Statement of Work

Project Relevance & Importance

Section One

Introduction

The Tehama Colusa Canal Authority is responsible for the Corning Canal and the Tehama Colusa Canal, of which the source of water is the Sacramento River. Water is diverted from the Sacramento River at the diversion dam in Red Bluff. The Corning Canal serves water districts over a 15 mile length while the Tehama Colusa Canal serves water districts over a 110 mile length.

Because of the age of equipment associated with monitoring and remotely controlling these systems, there has been an increasing number of spill incidents. Water, once entered into this closed canal system. Without a proper control system, spills & water waste are inevitable.

Water orders are placed with the Bureau of Reclamation a day in advance, and water is released from Shasta Dam in accordance with the order. As matters now stand, the water may arrive at the diversion point before we make the adjustments to our system, in which case the water is simply wasted, or in other cases we may make an increase in our diversion before the water has arrived, thus diverting water intended for someone else further down stream on the river.

Complicating matters further is the cycling of the pumps in the Corning Pumping Plant which feeds the Corning Canal. These starts and stops cause a cycling in our diversion from the river.

Project Defined

The proposal is to fully automate both the Corning Canal and Tehama Colusa Canal, incorporating appropriate alarming into both systems. With this advancement in control system technology we could accomplish the following:

1. Have more advanced warning of impending spills by virtue of cell phone notification to one or more respondents.

2. With remote access to the main control computers by virtue of a laptop computer and cell phone, it then becomes possible to respond to spills before they occur, from virtually any location and at any time an alarm is received.
3. Automate the time our diversions are changed to coincide with the arrival of water deliveries from Shasta Dam.
4. Automatically adjust our delivery into the Tehama Colusa Canal to offset the cycling of the Corning Pumping Plant, providing for a constant delivery from the Sacramento River.
5. Maintain an automated control of target elevations of pools on both canals without spills.

Relevance and importance

An improved control would provide for less unrecoverable loss through spills, less disturbance to the environmental balance by virtue of elimination of spills, and provide for less wasted water through proper timing of diversions from the Sacramento River. Thus providing benefit to all down stream water users including Bay-Delta.

Benefits and cost effectiveness

The benefits described can be locally cost effective, especially since the price per acre foot of water keeps increasing. The benefits would transfer primarily to the 'Bay Delta' water systems. The various districts we serve would applaud a stable supply and level of water in the pools. Once a system is developed to satisfy the goals above as well as our needs, this system would certainly have the potential to be adopted by other water agencies with similar diversions and delivery issues.

Local benefits would be identified as better monitoring and control of the delivery system. A minor savings in man hours required to take water samples when a spill occurs and a minor financial savings in having those samples analyzed. There would also be minor savings in administrative record keeping associated with the records related to the spill. While local cost benefits are minor, regional benefits are substantial.

Statement of Work

Technical/Scientific Merit, Feasibility

Section Two

Method: Full Automated Control

To achieve full automated control consistent with the objectives stated in Sec. 1, *Industrial Controllers or Computers*, which can be programmed with software developed to our requirements and specifications, would be placed at each of the 26 canal check structures on the Tehama Colusa Canal and at each of the 12 canal structures on the Corning Canal.

A *Master Industrial Controller or Computer* would be appropriately located and programmed, again to our requirements and specifications, to collect data from the remote field station controllers. The *Master* would function in these capacities:

6. Collecting data and storing it for later analysis and use.
7. Displaying current system status.
8. Monitoring the system and generating alarms.
9. Recording alarm response times as well as responder.
10. Provide the means to intervene manually or return to automated control.
11. Provide for remote computing access.
12. Provide for immediate access to remote stations for data and control.
13. Provide for emergency shut down of canal when Interstate or other vehicle traffic enters the canal through accident.
14. Provide for coordinated startup after an emergency shutdown.
15. Provide means to change pool target elevations as needed to allow back-flow from Stony Creek.

Alarms monitored under item 3:

1. Upstream High water level.
2. Upstream Low water level.
3. Downstream High water level

4. Downstream Low water level.
5. Gate failure.
6. Sensor Failure.
7. Unauthorized station entry.
8. Communications failure.

Upstream and downstream alarming is made possible by existing measurement stations down stream of each check structure. This provides a redundancy of monitoring, further reducing the possibility of a spill.

Communications between stations as well as Master and Remote stations will take place over two way radios on a radio system already established and licensed. Two separate control frequencies with repeaters are licensed, one for control of the Tehama Colusa Canal and the other, for the Corning Canal.

Spill control could be eliminated with the development of an appropriate alarm system and implementation of coordinated response by operations personnel. Aiding in this would be the field programs themselves, in which certain pools with spills would be closely monitored by control equipment and if possible, adjustments made. Obviously, if there power failure, the gate would have to be hand cranked to change their position. This will take time in any event, but with the inclusion of communications failure, such a power failure problem will be detected, most likely before there is a spill and in time to make appropriate changes in the system, depending on how wide-spread the power outage might be.

Stabilized diversion control would be attained by programming check 1 to deliver a specified flow into the system from the settling basin. The gates at check 1 would adjust to accommodate the cycling of the pumps in the Corning Pumping Plant, thus maintaining a constant level in the settling basin.

The Tehama Colusa Canal contains a reservoir of approximately 4600 acre feet at mile post 66. All check structures upstream of this reservoir would be operated on '*upstream control*'. In this method the gates at each check structure would operate to maintain a proper level upstream of the gate. Thus, what ever amount of water is delivered into the system by check 1 will be '*passed'* on to Funks reservoir. As such, Funks will serve as the regulation device for delivery and will either be increasing or decreasing in elevation. Since no water is delivered directly from this reservoir, its elevation is not critical.

