

DRAFT

CONTRACT CHANGE ORDER NO. 5

CONTRACT AWARDED BY: Fresno City Council DATE OF AWARD: November 20th 2015
PROJECT: Southeast Surface Water Treatment Facility
P.O. NO: FRSNO-0000070070 PROJECT ID NO: WC000057 BID FILE NO: 3369
CONTRACTOR: W. M. Lyles Co. of Fresno, California

The Contractor is hereby requested to make the herein described changes from the Contract Documents or do the following described work not included in the plans and specifications on this contract. NOTE: THIS CHANGE IS NOT EFFECTIVE UNTIL FULLY EXECUTED.

Description of Requested Change:

I. CHANGES TO CONTRACT PLANS AND SPECIFICATIONS.

A. This Change Order No. 5 adds scope of work for SCADA Integration for SESWTF and KRP projects. See Page 2 for summary description.

II. CONTRACT PRICE

A. This Change Order No.5 results in a net increase of \$2,493,750.00 to the contract price.

III. CONTRACT TIME

B. No time impacts

STATEMENT OF CONTRACT PRICE		STATEMENT OF CONTRACT TIME		
Original Contract Price	\$ 158,766,000.00		Calendar Days	Contract Dates
Approved Cost Change Orders to Date	\$ (1,736,091.00)	Contract Notice to Proceed		12/31/2015
Cost of this Change Order	\$ 2,493,750.00 See (Pg 2)	Calendar Days to Substantial Completion	910	
Total of all Contract Cost Change Orders including this Change Order	\$ 757,659.00	Calendar Days to Final Completion	1,000	
		Computed Date for Substantial Completion		6/27/2018
		Computed Date for Final Completion		9/25/2018
		Time Extension Days For Contract		
		Time extension days this CCO	0	
		Total time extension days previous CCO's	0	
		Total Time Extension Days To Date	0	
		Excess Adverse Weather Days To Date (Pg	0	
		Suspended Work Days To Date	0	
		Revised Substantial Completion Date		6/27/2018
		Revised Final Completion Date		9/25/2018
Net percentage change in Contract Price from original Contract Price	0.5%			
Revised Contract Price	\$ 159,523,659.00			

CONTRACTOR ACCEPTANCE

We, the undersigned contractor, have given careful consideration to the change proposed and hereby agree, if this proposal is approved, that we will provide all equipment, furnish all materials, except as may otherwise be noted above, and perform all services necessary for the work above specified, and will accept as full payment therefore the price shown above.

Acceptance Date: _____ Contractor: W. M. Lyles Co. of Fresno, California

Accepted By: _____ Title: _____

If the contractor does not sign acceptance of this order, his attention is directed to the requirements of the specifications as to proceeding with the ordered work.

OWNER APPROVAL

Submitted By: Ben Carlisle, Construction Manager Recommended By: Randy Hoffman, Project Manager Date: _____

Authorized By: ☒ Public Utilities Water Division Manager Michael Carbajal Date: _____

Approved By: ☒ Public Utilities Director Thomas Esqueda Date: _____

Approved By: ☒ City Council Minutes of Meeting Dated: _____

(Council approval required if change order or total change orders exceed 10 percent of contract price or if individual change order exceeds Fresno City Charter limit or Section 33422 Health and Safety Code for Agency contracts.)



DEPARTMENT OF PUBLIC UTILITIES
WATER DIVISION

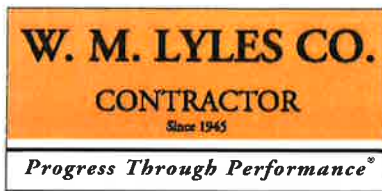
DRAFT

CONTRACT CHANGE ORDER NO.
Change Order Details

5



Change Order Request	Description	Amount	Time increase
1	Add Supervisory Control and Data Acquisition Integration scope of work for the South East Surface Water Treatment Facility and Kings River Pipeline projects as proposed in WM Lyles Change Order Proposal No. 023 which responded to Request for Proposals No. 5.	\$ 2,493,750.00	0
		\$ 2,493,750.00	0



California Contractor's License No. 422390

Central Division – Fresno Office
335 North Thorne Ave
Fresno, CA 93706
Telephone 559-268-1540
Fax 559-268-0420

www.wmlyles.com
An Equal Opportunity Employer

September 2, 2016

City of Fresno
Department of Public Utilities –Water Division
2101 G Street, Building A
Fresno, CA 93706

Attn: Ben Carlisle, Construction Manager

Project: Southeast Surface Water Treatment Facility

Subject: COP #23 – SESWTF and KRP System Integration (RFP-005)

Dear Mr. Carlisle,

As requested in RFP-005 covering SESWTF and KRP SCADA and System Integration, our lump sum price for this scope of work is \$2,493,750.00. This price includes a \$100,000 supplemental work allowance, as required.

A breakdown of these costs including the qualifications proposal from Technical Systems Inc. is attached. In addition, this proposal covers additional management costs to coordinate and ensure on time completion with the SESWTF.

This scope of work is time sensitive and critical to the overall project completion. We can currently offer no schedule impacts if notice to proceed for this work can be achieved within two weeks however reserve the right to reevaluate after this time has passed.

Bond costs have not been included and will be addressed at the end of the project once the final project costs are known.

Please review and respond at your earliest convenience. If you have any questions or require any additional information, please feel free to contact me.

Sincerely,

Tony Mueller
Sr. Project Manager
W.M. Lyles Co.

Attach
Cc: WML PCO 64

Corporate Office: 1250 W. Olive, Fresno, CA 93728 Telephone: (559) 441-1900 • Fax (559) 487-7958

Bakersfield (661) 387-1600

Fresno (559) 268-1540

Temecula (951) 973-7393

Sacramento (916) 375-1833

Visalia (559) 651-1450

W. M. Lyles Co.
 335 N. Thorne Ave
 Fresno, CA 93706

Attention: Ben Carlisle

JOB LOCATION: Fresno South East Surface Water Treatment Facility

DESCRIPTION: Request for Proposal 004
 SESWTF and KRP Integration

Item:		Unit	Total MH	MH Cost	Total MH Cost	Eq. Cost	Material	
1-5	SESWTF and KRP Integration (Items 1-5)	LS	0	-	\$ -	\$ -	\$ -	
6	Suppliemental Work Allowance	LS	0	-	\$ -	\$ -	\$ -	
Total Costs			0		\$ -	\$ -	\$ -	

Subtotal		\$ 2,375,000.00
Mark-up - Labor	20%	\$ -
Mark-up - Equipment	15%	\$ -
Mark-up - Materials	15%	\$ -
Mark-up - Subcontractor	5%	\$ 118,750.00
Bond	0%	\$ -
Total This Change Order		\$ 2,493,750.00

Comments:

Bond Costs have not been included in this proposal. These costs will be addressed as necessary at the end of the project, w

SESWTF and KRP Integration (Items 1-5)

Description							
N/A							
	0	0	0	0	0	0	0

B. Equipment

Description							
N/A							
	0	0	0	0	0	0	0

C. Materials

D. Subcontractor

	Quantity	Unit	Price	Extension
Helix	1	LS	\$2,375,000.00	\$2,375,000.00
Supplemental Work Allowance*	1	LS	-\$100,000.00	-\$100,000.00
*Inc. on Coversheet				\$0.00
				\$0.00
				\$0.00
			Total Subcontract =	\$2,275,000.00



Helix Electric, Inc.

Constructors

Engineers

Date: September 2, 2016

Cost Estimate #: 181506-018

Revision:

To: Mr. Tony Mueller
W.M. Lyles Co.
1210 West Olive Dr.
Fresno, CA 93728

Job Number: 181506
Job Name: Fresno Southeast Surface Water
Treatment Facility

FCO#:

Ref.: RFP-005

DESCRIPTION

This cost estimate covers the request for proposal to provide the DPU/Water SESWTF and KRP SCADA and PLC Software Installation and Integration.

