.

Caution: none noted

South Tip of Liberty Island @ (38°14'34.16"N 121°41'0.99"W)

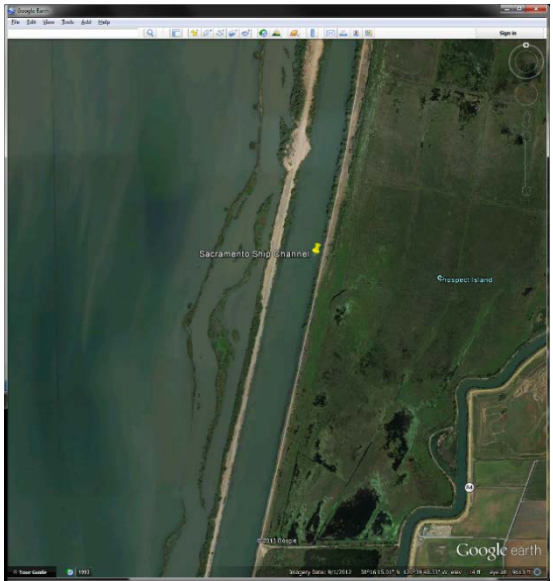


Representativeness: Located at the southern tip of the flooded Liberty Island and near the existing USGS station. Site intended to describe water quality exiting and entering onto Liberty Island.

Access: No access issues by boat.

Caution: Wind and current can quickly move boat onto/off of Liberty or into remnant levees! Lots of underwater hazards on Liberty, so don’t go much north of the USGS buoy.

Sacramento Deep Water Channel (SDWC) @ 38°16’31.39 121°39’37.81”W



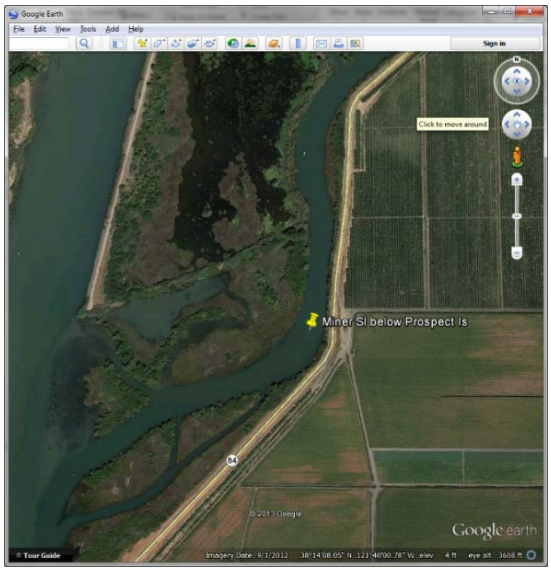
Representativeness: Location is at channel marker 54? which is located about half way up Prospect Island. A USGS gaging station is located on this channel marker.

Access to both: Land access would be through Port of West Sacramento gate. Have access permission and do not need to check in. Access through 'FedEx gate' with port key, or through I80 adjacent gate with PG&E key. Port Phone Number: 916-373-5800. Since we are sampling from boat, access is not an issue.

Miner slough below Prospect Island @ 38°14'6.18"N 121°39'57.55"W

Representativeness: Mid-channel location. Site is selected because it is below any proposed breach in Prospect Island. May move this site nearer to planned gaging/insitu monitoring site, but site location not certain yet.

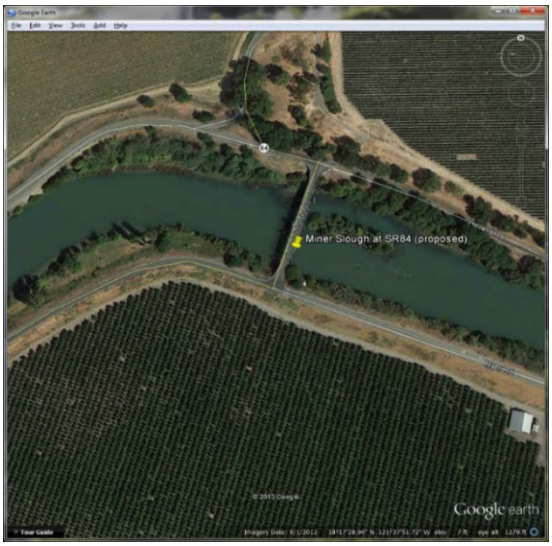
Access: No access issues by boat. Take main, middle channel. It doesn't look this obvious from the water.



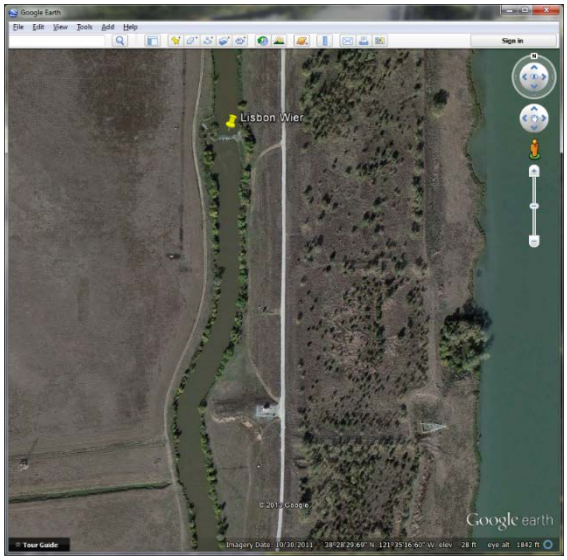
Miner Slough above Prospect Island (Highway 84 bridge) @ 38°17'29.89"N 121°37'51.06"W

Representativeness: This is a good, mid-channel sampling location that will be very representative of upper Miner Slough above any levee breach on Prospect Island.

Access: When approaching the Arrowhead Marina at the top of Prospect, no wake until you are safely past the moored houseboats. Also, be cautious of shallow conditions at the bend near these houseboats.



Lisbon Weir (East Yolo Bypass Toe-drain) @ 38°28’36.07"N 121°35’19.30"W



DWR’s Aquatic Ecology Section will collect this sample and attempt to do so on the same day as the rest of the collection.

Representativeness: Representative of the east Yolo toe drain. Gaging station and continuous sonde present on site. Upstream of tidal restoration projects and downstream of Putah Creek mouth. Proposed re-routing of Putah creek mouth may make adjustment to this site necessary as we would want to stay downstream of Putah to keep general flow conditions of site consistent (need to check on this). Sample from shore. Pin shows sample site upstream of weir, but Jared may be sampling downstream, near gaging station.

Access: Clear to enter port gates and access Lisbon. No contact necessary. Access through ‘FedEx gate’ with port key, or through I80 adjacent gate with PG&E key.

3.5.3 Field Supplies and Equipment

All reagents and consumables will be inspected to ensure they are not expired prior to use. See MWQI Field Manual (Appendix A) for required equipment and supplies. Processes not covered in the MWQI Field Manual are described in section 3.5.5, below.

3.5.4 Equipment Decontamination

See Appendix A for general instructions.

3.5.5 Collection of Water Samples

Collection of water samples will follow general procedures outline in the MWQI Field Manual (Appendix A), but some methods will be used in this study that are not covered in the MWQI Field Manual. These new methods are described in this section.

3.5.5.1 Boat Sampling

With boat sampling, some variations in sampling technique will be required. The sampling equipment and methodology is described below. When collecting samples on this study, the following setup will required:

1. 12 volt DC, peristaltic pump with *cigarette lighter or* battery clamp power connection
2. Power source (12 volt battery or *cigarette lighter* auxiliary connection)
3. Peristaltic pump tubing
4. 0.45 micron capsule filters
5. Capsule to peristaltic tube connection fittings
6. Stainless steel bucket

7. churnsplitter
8. short sampling cable
9. PVC conduit to house YSI probe
10. Sample preservative
11. CBOD/BOD sampling pole

Once at sampling site, ensure the vessel is located at the correct position in the channel. Look for appropriate shore based markers, channel markers, etc. Boat should be positioned so that the sample intake is upstream of the boat motor. Prior to sampling, flush 2 quarts of DI water through capsule filter and collect blanks, if appropriate. One run staff (*the filter staff*) will be responsible for sample collection from water body, and *dissolved* sample processing. The other run staff (*the field staff*) will be responsible for taking YSI and turbidity field measurements, chlorophyll sample processing, and total sample collection. Sample collection and YSI probe should be located 3 feet below the surface (or ½ the distance to the substrate, if less than 6 feet).

Filter Staff: First, collect sample with bucket. After container rinsing, fill bucket and churnsplitter approximately half full of sample water. Set aside, and prepare sample bottles for both total and dissolved constituents. Next, place peristaltic tubing in sample bucket and turn on peristaltic pump. Allow ½ quart of sample water to pass through the capsule filter prior to collecting "dissolved" samples. Rinse plastic containers 1 time with sample water unless preservative is already in container. Once this is complete, pump sample water from tube, and then begin flush with DI water. Flush peristaltic pump tubing with 2 quarts DI water. Pump DI water out of tubing (some residual water in line is okay). Stow filter apparatus.

Field Staff: First, take YSI measurement directly from the water body. YSI measurements will be read to the boat operator so that he can record results on field sheet. Next, process chlorophyll sample (see section below). Collect all 'total' samples and fill turbidity cell from churnsplitter. Rinse plastic sample containers 1 time with sample water unless preservative is already in container. Read turbidity measurement result off to boat operator. Rinse YSI probe with DI water and put into storage container. Rinse and add storage DI water to turbidity cell. Stow all items.

Depending on the speed at which staff are moving some of these activities can move from one staff to another.

3.5.5.2 Chlorophyll Sampling

For Chlorophyll collection the following items are required:

1. Plastic filter funnel
2. Vacuum system (3-4 psi)
3. GF/F filters, (47 mm)
4. Plastic wash bottle, 500 mL, for $MgCO_3$
5. Filter forceps
6. 500ml graduated cylinder
7. Plastic wash bottle, 500 mL
8. Opaque sample envelopes

Saturated Magnesium Carbonate Solution: Add 10 grams magnesium carbonate to 1000mL of DI water. The solution is settled for a minimum of 48 hours. Decant the clear solution in a new container for subsequent use. Only the clear "powder free" solution is used during subsequent steps.

Carry out the sampling and processing in subdued light, if possible. On board the boat, put the *Bimini* top up to shield out some light. Samples should be stored in dark conditions, on ice. Place filters, using forceps, textured side up. Assemble the filtration apparatus just prior to filtration. Spray a small amount of MgCO3 solution into the plastic filter funnel to wet the filter. Fill a graduated cylinder to 500ml, exactly. Actuate hand vacuum pump, not exceeding 3 psi. Pour sample from the graduated cylinder into the filter funnel. Only put as much sample on the filter as will pass through the filter. A 500ml samples is optimal, but less is okay if the filter is loading. If possible, use only a single filter. Two filters may be used if you believe the filter clogging is due to non-chlorophyll laden material. When all sample water has passed through the filter, allow vacuum to be maintained an extra 5-10 seconds to help remove moisture from filter. Using the forceps, fold and remove the filter and carefully place it into the bottom portion of the pre-labeled seal envelop. Make sure the 'green' side of the filter is folded in on itself. Record the volume of sample on the sample envelop. Place envelope in sealed plastic travel bag firmly between two well chilled blue ice packets. Make sure enveloped do not come in contact with additional moisture. Rinse processing apparatus with DI water to remove residual sample and stow.

3.5.5.3 THMFP/HAAFP Sampling

Collected THMFP/HAAFP samples will be filtered to 0.45 micron as has been done in the past on other MWQI studies. *Standard Methods* does not clarify if the analysis requires filtered or unfiltered water. All previous THMFP/HAAFP samples collected by MWQI have been filtered, and therefore, samples will be filtered for this study. Follow the collection procedure outlined in the DWR Field Manual. Fill 1 liter amber bottle so that there is no head space (no air present) in sample.

3.6 Monitoring Analyses and Measurements

In Table 5, some analyses listed are not specific to the Cache Slough Complex study. The discrepancy is the result of other ongoing studies where monitoring has been requested. The Table 5 constituent list represents the combined sample request for multiple studies. Table 4 lists the Cache Slough Complex Study specific constituents.

Table 4. Constituents at the sites being specifically collect for the Cache Slough Pre-Restoration Monitoring Project

Laboratory Analytes	Field Measurements
Standard Minerals	Dissolved Oxygen
Standard Nutrients (DWR 28-day method)	Turbidity
TOC/DOC	Specific Conductance
THMFP/HAAFP	pH

Bromide UVA Total Suspended Solids Chlorophyll	Temperature

Table 5. Cache Slough Complex Sample Sites and Constituents, FY 15/16.

Site	Analysis	Containers
Duplicate Site	whichever site is duplicated	whichever site is duplicated
Shag Sl. @ LibertyIslBr (west toe drain) B9S81841416	Standard Mineral, Bromide Standard Nutrients TOC DOC UVA Suspended Solids Chlorophyll CBOD & BOD THMFP/HAAFP	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 quart unfiltered 1 glass fiber filter in envelope 2 liter, unfiltered 1 liter, glass amber
Lindsey Slough at Hastings Bridge B9D81481421	Standard Mineral, Bromide Standard Nutrients (28d DWR Method) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Upper Cache Slough B9D81701460	Standard Mineral, Bromide Standard Nutrients (28d DWR Method) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Sacramento Deep Water Channel (SDWC) B9D81621397	Standard Mineral, Bromide Standard Nutrients (28d DWR Method) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Miner Slough at Highway 84 bridge B9D81751379	Standard Mineral, Bromide Standard Nutrients (28d DWR) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Miner Slough below Prospect Island B9D814103910	Standard Mineral, Bromide Standard Nutrients (28d DWR) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Cache Slough nr. Ryer Island gaging station B9D81281401	Standard Mineral, Bromide Standard Nutrients (28d DWR) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
South Tip of Liberty Island B9D81461410	Standard Mineral, Bromide Standard Nutrients (28d DWR) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope

Site	Analysis	Containers
Lisbon Weir (East Yolo Bypass toe-drain) B9D82851352	Standard Mineral, Bromide Standard Nutrients (28d DWR) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Wildlands Restoration Site B9D82011403	Standard Mineral(1), Bromide(36) Standard Nutrients (28d DWR) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Liberty Cut at Stairstep B9D82011400	Standard Mineral(1), Bromide(36) Standard Nutrients (28d DWR) TOC DOC UVA THMFP/HAAFP Suspended Solids Chlorophyll	1 quart filtered; ½ pint, filtered/fix ½ pint filtered, ½ pint unfiltered 40ml clear w/acid 40ml clear w/acid filtered 1/2 pint filtered 1 liter glass, amber 1 quart unfiltered 1 glass fiber filter in envelope
Nutrient Blank - Filtered	Standard Nutrients	½ pint filtered

Physical Parameters collected at all sites: Temperature, pH, Turbidity, Dissolved Oxygen, and Specific Conductance
Code 1 – Standard Mineral analysis includes: Ca, Mg, Na, K, S, Cl, B, Alkalinity, Nitrate, Dissolved Solids, and Specific Conductance
Code 2 – Standard Nutrient analysis includes: Nitrate + Nitrite, Kjeldahl Nitrogen, Organic Nitrogen and Ammonia, Total Phosphorus (unfiltered), and Ortho-Phosphate
Chlorophyll – Chlorophyll a and Pheophytin a

3.7 Chain-of-Custody Procedures

3.7.1 Bryte Lab

Follow standard Bryte Lab COC procedures (described in Bryte Lab QA Manual, Appendix G).

3.7.2 Contract Lab (WECK)

Follow procedures described in Appendix C (SOP: Sample Handling, Documentation, and Analysis), and Appendix D (Golden State Overnight Shipping Instructions).

3.8 Sample Handling and Transport

THMFP/HAAFP analysis has an undefined hold time according to Standard Methods. In place of a firm hold time *Standard Methods* says that "samples should be processed immediately, but if that is not possible, store at 4^0C and analyze as soon as possible." The contract laboratory, WECK Labs, says that formation potential hold times are 14 days *after the samples are preserved and the process begins*. We will handle the THMFP/HAAFP samples similar to previous samples sent to the contract lab. Samples will all be collected over two days and stored in a refrigerator at <4^OC. One shipment for all samples will be scheduled to occur on day 2 or, on the morning of day 3. This will allow for analysis to commence within 5 days at the contract lab.

CBOD and BOD samples collected at Shag Slough have a short hold time of 48 hours and need to be shipped to Weck Lab *the same day they are collected*.
See Appendix C for SOP of sample handling and documentation, and Appendix D for Golden State Overnight shipping instructions.

3.9 Field Run Documentation and Forms

As with all FLIMS based field runs, documentation for this study will consist of:

1. FLIMS COC & Analysis request form
2. FLIMS Field Sheets (Record all times in Pacific Standard Time (PST)
3. FLIMS derived container labels

For the sub-contract laboratory (WECK) we will also print and fill:

1. WECK Chain of Custody
2. Golden State Overnight shipping form

See Sample Handling and Transport for sub-contract shipping instructions.

3.10 Investigation-Derived Waste

There will be no special waste derived from field sampling operations.

3.11 Special Training Requirements and Certifications

For this study, MWQI staff will be required to sample from department vessels. For this reason, staff will take the DWR boat class, or receive California Department of Boating and Waterways certification prior to working on boats. In order to act as the vessel operator, staff must complete the USFWS Motorboat Operators Certification Course (MOCC) and show sufficient aptitude on board the vessels to be granted operator status.
Field run staff must also read, understand and agree to follow this document, the MWQI General Sampling Plan and the MWQI Field Safety Plan.

3.12 Field Quality Control Samples

Field run staff will following Bryte Lab and Weck Lab requirements for quality control samples, including the collection of one replicate sample for each analysis on each field run. This is commonly referred to as the duplicate site and is describe on the FLIMS field run paperwork. Additionally, *field blank* samples will be collected once per run for DOC, dissolved metals, and dissolved nutrients.

3.13 Laboratory Analysis

THMFP/HAAFP will need to be sent to a contract lab for analysis. The current contract is with Weck Labs.

Weck Laboratory
Laboratory Facilities
14859 East Clark Avenue
City of Industry, CA 91745
Phone: (626) 336-2139
Fax: (626) 336-2634
Contact: Brandon Gee

All other samples will be submitted to DWR's Bryte Lab for analysis. See Appendix G for *Bryte Lab QA Manual*.

Section 4. Data Management

4.1 DWR's Bryte Lab Data Management

DWR' Bryte Laboratory has its own data management system. See the Bryte Laboratory Manual for specifics.

All lab data collected will be available on the Water Data Library within a 2 month time frame. This amount of time is required because contract lab data needs to be manually entered by MWQI staff. Depending on staff availability, there could be some delay in the data entry to DWR's Bryte Laboratory *Chem Module* database. Until the contract lab data is entered, all field run results, including those analyzed by Bryte Lab, will be unavailable. The two month time frame should give ample time for the data to be made available on the WDL.

4.2 Contract Lab (WECK Labs) Data Management

All lab data collected will be available on the Water Data Library within a 2 month time frame. This amount of time is required because contract lab data needs to be manually entered by MWQI staff. Depending on staff availability, there could be some delay in the data entry to DWR's Bryte Laboratory *Chem Module* database. Until the contract lab data is entered, all field run results, including those analyzed by Bryte Lab, will be unavailable. The two month time frame should give ample time for the data to be made available on the WDL.
The contract lab sample submittal process is outlined in Appendix C.
The Chem Module data entry process is described in Appendix E.

4.3 Data Assessments and Response Actions

Analytical results for all monitoring locations will be available on DWR's Water Data Library (WDL) for analysis. Study lead will conduct spot checks of data to ensure that 1) data is available on the WDL, 2) replicate samples are within acceptance limits for replicates, and 3) no contamination is present based on the blank results.

The study lead will be responsible for these activities. If data is determined to be missing, the study lead will work with the appropriate parties to make sure the data gets to the WDL. If either the replicate samples or the blanks show problems, the study lead will take the appropriate steps to flag or remove the data from the WDL. No flagged or removed data will be deleted, only hidden from view on the public WDL website.

4.4 Reports to Management

Project status updates will be a routine part of MWQI Technical Advisor Committee (TAC) meetings. Part of the TAC meeting is completing written updates in the MWQI Program Status Report. A specific heading is listed in that report to give updates about this project. This will occur monthly.

Information to be discussed:

1. Monitoring updates
2. Results of performance evaluations & audits
3. Results of periodic data quality assessments
4. Any significant QA problems
5. Monitoring design re-evaluation

Aside from updates to the TAC, additional communication will occur with other groups monitoring within the *Cache Slough Complex*. MWQI monitoring updates will be provided to FRPA on an as needed basis.

Appendix A—MWQI's Field Sampling Plan
Appendix B—MWQI Field Safety Plan
Appendix C—SOP: Sample Handling, Documentation, and Analysis
Appendix D—Golden State Overnight Shipping Instructions
Appendix E—*Chem Module* Contract Lab Data Entry
Appendix F—Required Study Forms
Appendix G—Bryte Lab QA Manual

Chapter 3. Science Support (Special Studies)

7.1 Limnology of the SWP

Limnology of the SWP Project Charter

Limnology of the SWP - Project Charter

Version#: 1.0 **Date:** July 23, 2015

Project Name: *Write out the entire, specific name.*

Limnology of the SWP Program (from annual FY 13-14 MWQI Work Plan – Limnology of the SWP)

Sponsor	MWQI Program Funding Contractors
MWQI Program Manager	Cindy Garcia
SWPAC Project Manager	Elaine Archibald
DWR Project Administration Manager	Cindy Garcia
Project Lead Scientist	Dr. Rich Losee
Project Coordinator	Mark Bettencourt

Project Objective Statement: *What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).*

Limnology of the SWP is a long-term program whose goal is improving the management of the SWP, particularly in regard to drinking water quality, through the application of limnological and ecological principles. The program objective is to manage 10 sub-projects to completion that are led individually by principal investigators (PI) with assistance from the Project Lead Scientist, Project Managers, Project Coordinator, and several subject matter experts (SME).

NOTE - The 10 sub-projects seek to manage the occurrence of objectionable levels of algal produced taste and odor compounds and indirect impacts on drinking water quality through the obstruction of Contractor aqueduct turnouts by aquatic plant material by gaining an understanding of the limnology and ecology of the organisms involved and applying this knowledge to develop optimal control and treatment strategies.

Triple Constraint Trade-off

Resources	S	*Select a different flexibility letter for each constraint* *N= Not Flexible* *S= Somewhat Flexible* *M= Most Flexible*
Schedule	M	
Scope	N	

Estimated Start Date:	June 2013 **Project Coordinator**	**Estimated End Date:**	June 2017

Project Deliverables: *What is the project going to produce? Create a list of tangible products that will result from project.*

1. MWQI management staff will provide oversight of the 9 sub-projects and will work with the Project Coordinator to produce a monthly project budget report and a monthly project status report. Each report will be provided and discussed at each MWQI TAC meeting. These tracking reports will show the sub-projects costs in labor hours and operating equipment and expenses, and the work progress towards completion of the sub-projects major milestones including the completed project reports.
2. Conduct monthly Limnology Oversight Committee meetings – agendas and meeting minutes will be made available to the Project Core Team Members listed below.
3. Once several sub-projects are completed, commence the development of a final Limnology Project presentation demonstrating to DWR's upper Management that the sub-projects would benefit from cross collaboration throughout Divisions for the benefit of the SWP Contractors.

Strategic Fit: *What is the Strategic Initiative Identifier for this project?*

The Limnology of the SWP project fits the mission and strategic plan for the MWQI Program:
The mission of the MWQI Program is to: a) support the effective and efficient use of the Sacramento-San Joaquin Delta (Delta) and the State Water Project (SWP) as a source water supply for municipal purposes through monitoring, forecasting, and reporting water quality; b) provide early warning of changing conditions in source water quality used for municipal purposes; c) provide data and knowledge based support for operational decision-making on the SWP; d) conduct scientific studies of drinking water importance; and e) provide scientific support to DWR, the State Water Project Contractors Authority

1

Limnology of the SWP - Project Charter

MWQI-SPC, and other governmental entities.
The current MWQI 5-year strategic plan is in effect (July 1, 2012 through June 30, 2017), and a copy may be obtained by contacting the Project Coordinator.

Customer: *Who are you doing the project for?*

SWP Contractors.

Customer Benefits: *What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.*

This project addresses the SWP Contractors concerns of extensive problems of algal mass management at SWP facilities, and drinking water quality issues and concerns associated with of the SWP water.

Success Determination Factors *How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.*

To be successful, all the sub-projects need to be completed and then SWP operations need to take into account water quality in their daily operations of the SWP.

Project Background: *What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.*

This project was originally conceived in the FY 13-14 MWQI Work Plan, as a long-term limnological and ecological study of the SWP. It has evolved to more directly address the SWP Contractors' specific issues and concerns with the goal of demonstrably improving the management of the SWP, particularly in regard to drinking water quality, through the application of limnological and ecological principles. The SWP Contractors have identified an extensive list of problems, issues and concerns associated with drinking water quality of the SWP. These issues range from the occurrence of objectionable levels of algal produced taste and odor compounds, to indirect impacts on drinking water quality through the obstruction of Contractor aqueduct turnouts by aquatic plant material. Improved management of these problems will be achieved by gaining an understanding of the limnology and ecology of the organisms involved and applying this knowledge to develop optimal control and treatment strategies. To be successful, the entire project will require cooperation and collaboration across Divisions within DWR, including O&M Water Quality, OCO, and the Field Divisions, as well as the MWQI SPC, consultants and academics. An important function of the MWQI staff will be to coordinate and collaborate the efforts of the participating entities.

Project Scope:

In Scope: *List areas and functionality included in project.*	**Out of Scope:** *List areas and functionality not included in project.*
Sub-projects addressing improvement in the management of the SWP particularly with regard to limnological and ecological effects on drinking water quality within the SWP.	Projects not addressing limnological and ecological principles within the SWP.

Dependent Projects: *What projects must be underway or completed before this project can be successful?*

The 9 sub-project need to be completed before the Limnology of the SWP project will meet its goal and objectives, but overall project success will occur when the operations of the SWP are managed to improve water quality thus reducing the occurrence of algal production.