From Funks reservoir to the end of the canal, all stations will be on downstream control. In this method, the gates will operate to maintain the elevation of the pool downstream of the gate. This is a 'demand control'. In this section of canal we occasionally have spill problems in the spring. Farmers will be taking considerable amounts of water, and a spring rain storm will come through and the farmers shut off. Often, before we are able to curtail deliveries, water is spilled out the end of the canal. With the development of full automation within a new program, these spills

can be avoided.

Hardware

Hardware to operate the gates is already in place and wired. Control wiring is also in place to each upstream block house for automated control of the gates.

Thus, a hardware list is approximately as follows:

1. Appropriately equipped industrial controllers or computers.
2. Two-way radios.
3. Modems.
4. Antennae.
5. Power supplies.
6. Equipment housings.
7. Miscellaneous wire, terminal boards, terminal connectors, coax, RF connectors.
8. Gate position sensors, for two or three gates, depending on station.
9. Water level sensors, both upstream and down stream.

This hardware would be required in sufficient quantity to populate 26 stations on the Tehama Colusa and 12 stations on the Corning Canal with a 10% overage for maintenance and unexpected failures.

Task List & Schedule

1. Set forth requirement for developer bid.
2. Evaluate bids and select developer.
3. Enter into agreement with developer.
4. Acquire engineering drawings from developer and order hardware.
5. Install and wire hardware at all stations as per engineering drawings.
6. Monitor software download and testing.
7. Based on final installation, testing and performance analysis, accept the project as complete.

Statement of Work

Monitoring & Assessment

Section Three

Because the water waste, produced by diversion timing errors, did not produce a financial burden or associated cost, there has been no data collected that could be used as a baseline. Should the proposed project be implemented, a record keeping system will be implemented to record the timed diversions as they would correlate to the arrival of the water released from up stream reservoirs. There will be minor errors associated with this process for the federal agencies may not release the water at the exact time expected. But these errors should be small and insignificant.

In the arena of spills, we have the data available, but not in a form that provides us with baseline at this time. Again, if the project is to come to fruition, this data will be extracted from our records and assembled in a manner that can be compared with new data to be collected in an improved record keeping system.

Data will be collected in a computer data base program in which electronic files and/or paper files will be constructed that provide an adequate means for DWR and others to evaluate. These files may then uploaded to our web site and made available on that medium.

The method of data collection will be to set up the *Master Control Computer* to collect data from the field stations as related to diversion changes at the river and spills. The collected data will then be written to computer files of such a structure that they can be directly imported to the selected *Database* program. Periodically, staff will apply a *time filter* to the data, generating reports and electronic files which can be uploaded to our web site.

We are estimating the cost of implementing the monitoring, record keeping and web site maintenance at less than $10,000.00 per year.

APPENDIX C

PROJECT IMPLEMENTATION COSTS TABLE

APPLICANT: Tehama Colusa Canal Authority

PROJECT TITLE: T. C. C. Automation Upgrade

Section A projects must complete Life of Investment, column VII and Capital Recovery Factor, column VII. Do not use 0.

TABLE C-1: Project Costs (Budget)

	Category (I)	Project Costs $ (II)	Contingency % (ex. 5 or 10) (III)	Project Cost + Contingency $ (IV)	Applicant Share $ (V)	State Share $ (VI)	Life of Investment (Years) (VII)	Capital Recovery Factor (Table C4) (VIII)	Annualized costs $ (IX)
					0.4		20 Years	0.0872	
	Administration (for initiation of project)	0	0	0	0	0	0	0	0
	Salaries, wages	33927	0	33927	13571	20356	1696	148	1844
	Fringe Benefits	8482	0	8482	3393	5089	424	37	461
	Supplies	1500	0	1500	600	900	75	7	82
	Equipment	0	0	0	0	0	0	0	0
	Consulting services	6000	0	6000	2400	3600	300	26	326
	Travel	1000	0	1000	400	600	50	4	54
	Other	0	0	0	0	0	0	0	0
(a)	Total Admin. Costs	50909	0	50909	20364	30545	2545	222	2767
(b)	Planning/ Design/ Enginering	18000	1800	19800	7920	11880	990	86	1076
(c)	Equip. Purchases, Rentals, Rebates, Vouchers	672000	67200	739200	295680	443520	36960	3223	40183
(d)	Materials, Intallation, Implementation	446250	44625	490875	196350	294525	24544	2140	26684
(e)	Implementation Verification	206890	20689	227579	91032	136547	11379	992	12371
(f)	Project Legal / License Fees	5000	500	5500	2200	3300	275	24	299
(g)	Monitoring and Assessment	12000	1200	13200	5280	7920	660	58	718
(h)	Report Preparation	2000	200	2200	880	1320	110	10	120
(i)	Structures	0	0	0	0	0	0	0	0
(j)	Land Purchase / Easement	0	0	0	0	0	0	0	0
(k)	Environmental Compliance / Mitigation / Enhancement	0	0	0	0	0	0	0	0
(l)	Construction	0	0	0	0	0	0	0	0
(m)	Other (Specify)	0	0	0	0	0	0	0	0
(n)	Total (=a+..+m)	1413049	NA	1549263	619705	929558	NA	NA	84218
(o)	Cost Share Percentage	NA	NA	NA	40.0%	60.0%	NA	NA	NA