				TOTAL	
1) Total Labor	2) Material	3) Equipment	4) Unit Prices	5)	
479,166.00	-	-	-		479,166.00
				8)	
				9)	-
				10)	-
				11)	-
Small Tools and Consumables		0.00% of 5)		12)	-
SubTotal				13)	479,166.00
Markup- Contractor		20.00% of 1)		14)	95,833.20
		15.00% of 2),3),4)		15)	-
SUBCONTRACTOR DIRECT COSTS SUBTOTAL - (Sum of Above Lines)				16)	574,999.20
Totals Transferred from Sub-Subcontractor's Estimate of Direct Costs					
21) Total Labor	22) Material	23) Equipment	24) Lump Sum	25)	
-	-	-	1,800,000.00		1,800,000.00
				26)	-
				27)	-
				28)	-
SUB-SUB DIRECT COSTS SUBTOTAL - Sum of 25) through 29)				30)	1,800,000.00
Sub Markup on Sub-Sub Costs		0.00% of 30)		31)	-
				32)	-
TOTAL COST 16),30),31),32)				33)	2,374,999.20
Bond and Insurance Premium		of 33)		34)	-
Final Adjustment				35)	0.80
TOTAL COST 33),34),35)				36)	2,375,000.00

Notes:

- Extra work scope limited to those estimated herein.
- Time impact and delay costs excluded- to be measured and provided upon completion of impacted work

THIS PROPOSAL ONLY REFLECTS THE DIRECT COSTS FOR THIS ESTIMATE. HELIX ELECTRIC RESERVES THE RIGHT TO EXTENDED OVERHEAD, TIME EXTENSION, ACCELERATION, AND/OR ANY OTHER INDIRECT COSTS IMPOSED AS A RESULT OF THIS MODIFICATION. THE PRICE PROVIDED IS VALID FOR 30 CALENDAR DAYS FROM THE DATE BELOW.

I CERTIFY THAT (1) THE REQUEST FOR CHANGE IS MADE IN GOOD FAITH, (2) I HAVE REVIEWED ALL SUPPORTING DOCUMENTATION AND DATA, WHICH IS INCLUDED HEREWITH, AND IT IS ACCURATE AND COMPLETE, (3) I HAVE DETERMINED FROM MY INDEPENDENT REVIEW OF THE REQUEST FOR CHANGE THAT THE SAME IS MERITORIOUS, AND THAT THE AMOUNT AND/OR TIME EXTENSION REQUESTED ACCURATELY REFLECTS THE CONTRACT ADJUSTMENT FOR WHICH I BELIEVE OCSD IS LIABLE, AND (4) I AM DULY AUTHORIZED TO CERTIFY THE REQUEST FOR CHANGE ON BEHALF OF THE CONTRACTOR.


Joe White, Project Manager

09/02/16

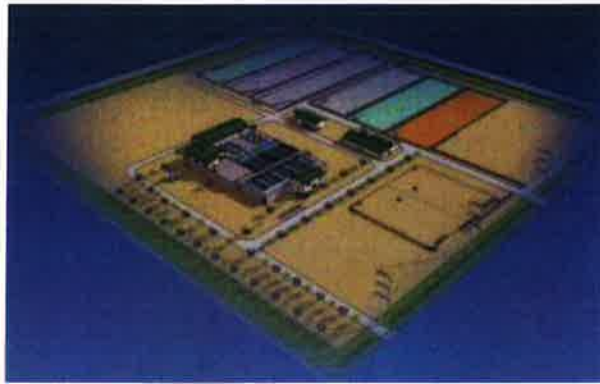
Date

HEI's Construction Estimate of Direct Costs

Total:				2.05		479,166.00		0.00		0.00			
No.	Item of Work	Qty	Unit	Labor				Material		Equlpt		Unit Prices	
				M.H. Per Unit	M.H. Total	Cost / M.H.	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost
1	Additional Project Management	1	LS	1.000	1.00	200,000.0	215,000.00		0.00				
					0.00		0.00		0.00				
3	Additional Commissioning	1	LS	1.000	1.00	150,000.0	264,166.00		0.00				
4					0.00		0.00		0.00				
5					0.00		0.00		0.00				
5					0.00		0.00		0.00				
6					0.00		0.00		0.00				
7					0.00		0.00		0.00				
8					0.00		0.00		0.00				
9					0.05		0.00		0.00				
10					0.00		0.00		0.00				
11					0.00		0.00		0.00				
13					0.00		0.00		0.00				
14					0.00		0.00		0.00				
15					0.00		0.00		0.00				
16					0.00		0.00		0.00				
17					0.00		0.00		0.00				
19													
20													
21	Taxes for above (8.225%)	1	Lot		0.00		0.00	0.00	0.00		0.00		0.00

Sub-Subcontractor's Construction Estimate of Direct Costs

Total:				0.00				0.00				0.00				1,800,000.0	
No.	Item of Work	Qty	Unit	Labor				Material		Equipt		Lump Sum				Unit Cost	Total Cost
				M.H. / Per Unit	M.H. Total	Cost / M.H.	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost		
1	Technical Systems Inc	1	LOT		0.00		0.00		0.00		0.00		0.00	1,800,000.00	1,800,000.0		
2			LOT		0.00		0.00		0.00		0.00		0.00				0.00



**Priced Request for Proposal for
DPU/WATER SESWTF AND KRP SCADA and
PLC Software Installation and Integration**

By:

Technical Systems, Inc.

Irvine, CA

Dixon, CA

Lynnwood, WA

September 2, 2016



September 2, 2016

Helix Electric
Attn: Joe White



Re: Priced Request for Proposal----
DPU/WATER SESWTF AND KRP SYSTEM INTEGRATION

Dear Mr. White,

Technical Systems, Inc. (TSI) submits this Request for Proposal for the Integrator to provide System Programming for the Southeast Surface Water Treatment Facility and the Kings River Pipeline . We believe Technical Systems, Inc. (TSI) more than meets all of the eligibility criteria that may be desired by the City including:

1. TSI has been a System Integrator on the West Coast for 46 years with strong experience in Water and Wastewater treatment. This experience includes system integration, design, communications, programming, startup and commissioning services with experience in Modicon PLC Unity Pro programming and Citect SCADA. In fact TSI is a Certified Schneider SI Alliance partner. TSI is a registered Engineering Corporation and has several licensed Professional Engineers on staff including staff registered in California. TSI has averaged approximately 50 employees over the last 5 years.
2. TSI is experienced with redundant PLC and HMI systems.
3. TSI has completed several SCADA/control projects of similar size and scope and this experience is reflected on the following pages. TSI has never been removed from a project due to performance, failure to meet project milestones, or any other issue.
4. **TSI is CSIA Certified!!** TSI is also able to bond up to \$15 million on a single project.
5. TSI has a fully staffed 24/7 service department operating 365 days a year. Our service department operates out of our Yorba Linda office and our Lynnwood headquarters. This service department handles all warranty and out of warranty calls with a 4 hour response time. All of our engineers are also on call to handle any SCADA, HMI or PLC software issues.

Please review the attached proposal. TSI looks forward to being the System Integrator for the Southeast Surface Water Treatment Facility and the Kings River Pipeline Projects.

Thank-you.

Sincerely,

Gary Conley, P.E.
Chief Executive Officer
Technical Systems, Inc.
(425) 678-4112 (direct line)
(425) 775-9074 (fax)
garyc@tsicontrols.com

Lynnwood, WA Dixon, CA Irvine, CA

Leadership in Control Systems for Over 45 Years



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TSI approaches every project individually with a team of engineers, programmers, and technicians that is dedicated to support the project from start to finish. The roles and time commitments of each team member are defined at the beginning of the project in order to provide the necessary expertise and project support to assure the project can be completed on time and in an efficient and thorough manner. For this project, the TSI team will consist of a project manager, lead programmer, programming team, network engineer, and administrative support staff. The project manager leads the project team and handles the primary coordination and communications with the customer, contractors, and equipment suppliers.

The size and complexity of the City of Fresno DPU/Water SESWTF and KRP System Integration project will require a highly experienced programming team who will be dedicated to this project through project completion. The TSI programming team is well versed in providing advanced PLC and SCADA software applications for water and wastewater treatment facilities with specific focus on customer coordination while developing software standards, tag naming conventions, and network integration. We strive to deliver a product that suites the customer's preferences as well as meeting all specifications. Our team has extensive experience with water treatment plant operations, redundant SCADA systems, VMWare virtualization, Modicon Unity programming, network enabled smart devices including MCCs, VFDs, soft starters, smart overloads, circuit breakers, instrumentation, and valve actuators. Coordination with equipment suppliers to provide a complete integrated plant control system is common on most large projects and we have great experience and success in working through database, graphics, control strategy, and testing coordination with other suppliers.