Risks: *What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.*

Lack of cooperation and collaboration across Divisions within DWR, including O&M Water Quality, OCO, and the Field Divisions will lead to project failure. Lack of timely MWQI sub-project reports will stall the project.

Assumptions and Constraints: *What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.*

To be successful, the entire project will require cooperation and collaboration across Divisions within DWR, including O&M Water Quality, OCO, and the Field Divisions, as well as the MWQI SPC, consultants and academics.

Limnology of the SWP - Project Charter

Major High-Level Milestone Targets: *What events measure progress? E.g. Initiation Approved, Analysis Complete.*

Milestones for overarching Limnology project and 12 sub-projects mid-study reports	Target Date
7.1 – Limnology of the SWP – a) Initiate, plan, organize, coordinate, monitor, track, and control the Limnology sub-projects b) Conduct monthly Limnology Oversight Committee meetings c) Provide monthly Limnology sub-projects budget and coordinators progress-tracking reports for meetings d) Produce a final Limnology Project presentation for the benefit of DWR's upper management.	a) July 2015 b) Ongoing c) Ongoing d) June 2017
Oversee the completion of these sub-projects: 7.1.1 - Nutrient Budget Study - understand the nutrient sources to the SWP and their fate and transport in the SWP.	June 2016
7.1.2 - Nutrient Index Study - investigate the theoretical nutrient limitation as it might occur over space and time in the SWP.	July 2015
7.1.3 - Nutrient and Nutrient Ratio Influence on Community Species Composition - literature review following the progress of Irwin van Nieuenhuyse's work and the Dick Dugdale group's work.	June 2016
7.1.4 - Light Limitation in the SWP - determine the amount of light reduction necessary to sufficiently reduce the growth of algae and submersed macrophytes in order to control the problems they cause in the SWP.	January 2016
7.1.5 - Algal and Macrophyte Growth Study - develop methods to measure algal and macrophyte growth rates in the laboratory and in the field.	April 2016
7.1.8 - Wide Swings in Canal pH Study - study are to 1) understand the magnitude of the problematic pH excursion events and the inorganic carbon chemistry and buffering capacity of the SBA; and 2) to quantify the magnitude and diurnal dynamics of specific pH excursion events before, during, and after algaecide treatment.	December 2016
7.1.9. San Luis Reservoir Limnology Study - conduct profiles in San Luis Reservoir to better understand the water quality implications of drawing down the reservoir levels.	To be determined.
7.1.10. Dyer Reservoir Limnology Study - investigate the water quality impacts from bird roosting and operations of Dyer Reservoir.	To be determined.
7.1.11. Del Valle Reservoir Limnology Study - investigate the limnological conditions in Del Valle Reservoir and potential methods of controlling methyl mercury.	To be determined.

Project Core Team Members

Team Member	Phone/E-mail	Role	Responsibilities
Rich Losee	(909) 451-1973 rflosee@dslextreme.com	Project Lead Scientist	As a Limnology subject matter expert, provide ongoing project support to the PI's; review project documentation, data, and reports; and participate in routine meetings and conference calls, and on project work-teams.
Elaine Archibald	(916) 736-3713 elaine.archibald@comcast.net	Project Sponsor (SWPCA) & Manager	As an Environmental Studies subject matter expert, provide ongoing project support to the PI's; review project documentation, data, and reports; and participate in routine meetings and conference calls, and on project work-teams.
Cindy Garcia	(916) 376-9715 Cindy.a.garcia@water.ca.gov	Project Administration Manager, and MWQI Program Manager	Provide ongoing project support to the PI's; collaborate with O&M staff, review project documentation, data, and reports; and participate in routine meetings and conference calls, and on project work-teams.

Limnology of the SWP - Project Charter

Mark Bettencourt	(916) 376-9717	Project Coordinator	Provide ongoing project support to the PI's; collaborate with O&M staff, and participate in routine meetings and conference calls, and on project work-teams, as needed.
Rachel Pisor	(916) 376-9711	MWQI Section Supervisor and Oversight Committee Member	As the MWQI Section Supervisor: supervise PI's and provide them ongoing project support; review project documentation, data, and reports; and participate in routine meetings and conference calls, and on project work-teams.
Steven San Julian	(916) 371-2284	Field Support Section Supervisor and Oversight Committee Member	As the Field Support Supervisor and as needed: provide project support to the PI's; review project documentation, data, and reports; and participate in routine meetings and conference calls, and on project work-teams.
Laura Young	(408) 265-2607 ex. 2461	Oversight Committee Member	Participate in routine meetings and conference calls, and on project work-teams, as needed.
Harry Ruzgerian	(213) 217-6082 hruzgerian@mwdh2o.com	Oversight Committee Member	Participate in routine meetings and conference calls, and on project work-teams, as needed.
Maria Lopez	(909) 392-5447 MTLopez@mwdh2o.com	Oversight Committee Member	Participate in routine meetings and conference calls, and on project work-teams, as needed.

Charter Version Number: 1.0	
Updated By: Cindy Garcia	**Date:** *7/6/2015*
Approved By:	**Date:**

Funding Information

Project Budget:	**$**	This project budget covers the time of MWQI Senior Supervisors to oversee the sub-projects.
Sub-Project Budget:	**$**	This budget amount covers the sub-projects, if additional time is needed to complete them.
Fund Center Title	Water Quality Assessment - SWP	
Fund Center Number	3860101029000300	
Organization	DWR, DES, MWQP Branch, MWQI Program	
Contact Person	Cindy Garcia	
Phone/E-mail	(916) 376-9715, cindy.a.garcia@water.ca.gov	

Limnology of the SWP - Project Charter

This Project Should Have: *Check all that apply*

Project Management Plan ■	Environmental Stewardship Plan ☐	Work Breakdown Structure ■	Communications Plan ■	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ■	Risk Register ☐	Project Budget ■	Project Schedule ■	DWR Form 1498 = Resources Agreement with O&M ☐

5

7.1.1 Nutrient Budget Study

Nutrient Budget Project Charter

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PROJECT CHARTER

Version#: 4 **Date:** 7/14/15

Project Name: Write out the entire, specific name.

Nutrient Budget Study

Sponsor/Program Manager	Rachel Pisor
Project Manager	Marcia Scavone-Tansey

Project Objective Statement: What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).

The goals of this study are to understand the nutrient sources to the SWP and their fate and transport in the SWP.

Triple Constraint Trade-off:

Resources	**M**	Select a different flexibility letter for each constraint N= Not Flexible S= Somewhat Flexible M= Most Flexible
Schedule	**S**	
Scope	**N**	

Estimated Start Date:	6/30/13	**Estimated End Date:**	7/16

Project Deliverables: What is the project going to produce? Create a list of tangible products that will result from project.

- **Spreadsheets with data and graphs for each nutrient in each location.**
- **A separate paper with data analysis from each nutrient in each location.**
- **Progress report**
- **Posters and presentations**

Strategic Fit: What is the Strategic Initiative Identifier for this project?

- Report SWP water quality;
- Provide data and knowledge based support for operational decision-making on the SWP;
- Conduct scientific studies of drinking water importance;
- Provide support to DWR, the State Project Contractors Authority – MWQI Specific Committee (SPC), and other governmental entities.

Customer: Who are you doing the project for?

This project is being conducted for the SWPCA MWQI SPC.

Customer Benefits: What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.

This project will provide information on nutrient concentrations, loads, and sources that will assist in understanding mechanisms for controlling and managing algal growth in the SWP aqueducts and reservoirs.

PROJECT CHARTER

Success Determination Factors: How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.

The MWQI SPC will consider the project successful if the following work products are completed:
Spreadsheets of data and graphs for each nutrient and each location identified in the scope of work.
Final papers that discuss the key findings for each nutrient at each location.
Final progress report that discusses the key findings.

Project Background: What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.

Excessive nutrients in the Delta water entering the SWP are responsible for algal and macrophyte growth in the aqueducts and reservoirs. Algal growth creates taste and odor and filter clogging issues at drinking water treatment plants. Algal growth in the SBA also leads to wide swings in pH that create challenges at SBA water treatment plants. Macrophyte growth restricts conveyance capacity and results in considerable time and expense to remove. This project will provide valuable information on the concentrations and sources of nutrients that will assist in understanding mechanisms for controlling and managing algal growth in the SWP aqueducts and reservoirs.

Project Scope:

In Scope: List areas and functionality included in project.	**Out of Scope**: List areas and functionality not included in project.
Collecting data, making graphs, and analyzing thoughtfully several different location on the Delta and California Aqueduct for ammonia, nitrate, nitrate plus nitrite, total nitrogen, total kjeldahl nitrogen, total phosphorus, and dissolved orthophosphate.	Data analysis for any locations that are not listed in the scope of work. Constituents that are not listed in the scope of work.

Dependent Projects: What projects must be underway or completed before this project can be successful?

None. This project is the first project initiated under the broader Limnology of the SWP project.

Risks: What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.

None.

Assumptions and Constraints: What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.

Assumptions
There will be sufficient data for each nutrient species at every location included in the scope of work.

Constraints
None

Environmental Stewardship and Sustainability Considerations: What is the process that will be used to ensure compliance with the Environmental Stewardship Policy? Include the Environmental Stewardship Coordinator and team members (this can be roles instead of specific names)

Environmental Stewardship Coordinator:	

PROJECT CHARTER

Major High-Level Milestone Targets: What events measure progress? E.g. Initiation Approved, Analysis Complete.

Project Life Cycle/ Major Milestones

Deliverables	Estimate Completion Date
Identify key components of the SWP to include in the study	June/13
Phase 1:	
1. Obtain water quality and flow/pumping data for Phase 1 locations	Sept/13
2. Develop time series graphs for Phase 1 locations	Feb/15
3. Conduct additional data analysis for Phase 1 locations	Apr/15
Phase 2a:	
4. Develop methodology for Phase 2a (Delta) locations	Apr/14
5. Obtain water quality and flow/pumping data for Phase 2a locations	Apr/14
6. Develop time series graphs for Phase 2a locations	Mar/15
7. Analyze Phase 2a data	Feb/15
8. Analyze Phase 1 data	Mar/15
9. Conduct Detailed Analysis on Phase 2a data	Mar/15
Phase 2b:	
10. Develop methodology for Phase 2e (Lake Silverwood) locations	Apr/15
11. Obtain water quality and flow/pumping data for Phase 2e locations	Apr/15
12. Develop time series graphs for Phase 2 e locations (Draft 1)	May/15
13. Conduct additional data analysis for Phase 2e locations (Final Draft)	Jun/15
14. Analyze Lake Silverwood Data	Aug/15
Phase 2c:	
15. Develop methodology for Phase 2c (Pyramid and Castaic Lake) locations	Sept15
16. Obtain water quality and flow/pumping data for Phase 2d locations	Sept/15
17. Develop time series graphs for Phase 2c locations (Draft 1)	Sept/15
18. Conduct additional data analysis for Phase 2c locations (Final Draft)	Oct/15
19. Analyze Pyramid and Castaic Lake Data	Oct/15
20. Conduct detailed analysis for phase 1, 2a, 2b, and 2c locations	Oct/16
21. Submit Draft Report to DWR management and SWPCA for Review	Jun/16
22. Respond to comments	July/16

Project Core Team Members:

Team Member	Phone/E-mail	Role
Marcia Scavone-Tansey	(916)376-9810 - mscavone@water.ca.gov	Principal Investigator
Rachel Pisor	(916)376-9711 - Rachel.Pisor@water.ca.gov	Program Manager
Rich Losee	(909)451-1973 - rflosee@dslextreme.com	Project Partner
Elaine Archibald	(916)736-3713 – elaine.archibald@comcast.net	Project Partner

Charter Version Number:	
Updated By:	**Date:**
Approved By:	**Date:**

PROJECT CHARTER

Funding Information:

Project Budget:	
Fund Center Title	
Fund Center Number	
Organization	
Contact Person	
Phone/E-mail	

This Project Should Have: Check all that apply

Project Management Plan ■	Environmental Stewardship Plan[1] ☐	Work Breakdown Structure ☐	Communications Plan ■	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ☐	Risk Register ☐	Project Budget ☐	Project Schedule ■	DWR Form 1498 ☐
Project Safety Plan[2] ☐					

Plus, the project has Conceptual Proposal, Project Initiation, Project Scope, and RACI Matrix (Responsibilities Assignment).

[1] See WREM 58b for more information about creating an Environmental Stewardship Plan.

[2] All project Managers must take into account safety policies and procedures for projects. A safety plan should be created if needed. For more information visit the Workplace Safety Project web site.

Nutrient Budget Project Management Plan

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PROJECT MANAGEMENT PLAN

Version#: 4 **Date:** 7/14/15

Project Title

Nutrient Budget Study

Sponsor/Program Manager	Rachel Pisor
Project Manager	Marcia Scavone-Tansey
Project Budget	

Project Summary/Description (include Scope statement)

The understanding of limnology of the State Water Project (SWP) deliveries and transportation is incomplete. However, reservoir and transport affects or controls organic carbon, taste and odor, and algal toxin levels entering our treatment plants. Nutrient dynamics control production of organic matter in the aqueduct; of which taste-and-odor compounds and algal toxins are of special interest to drinking water. This project would help us to understand the physical-chemical and ecological functioning of the conveyances in order to better manage the drinking water quality of the SWP.

Project-Specific Considerations (this can be legislative language or other guidelines that will drive project)

Nutrients play an important role in the proper functioning of aquatic ecosystems. However, when they are present in excessive concentrations, the algal growth that occurs may cause a variety of undesirable effects such as additional organic carbon resulting in algal blooms and reduced dissolved oxygen, significant taste and odor issues, production of toxic algal compounds, high levels of ammonia and undesirable disinfection byproducts, physical obstruction in conveyance facilities, obstruction in water treatment filters, and increased costs of water treatment. The objective of this initial study is to understand the sources of nutrients to the SWP. Data are available in the Water Data Library and from other sources that will be used to develop, a nutrient budget for the SWP. This will be a paper study that will identify data gaps and suggest next steps to elucidate the processes that define nutrient cycling and affect productivity and community structure in the SWP. The first step in this process will be to identify the key components of the SWP for which a nutrient budget will be developed (e.g. the Delta, major reservoirs, key reaches of the California Aqueduct). The next step will be to determine what data are available for each component and to develop a preliminary budget for various hydrologic and season conditions.

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Environmental Stewardship and Sustainability Considerations: (Describe the process that will be used to ensure compliance with the Environmental Stewardship Policy? Include how the project will achieve the environmental stewardship and sustainability objectives and expected outcomes/benefits. Include the Environmental Coordinator and team members).

This project has no environmental considerations because it is a paper study.

Environmental Coordinator	

Project Team Members

Principal Investigator	Marcia Scavone-Tansey
Program Manager	Rachel Pisor
Project Partner	Rich Losee
Project Partner	Elaine Archibald

Project Start Date:	6/30/13	**Estimated End Date:**	7/16

Project Life Cycle/ Major Milestones

Deliverables	Estimate Completion Date
Identify key components of the SWP to include in the study	June/13
Phase 1:	
1. Obtain water quality and flow/pumping data for Phase 1 locations	Sept/13
2. Develop time series graphs for Phase 1 locations	Feb/15
3. Conduct additional data analysis for Phase 1 locations	Apr/15
Phase 2a:	
4. Develop methodology for Phase 2a (Delta) locations	Apr/14
5. Obtain water quality and flow/pumping data for Phase 2a locations	Apr/14
6. Develop time series graphs for Phase 2a locations	Mar/15
7. Analyze Phase 2a data	Feb/15
8. Analyze Phase 1 data	Mar/15
9. Conduct Detailed Analysis on Phase 2a data	Mar/15
Phase 2b:	
10. Develop methodology for Phase 2e (Lake Silverwood) locations	Apr/15
11. Obtain water quality and flow/pumping data for Phase 2e locations	Apr/15
12. Develop time series graphs for Phase 2 e locations (Draft 1)	May/15
13. Conduct additional data analysis for Phase 2e locations (Final Draft)	Jun/15
14. Analyze Lake Silverwood Data	Aug/15
Phase 2c:	
15. Develop methodology for Phase 2c (Pyramid and Castaic Lake) locations	Sept15
16. Obtain water quality and flow/pumping data for Phase 2d locations	Sept/15
17. Develop time series graphs for Phase 2c locations (Draft 1)	Sept/15
18. Conduct additional data analysis for Phase 2c locations (Final Draft)	Oct/15
19. Analyze Pyramid and Castaic Lake Data	Oct/15
20. Conduct detailed analysis for phase 1, 2a, 2b, and 2c locations	Oct/16
21. Submit Draft Report to DWR management and SWPCA for Review	Jun/16

22. Respond to comments	July/16

Roles & Responsibilities

Project Manager:

- Identify Key Components of the SWP
- Obtain Water Quality and Flow/Pumping Data for Phase 1 Locations
- Develop Time Series Graphs
- Conduct Additional Data Analysis
- Develop Methodology for Phase 2 Locations
- Prepare Project Report

Project Partners:

- Read and give their feedback
- Being able to meet as required

Major Deliverables

- Spreadsheets with data and graphs for each nutrient in each location.
- A separate paper with data analysis from each nutrient in each location.
- Report to be published
- Posters and presentations

Resources Needed

- IT support
- Data availability
- Time for the partners to provide feedback

Quality Planning Considerations

- Much of the data being analyzed in this study is very old. There are occasions in which there are questions about this old data, but Bryte lab cannot verify the data due. Any data that pre-dates 1990 and is questionable, will still be included in the dataset, but will be flagged.

Risk-Response Considerations (list any potential positive or negative risks and planned responses)

- I will have a procedure book that I use and a logger so that if I need to leave, the person that assume my position will be able continue the project.
- If another team member leaves their position, a replacement will take their position.

Change Management Considerations/Procedures

- I will have a procedure book so that if I need to leave the person that assume my position will be able continue the work.

Baselines Attached	X
Work Breakdown Structure	
Project Budget	
Project Schedule	

Other Attachments	X
Stakeholder Register	
Communications Management Plan	
Human Resources Management Plan	
Risk Register	
Quality Management Plan	
Procurement Plan	
Environmental Stewardship Plan[1]	
Project Safety Plan[2]	

[1] See WREM 58b for more information about creating an Environmental Stewardship Plan.

[2] All project Managers must take into account safety policies and procedures for projects. A safety plan should be created if needed. For more information visit the Workplace Safety Project web site.

Nutrient Budget Study Scope of Work
Lead Investigator: Marcia Scavone-Tansey

Project Partners: Rich Losee and Elaine Archibald

Introduction

The objective of this initial study is to understand the sources of nutrients (nitrogen and phosphorus) to the State Water Project (SWP). Future aspects of this project include gaining an understanding of nutrient transformations and changes in conveyance structures and methods of potentially controlling nutrients. This work could lead to better control of algal and macrophyte growth. It could also potentially lead to development of a nutrient component of the aqueduct extension model. Data are available in the Water Data Library and from other sources that will be used to develop a nutrient budget for the SWP. This will be a paper study that will identify data gaps and suggest next steps to elucidate the processes that define nutrient cycling and affect productivity and community structure in the SWP.

Task 1. Identify Key Components of the SWP

The nutrient budget will initially be developed for the following locations:

Phase 1 Locations

- North Bay Aqueduct – Barker Slough
- Banks Pumping Plant
- South Bay Aqueduct (SBA) – includes South Bay Pumping Plant, Del Valle Check 7, Lake Del Valle releases to SBA
- O'Neill Forebay Outlet
- Coastal Branch – Check 21
- California Aqueduct – Check 29
- Bifurcation of Aqueduct – Check 41

After the study has been completed for the more straightforward locations listed above, a nutrient budget will be developed for the following locations:

Phase 2 Locations

- Delta – includes riverine inputs, Bay inputs, and in-Delta sources (wastewater, agricultural drainage)
- San Luis Complex – includes inputs from California Aqueduct (Banks), inputs from Delta Mendota Canal (O'Neill Pumping/Generating Plant) and inputs from San Luis Reservoir
- Inflow Reach of California Aqueduct

- Pyramid Lake – includes West Branch inputs and local runoff
- Castaic Lake – Pyramid Lake inputs and local runoff
- Lake Silverwood – includes East Branch inputs and local runoff

Task 2. Obtain Water Quality and Flow/Pumping Data for Phase 1 Locations

The water quality data will come primarily from the Water Data Library and from Metropolitan Water District (MWD). The MWD data will be provided by Rich Losee. The following water quality constituents will be included in the analysis:

- Nitrate + Nitrite
- Nitrate
- Ammonia
- Total Kjeldahl Nitrogen (TKN)
- Total Nitrogen (TKN + Nitrate + Nitrite)
- Total Phosphorus
- Dissolved Orthophosphate

The operations data will come from the State Water Project Annual Report of Operations available at:
http://www.water.ca.gov/swp/operationscontrol/monthly.cfm

Monthly pumping records will be used to calculate monthly loads when water quality data are only collected once a month. Daily pumping records will be used for locations where water quality data are collected more frequently. Tony Liudzius will provide the daily operations data in Excel format. Table 1 provides the locations of operations data for each of the water quality locations.

Table 1. Water Quality and Operations Data Information

Water Quality Station	Water Quality Station Number	Operations Data Location
Barker Slough	KG000000	Barker Slough Pumping Plant
Banks	KA000331	Banks Pumping Plant for California Aqueduct inputs
Banks	KA000331	South Bay Pumping Plant for SBA inputs
Del Valle Check 7	KB001638	South Bay Pumping Plant minus Zone 7 Diversions

Lake Del Valle	DV000000	Lake Del Valle Releases to SBA
O'Neill Forebay Outlet	KA007089	Dos Amigos Pumping Plant
Check 21	KA017226	Las Perillas Pumping Plant for Coastal Branch inputs
Check 29	KA024454	Buena Vista Pumping Plant
Check 41	KA030341	Edmonston Pumping Plant

Task 3. Develop Time Series Graphs

Time series graphs of concentrations and loads for each nutrient constituent at each of the phase 1 locations will be developed. The lead investigator will meet with the project partners to review the data and determine what additional analysis is needed. The data may be analyzed to determine trends over time or to investigate seasonal differences at each location. The data may also be analyzed to examine differences between each location. These decisions will be made after viewing the time series graphs.

Task 4. Conduct Additional Data Analysis

Any additional analyses identified in Task 3 will be conducted, if needed.

Task 5. Develop Methodology for Phase 2 Locations

The Phase 2 locations will be more challenging due to the complex hydrology at each of these locations so a methodology will be developed for each site. This will be accomplished in a meeting between SWPCA and MWQI staff. Tasks 2 through 4, described previously for the Phase 1 locations will be repeated for the Phase 2 locations.

Task 6. Prepare Project Report

A draft report will be prepared that describes the methods, data analysis, data gaps, results, conclusions and recommendations. The draft report will be reviewed by SWPCA and DWR staff. The lead investigator will respond to comments on the draft report and produce a final report. After appropriate review and revision, the final report will be posted on the MWQI website.

Schedule

Table 2 shows the key deliverables and the schedule for completing each of them.

Table 2. Nutrient Dynamics Study Deliverables and Timelines

Marcia to fill in dates, based on her availability and estimate of time to complete.

Deliverables	Participants	Estimated Start Date	Estimated Completion Date
Identify key components of the SWP to include in the study	**MWQI Program SWPCA**	**June 2013**	**June 2013**
Obtain water quality and flow/pumping data for Phase 1 locations	**MWQI Program SWPCA**	**TBD**	**TBD**
Develop time series graphs for Phase 1 locations	**MWQI Program SWPCA**	**TBD**	**TBD**
Conduct additional data analysis for Phase 1 locations	**MWQI Program SWPCA**	**TBD**	**TBD**
Develop methodology for Phase 2 locations	**MWQI Program SWPCA**	**TBD**	**TBD**
Obtain water quality and flow/pumping data for Phase 2 locations	**MWQI Program SWPCA**	**TBD**	**TBD**
Develop time series graphs for Phase 2 locations	**MWQI Program SWPCA**	**TBD**	**TBD**
Conduct additional data analysis for Phase 2 locations	**MWQI Program SWPCA**	**TBD**	**TBD**
Submit Draft Report to DWR management and SWPCA for Review	**MWQI Program SWPCA**	**TBD**	**TBD**
Submit Draft Report to DWR Editors for formatting and editorial review	**MWQI Program & Project Services Office**	**TBD**	**TBD**
Submit Draft to DWR management and SWPCA for Final Review	**MWQI Program SWPCA**	**TBD**	**TBD**
Final report published	**MWQI Program SWPCA**	**TBD**	**TBD**

7.1.2 Nutrient Limitation Study

Nutrient Limitation Project Charter

Project Charter

Version#: 1.2 **Date:** 20 July 2015

Project Name: *Write out the entire, specific name.*

7.1.2 SWP Limnology: Nutrient Limitation Study

Sponsor/Program Manager	State Water Project Contractors Authority MWQI Specific Project Committee/Rich Losee
Project Manager	Ted Swift

Project Objective Statement: *What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).*

This paper study will use the data assembled in Project 7.2.1 and other sources, and literature information to investigate the theoretical nutrient limitation as it might occur over space and time in the SWP. to investigate potential for nutrient limitation for algae and macrophytes that occur in the Delta, aqueducts and lakes of the SWP in specific seasons.

Triple Constraint Trade-off

Resources	N	*Select a different flexibility letter for each constraint* *N= Not Flexible* *S= Somewhat Flexible* *M= Most Flexible*
Schedule	S	
Scope	M	

Estimated Start Date:	July 2014	**Estimated End Date:**	August 2015

Project Deliverables: *What is the project going to produce? Create a list of tangible products that will result from project.*

- Spreadsheet & other documents calculating nutrient ratios at locations known to be sources of problematic algal or macrophyte growth.
- Progress report summarizing results of data analysis.
- Pending decision on progress report, a final report as an official MWQI work product OR results to be combined with results from other Limnology Project studies.
- Evaluation reporting feasibility of developing a nutrient status index for selected SWP locations within MWQI data products (e.g., RTDF Water Quality Report).

Strategic Fit: *What is the Strategic Initiative Identifier for this project?*

This project supports MWQI's mission of providing knowledge based support for operational decision-making and conducting scientific studies of drinking water importance.

Customer: *Who are you doing the project for?*

This project is a component of the overall Limnology Project, for which the customer is the Municipal Drinking Water Contractors (MWQI SPC) and the DWR O&M Water Quality Branch.

Project Charter

Customer Benefits: *What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.*

The SWP Contractors have identified problems, issues, and concerns associated with drinking water quality of the SWP, caused by biological activity within the SWP. Improved management of these problems can be achieved by gaining applicable knowledge of the limnology and ecology of organisms that produce these problems, and use of this knowledge to develop optimal control and treatment strategies. Investigating the feasibility of a nutrient status index will provide the Contractors with decision support information to decide whether to implement a nutrient status index that would predict likelihood of algal blooms or changes in algal species. These will assist optimal control and treatment strategies will reduce treatment costs, improve reliability, and improve drinking water customer satisfaction.

Success Determination Factors *How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.*

This project will be a success if it determines if, and if so where and when, nutrient limitation (e.g., nitrogen and/or phosphorus ratios needed for algal and/or macrophyte growth fall outside those found in the literature) occurs at locations within the dataset assembled in Project 7.2.1; if it clearly and completely reports those findings; and if it clearly spells out the feasibility of developing a nutrient status index for selected locations in the SWP.

Project Background: *What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.*

Drinking water quality is important to the 25 million customers of the State Water Project, and the drinking water contractors must meet government health and safety requirements for drinking water. Biological activity in the SWP affects water quality by producing compounds that negatively affect taste and odor, disinfection byproduct precursors, and changing pH, which in turn affects treatment plant operations. These increase costs for the water purveyors and affect customer satisfaction for the ultimate consumers. The current situation is that the contractors have many examples of these biological effects, yet little is known about the precise sources of the problems and the feasibility of reducing and/or controlling them. The desire is to understand the limnology of the SWP well enough to produce recommendations for actions or operational changes that would improve water quality, reduce treatment costs, and improve regulatory compliance. One mechanism that affects biological activity is nutrient limitation, in which a vital nutrient (e.g., nitrogen, phosphorus) is in short supply and limits biological activity and/or shifts biological activity to an ecological community that can better tolerate the nutrient limitation.

Project Scope:

In Scope: *List areas and functionality included in project.*	**Out of Scope:** *List areas and functionality not included in project.*
* Lit. review of nutrient limitation for Melosira, T&O-producing algae, and submerged macrophytes found or likely to be found in the SWP.	* Literature search of all reports of nutrient limitation. A
* Analyze the nutrient data from Project 7.1.1 for nutrient ratios, times and places within the data set.	* Greatly extend the 7.1.1 data set, other than spot-checks.
* Investigate feasibility of developing nutrient status index for selected locations in SWP.	* Implement nutrient status index data flow (real-time or manual)

Dependent Projects: *What projects must be underway or completed before this project can be successful?*

This Project depends on Project 7.1.1 Phase 1 being substantially complete. Work can commence without 7.1.1 Phase 2 completion, but conclusions will only extend over time periods and locations for which data are available. Literature review relies on access to the electronic literature catalogs, which the State doesn't provide, but which Ted Swift presently has through an affiliate computer account at UC Davis. This is expected to be available through the duration of the project.

Risks: *What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.*

* Available data may be of such unknown quality or insufficient quantity that conclusions are limited to fewer locations or time periods than expected. This is not a "show stopper" that would cause complete project failure, but would reduce the conclusions' scope of applicability. The project would still be an improvement on the present state of knowledge. Production of nutrient status index (this project will evaluate feasibility) may involve significant data-flow development to automate process.

Project Charter

Assumptions and Constraints: *What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.*

Assumptions: Sufficient data of sufficient quality will be available for analysis (very likely); sufficient knowledge exists (from literature) of nutrient limitation characteristics for species of interest (very likely); subject matter experts have sufficient knowledge to arrive at optimal conclusions. Constraints: Funding ("resources" in triple constraints, above) and therefore time are co-constraints.

Major High-Level Milestone Targets: *What events measure progress? E.g. Initiation Approved, Analysis Complete.*

Milestone	Target Date
Conduct literature review of nutrient limitation for Melosira, submersed macrophytes, T&O producing algae	29 July 2014
Examine nutrient ratios	29 July 2014
Develop nutrient status index	15 Aug 2014
Submit Draft Progress Report to DWR management and MWQI SPC for review	6 Apr 2015
Respond to comments and finalize Progress Report	31 July 2015

Project Core Team Members

Team Member	Phone/E-mail	Role
Ted Swift	916-376-9718, Ted.Swift@water.ca.gov	Lead Scientific Investigator
Rich Losee	(909) 392-5124, rflosee@dslextreme.com	Project Partner, Subject matter expert
Cindy Garcia	916-376-9715, Cindy.A.Garcia@water.ca.gov	MWQI Branch Chief, Program Management
Elaine Archibald	916-736-3713, elaine.archibald@comcast.net	Consultant to MWQI SPC, Program Management
Jeffrey Janik	916-653-5688, jjanik@water.ca.gov	Stakeholder, Subject matter expert

Charter Version Number:	
Updated By: Ted Swift	**Date:** 20 July 2015
Approved By:	**Date:**

Funding Information

Project Budget:	
Fund Center Title	7.1.2 Nutrient Limitation Study
Fund Center Number	VLIMNUTLIM14
Organization	DWR, Division of Environmental Services, Office of Water Quality
Contact Person	Ted Swift
Phone/E-mail	916-376-9718, Ted.Swift@water.ca.gov

Project Charter

This Project Should Have: *Check all that apply*

Project Management Plan ☐	Environmental Stewardship Plan ☐	Work Breakdown Structure ■	Communications Plan ☐	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ■	Risk Register ☐	Project Budget ■	Project Schedule ■	DWR Form 1498 ☐

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Nutrient Limitation Stakeholder Register

Stakeholder Register

Project Title: 7.1.2 SWP Limnology: Nutrient Limitation Study **Date:** 11 June 2014

Stakeholder	Interest in Project	Assessment of Power*	Strategies for Gaining Support or Reducing Obstacles
Ted Swift	Lead Scientific Investigator	High interest, moderate power	Ensure data & analysis obstacles are ID'ed early and removed
Rich Losee	Project Partner, Subject matter expert	High interest, moderate power	Ensure regular communication
Cindy Garcia	MWQI Branch Chief, Program Management	High interest, High power	Explain motivations, goals, timelines & resources clearly.
Municipal Contractors, represented by Elaine Archibald	Consultant to MWQI SPC, Program Management	High interest, High power	Explain motivations, goals, timelines & resources clearly.
Jeffrey Janik	Stakeholder, Subject matter expert	High interest, moderate power	Demonstrate applicability

(Rev.3/2011)

Stakeholder Register

***NOTE: Stakeholder Analysis.**
Use the following form to assess Amount of Power a stakeholder possesses for the project.

Stakeholder Analysis Form

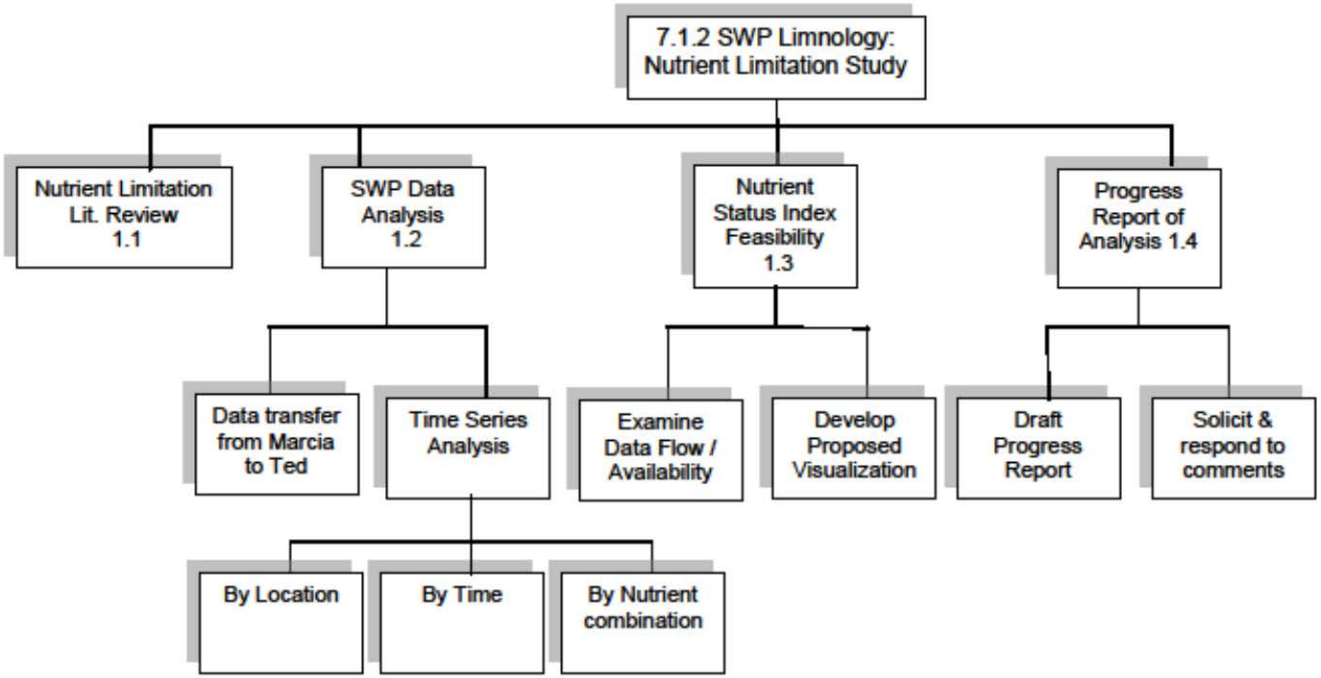
High Power		Municipal Contractors Cindy Garcia
Lower Power		Ted Swift Rich Losee Jeff Janik
	Low Interest	**High Interest**

(Rev.3/2011)

Nutrient Limitation Work Breakdown Structure

Work Breakdown Structure

Project Title: 7.1.2 SWP Limnology: Nutrient Limitation Study **Date:** 16 July 2014



(Rev.6/2011)

7.1.3 Nutrient & Nutrient Ratio Influence on Community Species Composition

Nutrient and Nutrient Ratios Project Initiation

Project Initiation

Version: 1.1 **Date:** 20 July 2015

Project Details

Project Name: 7.1.3 SWP Limnology: Nutrient & Nutrient Ratio Influence on Community Species Composition

Existing Problem/Need/Opportunity *Does something need to be fixed? Updated? Created? Expanded? Helped?*

The SWP Contractors have identified problems, issues, and concerns associated with drinking water quality of the SWP, caused by biological activity within the SWP. These effects cause costly problems in drinking water treatment plants ranging from taste & odor events that result widespread customer complaints to pH swings that complicate plant operations to filter-clogging algal production. Knowledge of the biological activity, the key drivers, and major biological players in the SWP is at a very rudimentary level. One facet of addressing these problems is developing a knowledge base on how nutrient concentrations and nutrient ratios (e.g., Nitrogen/Phosphorus) can affect benthic and planktonic algal community composition.

Solution *How will this project fulfill the above?*

Improved management of biologically-caused drinking water problems can be achieved by gaining applicable knowledge of the limnology and ecology of organisms that produce these problems, and use of this knowledge to develop optimal control and treatment strategies. This project will synthesize the work of Bay-Delta research that specifically pertains to effects of nutrients and nutrient ratios on benthic and planktonic algal community composition. The synthesis will guide further studies, potentially manipulating or at least predicting algal community. These in turn may provide optimal control and treatment strategies that will reduce treatment costs, improve reliability, and improve drinking water customer satisfaction.

Project Objective Statement *What will the project do? What does it look like?*

Review and follow the progress of Irwin van Nieuenhuyse's work and the Dick Dugdale group's work on nutrients and nutrient ratios as they affect benthic and planktonic algal community composition, respectively, in the Bay-Delta system. Following the literature review and reviewing the information developed in the Nutrient Budget Study (Project 7.1.1) and the Nutrient Limitation Study (Project 7.1.2), develop hypotheses of SWP community algal species composition. These hypotheses will guide and be tested in future studies of algal species composition. The work product from this study will be a progress report summarizing the key findings from the literature review and a list of hypotheses to be tested in the next phase of work.

Target Start Date	1 Jan 2016	**Target End Date**	30 June 2016
Proposed Project Manager(s)	Rich Losee / Ted Swift		
Proposed Project Sponsor(s)	State Water Contractors MWQI SPC		

Authorization *Specify if there is a mandated reason for project (e.g. Legislative; executive; water code, other)*

Requested by State Water Project Contractors Authority MWQI Specific Project Committee

Project Initiation

Partners

Within DWR	MWQI Branch, O&M Water Quality (information contact)
Other State Agencies	SFSU (R. Dugdale research group, information contact)
Federal Agencies	USBR (van Nieuenhuyse, information contact)
Local Organizations	Losee Limnology Consulting (subject matter expert)

Benefits and Consequences

Project is completed	Algal species in the SWP affect drinking water quality. Algal species composition is affected by nutrient concentrations and ratios, with deleterious or beneficial effects. Completion of this project will not in itself solve deleterious water quality effects, but will guide hypothesis-testing studies that may recommend biological manipulation strategies to control algal effects.
Project is not completed	The body of research in Bay-Delta algal community composition is an important clue to addressing the biological effects within the SWP. If this research synthesis is not included, further research is likely to waste financial and time resources in repeating previous research.

Environmental Stewardship

Policy Applicable ☐ **Policy Not Applicable** ■

Reason(s): This project is not expected to have any DWR policy implications.

Signatures

Prepared By: Ted Swift **Date:** 20 July 2015

Reviewer: _____ **Date:** _____

Project Recommended ☐ **Project Not Recommended** ☐

Reason(s):

NOTE: Once The Project Initiation document is completed and approved, please send a copy to your Division Chief and digital version sent to the Project Services Office for filing. (Even if the Initiation is not approved, please send a copy to PSO.)

7.1.4 Light Limitation in the SWP

Light Limitation Project Charter

Project Charter

Version#: 1.2 **Date:** 20 July 2015

Project Name: *Write out the entire, specific name.*

7.1.4 SWP Limnology: Light Limitation in the SWP; 688 hours

Sponsor/Program Manager	State Water Project Contractors Authority MWQI Specific Project Committee/Rich Losee
Project Manager	Ted Swift

Project Objective Statement: *What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).*

This study will determine the amount of light reduction necessary to sufficiently reduce the growth of algae and submersed macrophytes to limit their growth in the SWP

Triple Constraint Trade-off

Resources	N	*Select a different flexibility letter for each constraint* *N= Not Flexible* *S= Somewhat Flexible* *M= Most Flexible*
Schedule	S	
Scope	M	

Estimated Start Date:	1 August 2015	**Estimated End Date:**	31 Jan 2016

Project Deliverables: *What is the project going to produce? Create a list of tangible products that will result from project.*

- Literature review of light limitation of filamentous diatoms (e.g., *Melosira*), benthic cyanobacteria (e.g., T&O producers, if available), and submerged macrophytes (macrophytes (particularly of problematic species in the SWP).
- Progress report summarizing results of the literature review and the data analysis of light attenuation and photic depth versus turbidity data in the IEP database. The progress report will address the practicality of using light reduction to control algal or macrophyte growth.
- Develop peer-reviewed protocol to measure light and light attenuation in the SWP aqueducts.
- Purchase and test light sensors for further studies.

Strategic Fit: *What is the Strategic Initiative Identifier for this project?*

This project supports MWQI's mission of providing knowledge based support for operational decision-making and conducting scientific studies of drinking water importance.

Customer: *Who are you doing the project for?*

This project is a component of the overall Limnology Project, for which the customer is the Municipal Drinking Water Contractors (MWQI SPC) and the DWR O&M Water Quality Branch.

Project Charter

Customer Benefits: *What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.*

The SWP Contractors have identified problems, issues, and concerns associated with drinking water quality of the SWP, caused by biological activity within the SWP. Improved management of these problems can be achieved by gaining applicable knowledge of the limnology and ecology of organisms that produce these problems, and use of this knowledge to develop optimal control and treatment strategies. Understanding the light available for photosynthesis is fundamental to evaluating practical strategies. These will assist optimal control and treatment strategies will reduce treatment costs, improve reliability, and improve drinking water customer satisfaction.

Success Determination Factors *How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.*

This project will be a success if it determines sufficiently precise estimates of light requirements for species of concern in the SWP, if it develops useful and predictive relationships between light attenuation versus turbidity in the SWP, if it clearly and completely reports those findings; and if it acquires and develops clear protocols for measuring light climates for selected locations in the SWP.

Project Background: *What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.*

Drinking water quality is important to the 25 million customers of the State Water Project, and the drinking water contractors must meet government health and safety requirements for drinking water. Biological activity in the SWP affects water quality by producing compounds that negatively affect taste and odor, disinfection byproduct precursors, and changing pH, which in turn affects treatment plant operations. These increase costs for the water purveyors and affect customer satisfaction for the ultimate consumers. The current situation is that the contractors have many examples of these biological effects, yet little is known about the precise sources of the problems and the feasibility of reducing and/or controlling them. The desire is to understand the limnology of the SWP well enough to produce recommendations for actions or operational changes that would improve water quality, reduce treatment costs, and improve regulatory compliance. One mechanism that strongly affects biological activity is light availability for photosynthesis. Light is known to limit algal and macrophyte growth in the Delta, but the light climate changes as light attenuation changes within the SWP. Also, different species can tolerate different ranges of light, and light may play an important role in determining which species dominates within different portions of the SWP. E.g., there are anecdotes of T&O species changes after a period of low aqueduct flow reducing turbidity and thus increasing light availability.

Project Scope:

In Scope: *List areas and functionality included in project.*	**Out of Scope:** *List areas and functionality not included in project.*
* Literature review of light limitation for Melosira, T&O-producing algae, and submerged macrophytes found or likely to be found in the SWP. * Analyze the light and suspended matter data within the IEP monitoring database to develop relationships between suspended matter concentration and light attenuation. * Develop robust protocol for light and light attenuation measurements in SWP channel and reservoir environments. * Acquire appropriate light measurement instruments in time for the 2015 "growing season"	* Literature search of all reports of light limitation. * Survey in-situ light limitation of attached algae or macrophytes in the SWP beyond initial testing phase.

Dependent Projects: *What projects must be underway or completed before this project can be successful?*

This Project has no vital dependencies on other Limnology projects. Instrument procurement will depend on funding availability and will probably be subject to DWR procurement paperwork, which may be time consuming. Literature review relies on access to the electronic literature catalogs, which the State doesn't provide, but which Ted Swift presently has through an affiliate computer account at UC Davis. This is expected to be available through the duration of the project.

Project Charter

Risks: *What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.*

* Available IEP data may be of such unknown quality or insufficient quantity that conclusions are limited to fewer locations or time periods than expected. This is not a "show stopper" that would cause complete project failure, but would reduce the literature search conclusions' scope of applicability. The project would still be an improvement on the present state of knowledge.

Assumptions and Constraints: *What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.*

Assumptions: Sufficient IEP data of sufficient quality will be available for analysis (almost certain); sufficient knowledge exists (from literature) of light limitation characteristics for species of interest (very likely); subject matter experts have sufficient knowledge to arrive at optimal conclusions.
Constraints: Field testing of measurement protocols may involve intra-division coordination. Funding ("resources" in triple constraints, above) and therefore time are co-constraints. The best instruments for the job may

Major High-Level Milestone Targets: *What events measure progress? E.g. Initiation Approved, Analysis Complete.*

Milestone	Target Date
Purchase & field-test sensors, revise protocol further	27 Mar 2015
Conduct literature review and examine existing IEP light vs turbidity data	31 Aug 2015
Develop light measuring protocol and submit to DWR management and MWQI SPC for review	30 Sept 2015
Submit Draft Progress Report to DWR management and MWQI SPC for review	31 Oct 2015
Respond to comments and finalize Progress Report	22 Dec 2015
Respond to comments and finalize protocol	31 Jan 2016

Project Core Team Members

Team Member	Phone/E-mail	Role
Ted Swift	916-376-9718, Ted.Swift@water.ca.gov	Lead Scientific Investigator
Rich Losee	(909) 392-5124, rflosee@dslextreme.com	Project Partner, Subject matter expert
Cindy Garcia	916-376-9715, Cindy.A.Garcia@water.ca.gov	MWQI Branch Chief, Program Management
Elaine Archibald	916-736-3713, elaine.archibald@comcast.net	Consultant to MWQI SPC, Program Management
Jeffrey Janik	916-653-5688, jjanik@water.ca.gov	Stakeholder, Subject matter expert
Margaret Spoo-Chupka, MWDSC		T&O Algae Subject matter expert

Charter Version Number:	
Updated By: Ted Swift	**Date:** 20 July 2015
Approved By:	**Date:**

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Project Charter

Funding Information

Project Budget:	
Fund Center Title	7.1.4 Light Limitation in the SWP
Fund Center Number	VLIMLIGHTL14
Organization	DWR, Dvisision of Environmental Services, Office of Water Quality
Contact Person	Ted Swift
Phone/E-mail	916-376-9718, Ted.Swift@water.ca.gov

This Project Should Have: *Check all that apply*

Project Management Plan ☐	Environmental Stewardship Plan ☐	Work Breakdown Structure ■	Communications Plan ■	Procurement Plan ■	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ■	Risk Register ☐	Project Budget ■	Project Schedule ■	DWR Form 1498 ☐

Light Limitation Cost Activity Estimates

Activity Cost Estimates

Project Title: 7.1.4 SWP Limnology: Light Limitation in the SWP **Date:** 27 June 2014

WBS ID	Resource	Direct Costs $	Indirect Costs $	Reserve $	Estimate $	Assumptions/ Constraints	Additional Information
From WBS	*Labor, material, etc.*	*Related to project*	*Indirectly related to project*	*Contingency reserve amounts.*	*Approximate cost*	*Used in developing the estimate, such as labor cost per hour.*	*Cost of quality, interest rate; range of estimate; method used,(parametric, analogous); degree of confidence.*
1.1	Labor	2 weeks	-	-		T Swift's burdened rate	
1.2	Labor	6 weeks	-	-		T Swift's burdened rate	
1.3	Labor	4 weeks	-	-		T Swift's burdened rate	
1.4.1	Labor, purchase	4 weeks	PAR Sensor $??? / each x 2		$???	T Swift's labor, Instrument purchase price	Draft instrument quote needed
1.4.2	Labor, purchase	4 weeks	Radiometer $10,000		$10,000	T Swift's labor, Instrument purchase price	Draft instrument quote received
1.4.2	Labor	2 days				O&M Field Division Staff Time (coord with other field studies)	

(Rev.3/2011)

Light Limitation Quality Management Plan

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

Quality Management Plan

Project Title: 7.1.4 SWP Limnology: Light Limitation in the SWP **Date:** 15 Aug 2014

Quality Assurance Approach

Field measurements of light intensity at known locations, depths, light wavelengths, and time are fundamental to determining the light available for photosynthesis. Measurements undertaken for this study will be of known quality and sufficient accuracy and precision to allow efficient and accurate analysis necessary to derive useful conclusions about the underwater light conditions for plant and/or algae growth. Efficient and accurate analysis depends on measurement of the most applicable light variables, namely light intensity within a known wavelength band at known water depth, location, and time. Light intensity measured at several specific wavelengths provide dramatically more useful data than light measured across a broad spectrum: Wavelength-specific data can enable partition of light attenuation into separate fractions due to suspended inorganic sediment, dissolved matter, and suspended biological matter. Detailed measurement with depth enables identifying variation of those fractions with depth, e.g., stratified layers within a reservoir.

Training: Field measurements will be made by personnel trained in the proper operation of the measurement equipment. Training is not expected to be difficult or extensive, but will communicate the important parameters and likely pitfalls to collecting usable data.

Data Quality Objectives:

Measure underwater light intensity with a resolution of 0.01 umol/s/m2 (0.005 W/m2/) or less, stability < +/- 2% change per year. Measure light intensity as a function of depth to the bottom of the water body, or to 0.1% of surface light, whichever is shallower.

Measure light over well-defined wavelength bands, preferably at several specific 10 nm-wide bands, but as a minimum at the well-defined broad-band Photosynthetically Active Radiation (PAR) band.

Measure sensor depth with a resolution of 0.01 m and accuracy of +/-0.12 m.

Quality Control Approach

Instruments will be checked for proper operation before each field deployment. Whenever possible, data will be briefly reviewed in the field to confirm proper instrument operation and data recording. Data will be secured as soon as possible in the field and securely backed up in the office.

Field measurements will be made with the goal of minimizing artifacts in the light measurements due to shadows from bridges or boats, reflections from nearby structures, undocumented changes in the instrument orientation, or passing clouds. The instrument(s) will be deployed from, e.g., a bridge or boat, on the sunny side, away from canal edges and near the center of channels. If possible, surface illumination will be recorded concurrently in order to control for changes in surface illumination due to, e.g., passing clouds. If surface illumination cannot be measured, underwater light profiles should be made when surface illumination is constant, e.g., during clear weather.

Quality Improvement Approach

Data will be evaluated immediately after collection to determine proper instrument operation, lack of artifacts, etc. Any problems will be immediately communicated to field staff and revised field methods will be developed for subsequent deployments.

DWR 9701 (New 7/14)

Light Limitation Stakeholder Register

Stakeholder Register

Project Title: 7.1.4 SWP Limnology: Light Limitation in the SWP **Date:** 27 June 2014

Stakeholder	Interest in Project	Assessment of Power*	Strategies for Gaining Support or Reducing Obstacles
Ted Swift	Lead Scientific Investigator	High interest, moderate power	Ensure data & analysis obstacles are ID'ed early and removed
Rich Losee	Project Partner, Subject matter expert	High interest, moderate power	Ensure regular communication
Cindy Garcia	MWQI Branch Chief, Program Management	High interest, High power	Explain motivations, goals, timelines & resources clearly.
Municipal Contractors, represented by Elaine Archibald	Consultant to MWQI SPC, Program Management	High interest, High power	Explain motivations, goals, timelines & resources clearly.
Jeffrey Janik	Stakeholder, Subject matter expert	High interest, moderate power	Demonstrate applicability

(Rev.3/2011)

Stakeholder Register

***NOTE: Stakeholder Analysis.**
Use the following form to assess Amount of Power a stakeholder possesses for the project.