The Vijeo CitectSCADA software is a product that we have only a small amount of experience with, consequently we are committed to putting our lead programmers through Citect training and achieving the VCCP/VCCE certifications within four months of project kickoff. In addition, as a Schneider SI Alliance Partner we have 24/7 access to Schneider technical support and product experts. TSI has always committed to ongoing training for our staff and certifications to show our product expertise in software, instrumentation, networking, and motor control. We currently hold certifications in related software products: Wonderware SCADA and Historian software, Rockwell FactoryTalk HMI, Historian, PlantPAx, and VantagePoint software, Cisco networking CCENT and CCNA. We are also a Schneider SI Alliance Partner and VMware Solution Provider.

Project Experience

The logo for TSI (Technical Systems International) is located in the top right corner. It consists of the letters "TSI" in a white, serif font, centered within a dark blue square.

The following list of projects show our extensive experience with the criteria listed in SOW Section 5. Project details and customer contact information are listed on the following pages.

- Minimum of 7 years verifiable experience with water treatment plant automation using PLCs:
 - City of El Paso de Robles WTP (2014-2015)
 - Holden Mine WTP (2015-2016)
 - San Luis Unit Drainage Treatment Plant (2013-2016)
 - City of Longview Mint Farm Regional WTP (2011-2013)
 - Valley Water District View Royal WTF (2008-2009)
 - City of Lacey Hawks Prairie WTF (2007-2008)
 - Seattle Public Utilities Cedar WTF (2002-2005)
 - City of Escondido Vista WTP (2015-Present)
 - City of Oceanside Robert A. Weese WFP (2016-Present)
 - Santa Clara Valley Water Rinconada WTP (2015-Present)
- Minimum of 3 projects performed for water and/or wastewater facilities over the past 7 years, each with a minimum of 1000 combined hard and/or digital IO points.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - Inland Empire Utilities Agency Carbon Canyon WRF (2015-2016)
 - City of Thousand Oaks Hill Canyon WWTP (2014-2016)
 - William J. Hernandez Sport Fish Hatchery (2010-2011)
 - City of Visalia WWTP (2014-Present)
- Minimum of 3 projects performed over the past 7 years involving the integration and configuration of digital bus networks and digital bus enabled equipment.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - City of Visalia WWTP (2014-Present)
 - City of Thousand Oaks Hill Canyon WWTP (2014-2016)
 - King County Brightwater Influent Pump Station (2007-2011)
 - Picnic Point WWTP (2008-2012)
- Minimum of 3 projects performed over the past 7 years involving the deployment of redundant HMI SCADA servers.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - Inland Empire Utilities Agency Carbon Canyon WRF (2015-2016)
 - City of Visalia WWTP (2014-Present)
 - City of Thousand Oaks Hill Canyon WWTP (2014-2016)
 - Picnic Point WWTP (2008-2012)

Project Experience



- Minimum of 2 projects performed over the past 7 years involving the programming and deployment of a virtualized SCADA system.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - Inland Empire Utilities Agency Carbon Canyon WRF (2015-2016)
 - City of Thousand Oaks Hill Canyon WWTP (2014-2016)
 - City of Visalia WWTP (2014-Present)
 - Joint Base Lewis-McChord WTP (2015-2016)

- Minimum of 2 projects performed over the past 7 years involving the integration and configuration of network enabled MCCs with programmable overload starters.
 - King County Brightwater Influent Pump Station (2007-2011)
 - Holden Mine WTP (2015-2016)
 - Picnic Point WWTP (2008-2012)
 - PacifiCorp Swift and Merwin Fish Facilities (2011-2013)

- Minimum of 2 projects performed over the past 7 years involving the integration and configuration of digitally networked valve actuators.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - King County Brightwater Influent Pump Station (2007-2011)
 - Picnic Point WWTP (2008-2012)
 - City of Visalia WWTP (2014-Present)
 - PacifiCorp Swift and Merwin Fish Facilities (2011-2013)

- Experience programming and deploying redundant SCADA systems.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - Inland Empire Utilities Agency Carbon Canyon WRF (2015-2016)
 - City of Visalia WWTP (2014-Present)
 - City of Thousand Oaks Hill Canyon WWTP (2014-2016)
 - Picnic Point WWTP (2008-2012)

- Experience programming and deploying redundant SCADA Historian systems.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - Inland Empire Utilities Agency Carbon Canyon WRF (2015-2016)
 - City of Thousand Oaks Hill Canyon WWTP (2014-2016)



Project Experience

- Minimum of 4 years of programming experience with Modicon Unity based PLCs using the IEC61131-3 function block programming language.
 - Riverside Regional WWTP (2013-2016)
 - City of Kirkland Water System (2012-2016)
 - PacifiCorp Swift and Merwin Fish Facilities (2011-2013)
 - City of Oceanside Robert A. Weese WFP (2016-Present)
 - Santa Clara Valley Water Rinconada WTP (2015-Present)
- Minimum of 3 years of experience implementing virtualization systems in an automation environment.
 - City of Tacoma Process Control System Upgrade (2014-2016)
 - Inland Empire Utilities Agency Carbon Canyon WRF (2015-2016)
 - City of Thousand Oaks Hill Canyon WWTP (2014-2016)
 - Joint Base Lewis-McChord WTP (2015-2016)

Project Profiles

Inland Empire Utilities Agency Carbon Canyon Water Recycling Facility Upgrade

- Location: Chino, CA
- Contact Information: Gary Dix, 909-993-1670
- Description: TSI was selected by the Agency as the Prime Contractor/Systems Integrator for phase 1 of their SCADA Upgrade. TSI was involved in the hardware integration, panel fabrication (5 control panels) and programming of the Carbon Canyon Water Recycling Facility SCADA Enterprise System. This project replaced an existing Foxboro DCS system with Rockwell Automation's PlantPax platform which incorporates ControlLogix PLC's, Factory Talk SE, PlantPax objects as well as High Performance HMI standards. In addition to the control system upgrade, TSI installed an Enterprise Server backbone which provides a framework for future Agency water recycling treatment plant expansions.

Riverside Regional Wastewater Treatment Plant

- Location: Riverside, CA
- Contact Information: Steve Amsden, 951-351-6185
- Description: This project was for the expansion and upgrade to this large wastewater treatment plant. TSI handled the software and hardware integration for the project including the supply of over 300 instruments and 30 control panels. The control panels utilized Modicon PLCs programmed with Unity Pro software. The integration was performed and started up in an operating facility over many different phases, which was coordinated closely with operations staff. TSI also completed all commissioning and training of software and hardware.

City of Tacoma Process Control System Upgrade

- Location: Tacoma, WA
- Contact Information: Jeff McVicker, 253-502-2152
- Description: TSI was the prime contractor and systems integrator for this \$11,000,000 plant wide control system upgrade. The project consisted of replacement and upgrade of the existing ABB distributed control system (DCS) with Rockwell PlantPAx systems at the city's two wastewater treatment plants. TSI fabricated, installed, and programmed 22 PLC control panels and 32 Remote-IO panels as well as integrating 27 existing vendor control panels. Extensive Profibus-DP and Profibus-PA instrumentation and over 90 Rotork Profibus-DP intelligent valve actuators were also upgraded during the project and integrated into the PLC systems. A new fiber optic network communications backbone was installed with 18 new network communication cabinets to provide plant wide control system and business system networks. New server racks were supplied and installed at both plants with the PlantPAx software platform, Historian, VantagePoint, and AssetCentre software in a virtualized system. 5 operator workstations and 45 thin clients were installed across the two plants to complete the SCADA system. As operating treatment plants, TSI was responsible for close coordination with city staff to plan and schedule cutover from the existing DCS system to the new PlantPAx system for each process area while maintaining plant operation throughout the project. The new system provides the plant operators with visualization of the plant processes with extensive operational data, reports, and trends to allow optimization of the process on a continuous basis.