Stakeholder Analysis Form

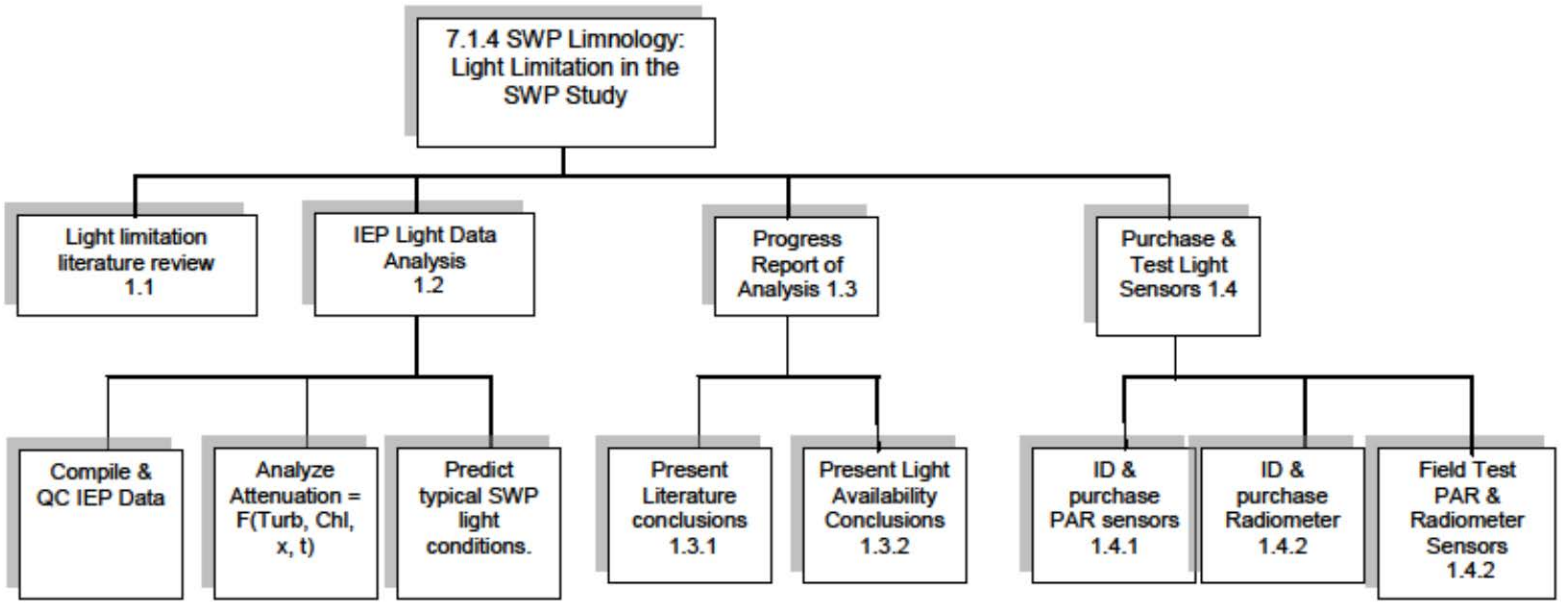
High Power		Municipal Contractors Cindy Garcia
Lower Power		Ted Swift Rich Losee Jeff Janik
	Low Interest	**High Interest**

(Rev.3/2011)

Light Limitation Work Breakdown Structure

Work Breakdown Structure

Project Title: 7.1.4 SWP Limnology: Light Limitation in the SWP **Date:** 15 Aug 2014



(Rev.6/2011)

7.1.5 Algal and Macrophyte Growth Study

Algal and Macrophyte Growth Project Initiation

Project Initiation

Version: 1.1 **Date:** 21 July 2015

Project Details

Project Name: 7.1.5 SWP Limnology: Algal and Macrophyte Growth Study

Existing Problem/Need/Opportunity *Does something need to be fixed? Updated? Created? Expanded? Helped?*

The SWP Contractors have identified problems, issues, and concerns associated with drinking water quality of the SWP, caused by biological activity within the SWP. These effects cause costly problems in drinking water treatment plants ranging from taste & odor events that result in widespread customer complaints, to pH swings that complicate plant operations, to filter-clogging algal production, to macrophytes slowing flow and blocking intake structures. Knowledge of the biological activity, the key drivers, and major biological players in the SWP is at a very rudimentary level. One facet of addressing these problems is developing a knowledge base on algal and macrophyte growth rates in the laboratory and in the field (SWP) as functions of nutrient and light availability, and how this can affect benthic and planktonic algal and macrophyte community composition, for good or ill.

Solution *How will this project fulfill the above?*

Improved management of biologically-caused drinking water problems can be achieved by gaining applicable knowledge of the limnology and ecology of organisms that produce these problems, and use of this knowledge to develop optimal control and treatment strategies. This project will synthesize the published research that specifically addresses lab and field measurement methods of growth rates of algal and macrophyte species. The synthesis will guide further studies that measure primary production (growth rates) in selected SWP facilities. These in turn may provide optimal control and treatment strategies that will reduce treatment costs, improve reliability, and improve drinking water customer satisfaction.

Project Objective Statement *What will the project do? What does it look like?*

Review and synthesize the state of the art in measuring primary production (growth rates) of benthic and planktonic algal species likely to be found in the SWP as functions of light and nutrient availability in the laboratory. Similarly summarize state of the art in field methods of estimating production for whole reaches of the CA Aqueduct, and field methods of measuring photosynthetic rates for small benthic areas of the aqueduct to compare variation in flow/turbulence and light level These methods may be used in future studies of algal and macrophyte species production in SWP facilities. The work product from this study will be a progress report summarizing the key findings from the literature reviews.

Target Start Date	Dec 2016	**Target End Date**	Apr 2016
Proposed Project Manager(s)	Rich Losee / Jason Moore		
Proposed Project Sponsor(s)	State Water Contractors MWQI SPC		

Authorization *Specify if there is a mandated reason for project (e.g. Legislative; executive; water code, other)*

State Water Contractors MWQI SPC

Project Initiation

Partners

Within DWR	MWQI Branch, O&M Water Quality (information contact)
Other State Agencies	UC Davis Dept of Plant Biology (information contact)
Federal Agencies	
Local Organizations	Losee Limnology Consulting (subject matter expert)

Benefits and Consequences

Project is completed	Algal and macrophyte species in the SWP affect drinking water quality. Algal and macrophyte species concentrations are determined by growth rates, with deleterious or beneficial effects. Completion of this project will not in itself solve deleterious water quality effects, but will provide tools needed for hypothesis-testing studies that may recommend biological manipulation and/or water operations strategies to control algal and macrophyte effects.
Project is not completed	Determining growth rates will be fundamental to understanding the biological effects within the SWP. If this research synthesis is not included, further research is likely to waste financial and time resources in repeating previous research.

Environmental Stewardship

Policy Applicable ☐ **Policy Not Applicable** ■

Reason(s): This project is not expected to have any DWR policy implications.

Signatures

Prepared By: Rachel Pisor and Jason Moore **Date:** 13 July 2015

Reviewer: _____ **Date:** _____

Project Recommended ☐ **Project Not Recommended** ☐

Reason(s):

NOTE: Once The Project Initiation document is completed and approved, please send a copy to your Division Chief and digital version sent to the Project Services Office for filing. (Even if the Initiation is not approved, please send a copy to PSO.)

7.1.8 Wide Swings in Canal pH Study

Wide Swings in Canal pH Project Charter

Version#: 1.1 **Date:** 10/03/2014

Project Name: *Write out the entire, specific name.*

7.1.8 Wide Swings in Canal pH Study

Sponsor/Program Manager	Rich Losee/Cindy Garcia
Project Manager	Jason Moore

Project Objective Statement: *What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).*

This is an MWQI project to identify causes of wide pH shifts in the South Bay Aqueduct through a monitoring program to assist customers in controlling drinking water treatment costs due to pH issues.

Triple Constraint Trade-off

Resources	M	*Select a different flexibility letter for each constraint* *N= Not Flexible* *S= Somewhat Flexible* *M= Most Flexible*
Schedule	S	
Scope	N	

Estimated Start Date:	May 2014	**Estimated End Date:**	June 2016

Project Deliverables: *What is the project going to produce? Create a list of tangible products that will result from project.*

- Pilot Study Plan (Complete)
- Pilot Study Report
- Revisited Pilot Study Plan
- Revisited Pilot Study Report
- Study Plan
- Final Project Report

Strategic Fit: *What is the Strategic Initiative Identifier for this project?*

This project fits with MWQI's mission of providing data & knowledge based support for operational decision-making and conducting scientific studies of drinking water importance.

Customer: *Who are you doing the project for?*

MWQI SPC, DWR O&M, SBA Water Contractors

Customer Benefits: *What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.*

Understanding the causes of the observed wide shifts in pH that have caused increased treatment costs for the water contractors using the South Bay Aqueduct will aid DWR O&M in developing more effective management of the system.

Success Determination Factors *How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.*

-Determine factors that contribute to wide swings in pH.
-Provide effective recommendations for management of the SBA to minimize wide shifts in SBA pH.

Project Background: *What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.*

Wide shifts in pH of the water in the SBA have caused increased costs treating water drawn from the SBA for municipal uses. These shifts are associated with diurnal variations in algal activity. The specific conditions associated with these shifts in pH are important for developing effective management practices. This project will look at the water's pH, nutrient composition, depth, temperature, velocity, and algal composition. In addition certain canal characteristics such as shading, sun exposure, and orientation as contributors to pH changes.

The goal of this effort is to apply limnological principles to decrease the treatment plant difficulties resulting from photosynthetically driven pH excursions in the SBA. Note that a solution to this problem will likely also solve the Melosira filter clogging issue. The objectives of this study are to 1) understand the magnitude of the problematic pH excursion events and the inorganic carbon chemistry and buffering capacity of the SBA; and 2) to quantify the magnitude and diurnal dynamics of specific pH excursion events before, during, and after algaecide treatment. The first step will be to analyze the historical data to identify the magnitude and frequency and seasonality of pH excursion events, and to understand the inorganic carbon chemistry and buffering capacity during the events. The work product from this phase will be a progress report that discusses the key findings from the data review.

The next phase will be to conduct monitoring during pH excursion events. This will involve continuous measurement of pH and oxygen, upstream and downstream of the reach of interest on the SBA before, during and after treatments to control Melosira. Inorganic carbon and alkalinity of the water will be monitored to assess the buffering capacity. This phase of the study will require coordination with O&M Water Quality and the Delta Field Division. Ideally, the monitoring will be conducted during the algal growth season of January to November, 2015.

Project Scope:

In Scope: *List areas and functionality included in project.*	**Out of Scope:** *List areas and functionality not included in project.*
This study will analyze conditions associated with pH shifts such as: *Nutrients, pH, water depth, water temperature, dissolved oxygen changes, algal composition through pigments, sun exposure, canal orientation, water velocity, and algal growth rates*	*Conditions outside of the SBA*

on artificial substrates. *This study will also look at the effects of algaecide treatment in specific reaches of the SBA*	

Dependent Projects: *What projects must be underway or completed before this project can be successful?*

Nutrient Budget Study – Spatial Temporal Distribution of Melosira in the SBA—Light limitation in the SWP – Nutrient Limitation Study – Algal and Macrophyte Growth Study

Risks: *What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.*

Data from associated studies are not readily available for final report.

Assumptions and Constraints: *What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.*

Assumptions: There will be access to the site. Collected data will highlight causes of pH shifts. Equipment will be available and functioning. Constraints: Funding for equipment. All work to be performed from bridges behind railing.

Major High-Level Milestone Targets: *What events measure progress? E.g. Initiation Approved, Analysis Complete.*

Milestone	Target Date
Pilot Study Plan	Completed
Pilot Study Report	July 2015
Revisited Pilot Study Plan	July 2015
Revisited Pilot Study Report	December 2015
Phase II Study Plan	January 2016
Final Project Report	June 2016

Project Core Team Members

Team Member	Phone/E-mail	Role
Rich Losee	rflosee@dslextreme.com	Sponsor/Project Partner
Jason Moore	jason.moore@water.ca.gov	Project Manager
Sonia Miller	sonia.miller@water.ca.gov	Researcher
Rachel Pisor	rachel.pisor@water.ca.gov	Supervisor

Project Core Team Members

Team Member	Phone/E-mail	Role
Rich Losee	rflosee@dslextreme.com	Sponsor/Project Partner
Cindy Garcia	cindy.a.garcia@water.ca.gov	Program Manager

Charter Version Number: 2.0	
Updated By: **Jason Moore**	**Date:** *10/03/2014*
Approved By:	**Date:** 10/8/2014

Funding Information

Project Labor Budget:	
Fund Center Title	7.1.8 Wide Swings in Canal pH Study
Fund Center Number	VLIMPHSTUD14
Organization	DWR DES MWQI
Contact Person	Jason Moore
Phone/E-mail	916-376-9713/ jason.moore@water.ca.gov

This Project Should Have: *Check all that apply*

Project Management Plan ■	Environmental Stewardship Plan ☐	Work Breakdown Structure ☐	Communications Plan ☐	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ☐	Risk Register ☐	Project Budget ☐	Project Schedule ☐	DWR Form 1498 ☐

Wide Swings in Canal pH Site Health and Safety Plan

The Department of Water Resources
South Bay Aqueduct

Water Quality Data Collection for pH Shifts in the State Water Project

1.0 INTRODUCTION AND SCOPE

This Site Health and Safety Plan (HSP) was developed to protect the health and safety of field personnel during the sampling of water from the proposed project site ("Site") as identified in the pH shifts Pilot Study Sampling Plan.

1.1 Site Location

The Site is South Bay Aqueduct (SBA) in Alameda County, California. The sampling will occur at two different farm bridges, the first at Mile marker 4.55 (GPS coordinates 37°44'49.21"N 121°40'30.99"W) and the second is Mile maker 7.61 (GPS coordinates 37°43'3.80"N 121°41'25.18"W).

DES will be coordinating work on the South Bay Aqueduct with the Delta Field Division (DFD) located from the DFD main office at:

Delta Field Division
South Bay Aqueduct
5280 Bruns Road
Byron CA, 94514-9612

1.2 Site Background

The SBA is a Department of Water Resources (Department) water conveyance structure consisting of over 42 miles of canals and tunnels spanning from Byron, CA to Santa Clara, CA. The first 16 miles of the SBA consists of above ground canals where this project will take place. The SBA canals are concrete-lined trapezoidal channels typically 5 – 7 feet deep and approximately 30 feet wide.

1.3 Scope of Work

The work to be performed by the Department's Municipal Water Quality Investigations (MWQI) field personnel under this HSP will involve the following tasks from the bridges previously identified:

- Pre-work Site scoping and hazard analysis visits
- Installation of standpipes on two bridges.
- Installation of YSI EXO 2 sondes at two bridges.
- Sampling and data collection will occur within the South Bay Aqueduct according to the pH Shifts Pilot Study Sampling Plan
- This study will be completed before the end of February 2015

1.4 Organization

This HSP is organized as follows:

Section 1:	Introduction and Scope
Section 2:	Task-Hazard Analysis
Section 3:	Chemical Hazards
Section 4:	Physical Hazards
Section 5:	Safety Procedures
Section 6:	Training Requirements
Section 7:	Contingency Plans
Section 8:	General Safety Requirements
Appendix I:	Personal Acknowledgement Sheet
Appendix II:	Tailgate Safety Meeting Form

1.5 Applicability

The HSP in this document is based on current regulatory requirements and guidelines contained in Title 29 of the Code of Federal Regulations (CFR), Title 8 of the California Code of Regulations (CCR), Title 17 (CCR), other applicable Federal and State laws and regulations, and experience conducting similar projects at other locations. In addition the Department's own Code of Safe Work Project (COSWP) sections 5.7 (draft), 5.10, and 5.12 will be followed.

This document is for use by employees of DWR only, and is specifically for the work and time period indicated above. DWR has no contractual responsibility to oversee employees of other independent contractors or other governmental agencies who may be on the Site, either as part of this sampling event or working on other activities.

1.6 Responsibilities

The following persons will be responsible for the onsite implementation and enforcement of this HSP:

1.6.1. Project Manager

The DWR Project Manager (PM) has the overall responsibility for developing, coordinating, and implementing the Sampling Plan in a safe manner and is the central point of contact with the regulatory agencies and other DWR personnel. The PM is responsible for providing the necessary resources to conduct the work safely, including appropriately trained field personnel and personal protective equipment (PPE). In addition, he or she is responsible for consulting with the DWR Safety Office and with the Site Safety Coordinator regarding any changes that may affect health and safety of the field team members. The PM for this sampling event is:

Jason Moore
Environmental Scientist
Office of Water Quality Branch
Municipal Water Quality Investigations
Work (916) 376-9713
Cell (530) 972-1707
Jason.Moore@water.ca.gov

1.7 DWR Safety Office

The DWR Safety Office has the responsibility for DWR's Safety Program. The office shall be available for consultation as necessary.
The DWR Safety Officer is:
Michael Donlon
Michael.Donlon@water.ca.gov
916-502-7738
With support from:
Rodney Teeter
Rodney.Teeter@water.ca.gov
and
Rene Mostert
Rene.Mostert@water.ca.gov

Delta Field Division Safety Engineer is:
Chris Ansell
christopher.ansell@water.ca.gov
(209) 833-2028

DES Safety Support Staff is
Don Guy
Donald.Guy@water.ca.gov
(916) 376-9837

1.8 Site Safety Coordinator

The Site Safety Coordinator (SSC) is responsible for ensuring compliance with the HSP, including health and safety procedures for work sites, monitoring and recording of conditions,

personal protective equipment and clothing, and consulting with the Safety Officer and PM regarding site conditions. The SSC shall document periodic work area inspections to ensure compliance with the HSP**.** The SSC for this sampling event is:

Jason Moore
Environmental Scientist
Office of Water Quality Branch
Municipal Water Quality Investigations
Work (916) 376-9713
Cell (530) 972-1707
Jason.Moore@water.ca.gov

1.9 Field Personnel

Field personnel are responsible for understanding and adhering to this HSP, and should also be alert to any unsafe conditions or practices which may affect their safety. Any safety deficiencies will be communicated to the SSC. Contact information for staff is found in section 9. Field personnel for sampling events are:

Jason Moore, Environmental Scientist
Sonia Miller, Environmental Scientist
Shaun Rohrer, Environmental Scientist
Steve San Julian, Senior Environmental Scientist
Arin Conner, Environmental Scientist
Travis Brown, Environmental Scientist
Jeremy Del Cid, Environmental Scientist
Ted Swift, Senior Environmental Scientist

2.0 TASK HAZARD ANALYSIS

This section describes the project tasks and the potential hazards involved in carrying out these tasks. All DWR field personnel should be aware that this HSP was prepared prior to mobilization, and that site conditions may be different than anticipated or change during sampling. Field personnel should inform the SSC immediately of changes in site conditions that are not discussed in this HSP. The SSC should contact the PM and have the HSP updated as required.
In addition to this HSP a Pre-Work Safety Plan (PWSP) has been prepared covering this 7.1.8 pH study and the 7.1.6 Algal Distribution study.

2.1 Task Analysis

This HSP has been prepared for the following study tasks:

2.1.1. Task 1: Data Collection Location Marking

Staff has made a preliminary site visit and selected data collection sites. The sites chosen for this study are on railed bridges that cross the SBA.

Potential hazards include:

- Slips, trips, and falls
- Effects of inclement weather (heat, cold, fog, wind)
- Vehicle traffic
- Canal flows
- Working near aqueduct (slips, falls, rushing water, cold water, currents)
- Bee and wasp stings, snakes, and spiders

2.1.2. Task 2: Standpipe Installation

The sondes that will collect data will be placed in standpipes attached to each bridge. The installation process for these standpipes is as defined in the sampling plan.

Potential hazards include:

- Slips, trips, and falls
- Effects of inclement weather (heat, cold, fog, wind)
- Vehicle traffic
- Livestock crossing bridge
- Encounters with wild animals (snakes, ticks, etc.)
- Canal flows
- Working near aqueduct (slips, falls, rushing water, cold water, currents)
- Bee and wasp stings, snakes, and spiders

2.1.3. Task 3: Data Collection

Data will be collected according to the methods described in the sampling plan.

Potential hazards include:

- Slips, trips, and falls
- Effects of inclement weather (heat, cold, fog, wind)
- Vehicle traffic
- Livestock crossing bridge
- Encounters with wild animals (snakes, ticks, etc.)
- Canal flows
- Working near aqueduct (slips, falls, rushing water, cold water, currents)
- Bee and wasp stings, snakes, and spiders

2.2 Hazard Analysis

The potential health hazards associated with this data collection include:

- Physical Hazards (Section 4.0)
- Heat-related illnesses (e.g., heat exhaustion and heatstroke)
- Cold-related illnesses (e.g., hypothermia and frost bite)
- Lifting
- Slips, trips, and falls
- Uneven walking and working surfaces
- Moving vehicles
- River and creek flows
- Working near aqueduct (slips, falls, rushing water, cold water, currents)
- Bee and wasp stings, snakes, and spiders

2.3 Transportation

The site will be accessed by a vehicle with high ground clearance. The vehicle may be used as part of a fall restraint anchor system. The following hazards exist:

- Driving fatigue
- Movement of vehicle while rigged as a fall restraint anchor

3.0 CHEMICAL HAZARDS

There are no known chemical impacts at the Site.

4.0 PHYSICAL HAZARDS

Physical agents that field personnel can reasonably be expected to encounter, and mitigation measures to reduce effects of these agents, are discussed below.

4.1 Heat-related Illness

There is a potential for heat-related illness from the use of protective clothing and climate conditions. One or more of the following procedures may be employed to alleviate potential heat-related illness problems in the event that site conditions warrant the use of personal protective equipment (PPE), or if ambient temperatures exceed 85° Fahrenheit.

4.1.1. General Precautions

DES has several 5-gallon water container and ice. Staff will provide sufficient liquids to replace body fluids (water and electrolytes) lost because of sweating. In extremely hot weather, conduct operations in early morning or evening. Workers will be provided water and shade and will be given the opportunity to take frequent breaks to drink water and get out of the sun.

Ensure that adequate shade is available for breaks to all staff to get out of the sun and adequate time to cool down.

If work must occur during hot conditions, implement a work-rest regimen. Initially start off with 30 minutes of work followed by a five minute break or more frequent if needed. Staff should keep an eye on each other. Talk to each other and let your partner know how they feel.

4.1.2. Effects of Heat on the Body

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat loading, a number of physical reactions can occur. The severity of these reactions ranges from mild (i.e., fatigue, irritability, anxiety, decreased concentration, dexterity, or movement) to severe (death).

Heat related illnesses include:

- Sunburns are caused by UV radiation reaching the skin. One of the most effective ways to prevent sunburn is to reduce the amount of UV radiation reaching the skin. Wear long sleeved shirts, long pants, sunglasses, wide brimmed hats, closed footwear, and gloves to block UV radiation from reaching the skin. If skin is exposed to UV radiation apply sunscreen with a Sun Protection Factor (SPF) of 30 or greater. Lip-Balm with a 30 or greater SPF should also be applied to lips.

- Heat Rash (also known as prickly heat rash) is caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Heat rash decreases the ability to tolerate heat, is a nuisance, and reduces worker effectiveness. Signs are red prickly-like rashes. Employees exhibiting signs of heat stress will be directed to take frequent breaks, to drink water, and get out of the sun.

- Heat Cramps are caused by profuse perspiration with inadequate fluid intake and electrolyte replacement (especially salts). Signs are muscle spasms and pain in the extremities and abdomen and may occur several hours after work has stopped. Employees showing signs of heat cramps will be directed to lie in a cool, shady area, and drink cool fluids. The site safety coordinator will contact the staff immediate supervisor and keep a close eye on the person. If symptoms persist or worsen, 911 will be called and the employee will be transported to where emergency services can evaluate the situation or to the nearest hospital.

- Hyponatremia is caused by an abnormally low concentration of sodium in the blood. It can be caused by replenishing body fluids with water only. The symptoms of hyponatremia include bloating and puffiness in the face and fingers, nausea, vomiting, muscle weakness, headache and disorientation. Symptoms may occur independently or in conjunction with the symptoms of other heat-related illnesses. Employees exhibiting signs of hyponatremia will be instructed to drink an electrolyte replacement drink. Do not treat with more water. If symptoms persist or worsen, the employee should be transported to an emergency facility.

- Heat Exhaustion is caused by increased stress on various organs to meet increased demands to cool the body. Signs are shallow breathing; pale, cool, moist skin; profuse sweating; dizziness and fatigue. Employees with signs of heat exhaustion will be brought to a cool, shady location and given fluids. If the victim is unconscious, call 911 or conditions persist, the victim should be transported to where emergency can evaluate the situation or to the nearest Hospital.

- Heat Stroke is the most severe form of a heat-related illness. The body must be cooled immediately to prevent severe injury and/or death. Signs and symptoms are red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and/or coma. **HEAT STROKE IS A MEDICAL EMERGENCY.** The victim will be brought to a cool area, aggressively treated by removing constricting clothes and applying wet towels or ice packs, and transported without delay to an emergency facility.

4.2 Hypothermia

Hypothermia sets in when the body loses heat faster than it produces it. During hypothermia body temperature, normally 98.6°F, begins to fall and vital organs fail. When body temperature falls below 78°F death is likely. There are two types of hypothermia. Acute, or sudden, is usually caused by sudden immersion in cold water which can cool the body twenty-five times faster than cold air.

Chronic or long-onset hypothermia can develop with exposure times of several hours. It occurs when working in temperatures below 60°F and the body is wet from precipitation or perspiration. Air temperature below freezing is not required.

- Mild Hypothermia - The body temperature is 97°F or lower. Symptoms include cold hands and feet, alertness by some numbness, clumsiness and pain from cold. Treatment includes preventing further heat loss and letting the body regain warmth. Give warm sweet drinks; no alcohol or caffeine. Keep the victim warm for several hours.

- Moderate Hypothermia - The body temperature is 93°F or lower. Symptoms include the decreasing or ceasing of shivering. Treatment includes the application of gentle heat to stabilize temperature. Offer drinks only after victim is fully conscious. Have victim checked by a doctor.

- Severe Hypothermia - The body temperature is 90°F or lower. Symptoms include the decreasing or ceasing of shivering, the loss of mental clarity, and abnormal behavior. The victim may appear drunk and resist help, or be semiconscious or unconscious. Muscular rigidity increases. Treatment includes the avoidance of jarring the victim. Handle victim gently, and ignore pleas to be left alone. Lay victim on back and keep immobile. Apply mild heat from heat packs found in first aid kit.

- Critical Hypothermia - The body temperature is 82°or lower. Symptoms include unconsciousness, little or no apparent breathing or pulse, cold skin which may be bluish-gray, dilated eyes, and extreme rigidity of body. Treatment includes reviving the victim. Look, listen, and feel for breathing and a pulse for two minutes.

If a pulse is detected, do not give CPR. If no breathing or pulse, begin CPR. Seek medical attention immediately. Call 911.

4.3 Lifting and Walking Hazards

Field operations often require that physical labor tasks be performed. All employees should utilize proper bending and lifting procedures. Whenever an object is lifted, the employee should bend at the knees and lift the object using the legs. Additionally, an employee should not attempt to lift bulky or heavy objects without assistance.

To keep the work area from becoming hazardous due to supplies, equipment, and tools used on the job, all work supplies, equipment and tools shall be neatly stored in the vehicle away from the main work area on the bridge until needed. Keep tools and equipment neat and orderly. Only perform work when standing on secure surfaces.

Depending on the weather, area around the bridge may be wet and slippery due to rain. If the ground is wet, extra caution shall be taken while walking on slippery surfaces or walking on the SBA skirt. The SBA skirt's sides have a steep slope; appropriate care should be taken while walking on the SBA skirt.

4.4 Equipment

DWR field personnel will use hand tools for completion of this sampling event. They must comply with the following provisions:

- All tools and equipment must be in good repair and free of damage, cracks, chips, etc.

- All manufacturers' recommended safety equipment (i.e. safety goggles) must be properly used when using the equipment.

4.4.1 Equipment List:

- 2 x YSI EXO2 Sondes
- 2 x Standpipes and connecting brackets
- Hand tools for attaching standpipes

4.5 Other Concerns

Staff needs to be aware of rapidly changing conditions at all times.

Wildlife may be present in the area at any time of the year. Bees and wasps may sting. Avoid agitating them if they are in the area. Spiders can inject poisonous venom if they bite. Be careful where gear is placed and aware of where hands and feet are at all times. Snakes may be present in warmer weather. Avoid poisonous snakes if encountered.

The sampling locations are located within the coastal mountain range. Potential sampling locations are on the South Bay Aqueduct, which may have flow.
There may be creeks that will need to be crossed. The creeks are known to, during certain flows, to engulf vehicles and trailer. Therefore extreme caution should be taken when crossing any water bodies.

4.6 Protective Measures

- Only appropriately trained field personnel will be allowed to operate sondes
- Sondes will be decontaminated between sample locations.
- The PM will designate the driver of the vehicle; vehicle will not exceed 15 mph at sampling site.
- The PM will also be in charge of documenting data collection information.
- Life vest will be available to each staff member.
- The vehicle will be equipped with a safety line and medical kit.

4.7 Protective Clothing

- Each employee shall wear anti-slip footwear.
- Each employee shall wear a Personal Flotation Device (PFD) when needed.

- DBI SALA fall protection harnesses are to be worn and tethered to an appropriate anchor when accessing SBA concrete skirt

5.0 SAFETY PROCEDURES

The following procedures will be followed on the job site.

5.1 Engineering Controls

Engineering controls include all measures designed to minimize the possibility of allowing inhalation, ingestion, or contact hazard to occur. Engineering controls are to be the first step in reducing worker exposure at each sampling or job site location. The principal engineering controls for this study will be the bridge railing itself that prevents falls from the bridge.

5.1.1. Work Area Control

The Area Control Center (ACC) will be notified while travelling to the study site, prior to the daily safety meeting, and upon leaving the site. Delta Field Division ACC phone number is:

(209) 833-2180

5.2 Personal Protective Equipment

Personal protective equipment (PPE) as described in the previous sections must be worn or used by all field personnel as required, for the safe performance of this sampling event. PPE is used as a last resort, if feasible engineering controls cannot remove the hazard from the work area.

5.2.1. Standard PPE

The following PPE will be worn or used at all times at each sampling location as required:

- Long pants
- Anti-Slip footwear
- PFD (Class III)
- Harness, anchor, and lifeline

6.0 TRAINING REQUIREMENTS

All field personnel shall be trained and experienced in environmental sampling prior to assignment.

Field personnel will receive instruction on proper ergonomic methods for each task to be performed that day during the pre-work tailgate safety meeting.

Field personnel will have participated in the Department's Defensive Driver Training course.

Field personnel will receive instruction by the PM in the deployment of YSI EXO2 sondes prior to sonde placement.

Field Personnel will receive CPR/First Aid training.

Field personnel assigned to approach the concrete skirt of the SBA and therefore required to wear a fall restraint harness and associated fall restraint rigging will be trained in the proper use of this equipment by attending a fall prevention/protection course.

All field personnel must attend an initial safety meeting to review hazards prior to entering the Site.

Each DWR employee must sign and date the Personal Acknowledgment Sheet stating that he or she has read and understood this HSP.

The SSC must conduct a tailgate safety meeting with all field personnel on a daily basis to review the contents of this HSP. For documentation purposes, the SCC will complete a Tailgate Safety Meeting Form after each meeting.

At a minimum, all field personnel shall have received the following training:

- Field personnel will have participated in the Department's Defensive Driver Training course.
- Field personnel will receive instruction in the deployment of YSI EXO2 sondes prior to sonde placement.
- Field Personnel will be instructed in the proper usage of a PFD and where PFD use is required.

7.0 CONTINGENCY PLANS

The SSC will be responsible for maintaining a clean job site, (free from hazards) and for providing safe egress from the job site. The SCC will be the lead during any onsite emergency or accident.

7.1 Equipment

The following safety equipment will be maintained on the job site during work activities:

- Adequate supplies of drinking water. California Department of Industrial Relations requires one quart per employee per hour for drinking for the entire shift (Title 8 CCR, Section 3395).
- Appropriate PPE for each worker
- Personal Flotation Device (PFD)
- Work Gloves
- First Aid Kit
- Cellular telephone or other mobile communication device such as a SPOT unit
- PFDs type 2 or 3
- Safety throw line
- Fall restraint system (Fall protection harness, safety lanyard, anchor and base)

7.1.1 Equipment Retrieval

Working with equipment near water has unique conditions that need to be addressed. Slippery canal liners and wet equipment may result in equipment being dropped or dislodged and entering the canal. In this case the following contingency plan for retrieving equipment from the canal has been established:

- Prior to setting up the DBI SALA hitch mounted davit and anchor system the Ford F350 will be positioned on the levee road next to where the equipment is believed to have fallen.
- Personnel will tag-out and lock-out the vehicle with the following protocol:
    - The vehicle will be put in park with the parking brake on.
    - The keys will be removed from the vehicle and placed in the red lock box.
    - The red lock box will be locked with a red lock-out padlock and placed on the seat of the vehicle
    - A red and white lock-out/tag-out cover will be placed on the steering wheel and a red lock-out hasp will be placed through the grommets of the steering wheel cover and through the steering wheel.
    - Another red padlock will be used to lock the red hasp onto the steering wheel
    - The keys to the padlocks on the hasp and the lock-out/tag-out box are on a carabineer that will be attached to the fall protection harness of the person retrieving lost equipment
- Personnel will set up the DBI SALA hitch mounted davit and anchor system according to manufacturer's instructions (attached forms 5903195 Rev. A and 5902434 Rev. E) near the area where the fallen equipment is believed to be.A staff member will rig the

DBI SALA vertical lifeline and safety rope-grab lanyard per manufacturer's instruction (attached forms 5902127 Rev. K and 5902281 Rev. E) to the DBI Davit anchor point.

- Personnel retrieving equipment will wear a DBI SALA Exofit fall protection harness per manufacturer's instructions (attached form 5902159 Rev. H).
- Prior to use of the retrieval equipment a visual inspection will occur to ensure the anchor, lanyard, and harness are all in working order.
- The end of the vertical line will have a knot tied near it and another knot will be tied in the line at about three feet shorter than the distance from the anchor to the water.
- Personnel retrieving equipment will attach their harness to the safety lanyard.
- A large grappling hook and rope will be taken to the water edge and thrown across the canal.
- The staff member retrieving the fallen equipment will then pull the hook across the bottom of the canal to engage the equipment
- The previous two steps will be repeated until the equipment is engaged and able to be pulled from the water.

7.2 Communications

Prior to work startup, emergency medical procedures and lines of communication will be established. Communications will be with a cellular telephone or other mobile communication equipment (SPOT messaging unit) located at the jobsite, if a fixed telephone is not available. Cell phone coverage is good throughout the study area. Section 9 of this document contains a list of MWQP personnel.

The DFD ACC will be contacted when the crew is in transit to the location. Upon arrival at the job site the DFD ACC will be contacted again. Before leaving the job site the DFD ACC will be informed that the work crew is leaving the job site.

The fire department, ambulance service, project personnel, and directions to the nearest hospitals with an emergency room are identified below in Table 7-1 Emergency Notification. Table 7-2 provides the Emergency Medical Facility information. Table 7-3 is the written direction to the hospital. Figure 7-1 shows the route to Emergency Medical Facilities. Section 7.5 covers the directions and map to the nearest water drinking water replenishment area.

Any incident should be reported to the DWR HSC as soon as possible.

7.3 Emergency Procedures

The following procedures will be discussed with DWR field personnel prior to the start of the work:

7.3.1. Medical Emergency

At a minimum, one field personnel shall be capable of rendering standard first-aid, rescue breathing, and cardiopulmonary resuscitation (CPR). A first-aid kit and an adequate supply of

fresh water will be available at the job site. The local fire department will provide Advanced Life Support (ALS) services and emergency transport. .3.2 Water Rescue

Field personnel must wear appropriate protective gear (PFD, fall restraint, etc.) when accessing areas of the SBA lacking fall prevention (guard railing). Any field personnel accessing the area between the SBA concrete skirt and the levee road must wear a PFD. In order to access the SBA concrete skirt a fall restraint rigging is required to be used.

7.4 Incident Follow-up

Following an incident, the SSC or his designate will notify the PM and HSC as soon as it is safe to do so. The HSC will determine whether the incident meets the definition of a recordable incident for purposes of OSHA reporting on the OSHA Log, and will make any necessary notifications to Cal/OSHA within 8 hours. Records of all onsite accidents and first aid treatments will be maintained by the PM or SSC. Additionally, records of recordable work place injuries and illnesses are routinely maintained at DWR's office for at least 5 years, as required by OSHA.

Table 7-1. Emergency Notification

Fire Department/Paramedic/Ambulance Service **When dialing 911, it is best to use a fixed telephone if available, as it is easier for the 911 system to track the call.*	911*
Underground Service Alert	(800) 422-4133
Division of Environmental Services	(916) 376-9700
Municipal Water Quality Program Branch ***Cindy Garcia***	(916) 376-9715 office (916) 712-0739 cell
Project Manager – Jason Moore	(916) 376-9713 office 530-792-1707 cell
DWR Safety Coordinator – ***Michael Donlon***	(916) 574-1299 office (916) 916-502-7738 cell
DFD Area Control Center (ACC)	(209) 833-2180

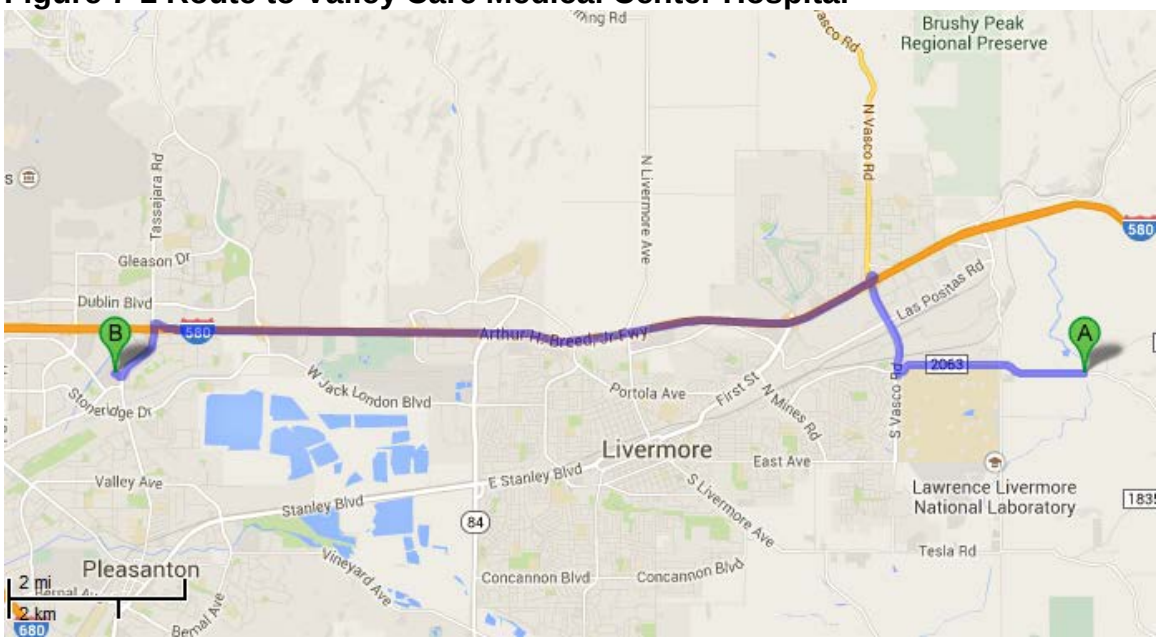
Table 7-2. Emergency Medical Facility Information

Valley Care Medical Center 5555 West Las Positas Boulevard Pleasanton, California 94588 (925) 847-3000	SEE BELOW FOR DIRECTIONS ⇩

Table 7-3 Directions to Valley Care Medical Center

Time	Mile	Instruction	For	Toward
9:00 AM	**0.0**	**Depart near Greenville Rd in Livermore, CA on SBA access roads**	**2.2 mi**	
9:04 AM	2.2	Head **west** on **Patterson Pass Rd** toward **Greenville Rd**	1.1 mi	
9:06 AM	3.3	Turn right onto **S Vasco Rd**	0.4 mi	
9:07 AM	3.3	Slight right onto the ramp to **Oakland**	0.4 mi	
9:15 AM	3.7	Merge onto **I-580 W**	7.8 mi	
9:16 AM	9.7	Take the **Tassajara Rd** exit toward **Santa Rita Rd**	0.3 mi	
9:16 AM	10.0	Turn left onto **Santa Rita Rd/ Tassajara Rd** Continue to follow Santa Rita Rd	0.8 mi	
9:16 AM	10.0	Turn right	200 ft	
9:16 AM	10.1	Turn right	335 ft	
9:17 AM	**10.2**	**Arrive Valley Care Medical Center**		Summary: 12.6 miles (17 minutes)

Figure 7-1 Route to Valley Care Medical Center Hospital

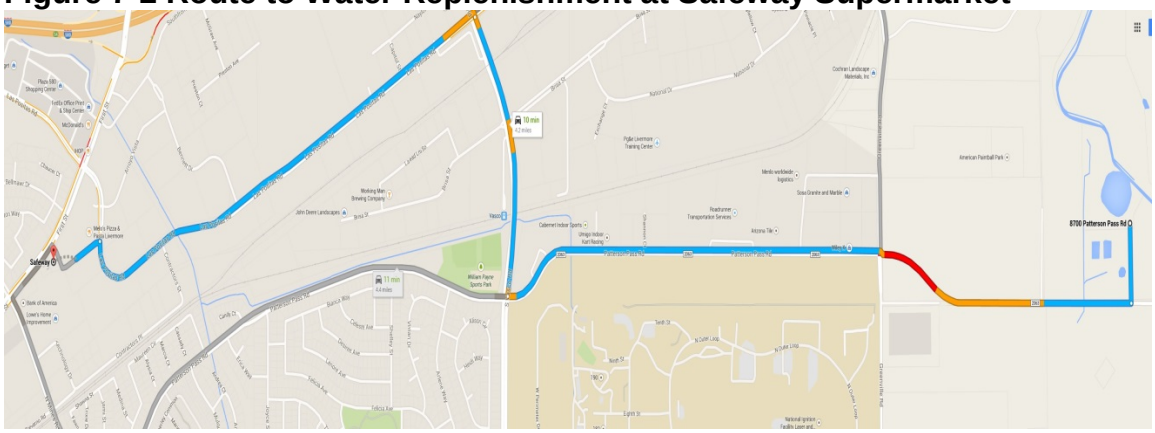


7.5 Water Replenishment Directions and Map

Table 7-4 Directions to nearest water replenishment

Time	Mile	Instruction	For	Toward
9:00 AM	**0.0**	**Depart near Greenville Rd in Livermore, CA on SBA access roads**	**2.2 mi**	
9:04 AM	2.2	Head **west** on **Patterson Pass Rd** toward **Greenville Rd**	2.0 mi	
9:06 AM	4.2	Turn right onto **S Vasco Rd**	0.6 mi	
9:07 AM	4.8	Turn left onto Las Positas Rd	1.4 mi	
9:09 AM	6.2	Turn left onto First St	436 ft	
9:10 AM	**6.3**	**Safeway Supermarket 4495 First St Livermore, CA 94551**		Summary: 6.3 miles (10 minutes)

Figure 7-2 Route to Water Replenishment at Safeway Supermarket



7.6 Livestock or farm equipment crossing the bridge.

In the event that livestock or farm equipment cross the bridge at the time of sampling all sampling equipment will be removed from the bridge and staff will wait in the vehicle away from the bridge until the livestock or farm implements have passed over the bridge.

8.0 GENERAL SAFETY REQUIREMENTS

The following section summarizes the safety requirements that will be enforced for this sampling event.

8.1 General Requirements

- The PWSP must be reviewed and followed by all personnel on the job site
- JHA will be reviewed during the tailgate safety meeting and be available for review by all personnel at any time.
- No worker shall be allowed to work alone.
- Communication - work crews will have a cell phone or spot unit for all field work.
- No drinking of alcoholic beverages will be permitted, and intoxicated persons will not be allowed entrance to the job site.
- Use or possession of illegal drugs or stimulants will not be permitted on the job site.
- Work area must be kept clean, and debris must be disposed of daily.
- No salvaging or waste retrieval is permitted.
- No weapons of any kind are permitted on the job site.

8.2 Personal Equipment

- Personnel are responsible for maintaining his or her personal protective equipment, including boots and gloves.
- Damaged equipment should be replaced immediately.

9.0 List of Personnel and Contact Information

MUNICIPAL WATER QUALITY PROGRAM
P.O. Box 942836, Sacramento, CA 94236-0001

Name	Work Phone	W. Cell Phone	Per P. Cell Phone	E-Mail Address
Bettencourt, Mark	376-9717			mark.bettencourt@water.ca.gov
Brown, Travis	375-6809			travis.brown@water.ca.gov
Conner, Arin	371-3121		530-604-5669	arin.conner@water.ca.gov
Del Cid, Jeremy	371-3118			jeremy.delcid@water.ca.gov
Garcia, Cindy	376-9715	916-712-0739	916-494-9049	cindy.a.garcia@water.ca.gov
Harrelson, Rose	375-4660			rose.harrelson@water.ca.gov
Koski, Kim	376-9722		9f16-223-5911	kim.koski@water.ca.gov
Lindsey, Otome	376-9716		916-599-5717	otome.lindsey@water.ca.gov
Miller, Sonia	376-9712		916-213-4774	sonia.miller@water.ca.gov
Moore, Jason	376-9713		530-792-1707	jason.moore@water.ca.gov
Ngatia, Murage	376-9714			murage.ngatia@water.ca.gov
Pisor, Rachel	376-9711		916-258-2525	rachel.pisor@water.ca.gov
Rohrer, Shaun	376-9710			shaun.rohrer@water.ca.gov
San Julian, Steve	371-2284		209-482-1320	steve.sanjulian@water.ca.gov
Scavone-Tansey, Marcia	376-9810		916-996-8815	marcia.scavone-tansey@water.ca.gov
Swift, Ted	376-9718		530-304-8092	ted.swift@water.ca.gov

MWQI Field Phone #1	916-591-3463
MWQI Field Phone #2	916-708-9021
MWQI Field Phone #3	916-402-5985

	Work Phone	**FAX**
MWQI Wsac	376-9711	376-9688
DES Main Line	376-9800	
WQA Field Trailer	322-5786	371-3132
Bryte Lab	375-6008	375-6019
Banks Monitoring Station	209-835-7692	
Hood Monitoring Station	916-775-4711	
Vernalis Monitoring Station	209-836-8732	
Jones Monitoring Station	209-839-0417	
Dept. of General Services Car Reservations	916-657-2327	
Delta Field Division Area Control Center	209-833-2180	

EMERGENCY Ph. Numbers

Emergency	9-911	
CHP Non-Emergency	530-662-4685	
DES- Dean Messer, Chief	376-9700	798-1346 Cell
Employee Emergency #	866-389-5687	

PERSONAL ACKNOWLEDGMENT SHEET

PERSONAL ACKNOWLEDGMENT

TO: All Field Personnel

A component of the Site Health and Safety Plan (HSP) requires that you receive training as described in the HSP prior to commencing work at the subject job site. Additionally, you are required to read and understand the HSP. When you have fulfilled these requirements, please provide your name and signature below:

Name (Printed)	Signature	Date

PERSONAL ACKNOWLEDGMENT

TO: All Field Personnel

A component of the Site Health and Safety Plan (HSP) requires that you receive training as described in the HSP prior to commencing work at the subject job site. Additionally, you are required to read and understand the HSP. When you have fulfilled these requirements, please provide your name and signature below:

Name (Printed)	Signature	Date

TAILGATE SAFETY MEETING FORM

TAILGATE SAFETY MEETING FORM

Date: _____Time: _____ AM / PM

Project Name: _____

Location: _____

Work Description:

_____

_____
_____

Site Safety Coordinator: _____
(Signature)

SAFETY TOPICS PRESENTED

- ☐ Chemical Hazards _____
- ☐ Physical Hazards _____
- ☐ Protective Measures _____
- ☐ PPE/Clothing _____
- ☐ Emergency Response _____
- ☐ Medical Facility Routes _____
- ☐ Other _____

Wide Swings in Canal pH Pre-work Safety Plan

Pre-Work Safety Plan **Activity: South Bay Aqueduct Installation of Test Equipment & Sampling** **1. Mobilization** **2. Job Site Set Up** **3. Install Stand Pipes & Test Equipment** **4. Perform Sample Collection** **5. Demobilization**		**Location: South Bay Aqueduct. Date: February 19, 2015** **Prepared By: Jason Moore**	
Sequence of Basic Job Steps	**Potential Accidents or Hazards**	**Mitigations**	**Actionable Measure**
1) Mobilization	1. a.) Heavy Traffic	1. a.) Obey all traffic laws. Drive defensively. Ensure Vehicle is in good repair. Leave with plenty of time.	**1 - All training records will be required to be accessible at the jobsite.**
	1. b.) Stuck By/Crushing	1. b) Do not place any body part between a stationary object and vehicle. Use good communication during vehicle placement during job site set up. Employ both audial and visual communication methods when spotting for vehicles. When possible utilize a spotter for backing vehicle.	**2- Emergency Response Plans will be needed for review by Delta Field division Safety prior to the start of the project. A designated person identified to initiate EMS in the event of an accident.**
	1 .c.) Low Visibility	1. c) Use signaling devices to communicate intention. Reduce speed when off road, pre walk intended path of travel if allowable. Avoid muddy or slippery areas.	**3 - For this project the minimum required PPE will be determined by Project Management and Safety Advisor created Hazard Assessment that has been conducted prior to the start of work.**
2) Job Site Set Up	2. a.) Heat/Water	2. a.) Be aware of the effects of heat on the human body. Drink plenty of water in high heat conditions.	

			4 – Conduct a Tailgate safety meeting coordinating work steps.
	2. b.) Slips/Trips/Falls	2. b.) Keep eyes on path and ensure good footing. Identify, remove, or barricade trip hazards.	**5 – Ensure the JHA is completed daily and available on site for all employees to view.**
	2. c.) Limited Communication	2. c.) Voice communication will be the first option since work site is in a small area. A cellular phone will be utilized to contact ACC at 209-833-2180. A SPOT unit will be available for emergencies.	**6 – Constant monitoring of equipment to ensure constant Safe operations.**
	2. d.) Uncontrolled Traffic Entering Work Site	2. d) Set up signage, warning of work being performed at 100 yards to all approaches to work site.	**7 – Any Employee has the right and authority to stop work being done if they believe the safety of anyone on the job site is at risk.**
3) Install Stand Pipes & Test Equipment	3. a.) Damaged Hand/Power Tools	3. a.) Ensure all hand/power tools are in good condition. Utilize all hand/power tools as with their intended use. Do not modify tools. Remove broken or damaged tools from service.	
	3. b.) Pinch/Crush Hazard	3. b.) Watch hand placement and keep body out of line of fire during tool use to prevent pinch/crush injuries.	
	3. c.) Back injuries	3.c.) Follow proper Ergonomic procedures while bending, picking, and installing stand pipes & test equipment.	