City of Visalia WWTP

- Location: Visalia, CA
- Contact Information: Jeff Misenhimer, 559-713-4465
- Description: This current project involves the instrumentation and controls upgrade to an operating wastewater treatment plant. This project includes multiple PLCs and a redundant SCADA system utilizing Wonderware HMI and Historian software. The system also integrated multiple intelligent valve actuators on Profibus-DP networks. TSI is performing all PLC and HMI programming services. TSI is also completing all detailed control panel design, instrumentation and control panel supply, calibration, commissioning, and training services.

City of El Paso de Robles Water Treatment Plant

- Location: Paso Robles, CA
- Contact Information: Mike Maaser, 805-237-3867
- Description: This project included the instrumentation and controls upgrade to an operating wastewater treatment plant. This project utilized Allen-Bradley CompactLogix PLCs and Wonderware HMI and Historian software. TSI performed all PLC and HMI programming services including the integration and coordination of several vendor packaged systems. TSI supplied over 50 instruments, 5 control panels, SCADA servers, workstations, software, and networking equipment and performed calibration, commissioning, and training services for the complete I&C system

Picnic Point Wastewater Treatment Plant

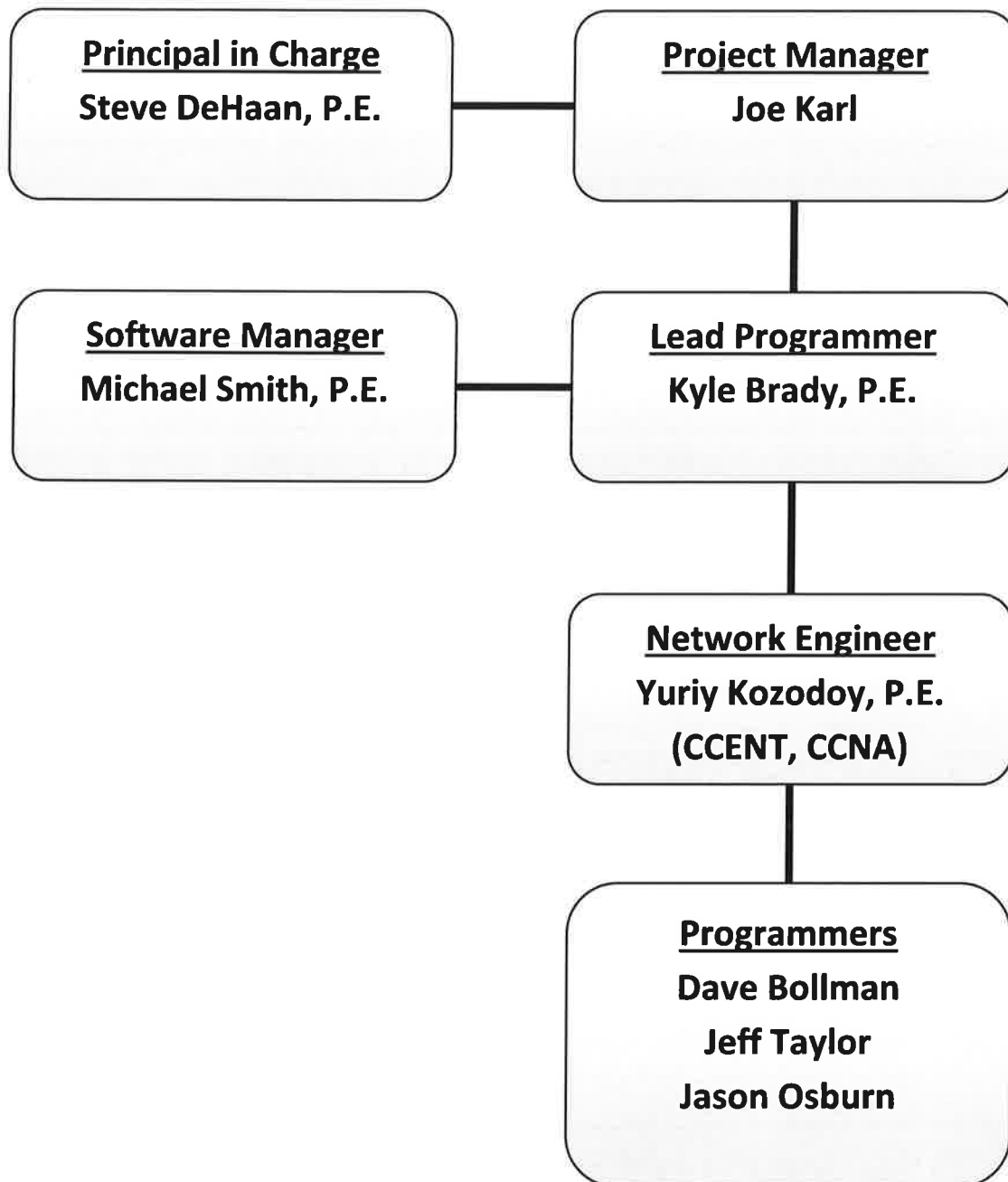
- Location: Lynnwood, WA
- Contact Information: Tom Wilkie, 425-787-1940 ext. 8311
Email: twilkie@awwd.com
- Description: A major SCADA and controls upgrade and expansion project utilizing five 5 new PLC panels, with over 1,800 hard-wired and soft I/O points. Networks used in this project included Ethernet/IP, DeviceNet, and Foundation Fieldbus. In addition to the Allen-Bradley PLCs and PanelViews used, TSI provided intelligent MCCs and supplied and programmed Redundant Proficy iFIX HMI Servers, iFIX Historian, and multiple SCADA Clients. The PLC system interfaced with intelligent MCC's, networked valve actuators, building control systems, and a vendor packaged MBR system.

Brightwater Wastewater Treatment Plant Influent Pump Station

- Location: Bothell, WA
- Contact Information: Randy Geist, 206-477-5579
- Description: For this major wastewater pump station, TSI supplied the control panels, instrumentation, programming, and commissioning. This project utilized twelve (12) Allen-Bradley ControlLogix PLCs that were supplied and programmed by TSI. TSI also was responsible for coordination and communication programming with eight (8) vendor supplied PLCs for process control interlocks, monitoring, and data collection. In addition TSI programmed seven (7) offsite remote stations that communicated back to the plant over a wide area fiber optic backbone network to provide regional control of the entire wastewater system for flow control, storage, and diversion for the Brightwater WWTP system. There were approximately 5000 I/O points including soft I/O points for the facility control system. Networks used on this project were Ethernet/IP, Foundation Fieldbus, ControlNet, DeviceNet, Modbus, and Modbus/TCP. The PLC system interfaced with intelligent MCC's, medium voltage VFDs, networked valve actuators, building control systems, and a paralleling switchgear system with three generators. In addition to the Allen-Bradley PLCs, TSI supplied and programmed PanelView Plus OITs. The client supplied the Emerson Ovation DCS system, and TSI had to coordinate all of the database points between the PLCs and DCS for graphics, controls, alarms, and historian data. Emerson Ovation Process Historian was used for the Historian.

Technical Systems, Inc (TSI)

Project Staffing Organization Chart



Steve E. DeHaan, P.E.

PRINCIPAL IN CHARGE

RESPONSIBILITIES

Mr. DeHaan has extensive experience in municipal wastewater and water projects. He has experience in control system conceptual, preliminary and final design, system integration, start-up, operator training, application software development and documentation of programmable logic controller PLC and personal computer-based monitoring systems for in-plant and supervisory control and data acquisition (SCADA) control systems. He has experience in programming Citect SCADA systems, Wonderware HMI, and Allen-Bradley and Modicon PLCs. Mr. DeHaan also has experience with DeviceNet, ControlNet, Foundation Fieldbus and fiber optic Ethernet networks.

Education

B.S. Mechanical
Engineering, University
of Washington

Instrumentation &
Control Electronics
Certificate, J.M. Perry
Technical Institute,
Yakima, Washington

Registration

Control System
Engineer

PROJECT EXPERIENCE

Cedar Treatment/Lake Youngs Water Treatment Plant Upgrade, Seattle Public Utilities, Seattle, WA

As part of a design/build team, Mr. DeHaan was the project superintendent and project manager in this major upgrade of a Seattle water plant (surface water treatment). Mr. DeHaan worked closely with the design team and the contractors to complete the integration of the I&C system. Mr. DeHaan also had to work with SPU's Operations Group closely so that the production of water is not stopped during upgrade of this existing facility. In addition to design, programming assistance, Mr. DeHaan also managed the supply of all field instrumentation, control panels, startup and training.

Anchorage Water and Wastewater Utility, Anchorage, Alaska

Mr. DeHaan designed, programmed, and implemented A-B PLC based RTUs and modification of the Utility's HMI screens for the RTUs. Each PLC involved pump control, communications protocol programming, and power failure scenario programming. Work also included startup services and training of Utility personnel.

Brightwater Influent Pump Station, Bothell, WA

For this large wastewater pump station project, Mr. DeHaan was responsible for the project management and overall detailed design and programming of this new control system. This new system involved Allen-Bradley ControlLogix PLCs, instrumentation, and interface to Emerson DCS system. Mr. DeHaan also coordinated all startup, commissioning, and training services.

Joe Karl

PROJECT MANAGER

RESPONSIBILITIES

Mr. Karl will be assigned the **Project Manager for the City of Fresno DPU/WATER SESWTF AND KRP SYSTEM INTEGRATION**. Mr. Karl serves as a Project Manager with experience in municipal and industrial wastewater and water projects. He has experience in control system conceptual, preliminary and final design, system integration, radio systems, start-up, operator training, application software development and documentation of programmable logic controller (PLC) and personal computer-based monitoring systems for in-plant and supervisory control and data acquisition (SCADA) control systems.

PROJECT EXPERIENCE

Joint Base Lewis McCord, Tacoma, WA

Mr. Karl is the Project Manager for the upgrade to 2 wastewater treatment plants on this military base. Mr. Karl is responsible for all scheduling, coordination, and communications for the TSI team with the government employees.

Tacoma WWTP, Tacoma, WA

Mr. Karl was the Project Manager for this \$10 million SCADA system that involved the supply of instrumentation and controls and programming of all systems using A-B Plant PAX software to the Northend plant and the Central Plant. Mr. Karl was responsible for supervising subcontractors, scheduling, working with Operations and Maintenance staff, and supervising the work of TSI employees on this large project. The project is only a few months away from completion.

Douglas County Wells Hatchery, Douglas County, WA

For this SCADA project, Mr. Karl was responsible for the project management, hardware design, supervising TSI designers and programmers, startup, and testing. Mr. Karl also worked closely with the electrical contractor for all installation services,

Education

B.S. Informational Technology and Project Management, Central Washington University, Ellensburg, WA

Certificate in Industrial Controls Technology, Perry Institute, Yakima, WA



Kyle Brady

LEAD SOFTWARE PROGRAMMER

RESPONSIBILITIES

Education

B.S. Electrical
Engineering, University
of Washington

As a Senior Engineering Team member Mr. Brady is responsible for system integration, start-up, operator training, application software development, testing, and documentation. Mr. Brady is experienced in all PLC platforms and is a HMI expert. Included with his HMI experience is expertise in Factory Talk/RS View. For his Wonderware expertise, Mr. Brady is certified in System Platform, Historian, and InTouch. Mr. Brady also has experience with SQL, VS.net, Visual Basic, Java, and Ladder and Function Block logic.

EXPERIENCE

Water/Wastewater

As a Project Engineer, Mr. Brady designed, installed, and participated in the programming, startup and support for PLC, HMI, and DCS applications for various processes in water and wastewater facilities. These facilities include Visalia WWTP, Los Osos WWTP, Paso Robles WWTP, and Joint Base Lewis McCord Water Plant. Mr. Brady also assisted in the development of long term SCADA Master Plans. Mr. Brady implemented a remote server-based training and programming environment for engineers.

Kimberly-Clark Corporation

Mr. Brady redesigned Logic and Visualization for product sorting Control system. Developed a SQL database and trained others to utilize it to track mobile equipment information. Retrofitted high-speed converting equipment to as part of an update to newer PLC Controllers. Worked on a team with technicians to assemble and fabricate electrical equipment. Designed and implemented safety circuit tests for Materials Handling automation equipment.

Michael J. Smith, PE

SOFTWARE MANAGER

RESPONSIBILITIES

Mr. Smith also has a wide variety of experience in the programming of operator interfaces including Wonderware, RSView, PanelView, and Maple Systems. Mr. Smith is an expert in Allen-Bradley and Modicon PLC design and programming and has heavy experience in wastewater treatment instrumentation and control, and specializes in network design and Ethernet fiber optic communications. Mr. Smith's experience also includes testing and start-up activities. Additionally, as with other TSI engineering team members, he is responsible for maintaining good client communications and relations and assisting and providing cross training to other team members.

Education

Electrical
Engineering, Auburn
University

License: Professional
Engineer, State of
Washington, #39442

PROJECT EXPERIENCE

- **Snohomish County PUD Water System Infrastructure SCADA project.**
Everett, Washington – As part of a major SCADA repair, Mr. Smith is responsible for all Allen-Bradley PLC RTU and HMI programming, testing, startup activities. This on-call contract involved repair to a complex water SCADA system program and fine tuning of the RTU programming. In addition, the entire programming, instrumentation, and VFD's for the Machias Pump Station were performed as a separate contract.
- **City of Friday Harbor Waste Water Treatment Plant**
Friday Harbor, WA – Mr. Smith was responsible for all PLC and HMI programming, testing, and startup activities for the control of the phase I upgrades of the WWTP. The work also included all instrumentation for this upgrade.
- **City of Aberdeen Waste Water Treatment Plant**
Aberdeen, WA – Mr. Smith was responsible for all PLC and HMI programming, testing, and startup activities for the control of this entire WWTP. The work also included all instrumentation for the plant.
- **City of Florence Waste Water Treatment Plant**
Florence, Oregon – Mr. Smith was responsible for all PLC and HMI programming, testing, and startup activities for the control of this entire WWTP. The work also included all instrumentation for the plant.

Dave Bollman

PROJECT ENGINEER/SOFTWARE ENGINEER

Education

B.B.A Management
Information Systems,
University of New
Mexico

RESPONSIBILITIES

Mr. Bollman serves as a Project Engineer and Programmer with experience in municipal and industrial wastewater and water projects. He has experience in control system conceptual, preliminary and final design, Ethernet SCADA radio communications, instrumentation, low voltage and medium voltage systems, system integration, start-up, and operator training. He has heavy experience in variable frequency drives, programming of WIN CC, and RS View HMI along with strong experience with Siemens, Allen-Bradley, and Modicon PLCs.

PROJECT EXPERIENCE

Port Angeles Water Treatment Plant, Port Angeles, WA For this water treatment plant, Mr. Bollman designed, programmed, and implemented new PLC's using Profinet and Profibus protocols for communication and control of the several processors and many devices in the system. Mr. Bollman also programmed the **1200+ I/O point** HMI system incorporating an interface with the City's existing control system and HMI. Report generation was also configured by Mr. Bollman.

Lynden Water System SCADA Upgrade, Lynden, WA For this complex water system, Mr. Bollman designed, programmed, and implemented new A-B PLC's, power monitoring, MCCs, and VFDs to a treatment plant built in 1925 incorporating **over 1200 I/O points**. Mr. Bollman also designed and implemented modifications to remote pumping stations, programmed the telemetry utilizing Ethernet radios in these stations and tested the system during startup. Alarm software, report generation and remote access were also configured by Mr. Bollman.

Skyway Water and Sewer District, Seattle, WA

For various pumping stations, Mr. Bollman designed and programmed the telemetry and controls. Mr. Bollman completed the HMI and PLC programming, startup, and testing. In addition, Mr. Bollman configured Ethernet radio communications and also completed the detailed design of the pump station MCCs and VFDs and provided training of the new controls.

Jason Osburn

SOFTWARE PROGRAMMER

RESPONSIBILITIES

As an Engineering Team member, Mr. Osburn is responsible for control system programming, testing, documentation, and startup. Mr. Osburn is an expert in Modicon PLC programming and has past experience in Citect HMI software. He also has experience in a multitude of other PLC and HMI platforms including Allen-Bradley, Siemens, and GE processors. Mr. Osburn's experience in HMI besides Citect include Wonderware, FactoryTalk, and iFIX.

PROJECT EXPERIENCE

Kitsap County WWTP, Bremerton, WA

As the Project Engineer, Mr. Osburn was responsible for programming of the PLCs and the SCADA system and responsible for network design. Mr. Osburn completed all phases of startup, training, and documentation.