4) Perform Sample Collection	4 .a.) Fall Potential 4. b.) Fall Potential 4. c.) Dragged by Vehicle 4. d.) Water/Drowning Hazard	4. a) Do not climb on top of bridge guardrails. Do not extend or reach more than 20% of body past bridge guardrails. 4. b.) Fall Restraint, consisting of a full body harness, positioning rope, & rope grab will be utilized during sample collection to prevent falls. All lines for single person use will be connected to an anchor point capable of supporting 5000 lbs. All Fall Protection equipment will be inspected as mandated by regulatory agencies and prior to each use. 4. c.) When any employee is attached to vehicle mounted anchor point lock-out/tag-out procedures as outlined in the Health and Safety Plan will be followed 4. d.) All employees who come within 6 feet of any unprotected edge next to water shall wear a Coast Guard approved personal floatation device. In addition, a rope throw bag will be staged in close proximity and be ready for use in the event of a fall into the water.	
5) Demobilization	5. a) Heavy Traffic	5. a.) Obey all traffic laws. Drive defensively. Ensure Vehicle is in good repair. Leave with plenty of time. 5. b.) Do not place any body part between a stationary object and vehicle. Use good communication during vehicle placement during job site set up. Employ both audial	

	5. b.) Stuck By/Crushing 5 .c.) Low Visibility	and visual communication methods when spotting for vehicles. When possible utilize a spotter for backing vehicle. 5. c) Reduce speed. When off road, pre walk intended path of travel if allowable. Avoid muddy or slippery areas.	

Zero Discharge Analysis

Potential Spill Sources	Recommendations to Prevent Discharges and Backup Containment Procedure

Wide Swings in Canal pH Job Hazard Analysis

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

Job Hazards Analysis

Work Start Date:
Finish Date:

Section A – General Information

Notification #: Type: SAP Notification Must Be Attached (if applicable)

Location: South Bay Aqueduct Livermore CA Equipment:

First Line Supervisor/Lead: Rachel Pisor Phone Number: 916-376-9711

Person Leading Work: Jason Moore Phone Number: 916-376-9713

Work to be completed with a: ☐ Ok to work: Eligible Worker ☒ Clearance Holders

Scope of Work:

Section B – General Hazard Assessment

Potential or Known Hazards: (Check those that apply)

- ☒ Flooding
- ☐ Skin Irritants
- ☐ Fall Potential
- ☐ Toxic Material
- ☐ Adjacent Work
- ☒ Lifting Hazards
- ☒ Difficult Access
- ☐ Shoring/Sloping
- ☒ Traffic/Vibration
- ☒ Third Party/Public
- ☐ Other:
- ☐ Confined Spaces
- ☐ High Noise Levels
- ☐ Ionizing Radiation
- ☐ Excavation Hazard
- ☐ Elevated Load or Work
- ☐ Inadequate Ventilation
- ☒ Water/Drowning Hazard
- ☒ Environmental Extremes (Heat, cold, wind, etc.)
- ☐ Employees/ New or Temp
- ☒ Multi-Employer Workplace
- ☐ Fire or Explosion Potential
- ☐ Compressed Gasses/Liquids
- ☐ *Welding/Burning Operations
- ☒ Pinch, Crush, or Striking Hazards
- ☒ Sharp Edges or Hot/Cold Surfaces
- ☐ Chemical Exposure/Material Safety Data Sheet
- ☐ Electrical Shock /Energized Equipment
- ☐ Potential Release of Energy Kinetic/Gravity
- ☐ Lead/Asbestos Exposure, if no check below
  - ☐ Tested
  - ☐ Master List
  - ☐ Material Doesn't Apply
- ☒ Bio Hazards (Wildlife, etc.)

*A Supplemental Hot Work Permit May Be Required for Welding and Burning Operations

Applicable Safe Work Practices (OP2 and other Codes and Regulations): (Check those that apply)

- ☒ First Aid
- ☐ Energy Isolation / Lock-out Tag Out
- ☐ Use of Barricades
- ☐ Approved Lighting
- ☒ Site/Job Orientation
- ☒ Use of Specialized PPE
- ☐ OP2 Procedure
- ☐ Confined Space Entry Permit
- ☒ Rescue/Retrieval Plans
- ☐ Use of Specialized Equipment
- ☒ Specialized Training Required
- ☐ Other: Dig Alert – Call 811 for Clearance
- ☒ Standard Operating Procedures
- ☒ Review of Emergency Action Plans
- ☒ Special Pre-Job Safety Discussions
- ☐ Hot Work Permit: Electrical/Welding
- ☒ Communications: Visual/Audio
- ☐ Other:

Special Precautions (OP2 and other Codes and Regulations): (Check those that apply)

- ☐ Simultaneous Operations
- ☐ Pollution Prevention Measures
- ☐ Redundant Protection Measures
- ☒ Special Pre-Job Safety Discussions
- ☐ Near Miss/Incidents
- ☐ Hazardous Waste Disposal
- ☐ High Heat Conditions >95°
- ☐ Other:

Electrical Power Line Issue

- ☐ Overhead or Underground Power Lines Present
- ☐ Overhead Power Lines within 100 feet of Work Site –If yes, develop Plan to Address Hazard

Personal Protective Equipment (PPE): (Check those that apply)

- ☐ Hard Hats
- ☐ Eye Protection
- ☐ Face Protection
- ☐ Ear Protection
- ☒ Safety Footwear
- ☐ Other:
- ☐ Personal Grounds
- ☐ Fire Resistance Clothing
- ☐ Chemical Protective Clothing-Specify
- ☒ Hand Protection- Specify
- ☒ Fall Protection /Fall Restraint Equipment-Specify
- ☐ Other:
- ☐ Respirators – Specify Below

Section C – Emergency Contingency Plan

Emergency Numbers 911 Area Control Center (209) 833-2180 Safety Officer Michael Donlon Cell 916-502-7738

Draw a map of work location with wind direction, evacuation routes and primary and secondary emergency muster points

If an accident occurs during this job, a copy of the JHA should be in the investigation report.

Job Hazards Analysis

Work Start Date: 02/20/2015
Finish Date: 02/20/2015

Section D - Hazardous Assessment

List and discuss the Basic Job Steps, the Potential Hazards of each step and associated Consequences, and the Recommendations to eliminate or Reduce Hazards, and revise as conditions change during the course of the day's activities: ***Attach additional pages if necessary.***

Sequence of Basic Job Steps	Potential Hazards & Consequences	Recommendations to Eliminate or Reduce Hazards
Mobilization	1. a.) Heavy Traffic 1. b.) Stuck By/Crushing 1 .c.) Low Visibility	See Pre-Work Safety Plan (PWSP)
Job Site Set Up	2. a.) Slips/Trips/Falls 2. b.) Limited Communication 2. c.) Uncontrolled Traffic Entering Work Site	See PWSP
Install Stand Pipes & Test Equipment	3. a.) Damaged Hand/Power Tools 3. b.) Pinch/Crush Hazard 3. c.) Back injuries	See PWSP
Demobilization	5. a) Heavy Traffic 5. b.) Stuck By/Crushing 5 .c.) Low Visibility	See PWSP

Notes:

Section E – Job Hazards Analysis Review Sign Off

Organization	Print Name	Initial	Organization	Print Name	Initial	Organization	Print Name	Initial

All near-misses/hazards found or created along with incidents must be reported. Send a copy of this form to the Safety Office.

Wide Swings in Canal pH Literature Review

Problematic pH Excursions in the South Bay Aqueduct: an initial assessment.
Prepared by Rich Losee, Losee Limnology Consulting
For the SWPCA MWQI Special Project Committee
July 15, 2014

Background:
Wide swings in pH periodically occur on the South Bay Aqueduct (SBA). These pH excursions are problematic for the SBA Contractors because the pH of the treatment plant influent water must be adjusted to within a specific range for the drinking water treatment process to meet regulations and to effectively disinfect the water. Tracking rapid pH changes and adjusting acid feed makes it difficult to meet water treatment regulations and increases treatment costs. Treatment costs increase because acid is added to lower pH going into the plant and then must be subsequently offset by addition of base to raise pH of the finished water leaving the plant to meet the requirements of the lead and copper rule.

Cause of pH Swings:
pH increases on the SBA are most likely a result of photosynthetic removal of carbon dioxide (CO_2) from the water along the length of the open canal, primarily by algae, shifting the dissolved inorganic carbon equilibrium toward predominance of bicarbonate, carbonate and hydroxyl ions.

Hydrogen ions (H^+) are produced when CO_2 dissolves in water and is hydrated to form carbonic acid (H_2CO_3), a slow reaction, which subsequently dissociates to produce H^+ and bicarbonate (HCO_3^-), which also dissociates to form another H^+ and carbonate (CO_3^{2-}):

$$CO_2(air) \leftrightarrow CO_2\ (dissolved) + H_2O$$
$$CO_2 + H_2O \leftrightarrow H_2CO_3$$
$$H_2CO_3 \leftrightarrow H^+ + HCO_3^-$$
$$HCO_3^- \leftrightarrow H^+ + CO_3^{2-}$$

In addition, HCO_3^- and CO_3^{2-} dissociate to form hydroxyl ions (OH^-):

$$CO_3^{2-}\ H_2O \leftrightarrow HCO_3^- + OH^-$$
$$HCO_3^- + H_2O \leftrightarrow H_2CO_3 + OH^-$$
$$H_2CO_3 \leftrightarrow H_2O + CO_2$$

These for equations describe how dissolved inorganic carbon buffers pH in aquatic systems with a set of equilibrium reactions producing $H^+$and the other set producing OH^-. The addition of CO_2 pushes equilibrium in the direction of H^+production, lowering pH and removal of CO_2 pushes equilibrium in the direction of OH^- production, increasing pH. Addition of cations, such as calcium (Ca^{++}) to the water adds buffering capacity (we measure this as alkalinity) and shifts the OH^-: H^+ balance toward the OH^- side and higher pH. The calcium associates with the bicarbonate and carbonate leaving excess OH^- to push up the pH.

SBA pH Analysis:
The Department of Water Resources, Delta Field Division, has maintained a pH sensor, since March 2003, at Del Valle Check 7. Since Check 7 is at the end of the open reaches of the SBA, pH at this location reflects the cumulative effects of the water passing through the canal. Hourly pH readings from this station were used to assess the pH excursions on the SBA. During this period there were about 80,560 hourly readings, but no results were recorded about 20% of the time. In addition, there are some extreme values in the dataset that are of

questionable veracity. The maximum pH values of 10 to 10.2 may be an overestimate of the actual values. However, the patterns of pH change when these values occurred, are realistic. When considering the low end of the pH values recorded, it would take a significant effort to determine what the legitimate low end pH value is for the SBA. However, since the complications for the treatment plants occur at high pH levels, it is not necessary or cost effective to make this effort.

The Del Valle Check 7 dataset has some problems with the quality and reliability of the pH values. While this data quality problem significantly increases the effort required to analyze the data and decreases confidence in the inferences made from the analyses, the large dataset somewhat offsets this data quality concern.

The mean and median pH for the SBA was 8.2 with a maximum of 10.2 (Fig. 1). From 2003 to 2014 the pH was 9.0 or greater 9% of the time and a pH 9 or more event occurred at least once every year. High pH events occurred in all months. In all years but 2005 and 2010, pH was 9 or greater in nearly every month. In 2005 and 2010, high pH readings were much rarer events than in other years (Fig. 2). There are over 100-days of missing data from 2005; no conclusions can be drawn from this year of data.

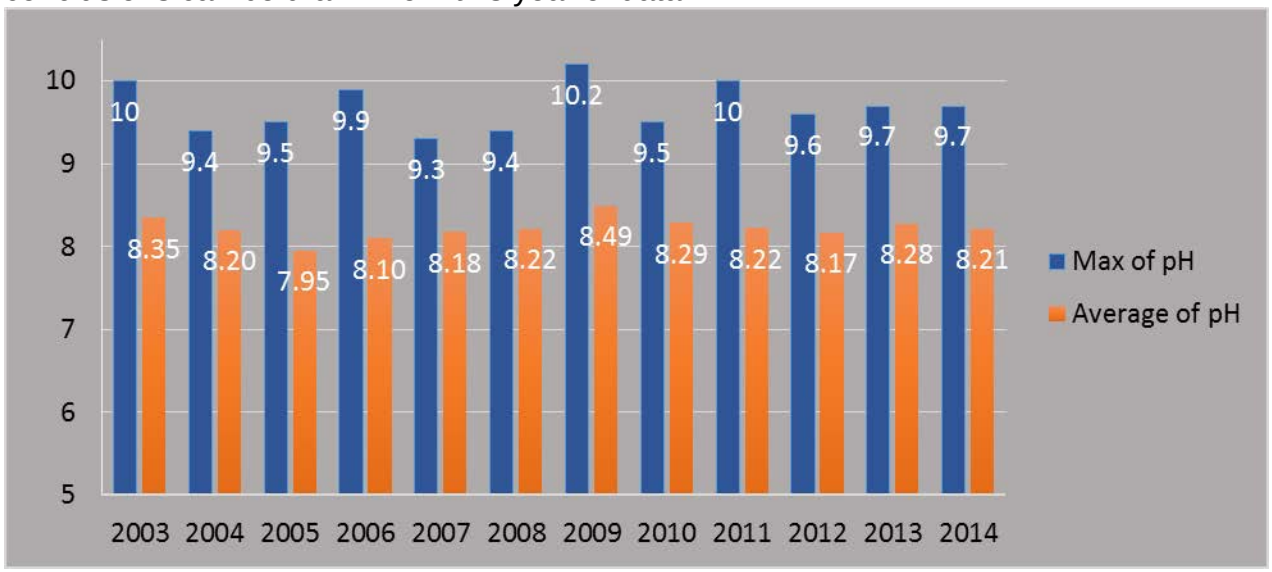


Figure 1. Del Valle Check 7 pH

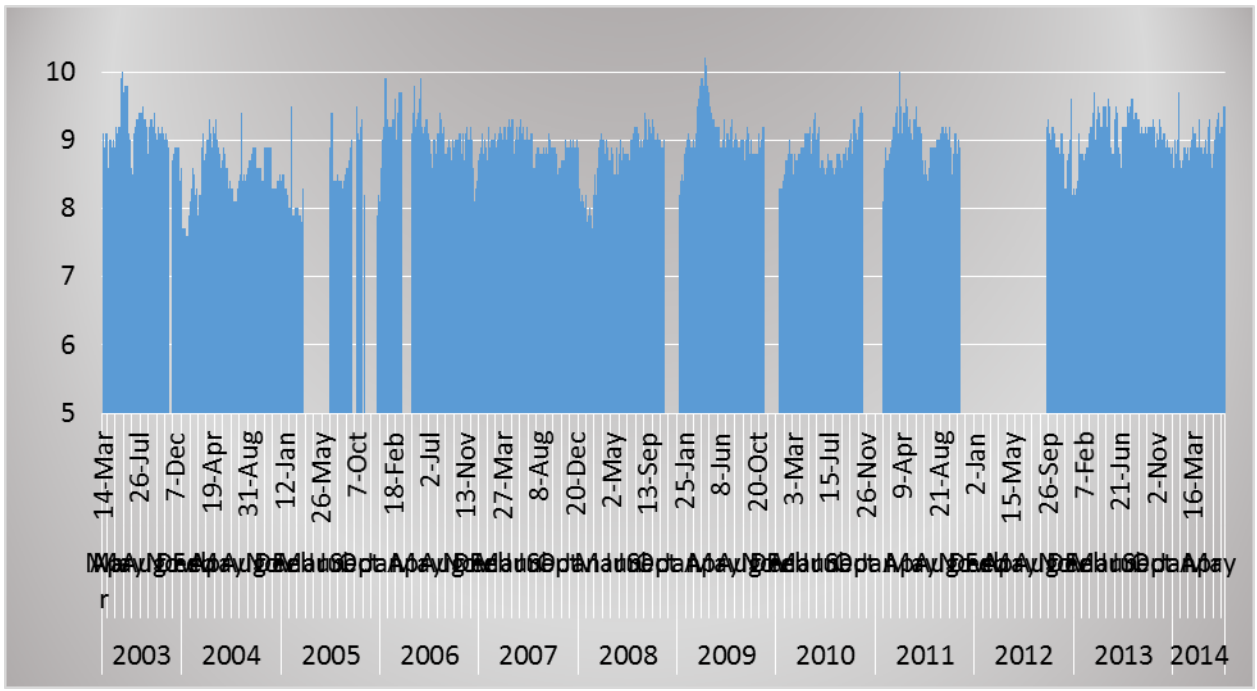


Figure 2. Del Valle Check 7 Daily Max pH

Conceptual Model and Supporting Observations:

Based on the biology and inorganic chemistry of aquatic ecosystems, the *a priori* model of pH dynamics in the SBA is based on sunlight driven photosynthesis of algae, both floating in the water column and attached to the sides and bottom of the canal, shifting the dissolved inorganic carbon equilibrium toward bicarbonate, carbonate and hydroxyl ions. Figure 3 shows 72 hours of recorded pH at Check 7. In this example pH decreases in the early morning hours reaching a minimum value at 6 a.m., then pH increases throughout the day on January 13 and 15 until peaking at 5 p.m. and 7 p.m., respectively. However, on January 14th pH only slightly increases after 6 a.m. The meteorological observations for these days indicate relatively clear condition on the 13th and 15th and cloudy, rainy conditions on the 14th. Cloud conditions on the 15th were slightly clearer than on the 13th and this observation correlates well with slightly higher pH on the 15th. This sequence of pH change, coupled with the cloud cover observations for these days, supports the *a priori* model of photosynthesis altering the dissolved inorganic carbon equilibrium that, in turn, determines pH.

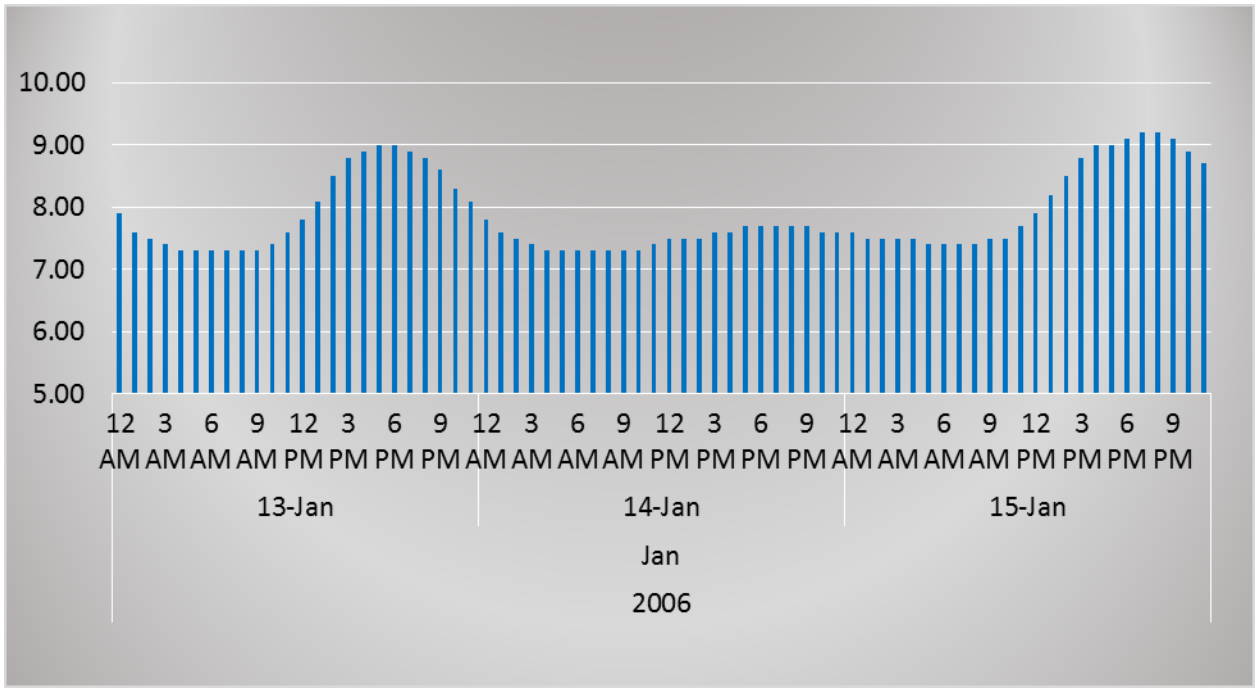


Figure 3. Del Valle Check 7 Hourly pH

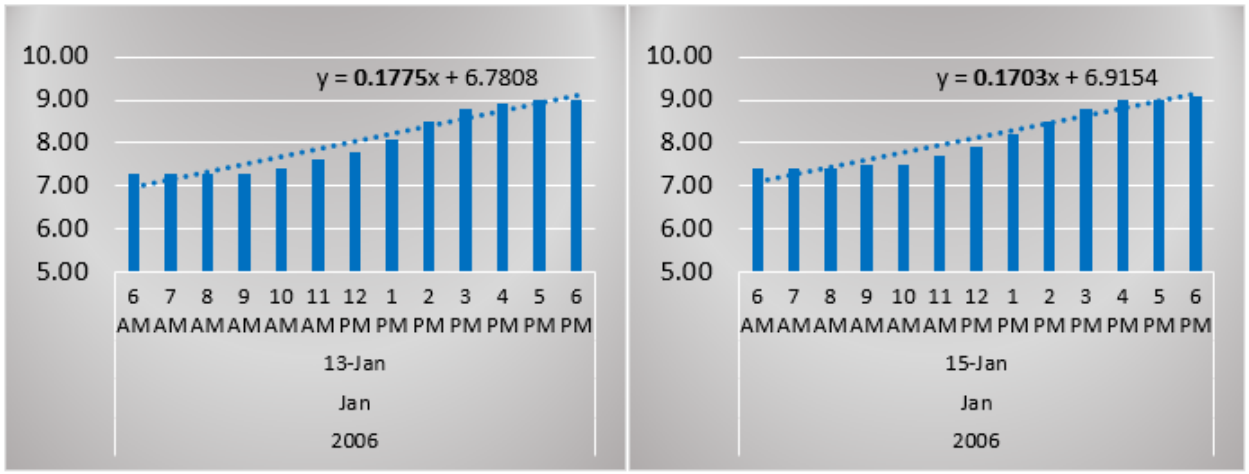


Figure 4. Del Valle Check 7 pH rate of increase.

The pH excursion events shown in Figure 3 took place in January and the pH increased at about 0.18 and 0.17 pH units/hour on the 13th and 15th, respectively (Fig. 4). Another example of a pH excursion event took place on consecutive days, April 14 and 15, 2009, where pH peaked at 10.2, the maximum value over the period of record (Fig. 5). On these days the rate of pH increase was 0.2 and 0.13 pH units per hour, respectively (Fig. 6). The different rates of pH increase in these pH excursion examples, indicate the factors contributing to pH increase vary over time. It is in elucidating these controlling factors that it may be possible to find effective means in managing pH swings on the SBA.

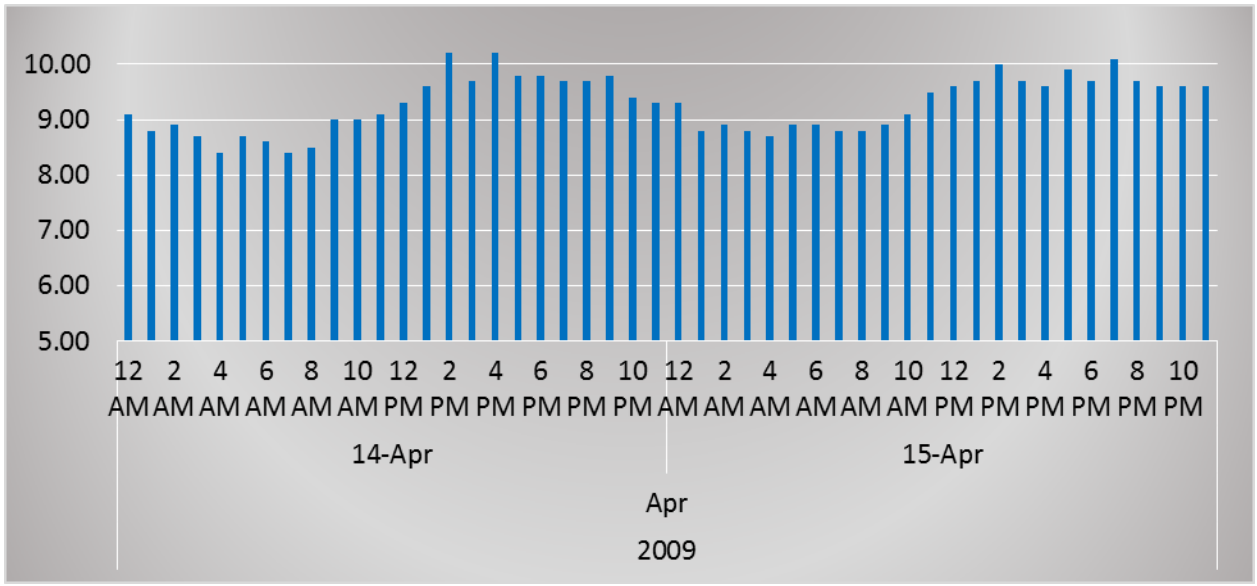


Figure 5. Del Valle Check 7 pH excursion event, April 2009.

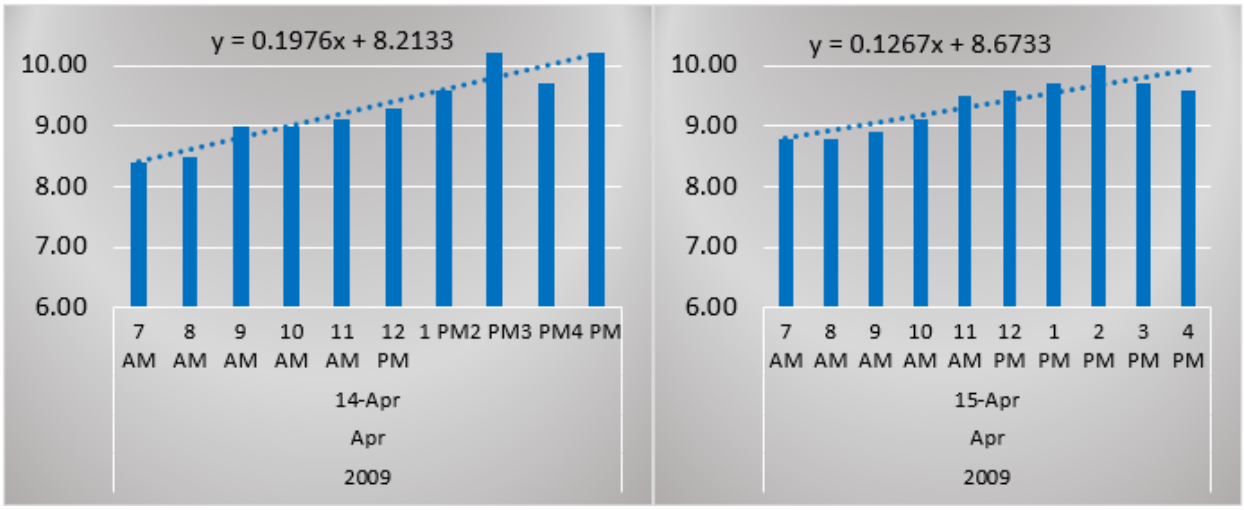


Figure 6. Del Valle Check 7 pH rate of increase.