Escondido Vista Water Treatment Plant, Escondido, CA

Mr. Osburn was the lead programmer in this complex water treatment plant. Mr. Osburn programmed the A-B Compact Logix PLCs and configured the Wonderware HMI. Mr. Osburn also programmed the Historian and set up trending screens for the Operations staff. In addition, Mr. Osburn completed all training of City staff on the PLC and HMI platforms.

MicroTech Designs, Hampstead, MD

Mr. Osburn programmed Allen Bradley, Modicon, Siemens, and GE controllers. He also developed HMI packages using Wonderware, Citect, Quickpanel, Intellution, and Square D Magelis.

Mr. Osburn commissioned and troubleshot a wide range of communications protocols including Modbus, Modbus Plus, Modbus Ethernet, Devicenet, DH+, DH485.

Education

Bachelor of Science, Chemical Engineering, University of Alabama

Jeff Taylor

SOFTWARE PROGRAMMER AND FIELD ENGINEER

RESPONSIBILITIES

As an Engineering Team member, Mr. Taylor is responsible for control system programming, testing, documentation, and startup. Mr. Taylor also has experience in PLC and HMI programming, specializing in Modicon and Allen-Bradley. Mr. Taylor also provides water resource services supporting the design, fabrication and deployment of controls and instrumentation for Potable & Non-Potable Water Production, Storage & Distribution, Water & Wastewater Treatment Pumping Facilities, Cogeneration & Solar Power Production, Water Quality and Environmental Monitoring, and Recreational Aquatic Facilities

PROJECT EXPERIENCE

Riverside WWTP, Riverside, CA

As the Project Engineer, Mr. Taylor was responsible for programming Modicon PLCs utilizing Unity Pro software at this large complex expansion of a WWTP. Mr. Taylor completed startup and training activities during the different phases of plant construction. In addition, Mr. Taylor worked closely with Operations to make sure each phase was started up in a timely manner and did not affect other operations of the existing plant.

Santa Fe Irrigation District, Rancho Santa Fe, CA

Mr. Taylor programs the control system and supports the long term maintenance of the water plant for this water district. Mr. Taylor troubleshoots control issues, trains personnel, and calibrates instrumentation as part of a maintenance program.

JWC Environmental, Santa Ana, CA

Mr. Taylor programmed PLC and OIT platforms for the control and interface of the grinder systems (Muffin Monster), augers, washer/compactor systems and screenings systems built by the company for the wastewater industry. PLCs used included Panasonic FPX, Allen Bradley MicroLogix 1400, 1500, and 1100s, SLC500 PLC, ControlLogix PLC, CompactLogix PLCs and PanelView OITs, RedLion OITs and Beijer IX panels. Other PLCs specified by customers included GE RX3i PAC, Modicon PLCs and PACs using ProWorks32 and Unity Pro software. We also used Siemens S7-200 PLCs and the STEP 7 Micro/WIN software and were migrating to the S7-1200 using the TIA Portal software.

Education

Associate of Science Water Utility Science: Water
Distribution
Santiago Canyon College

Associate of Science Computer Information Systems
Orange Coast College



Yuriy Kozodoy, P.E.

NETWORK ENGINEER

RESPONSIBILITIES

As an Engineering Team member, Mr. Kozodoy is responsible for control system design, testing, documentation, and startup. Mr. Kozodoy also has experience in PLC and HMI programming, specializing in Allen-Bradley. Mr. Kozodoy also has experience in setting up and configuring Cisco routed networks with VPN secure remote access. Mr. Kozodoy is CCENT and CCNA certified.

PROJECT EXPERIENCE

Boeing Mather Field, Rancho Cordova, CA

As the Project Engineer, Mr. Kozodoy was responsible for hardware design and the programming of the A-B PLCs, SCADA and operator interfaces. As part of this large EPA Superfund ground water contamination site, Mr. Kozodoy also completed some training, setting up VPN for remote access and startup activities working closely with Boeing's operation group.

Anacortes, Wastewater Treatment Plant, Anacortes, WA

Mr. Kozodoy was a control system engineer for projects at the Anacortes WWTP and some pump stations, where he was responsible for the design of control systems and the programming of the A-B PLC and Human Machine Interface software. Mr. Kozodoy completed all testing, startup activities.

Umpqua Basin Water Association Water Treatment Plant, Roseburg, OR

As part of the engineering team, Mr. Kozodoy was a field engineer for the Umpqua WTP completing the detailed plant and office network implementation, programming network devices and VPN for remote access, and performing all startup, field instruments calibrations, commissioning and training activities for this treatment plant expansion. Work also included Mr. Kozodoy modifying the plant's existing HMI application.

Education

B.S. Electrical Engineering, Murmansk Technical University

Registration

Electrical Engineering

Schneider Electric

Alliance Integration Partnership Certificate

Technical Systems, Inc.

is a valued
Alliance Integration Partner with
Schneider Electric

On the scope of
PlantStruxure Controls
PlantStruxure SCADA

Partnership number

SEAP1437US

Valid through

June 30, 2017

Authorized by

System Integrator
Channel Manager



System Integrator
Alliance Program Director



Life Is On



Technical Systems, Inc.

has been audited and conforms to all requirements necessary to be a

CERTIFIED MEMBER

of the

CONTROL SYSTEM INTEGRATORS ASSOCIATION

April 4, 2014 – April 4, 2017

Robert Lowe, CSIA Executive Director

CSIA Member Since: 2012

Lynda Patterson, FASAE, C

CSIA Certified Si

Proposal Pricing



Cost Item 1: Project Management, Coordination and Meeting	<u>\$255,000.00</u>
Cost Item 2: PLC & SCADA Programming Standards	<u>\$40,000.00</u>
Cost Item 3: System Integration Programming (SESWTF & KRP)	<u>\$770,000.00</u>
Cost Item 4: Testing & Startup (SESWTF & KRP)	<u>\$540,000.00</u>
Cost Item 5: City Training and O&M Manuals (SESWTF & KRP)	<u>\$95,000.00</u>
Cost Item 6: Supplemental Services Allowance	<u>\$100,000.00</u>

Total Cost Amount: \$1,800,000.00

One Million Eight Hundred Thousand Dollars and Zero Cents



Request for Proposal

City of Fresno Southeast Surface Water Treatment Facility

**REQUEST FOR PROPOSAL
No. 005**

TO:	W.M. Lyles Co. 42142 Roick Drive Temecula, CA 92590	DATE:	08/23/2016
ATTENTION:	Tony Mueller	CAROLLO W.O. NO:	9279A.21
SUBJECT:	DPU/Water SESWTF and KRP System Integration	REFERENCE DWG:	See Attached
		REFERENCE SPEC SECTION:	See Attached
		RFP NO:	005
		REF DOC NO:	N/A

Dear Tony Mueller:

Attached is the system integration services scope of work for the City of Fresno's Southeast Surface Water Treatment Facility and Kings River Pipeline projects, including applicable project drawings and specifications. Please provide a proposal for incorporating the additional scope of work into the contract.

Please contact us if you have questions or need additional information.

Sincerely,

CAROLLO ENGINEERS, INC.

Ben Carlisle

Enclosures:

- DPU/Water SESWTF and KRP System Integration Scope of Work
- SESWTF Drawings
- SESWTF Specifications
- Kings River Pipeline Drawings
- Kings River Pipeline Specifications

cc: Randy Hoffman

SCOPE OF WORK

DPU/WATER SESWTF AND KRP SYSTEM

INTEGRATION

City of Fresno, California

1. INTRODUCTION

The City of Fresno, Department of Public Utilities/Water Division (City) is currently seeking proposals from a Control Systems Integrator (Integrator) to perform system integration services for the Southeast Surface Water Treatment Facility (SESWTF) and the Kings River Pipeline (KRP).

The SESWTF and KRP projects are currently in construction. The two projects will be constructed by two different general contractors. The integration services will include correspondence and coordination with both contractors throughout the construction periods.

The integration services will be provided through a standalone contract with the City and independent of the contracts that the City will execute with the general contractors for construction of the SESWTF and KRP.