While high pH events occurred in all month, the lowest average pH occurred in the three winter months, December, January and February (Fig. 7). In the winter months, day length and shallow sun angle result in lower light available for photosynthesis. These examples further support the model where pH levels are a function of light driven photosynthesis. Oddly, July also had a low average pH, indicating there may be other important factors impacting pH.

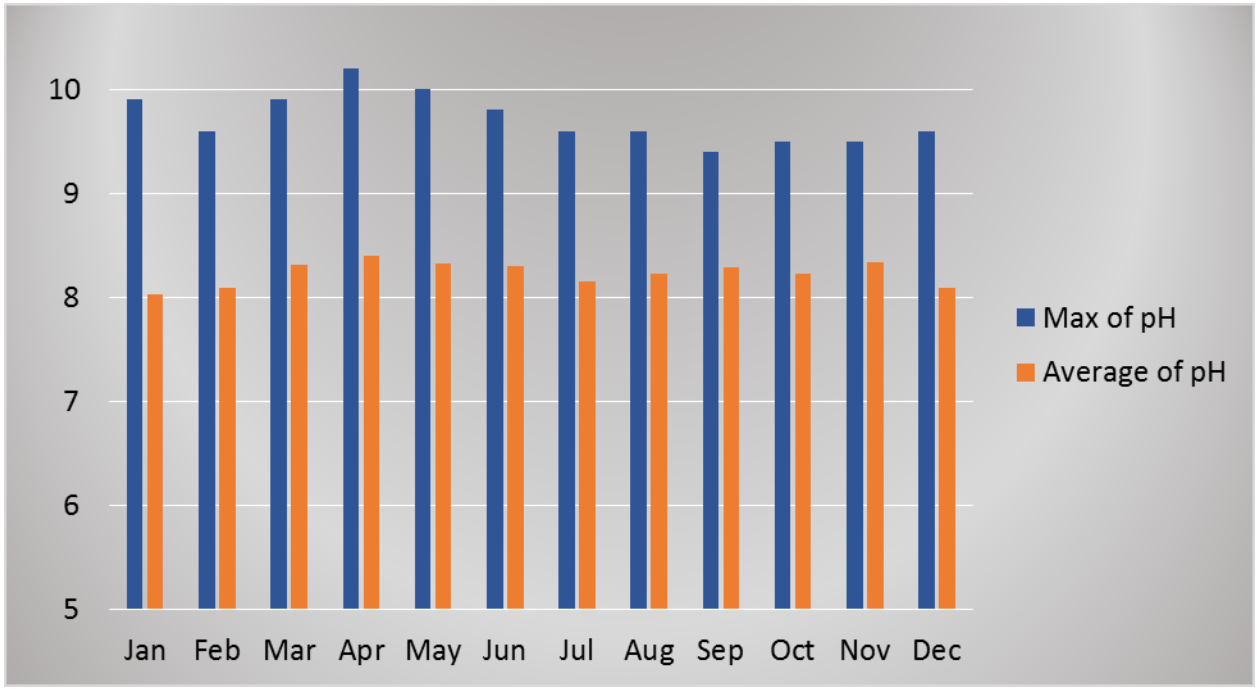


Figure 7. Del Valle Check 7 maximum and average pH by month for 2003-2014.

In the small datasets provided for the Del Valle and Paterson Pass water treatment plants, elevated pH occurred more frequently at the downstream Del Valle plant than the upstream Paterson plant. This fits with the idea that distance travelled in the open canal is important to determining the magnitude of pH increases due to photosynthesis.

Problematic pH excursions on the SBA occurred over 9% of the time between 2003 and 2014 and they occurred at all times of the year. This analysis did not provide an indication of the kinds of algal plant growth in the SBA that are necessary for problematic pH excursions to occur. However, the January 2006 example does suggest that when conditions in the SBA are such that a pH excursion may take place, cloudy weather can prevent an excursion from occurring.

The Vallecitos monitoring station is about 6 miles downstream from the Del Valle Check 7 station. Importantly, this reach of the SBA is enclosed in a pipe, therefore there is no sunlight and no photosynthesis. While there is no photosynthesis in this reach removing CO_2, there is respiration contributing CO_2 by organisms in the water column and surface film of the pipe. The conceptual model indicates that pH should decrease in the pipe. The pH difference between Del Valle and Vallecitos is a function of flow time and CO_2 induced pH decrease. Figure 8 shows a comparison of average hourly pH at the two stations for the entire dataset. The average hourly pH peak at Del Valle was at 5 p.m. and the peak at Vallecitos was at 8 p.m., suggesting there has been an average flow time at this time of day of 3 hours between these stations. Also note that average hourly minimum pH at Del Valle was at 8 a.m. and 10 a.m. at Vallecitos, indicating that flows, on average, tend to be a little faster through the night hours. When accounting for the flow-time offset, there is a decrease of about 0.2 pH units on the increasing side of the pH curve. By morning there was little difference in pH between stations suggesting the inorganic carbon dynamics were approaching equilibrium. This

observation is probably a result of no photosynthesis and only respiration (and CO_2 exchange with the atmosphere) occurring in the water traveling through the open canal at night.

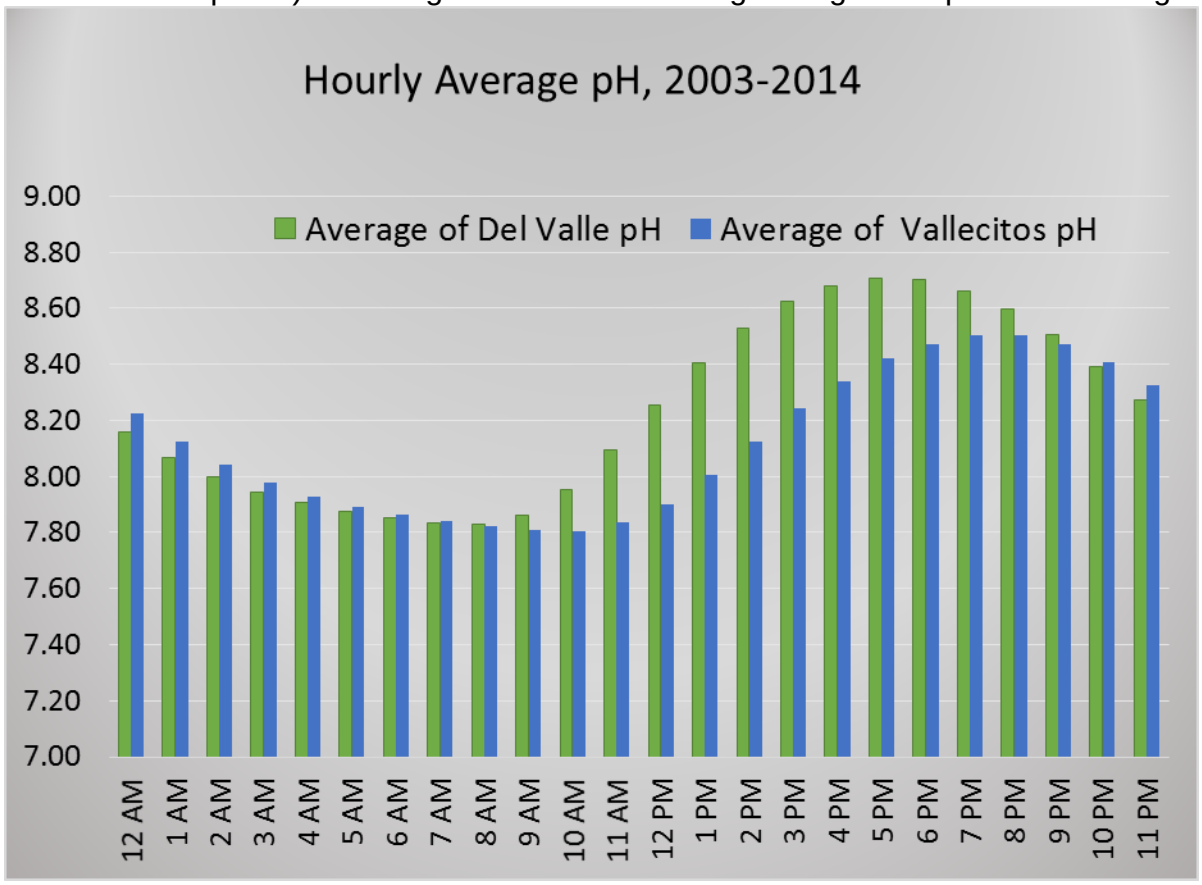


Figure 8 Hourly average pH at Del Valle Check 7 and Vallecitos Stations, 2003-2014

This cursory analysis of the pH excursions in the SBA suggest two potential points in the natural processes that cause the rapid increase in pH, which may be targeted for control. The first is in preventing the development of the precursory community necessary for an event to occur and the second is to limit the light available to drive an event. The current periodic algaecide treatments alter the attached algal community to either prevent development of an attached algal community that can increase pH to problematic levels, or to change an already developed problem causing community.

By carefully studying the SBA attached algal community associated with pH excursions, it will be possible to more completely understand this relationship, as well as the physical factors involved. Armed with this knowledge, it should be possible to know whether targeted management strategies could be cost effective in managing these pH excursion events. Lastly, if new algal management strategies appear viable, the methods used in the study can be used to test and fine-tune these new protocols.

Two points have become come clear in using this large dataset to assess pH excursions in the SBA. First, it is very important to protect the integrity of the data. That means the instruments must be well maintained and strict attention paid to quality control of the data. Second, since changes in pH take place over the course of an hour, it is necessary to know the flow with this level of temporal resolution, that is, hourly.

Wide Swings in Canal pH Pilot Study Plan

2014-2015 MWQI work plan – 7.1.8 Wide Swings in Canal pH

South Bay Aqueduct Large pH Shifts Pilot Study Plan

Background

The Sacramento San Joaquin Delta (Delta) is a nutrient rich aquatic system. In spite of the relatively high measurements of nitrogen, phosphorous, carbon and other nutrients in the Delta, less than expected primary productivity has been observed there. The Delta is also the hub for the State of California's water distribution network known as the California State Water Project (SWP). When water intended for municipal and agricultural purposes is taken from the Delta and enters the SWP distribution networks, the expected primary productivity is realized as seasonal growths of algae coat the walls of distribution channels. In turn, these algal growths are believed to be the cause of large diurnal shifts in pH. This is problematic at treatment plants downstream because water treatment costs increase as large pH shifts occur.

Hydrogen ion (H^+) concentration is expressed in pH units. Diurnal shifts in pH are largely due to algal photosynthesis and respiration of all aquatic organisms. During the day algal photosynthesis increases dissolved oxygen (DO) levels in canals. Also, carbon dioxide (CO_2) levels decrease during photosynthesis. At night animal, plant, and microorganisms continue to respire, decreasing the DO levels of the water. In addition to the decreasing DO at night CO_2 levels increase during respiration (Horne & Goldman, 1994). The increase in CO_2 due to respiration causes decreases in pH following this reaction;

$H_2O + CO_2 = H_2CO_3 = H^+ + HCO_3$ (Horne & Goldman, 1994)

This proposed Municipal Water Quality Investigations (MWQI) pilot study intends to test the methodologies for documenting the shifts in pH caused by algae in the South Bay Aqueduct (SBA) of the SWP. The information from this pilot study will be used to design a 1-year study of the pH swings in the SBA. Understanding the environmental conditions associated with pH shifts is essential in developing the best methods for controlling these shifts. During the pilot, study the equipment and methods for collecting data will be tested.

This pilot study and the future study stem from the 2014-2015 MWQI work plan. This work plan describes a series of MWQI Limnology project studies to document the limnology of the SWP. Various parameters will be investigated in other Limnology project studies presented in the 2014-2015 MWQI work plan and in future work plans. The final goals of the MWQI Limnology project include a synthesis report that will take into account all the factors affecting SWP limnology. Additional information on this study can be found in the Project Charter, which is currently in version 1.1.

Safety

Safety procedures for working around any of the Department of Water Resources water conveyance structures are discussed in a separate Health and Safety plan that includes an explanation of the specific safety protocols that will be followed throughout this pilot study. The Health and Safety plan and a Job Hazard Analysis will be reviewed and approved by the DWR Safety Office and the MWQI Limnology project subcommittee prior to commencing any work on the SBA. Safety meetings will be held prior to any visit to the SBA.

Study Design

This pilot study will take place within the open air portion of the SBA. The SBA is ideal due to its small size, relatively close location to headquarters, and known presence of large shifts in pH. There is a possibility of expanding the study to other reaches of the SWP in the future.

The pilot study will take place before the end of December 2014 and will consist of two sampling events two to four weeks apart. The locations of the sampling sites are at the bridges at miles 4.55 and 7.61 of the SBA on either side of the siphon that runs under I-580. The environmental data for this study will be collected via two YSI EXO2 sondes equipped with various sensors. Sampling will take place before the end of December 2014 and will consist of placing the two sondes in bridge mounted standpipes and retrieving them two to four weeks later. The locations of the sampling sites are at the bridges at miles 4.55 and 7.61 of the SBA on either side of the siphon that runs under I-580.

For this study there are four sensors that collect environmental data. The sensors acquired for this study include an electrical conductivity and temperature sensor that measures conductance in micro Siemens per centimeter and temperature in degrees centigrade, a pH sensor that measures pH, an optical dissolved oxygen sensor that measures dissolved oxygen in mg per liter, and a total algae sensor that measures chlorophyll *a* and phycocyanin in µg per liter. The sondes also have a central wiper that prevents bio-fouling of the sensors. The sampling methods for the monitoring study are intended to quantify pertinent environmental factors that affect pH shifts.

This study will analyze the variance in environmental parameters between the water prior to entering the siphon. Before the canal water enters the siphon it is subject to photosynthesis during daylight hours. When water enters the concrete lined siphon all photosynthesis ceases and only respiration occurs. Periphyton consists of all organisms living attached to surface and includes benthic algae. The siphon is free of the benthic algae portion of the periphyton but is likely coated with non-photosynthetic periphyton species. The respiration of planktonic microorganisms and periphyton within the siphon will likely increase the CO_2 concentration, decrease the DO concentration, and decrease the pH in the water.

Figure 9: Satellite image of study area

Participants

Team Member	**Phone/E-mail**	**Role**
Rich Losee	rflosee@dslextreme.com	Sponsor/Project Partner
Jason Moore	jason.moore@water.ca.gov	Project Manager
Sonia Miller	sonia.miller@water.ca.gov	Researcher
Rachel Pisor	rachel.pisor@water.ca.gov	Supervisor
Cindy Garcia	cindy.a.garcia@water.ca.gov	Program Manager
Arin Conner	arin.conner@water.ca.gov	Researcher

Methods

Standpipes

Standpipes will be installed by MWQP staff at the first two farm bridges in the open air portion of the SBA for the pilot study (see figure 1). For the one year monitoring study additional standpipes will be installed at the remaining farm bridges (see table 1). The four inch PVC standpipes will protect and keep the YSI EXO2 sondes with the sensors at a depth of approximately one meter below the water surface.

Table 1: Potential Study Bridges, Mile Posts and Descriptions.

Bridge #	SBA Mile post	Description
1	4.55	In between Dyer and 580 siphon
2	7.61	Downstream of 580 siphon
3	8.03	In Between Patterson and 580 siphon
4	8.75	In Between Patterson and 580 siphon
5	13.60	Near Cedar Mountain
6	15.18	Near Farm with corn maze
7	15.72	Near Murrieta's Well - Very close to Bridge 8
8	15.93	Nearest end of Line

Installation

The standpipe installation on the bridges occurs in several steps. First the standpipe height is measured and cut to a length the same as the distance between the top of the bridge handrail and the bottom of the canal. The guy wire support rigging is attached to the standpipe near the surface of the water prior to bridge installation, as seen in figure 2. A float is attached on the end of a rope and the other end is tied off to the bridge's upstream handrail and tossed into the water. The float is retrieved with a grappling hook attached to the end of another rope on the downstream side of the bridge and the float is placed on the deck of the bridge.

Three stainless steel cables of the appropriate lengths are attached to the standpipe rigging. The standpipe is leaned up against the bridge handrail in the middle of the bridge with the bottom of the pipe overhanging the bridge and the rigging placed near the handrail. The longest cable is attached to the float and thrown over the downstream handrail. From the upstream side of the bridge, pull the float and cable under the bridge. Attach the longest cable to the upstream handrail in the middle of the bridge near the bridge deck. The other two cables are attached on the downstream handrail, equidistant from the bridge center, near the bridge deck, as seen in figure 3.

The standpipe is lowered over the handrail to the desired depth, about 2 feet from the bottom of the canal. The top of the standpipe is attached to the centermost handrail of the bridge with U-clamps or hose clamps, as in figure 4. A security cap is installed to protect the instrument from tampering, as in figure 5.

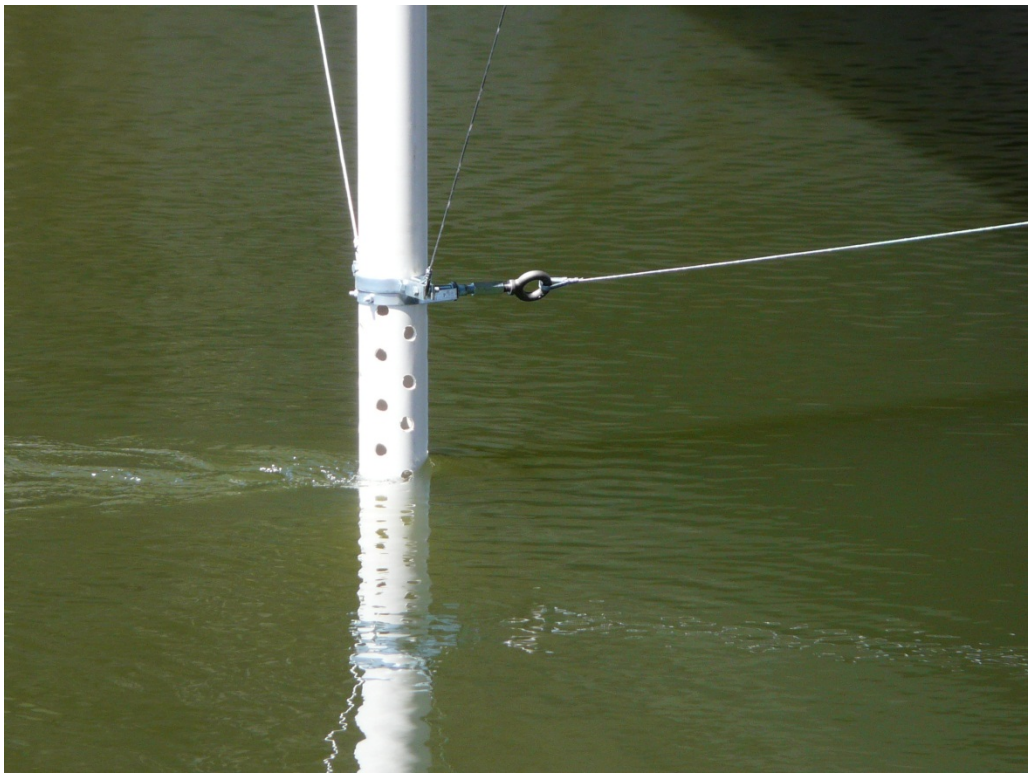


Figure 2 Three guy wire attachment to standpipe.

Figure 3 Standpipe installed on a Farm Bridge in San Luis Field Division.

Figure 10 Standpipe attachment to bridge railing.

Figure 11 Security cap installed on standpipe.

Data Collection

The YSI sondes will be calibrated per manufacturer's instructions and verified with available check standards before deployment. Prior to deployment a vertical profile of the water column will be taken by setting the sonde to log high frequency data at 15 second intervals. The sonde will then be lowered slowly over a 5 minute period from the water surface to the bottom of the canal through the standpipe. The vertical profile data will be collected at each site. The sondes will be set to log at 15 minute intervals and deployed for the extended period.

The sondes will be retrieved two to four weeks later depending on operation and time constraints. At which time they will be recalibrated to document any sensor drift. The sonde data will be transferred to a laptop computer in the field for further analysis in the office. At the time of sensor retrieval discrete measurements will be taken with one of the MWQI field unit's YSI handheld to verify proper sonde function. Chlorophyll *a* samples will be taken from the water column using methods described in Standard Methods section 10200 H (American Public Health Association; American Water Works Association; Water Environment Federation, 2012). The data from these chlorophyll *a* samples will aid in the validation of sensor chlorophyll *a* estimated values.

Data Analysis

Data collected from the sondes will be analyzed for variances between the pre-siphon area and the post siphon area. Discreet data collected will be used to create a regression equation for verification of sensor data. Statistical analysis will be done to show what differences there are between incoming and outgoing water. In addition to the differences between the two sites it will also be possible to determine if mixing is complete of the water from Dyer Reservoir and the origination pool of the SBA by comparing parameters and looking at differences and similarities in the vertical column profiles.

This analysis will answer the following questions for the purpose of informing the one year study;

1. Are these new sondes effective instruments for the proposed study?
2. What locations most useful for sonde deployment?
3. Does the standpipe setup design work?
4. Is there uniformity of vertical mixing at the upstream and downstream site?
5. Is there a substantially different pH upstream and downstream of a siphon?
6. Can we detect changes in pH and DO as water flows through the Dyer-Altamont siphon?

All this information will be compiled into a pilot study progress report.

For questions or comments please contact Jason Moore at:

jason.moore@water.ca.gov

916-376-9713

Works Cited

American Public Health Association; American Water Works Association; Water Environment Federation. (2012). *Standard Methods for the Examination of Water and Wastewater.* Washington DC: American Public Health Association.

Horne, A., & Goldman, C. (1994). *Limnology.* New York: McGraw Hill.

7.2.1 Status of Cattle Grazing in the State Water Project

Status of Cattle Grazing Project Charter

Project Charter

Version#: 1.1 **Date:** 6.13.2014

Project Name: *Write out the entire, specific name.*

Status of Cattle Grazing in the State Water Project (SWP)

Sponsor/Program Manager	Elaine Archibald
Project Manager	Sonia Miller

Project Objective Statement: *What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).*

Conduct an update of Cattle Grazing in the watersheds of the State Water Project from previous sanitary surveys.

Triple Constraint Trade-off

Resources	N	*Select a different flexibility letter for each constraint* *N= Not Flexible* *S= Somewhat Flexible* *M= Most Flexible*
Schedule	M	
Scope	S	

Estimated Start Date:		**Estimated End Date:**	

Project Deliverables: *What is the project going to produce? Create a list of tangible products that will result from project.*

Prepare a short report that updates the status of cattle grazing in the watershed of the State Water Project.

Strategic Fit: *What is the Strategic Initiative Identifier for this project?*

The sanitary survey is a requirement by law.

Customer: *Who are you doing the project for?*

California Department of Public Health and State Water Project Contractors

Customer Benefits: *What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.*

Fulfills a legal requirement.

Project Charter

Success Determination Factors *How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.*

A report on cattle grazing completed by September 2015

Project Background: *What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.*

Take a large report and break it down into manageable sections, by conducting investigations on specific areas of concern within the watershed. This year's investigation is to be conducted on cattle grazing in the watershed of the State Water Project. Cattle grazing in the State Water Project watershed has not been updated since 2001.

Project Scope:

In Scope: *List areas and functionality included in project.*	**Out of Scope:** *List areas and functionality not included in project.*
Conduct research on past sanitary surveys, update relevant information on cattle grazing, produce a report by September 2015	*Conducting research on anything but cattle grazing in the watershed*

Dependent Projects: *What projects must be underway or completed before this project can be successful?*

none

Risks: *What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.*

None

Assumptions and Constraints: *What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.*

Project Charter

Major High-Level Milestone Targets: *What events measure progress? E.g. Initiation Approved, Analysis Complete.*

Milestone	Target Date
Develop detailed scope of work	October 2014
Obtain data for analysis and prepare Draft Report	December 2014
Submit Draft Report to Sanitary Survey Subcommittee for initial review	August 2015
Respond to comments	August 2015
Submit Revised Draft Report to Sanitary Survey Subcommittee for review	September 2015
Respond to comments	September 2015

Project Core Team Members

Team Member	Phone/E-mail	Role
Sonia Miller	(916) 376-9712 Sonia.Miller@water.ca.gov	Lead Investigator
Elaine Archibald		Project Partner

Charter Version Number:	
Updated By:	**Date:**
Approved By:	**Date:**

Funding Information

Project Budget:	
Fund Center Title	
Fund Center Number	VSANSURVEY14
Organization	
Contact Person	
Phone/E-mail	

Project Charter

This Project Should Have: *Check all that apply*

Project Management Plan X	Environmental Stewardship Plan ☐	Work Breakdown Structure ☐	Communications Plan ☐	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ☐	Risk Register ☐	Project Budget ☐	Project Schedule X	DWR Form 1498 ☐

Status of Cattle Grazing Scope of Work

Background

Since 1990, the water agencies treating water from the State Water Project (SWP) have been required to conduct a watershed sanitary survey at least every five years. This is a requirement based on the California Surface Water Treatment Rule, and is administered by the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW). In Title 22 of the California Code of Regulations, a sanitary survey is defined as "a physical and hydrogeological description of the watershed, a summary of source water quality monitoring data, a description of activities and sources of contamination, a description of any significant changes that have occurred since the last survey which could affect the quality of the source water, a description of watershed control and management practices, an evaluation of the system's ability to meet requirements of this chapter, and recommendations for corrective actions."