The Cost Proposal Form identifies six (6) Cost Items that comprise the Total Cost Amount. Following is a general description of the Cost Items:

Cost Item # 1 – Project Management, Coordination, & Meetings: The scope of this cost item includes the management of the project as defined in Scope of Work (SOW) Sections 3, 6, and 9 as well as any other SOW tasks not specifically included in Cost Items # 2 through # 5. It also includes the cost of insurance and other General Condition requirements.

Cost Item # 2 – PLC & SCADA Programming Standards: The scope of this cost item includes the development of programming standards as defined in SOW Section 5. These standards will serve as the basis for all PLC and SCADA programming associated with the SESWTF and KRP and shall be written so that they can serve as a City Water Division standard for future projects.

Cost Item # 3 -- System Integration Programming (SESWTF & KRP): The scope of this cost item includes the integration programming as defined in SOW Sections 7 and 8.

Cost Item # 4 -- Testing & Startup (SESWTF & KRP): The scope of this cost item includes the testing and startup services as defined in SOW Section 10.

Cost Item # 5 -- City Training and O&M Manuals (SESWTF & KRP): The scope of this cost item includes the training of City staff as defined in SOW Section 11.

Cost Item # 6 -- Supplemental Services Allowance: The scope of this cost item is Supplemental Services that are not specifically defined in Sections 1 through 11 and are not General Condition requirements.

Partial Payments will be made based on status of deliverables according to the Major Milestone Schedule provided in Section 2 of this SOW.

2. OVERVIEW OF THE SCOPE OF WORK

The integration services scope of work shall consist of the following:

- Development of PLC and SCADA software standards for the City. These standards will be utilized throughout construction of the SESWTF and KRP and will be written so that they can serve as a City standard for future projects.
- Development of new Vijeo CitectSCADA V.7.2 SP3 or newer SCADA software and the latest version of Modicon's Unity Pro PLC software to implement the process control and monitoring requirements of the SESWTF and KRP facilities. The Vijeo CitectSCADA and Modicon Unity Pro PLC integration shall include, but is not limited to development of all SCADA screens, historian database, I/O trending, alarm database, reporting, and active operator messaging (alarm paging/texting).
- Configuration of all the SESWTF and KRP communication networks including but not limited to the PLC, SCADA, business, actuator, motor control center, and electrical distribution networks.
- Configuration of all SESWTF and KRP computer equipment including but not limited to laptops, workstations, operator interface terminals, printers, servers, switches, network storage devices, and network security appliances.

All SCADA software and associated licenses for the facilities will be purchased by the City. The Integrator shall make a recommendation to City staff on what software is required for the SESWTF and KRP facilities. The Water Division will then purchase the required software and licenses under a separate contract.

All SCADA, PLC, instrumentation, networking, and computer hardware will be purchased by the SESWTF and KRP Contractor. The Integrator will make a recommendation to the SESWTF and KRP Contractor on required hardware based on the construction drawings and specifications for construction of the SESWTF and KRP (SESWTF and KRP Contract Documents). The SESWTF and KRP Contractor will then purchase the required hardware as a part of their construction contract.

The integrator will be responsible for coordinating with the SESWTF and KRP contractor to develop a schedule for delivery of major project milestones in accordance with the SESWTF and KRP Specification Section 01324A. After each milestone is completed, the integrator shall present the completed milestone work product to City of Fresno Water Division Project Manager. The integrator is required to have the City sign off before continuing with the next phase. Major Milestones and the associated absolute deadlines are shown in the following table:

MAJOR MILESTONE SCHEDULE

Activity	Major Milestones	Activity Completion Date
1	Project Kickoff	Aug 22, 2016 (See Note 1)
2	Preliminary Programming Standards Planning Meeting	Aug 22, 2016 (See Note 1)
3	SCADA Equipment Review Meeting	Aug 22, 2016 (See Note 1)
4	Secondary Programming Standards Planning Meeting	Aug 29, 2016
5	Delivery of PLCs and SCADA hardware to the Integrator	Sep 09, 2016
6	Preliminary System Configuration Meeting	Oct 09, 2016
7	Intermediate System Configuration Meeting	Dec 08, 2016
8	Final System Configuration Meeting	Jan 07, 2016
9	Software Acceptance Test	Mar 06, 2017
10	Delivery of PLCs and SCADA hardware to the Factory Acceptance Test Site	Mar 20, 2017 (See Note 2)
11	Factory Acceptance Test (performed at panel builders shop)	May 16, 2017
12	Loop Check/Validation (performed in coordination with Contractor)	Dec 16, 2017
13	Pre-Commissioning or Functional Test (including control logic operational validation and loop tuning)	Feb 19, 2018 (See Note 2)
14	Staff Training	Mar 12, 2018
15	O&M Submittal (including delivery of all software licenses)	Jan 22, 2018
16	Substantial Completion	Jun 28, 2018
17	Final Completion	Sep 25, 2018

Notes: 1) Activities 1, 2, 3, 16, & 17 are Required Activity Completion Dates.

2) Activities 10 & 13 are Absolute Required Completion Dates associated with Liquidated Damages. Item 10 is only relevant if the Integrator requires possession of the PLCs and SCADA hardware to support programming.

3) All other Activities can be shifted if necessary to match a City approved Project Execution Plan.

The integration contract does not include the purchase of any equipment, software, or licenses.

3. PROJECT MANAGEMENT

The Integrator shall submit a Project Management Plan (PMP) including the following elements:

- Scope
- Budget
- Team Structure
- Team member contact information
- Workshop/Meeting Plan
- Schedule - tasks, meetings, milestones, delivery dates, regular monthly meetings and milestones
- Expectations of City

The Integrator shall submit monthly progress reports with each invoice to substantiate the progress of work to date, including potential out-of-scope items. This information will be utilized to determine if any changes are required in the management of the project. The Integrator shall oversee project efforts, coordination with City and the SESWTF and KRP contractors, monitor progress and budget expended, and ascertain proper execution of the project in accordance with the project scope, schedule, and budget.

4. REQUIRED SOFTWARE EXPERTISE

The design of the SESWTF and KRP process control system requires the installation of a large and sophisticated automation system to perform the majority of treatment functions automatically.

The four core components of the automation system are:

- Vijeo Citect with Redundancy (the SCADA operator interface) and Vijeo Historian (the plant historian)
- Unity Pro based Modicon M340 PLCs
- Ethernet enabled smart devices (e.g. valves, motors, soft starters, variable frequency drives, circuit breakers, etc.)
- Virtualization of all server and client infrastructure using VMware ESXi

Due to the sophistication necessary to design, configure, program, and deploy the automation system and its core components, the City is seeking the services of a Level 2 – SI Alliance Partner with relevant experience and expertise. The Integrator's programming team for this project is expected to include key technical personnel with expertise in the four core component areas of the automation system.

To demonstrate the high competency required by the City, the Integrator must provide verification that they are a Level 2 – SI Alliance Partner.

Commented [HR1]: Addendum 2

5. PROJECT EXPERIENCE

The Integrator shall demonstrate project experience that meets the following criteria:

- Familiarity with water treatment plant operations and processes with a minimum of 7 years verifiable experience with water treatment plant automation using PLCs
- A minimum of 4 years of programming experience with Vijeo Citect SCADA
- Experience programming and deploying redundant Vijeo Citect SCADA systems
- A minimum of 4 years of programming experience with Modicon Unity based PLCs using the IEC61131-3 function block programming language
- A minimum of 3 years of experience implementing VMWare ESXi systems in an automation environment

The Integrator shall provide project profiles verifying and detailing the required project experience.

Commented [HR2]: Addendum 2

6. PLC AND SCADA PROGRAMMING STANDARDS

The Integrator shall develop PLC and SCADA programming standards to serve as the basis for all PLC and SCADA programming associated with the SESWTF and KRP and shall be written so that they can serve as a City standard for future projects.

The Integrator shall submit a draft submittal for City review followed by a final submittal incorporating the City's comments from the Draft submittal.

The Integrator shall conduct two Programming Standard planning meetings as follows:

- Preliminary Programming Standards Planning Meeting:
 - Conduct meeting prior to starting the draft programming standard submittal to establish software standard expectations.
 - Bring example SCADA HMI screens, graphics, pop-ups, objects, alarms, trends, overview pages, etc. to establish an approach to SCADA visualization and user interface.
 - Bring example programs including PLC function blocks for standard control equipment such as valve actuators, pumps, and instruments to establish an approach to PLC programming organization and format.
- Secondary Programming Standards Planning Meeting:
 - Conduct meeting no less than one week after submitting the draft programming standard to the City.
 - Provide overview of the draft programming standard submittal.