Although a sanitary survey is required to be completed at least every five years, last year marked the beginning of a new format for the SWP Watershed Sanitary Survey. In prior years, one survey was completed to satisfy the mandated requirement in the 5th year. This was a tremendous effort each time the survey was completed. The SWRCB, Municipal Water Quality Investigations (MWQI) Program staff, and MWQI Special Projects Committee (MWQI SPC) have agreed to an approach that will make the sanitary surveys more useful to DDW and the MWQI SPC, and will not require an inordinate amount of staff time in one year. The new format consists of four annual surveys, focused on a particular issue or region of interest, and a fifth survey that reviews the water quality data for the entire SWP. The five annual reports will be submitted to DDW as they are completed and will be packaged together in the 5th year. This new format has been developed with the approval of DDW, and will satisfy the requirement of a sanitary survey every 5 years. The San Joaquin River Watershed Sanitary Survey was the first survey completed under this new format.

This project is the second annual survey using the new format. DDW determined that the focus of this sanitary survey should be on updating the information on cattle grazing in the SWP watershed. Each of the previous SWP Watershed Sanitary Surveys has addressed cattle grazing in various watersheds of the SWP. The objective of this sanitary survey is to update the information and consolidate it into one report. The previous SWP Watershed Sanitary Surveys were reviewed to determine which watersheds have (or previously had) cattle grazing. Table 1 provides a summary of this information.

Project Management

The project will be conducted by the MWQI Program under the direction of State Water Project Contractors Authority (SWPCA). The project will be managed using the Project Management Institute (PMI) project management framework. This framework of project initiation, planning, executing, and closing-out projects will be used to help ensure the success of the sanitary survey within the constraints of scope, deadline, and budget. For the sanitary survey, the PMI tools that will be used are: Project Charter, Project Management Plan, Project Scope, and Project Schedule. Additional tools may be used as needed.

MWQI staff involved in the project will participate in the Sanitary Survey Subcommittee and will update the MWQI Technical Advisory Committee (TAC) on a monthly basis. Written updates will be provided to the TAC through the Municipal Water Quality Program's (MWQP's) monthly status reports. Throughout the project, Sanitary Survey Subcommittee members will help to guide the production of the sanitary survey.

Description of Tasks and Deliverables

Task 1. Conduct Regulatory and Policy Review

State and local regulations and policies on cattle grazing in watersheds of drinking water supplies will be described. This review will include, but is not limited to, Total Maximum Daily Loads (TMDLs), programs to manage and control runoff from cattle grazing into the watersheds of the SWP such as the Rangeland, Grazing Land, and Grassland Protection Program, and local guidance on cattle management.

Deliverables: Draft Regulatory and Policy Review (Section III. of the final report)

Task 2. Cattle Grazing Status and Impacts on Water Quality organized by Aqueduct Sections

A synopsis of all of the locations from past surveys will be presented, along with any new information available (Table 1). The information on number of cattle, seasonality of grazing, and grazing management practices will be updated for the watersheds of the State Water Project. These watersheds include the North Bay Aqueduct, South Bay Aqueduct, Coastal Aqueduct, the East and West branches of the Aqueduct, the stretch from Clifton Court Forebay to the bifurcation of East and West Branch, and the San Joaquin River watershed (Figure 1). Any activities that have occurred to limit the impacts of grazing, such as development of grazing management practices or installation of fencing will be described. This discussion will also address recommendations from the prior sanitary surveys.

Pathogen and indicator bacteria data will be reviewed to determine if there are any discernible impacts of cattle grazing on water quality. When available, *Giardia* and *Cryptosporidium* data will be evaluated. Data for pathogen indicator organisms (total coliforms, fecal coliforms, and *E. coli* bacteria) will be analyzed in the absence of *Giardia* and *Cryptosporidium* data.

Data for these constituents will be analyzed from as early as 1987 to the end of water year 2013-14 (September 31, 2014.) Past surveys will be referred to for former sampling locations, and for sources of grazing and pathogen data. Data will be analyzed for any seasonal trends, upstream/downstream trends, trends in time, or other patterns in the data. Potential sources of data are CIWQS, CEDEN, USGS, and appropriate water agencies.

Deliverables: Draft Water Quality Impacts (Section IV. of the final report)

Task 3. Develop Key Findings and Recommendations

Key findings and recommendations will be developed based on the analysis of the cattle grazing information and water quality data. These findings and recommendations will be incorporated into action items which will be included in the final report.

Deliverables: Key Findings and Recommendations (Section V. of the final report)

Task 4. Prepare Report

The purpose of the project report is to incorporate all of the research from prior tasks into a final report that will be approved by the Sanitary Survey Subcommittee and be submitted to DDW. The number of hard copies of the report has yet to be determined; however, the final report will be available by CD and by download from the MWQP website. The report will be in color, and printed copies will be on recycled, double-sided paper. The sections of the report will be as follows:

The sections of the report will be as follows:

I. **Executive Summary** - A brief account of the summary and findings of the analyses conducted, and of the action items
II. **Introduction** - Explanation of the purpose of the Sanitary Survey, history of the SWP Sanitary Survey, explanation of the changes in format, scope and objectives, and report organization
III. **Regulatory Environment** - "Regulatory and Policy Review" task deliverable
IV. **Status of Grazing and Water Quality** – "Cattle Grazing Status and Impacts on Water Quality" task deliverable for the following locations: North Bay Aqueduct, Sacramento-San Joaquin Delta, Bethany Reservoir, South Bay Aqueduct, Coastal Branch California Aqueduct, San Joaquin River watershed, California Aqueduct, West Branch California Aqueduct, and East Branch California Aqueduct
V. **Key Findings and Recommendations** - "Key Findings and Recommendations" task deliverable. This section will also include any action Items.

Deliverables:
Draft Sanitary Survey Report
Final Sanitary Survey Report
Spreadsheet(s) of Data used in the analyses

Schedule

The schedule for the project is as follows:

- Draft Introduction - January 2015
- Draft Regulatory Environment – February 2015
- North Bay Aqueduct cattle grazing status and water quality impacts – February 2015
- South Bay Aqueduct cattle grazing status and water quality impacts – February 2015
- Sacramento San Joaquin Delta cattle grazing status and water quality impacts – March 2015
- Bethany Reservoir cattle grazing status and water quality impacts – March 2015
- Coastal Branch cattle grazing status and water quality impacts - March 2015
- San Joaquin River Watershed cattle grazing status and water quality impacts – March 2015
- California Aqueduct cattle grazing status and water quality impacts – March 2015
- West Branch California Aqueduct cattle grazing status and water quality impacts – April 2015
- East Branch California Aqueduct cattle grazing status and water quality impacts – April 2015
- Draft Key Findings and Recommendations – April 2015
- Draft Report circulated to Sanitary Survey Subcommittee and SWRCB for review and comment - April 2015
- Revised draft report circulated for final review - June 2015
- Draft final report submitted to SWRCB for approval - July 2015
- Publication of final report and posting on MWQI website - August 2015

Budget

The MWQI budget for this project is $46,560. This budget will be dedicated to MWQI staff time in conducting the research and developing the draft and final reports. SWPCA will provide a project partner to serve as a

technical resource and reviewer. Assistance from SWPCA in guiding the development of the sanitary survey is not included in the budget.

Table 1 Cattle Grazing from Past Sanitary Surveys

	Location	2011	2006	2001	1996	1990	Last mentioned status
North Bay Aqueduct							
	Barker Slough watershed	✓	✓	◉	◉	○	Fencing has been installed along Barker Slough upstream of Campbell Lake to restrict livestock access to Barker Slough.
	Cordelia Forebay					□	Cattle graze downhill of the forebay, so there is no threat.
Sacramento San Joaquin Delta				◉			Grazing occurs in all counties encompassed within the Delta. Solano County saw the largest increase of grazing acres, but San Joaquin County had the most livestock.
Bethany Reservoir		•	◉	◉		◉	Grazing occurs on private and state-owned land and cattle have access to Bethany Reservoir. The SBA Watershed Program Protection Plan recommended grazing land management practices. Further investigation of potential control measures is needed.
South Bay Aqueduct							
	Open canal sections SBA	✓	◉	○		◉	Open canal sections previously received runoff from livestock grazing areas and wooden farm bridges. New drainage overcrossing structures have eliminated drainage to the canal and the farm bridges have been replaced with new concrete bridges that do not drain into the canal.
	Dyer Reservoir						New reservoir constructed in September 2011. Not addressed in previous sanitary surveys.
	Patterson Reservoir					□	The reservoir area is fenced to exclude cattle and there is no drainage into the reservoir.
	Lake Del Valle		◉	◉	◉	◉	Grazing occurs on private property and land managed by East Bay Regional Parks in the watershed. The

	Location	2011	2006	2001	1996	1990	Last mentioned status
							SBA Watershed Program Protection Plan recommended grazing land management practices.
California Aqueduct to O'Neill Forebay						○	Minor drainage from adjacent land.
San Joaquin River Watershed							Unknown at this time
O'Neill Forebay and San Luis Reservoir							
	O'Neill Forebay				○	○	Limited grazing in the watershed (sheep observed grazing).
	San Luis Reservoir	●	◉	◉	◉	○	Grazing remains a major concern. SWPCA, DWR, and U.S. Bureau of Reclamation were working on limiting access of cattle to San Luis Reservoir in the Cottonwood Creek area. This effort has been delayed after a lawsuit was filed after a cow caused a fatal car accident.
O'Neill Forebay to End of San Luis Field Division							
	Open canal sections O'Neill/San Luis			○		○	Grazing is present, but is not considered a significant threat to water quality.
	East Side Drainage-Cantua Creek, Panoche Creek, Arroyo Passajero, Salt Creek			○		○	Grazing is present, but is not considered a significant threat to water quality.
End of San Luis Field Division to Kern River Intertie							
	San Luis to Kern River			○		○	Undercrossings involve 10 pipelines that drain lands grazed by cattle.
Coastal Aqueduct							
	Open canal sections Coastal Branch			◉	○	○	Grazing adjacent to the open canal, runoff can enter canal. Fencing at mile 13.1 was missing as of 2001, allowing livestock to reach canal.
Kern River Intertie to Bifurcation of East Branch/West Branch							
	Open Sections Kern to E/W branch					○	Grazing nearby, concern with undercrossings which involve 19 pipelines that drain lands grazed by cattle and overchutes which convey drainage from grazing lands.
	Tehachapi					○	Grazing nearby, runoff drains to afterbay.
West Branch							
	Open canal sections					○	Grazing nearby, some drain inlets

	Location	2011	2006	2001	1996	1990	Last mentioned status
	West Branch						convey water from grazed lands.
	Quail Lake			◉	◉	◉	Grazing nearby, runoff is conveyed through natural drainage and piped conduits. The amount of drainage is unknown.
	Pyramid Lake			○	◉	◉	Cattle grazing in watershed, concern with drainage.
	Castaic Lake	✓	✓	○	◉	◉	Fencing Installed 2003 around Elderberry Forebay. Grazing greatly decreased in the watershed due to endangered species issues; however, there are concerns with grazing on adjacent lands to the forebay. Poorly maintained and destroyed fences allow cattle access to the water. Considered a significant threat.
East Branch							
	Open canal sections East Branch					○	Some drains inlets convey water from grazed lands. Culverts of overchutes, overcrossings and undercrossings convey runoff from grazed lands. There are cattle impoundments near the canal.
	Silverwood Lake			☐			Grazing has not occurred in watershed since 1990.
Key to rating system symbols used above							
✓	Action Taken in the watershed						
☐	No Threat to the watershed						
○	Mentioned or identified as an Unknown Threat in the watershed						
Key to rating system symbols used above							
◉	Identified as a Potential Contaminant Source in the watershed						
●	Identified as a Problem in the watershed						
	Blank cells indicate the site was not mentioned						

Figure 1**. Map of the State Water Project**

source: DWR Bulletin 132-11, available at http://www.water.ca.gov/swpao/docs/bulletins/bulletin132/Bulletin132-11.pdf

7.3 Fluorescence of Dissolved Organic Matter Phase II

FDOM Phase II Project Charter

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PROJECT CHARTER

Version#:	**2.0**	**Date:**	**6/10/15**

Project Name: Write out the entire, specific name.

Fluorescence of Dissolved Organic Matter Phase II

Sponsor/Program Manager	SWPCA
Project Manager	

Project Objective Statement: What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).

To measure the correlation between FDOM and Organic Carbon (dissolved and total) at Banks Pumping Plant for one year and compare that to Barker Slough.

Triple Constraint Trade-off:

Resources	N	Select a different flexibility letter for each constraint N= Not Flexible S= Somewhat Flexible M= Most Flexible
Schedule	M	
Scope	S	

Estimated Start Date:	June 2014	**Estimated End Date:**	November 2015

Project Deliverables: What is the project going to produce? Create a list of tangible products that will result from project.

The project will produce daily data on fluorescence and DOC/TOC from Banks PP. Correlations will be produced based on the data. FDOM and organic carbon data from Barker Slough will also be included in the final report to highlight comparisons of two vastly different systems along the State Water Project.

Strategic Fit: What is the Strategic Initiative Identifier for this project?

It may be possible to cut costs on expensive organic carbon analyzers used to obtain DOC and TOC measurements at several key water quality stations in the Delta. It may also be possible to place FDOM sensors in riverine environments without the use of filtration systems to obtain real-time fluorescence data in other areas where water quality stations are not feasible.

Customer: Who are you doing the project for?

SWP contractors and MWQI.

PROJECT CHARTER

Customer Benefits: What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.

Avoid costs in the future of equipment/maintenance of organic carbon analyzers and/or obtaining data from areas where it is not feasible to build water quality stations.

Success Determination Factors: How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.

At the end of the project, a correlation will be analyzed between FDOM and several different DOC/TOC sources. A strong correlation would be a success, however a weak correlation will still provide important information.

Project Background: What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.

DOC is a particular concern to water treatment operators. During the water treatment process, disinfection agents such as chlorine and ozone, react with the DOC to form DBPs, which are suspected carcinogens. It is difficult to manage the balance between removing disease causing organisms while protecting the population from DBP's. DBP's are classified under two different categories; trihalomethanes (THM's) and haloacetic acids (HAA's). Due to the possible health effects of these DBP's, the Environmental Protection Agency (EPA) regulates the amounts in drinking water. To assist water treatment plant operators and the drinking water treatment process, DOC concentrations are monitored at select locations throughout the Delta. The sampling can be completed by taking grab samples at predetermined intervals or real time monitoring using equipment designed to read DOC/TOC samples at given intervals. The equipment can be costly to purchase upfront while also demanding continuous maintenance and repairs.

We propose to use an in-situ fluorometer installed at Banks to expand on Phase I of this project and continue to correlate FDOM values to those of DOC but also include TOC at different levels of filtration. The fluorometer will be given unfiltered, 100 um filtered, and 0.45 filtered um water while DOC/TOC values will be collected through a Sievers OC analyzer with a water splitting device set up to split a stream for DOC. Data supplied by Solano Water Agency at Barker Slough will be supplied to compare the results of FDOM to DOC correlations at two vastly different sites along the SWP.

Project Scope:

In Scope: List areas and functionality included in project.	**Out of Scope:** List areas and functionality not included in project.
Basic sensor maintenance The use of certified standards (if they are available) Data management Final Report publication Include corrections of the data if necessary including temperature and turbidity	DBPs were originally included but were cut due to funding complications. DBP samples are out of scope.

Dependent Projects: What projects must be underway or completed before this project can be successful?

Data collection at both Banks PP and Barker Slough.

PROJECT CHARTER

Risks: What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.

If the sensor is damaged in any way, or malfunctions during the course of the project, the necessary data will not be collected and the correlations between organic carbon and FDOM will be difficult to produce.

Assumptions and Constraints: What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.

The assumption is that the data will be collected consistently for one year total, with no interruptions. The constraint is there may be outside factors that may cause in interruption in data collection including power outages at Banks PP or a malfunction in the FDOM sensor. The same goes for the sensor deployed at Barker Slough.

Environmental Stewardship and Sustainability Considerations: What is the process that will be used to ensure compliance with the Environmental Stewardship Policy? Include the Environmental Stewardship Coordinator and team members (this can be roles instead of specific names)

Environmental Stewardship Coordinator:	

Major High-Level Milestone Targets: What events measure progress? E.g. Initiation Approved, Analysis Complete.

Milestone	Target
Installation complete	09/14
Data Collection	09/14-15
Mid Study Report	-
End Data Collection	09/15
Final Report	-
Final Draft Edits	-
Incorporate Final Draft Comments	-
Final Report Published	-

Project Core Team Members:

Team Member	Phone/E-mail	Role
Alex Rabidoux	707-451-6090	Project Partner/Advisor
		Project manager
Steve San Julian	916-371-2284	Field Unit Supervisor
Mark Bettencourt	916-376-9717	Team member

PROJECT CHARTER

Project Core Team Members:

Team Member	Phone/E-mail	Role
Alex Rabidoux	707-451-6090	Project Partner/Advisor

Charter Version Number: 2.0	
Updated By: Shaun Rohrer	**Date:** 6/10/15
Approved By:	**Date:**

Funding Information:

Project Budget:		**Project Hours:**	800
Fund Center Title	FDOM Phase II		
Fund Center Number	VFDOMPOCS013		
Organization	DWR		
Contact Person	Shaun Rohrer		
Phone/E-mail	916-376-9710/shaun.rohrer@water.ca.gov		

This Project Should Have: Check all that apply

Project Management Plan ■	Environmental Stewardship Plan[1] ☐	Work Breakdown Structure ■	Communications Plan ■	Procurement Plan ☐	Human Resources Plan ☐
Quality Management Plan ☐	Stakeholder Register ☐	Risk Register ☐	Project Budget ☐	Project Schedule ☐	DWR Form 1498 ☐
Project Safety Plan[2] ☐					

[1] See WREM 58b for more information about creating an Environmental Stewardship Plan.
[2] All project Managers must take into account safety policies and procedures for projects. A safety plan should be created if needed. For more information visit the Workplace Safety Project web site.

FDOM Phase II Project Management Plan

Project Management Plan **Date 7/14/15**

Project Life Cycle/ Major Milestones

	Planned	Actual
Complete Installation	6/14	9/14
Collect Data	6/14	10/14
Mid Study Report	11/14	
Final Report	1/15	
Final Draft Editing	3/15	
Incorporate Final Draft Comments	4/16	
Final Report Published	6/16	

Roles & Responsibilities

Project Manager: Jeremy Del Cid. This role is responsible for the projects status updates as well as the deliverables. The project manager will need to remain in constant communication with the sponsor and other interested parties. It is the responsibility of the project manager to document any changes made within the scope of the project.

Project Team: MWQI Field Unit. The MWQI Field Unit will be responsible for updating the project manager any status changes in the equipment currently located at Banks PP. To save time and resources, it will also fall on the field staff to maintain a service schedule for the FDOM as they are routinely in the field to maintain their equipment. If any issue arises, it will be imperative to communicate this with the project manager.

Major Deliverables

This project will have the following major deliverables:

- 12 months of data collection
- A mid-study progress report at 6 months
- A final report correlating DOC/TOC data and FDOM, and comparing Banks FDOM data to Barker Slough FDOM data

2

Project Management Plan **Date 7/14/15**

Major Deliverables

Resources Needed

The FDOM has already been purchased and is currently collecting data for the conclusion of Phase I.

Filters (0.45micron and 100 micron) will be used to reduce some of the turbidity of the water.

Project Management Plan **Date 7/14/15**

Quality Planning Considerations

The quality of the FDOM data is largely dependent on regular review of the data being recorded from the FDOM. It is also dependent of the routine maintenance of the instrument and the water delivery system. To accommodate this, the data will be reviewed approximately daily, and a weekly maintenance schedule will ensure that biofouling of the instrument will be kept to a minimum. Additional details on the quality assurance and quality control of the FDOM data can be found in the FDOM Study QAPP.

Risk-Response Considerations (list any potential positive or negative risks and planned responses)

1. Power outages do occur at Banks PP. When they occur, data is lost for the duration of the outage. Hopefully they don't last longer than necessary to ensure quality data is still collected.
2. The sensor may require maintenance beyond the staff's abilities. There may not be enough room in the budget for this to occur in which case the project may be put on hold.

Change Management Considerations/Procedures

1. If anything needs to change from the original scope of the project, then it must be approved by SWPCA and DWR management to see if it is accepted. If it is in agreement, the changes can take place and should be well documented.

Baselines Attached	X
Work Breakdown Structure	x
Project Budget	x
Project Schedule	x

Other Attachments	X
Stakeholder Register	
Communications Management Plan	x
Human Resources Management Plan	
Risk Register	
Quality Management Plan	
Procurement Plan	
Environmental Stewardship Plan	x

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FDOM Phase II Communications Plan

Communications Management Plan

Project Title: Fluorescence of Dissolved Organic Matter Phase II **Date:** 6/12/14

Information Recipient	Recipient Requirements (format, delivery method)	Information to be Communicated (content, level of detail, reason)	Communication Constraints	Time Frame/ Frequency	Responsible for Communication
Sponsor: SWPCA	Email; meetings Project Status Reports	Project progress, any issues and resolutions	Workload priorities	As needed Weekly-monthly	Shaun Rohrer
Project Manager: Shaun Rohrer	Email; meetings Project Status Reports Phone conversations	Project progress on tasks and deliverables	Workload priorities	As needed Weekly-monthly	Shaun Rohrer
Project Team Members	Email; meetings Phone conversations	Issues related to Banks PP and the installed equipment	Workload priorities	As needed	MWQI Field Staff

Ground Rules:

Any proposed changes will be circulated through all recipients
Emails/phone calls are responded to as quickly as possible

(Rev.3/2011)

FDOM Phase II Responsibility Matrix

Responsibility Assignment – RACI Matrix

Project Title: Flourescence of Dissolved Organic Matter Phase II **Date:** 7/21/2014

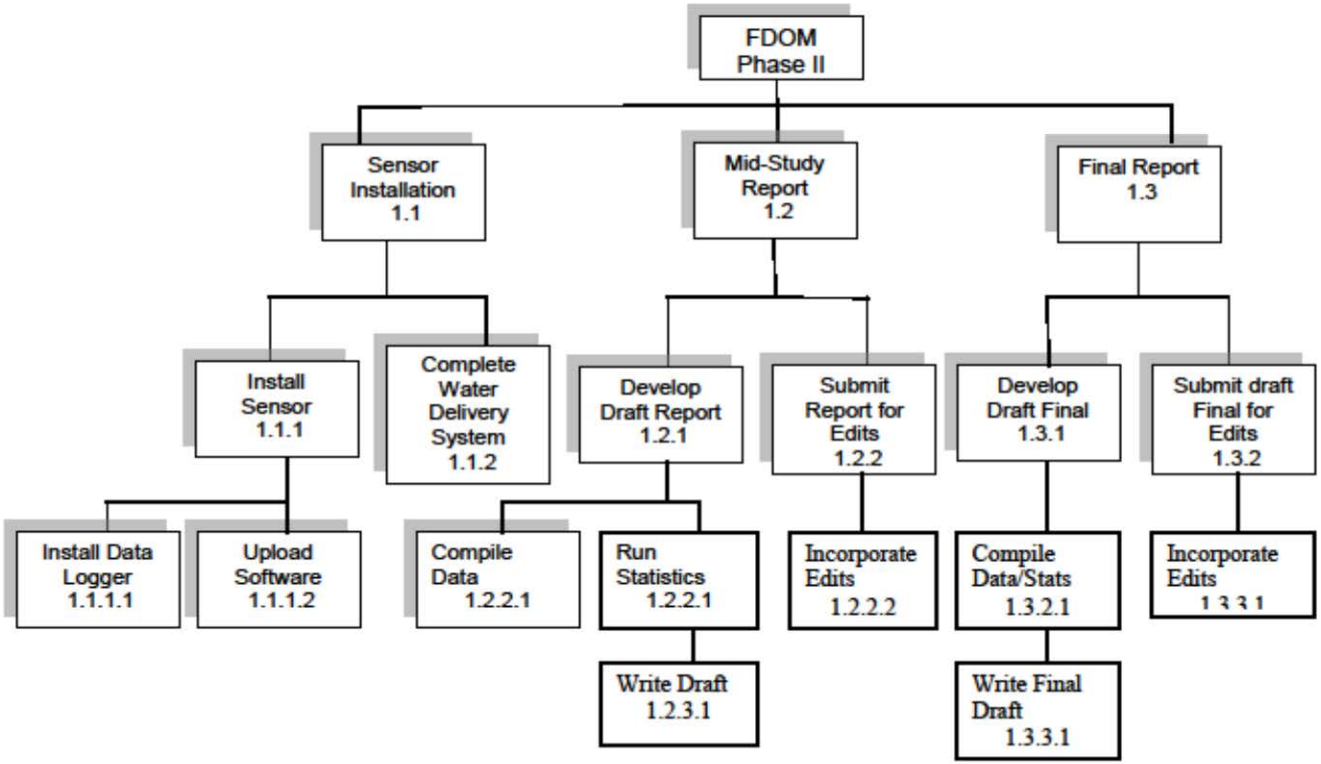
Project Deliverables	Project Role/Name						
	Rachel Pisor Steve San Julian	Alex Rabidoux	Jeremy DelCid	Mark Bettencourt	Dennis Huff		
	Responsibility Assigned R = Responsible A = Accountable C = Consulted I = Informed						
Sensor Installation	I	I	A	R	I		
Collect and Download Data	C	I	R	C	C		
Maintenance Visits	C		A	R			
Develop Mid-study Progress Report	C	I	RA				
Continue Data Collection and Download	C	I	R	C	C		
Continue Maintenance Visits	C		A	R			
Develop Draft Final Report	C	I	RA				

(Rev.3/2011)

FDOM Phase II Work Breakdown Structure

Work Breakdown Structure

Project Title: Fluorescence of Dissolved Organic Carbon Phase II **Date:** 7/17/2014



(Rev.6/2011)