The content of the PLC and SCADA Programming Standards document shall include but not be limited to the following content:

- HMI Template Standards
 - Screen Overview
 - Navigation Methodologies
 - System Diagnostics and Administrative Tools
 - Screen Objects and Styles
 - Popups
 - Alarm Screen
 - Trends
 - Security
 - Communication and Health Monitoring
- PLC Standards
 - Naming and Addressing Conventions
 - Program Organization and Philosophy
 - Program Annotation and Documentation Requirements
 - Derived Function Blocks
 - Inputs and Outputs
 - Alarms
 - Pumps
 - Variable Frequency Drives
 - Valve Actuators
 - Accumulators
 - Miscellaneous Functions

HMI and PLC templates shall be created and delivered as a part of the PLC and SCADA Programming Standards for utilization by City for maintenance and/or future development. For all standard derived function blocks, provide the logic inside the block, documentation for the associated logic, and the explanation of how the block functions.

While the City does not currently have any documented programming standards, the existing programming and screens utilized for the Groundwater SCADA can be utilized as a starting point in developing the programming standards. Sample screen shots from the Groundwater SCADA can be provided upon request and after signing a confidentiality agreement.

7. SUBMITTALS

The Integrator shall provide the following submittals:

- Process Control Software Submittal:

- Submit a complete description of the standard application software programs, operating system and utility programs, including modifications and explanation of how the specific functional requirements are met:
 - A complete listing of the process control system point I/O database:
 - Include for each data point, relevant parameters such as range, contact orientation, limits, incremental limits, I/O card byte, I/O hardware address, and PLC assignment.
- Organize on an area-by-area basis, separate by point type.
- In addition to the active I/O points, list the implemented spare I/O points and the available I/O points remaining on each card, as well as other defined future points specified or shown.
- Detailed descriptions of procedures used to implement and modify control strategies and database construction.
- Preliminary overview, screens, station graphic displays, and preliminary reports.
- Control Descriptions:
 - For each control loop, provide a detailed functional description of the operation of the equipment, signals, and controls as shown on the P&IDs in the SESWTF and KRP Contract Documents:
 - Include all functions depicted or described in the Contract Documents.
 - Refer to Specification Sections 17100, 17101, 40_61_15, and 40_61_16 of the SESWTF and KRP contract for preliminary control descriptions and required format.
 - Include within the Control Description content:
 - ♦ All specific requirements.
 - ♦ All common requirements that pertain in general to all loops.
 - ♦ Listing all ranges, set points, timers, values, counter values, etc.
- Test Procedures:
 - Develop and submit detailed test procedures to show that the integrated SCADA system software is fully operational.
 - Provide a statement of test objectives for each test.
 - Prepare specific procedures for each process system.
 - Describe sequentially the steps to be followed in verifying the correct operation of each process system, including all features described in the loop descriptions, control strategies, and shown in the P&IDs.
 - Specify who will perform the tests, specifically what testing equipment will be used, and how the testing equipment will be used.
 - Describe the expected role of the Engineer, as well as any requirements for

assistance from City's staff.

- Provide all forms and checklists to be used.
- Provide estimated test duration.
- Provide details on the simulator construction, components, and operation.

- Testing binders:

- For each sub-system to be tested, provide and submit a test binder containing all test procedures and individual test forms for the test.
- Fill out in advance headings and all other information known before the test.
- Include applicable test plan information, as well as a list of all test prerequisites, test personnel, and equipment.
- Include or list reference material and provide separately at the time of the test.
- Record test results and verify that all test requirements and conditions have been met.

- Test reports:

- At the conclusion of each test, submit a complete test report, including all test results and certifications.
- Include all completed test binders, forms, and checklists.

- Operation and Maintenance Manuals:

- Provide operation and maintenance material to the Contractor for incorporation into the overall project O&M Manuals. Required material includes:
 - Finalized Control Description Submittal
 - Finalized Control System Software Submittal
 - Finalized Test Binders
 - Finalized Training Manuals
 - Complete documentation of all the software programs provided for the entire control system, including but not limited to:
 - ♦ Listings of all application software on both hard copy and DVD-ROM
 - ♦ Database, both hard copy and DVD-ROM
 - ♦ Communication protocols
 - ♦ All documentation necessary to maintain, troubleshoot, modify, or update the software system

- Software Licenses

- The Integrator shall coordinate and complete all of the license transfers for all of

the software licenses to the City prior to substantial completion.

8. SESWTF SYSTEM INTEGRATION

The SESWTF consists of a dedicated PLC, SCADA, and Business Network. The PLC network consists of six plant PLCs and various vendor PLCs located in Vendor Control Panels. Vendor PLCs will be programmed by the equipment vendor. The SCADA network consists of virtualized servers consisting of redundant SCADA servers, historian server, redundant terminal servers, and domain server. In addition, the SCADA network contains various workstations, thin clients, remote clients, laptop clients, and a control room monitor array. The Business network provides access to the Fresno City Hall secure internal Water Network. The Business network consists of a VPN access security appliance, business workstations, printers, and various network ports.

The following is a list of the specific integration activities that the Integrator will be required to provide for the SESWTF:

- PLC Programming including:
 - PLC-TWPS located at the treated water pump station
 - PLC-WWRPS located at the washwater recovery pump station
 - PLC-WTF located in the Ozone building
 - PLC-FILT located in the filter gallery
 - PLC-CHEM located at the chemical building
 - PLC-MAINT located at the maintenance building
 - Hard and Soft I/O points indicated on the SESWTF P&IDs, digital network tables, I/O list, and as described in the general and specific control strategies.
 - Configuration and integration of the dedicated PLC network and associated components including but not limited to all network switches, networked electrical equipment, networked valve actuators, networked vendor control panels, networked ancillary networks like fire alarm and corrosion control.
 - PLC programming in accordance with the Control Strategies specified in Specification Sections 17100, 17101 of the SESWTF and KRP Contract Documents.
- Configuration of the electrical gear network to provide the monitoring and control identified in the network block and routing diagrams, P&IDs, digital network tables, Control Strategies Specifications 17100 and 17101, and associated Electrical equipment Specifications included in the SESWTF and KRP Contract Documents. Electrical equipment being networked includes but is not limited to Motor Control Centers (MCC), Switchgear, Variable Frequency Drives (VFD), Reduced Voltage Solid State Starters (RVSS), Uninterruptable Power Supplies (UPS), Generators, Distribution Panels (DP), and Lighting Panels (LP).
- Configuration of the valve actuator network to provide the monitoring and control

identified in the network block and routing diagrams, P&IDs, digital network tables, Control Strategies Specifications 17100, 17101, 40_61_15, and 40_61_16, and Intelligent Actuator Specification 13448 included in the SESWTF and KRP Contract Documents.

- Coordination with the Ozone vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, Control Strategies Specifications 17100 and 17101, and Ozone equipment Specifications 11264A, 11264B, 11264C, 11264D, 11264F, 11264G, 11264H, 11264I, 11264J included in the SESWTF and KRP Contract Documents.
- Coordination with the Air Scour Blower vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, Control Strategies Specifications 17100 and 17101, and Blower equipment Specifications 11376E included in the SESWTF and KRP Contract Documents.
- Coordination with the Fire Alarm vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, and Fire Protection Specifications 13930A, 13930B, 13930C, 13930D, 13930E, 13930F, 13930G, 13930H included in the SESWTF and KRP Contract Documents.
- Coordination with the Corrosion Control vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, and Corrosion Monitoring System Specification 13114 included in the SESWTF and KRP Contract Documents.

- SCADA Programming:

- SCADA points indicated on the SESWTF P&IDs, digital network tables, I/O list, and as described in the Control Strategies Specifications 17100 and 17101 included in the SESWTF and KRP Contract Documents.
- Configuration and integration of the dedicated SCADA network and associated components including but not limited to all network switches, virtualized host servers, SCADA servers, Historian Servers, Network Attached Storage, workstations, and OITs.
- SCADA development in accordance with the Control Strategies Specification Sections 17100 and 17101 included in the SESWTF and KRP Contract Documents.
- Configuration of the electrical gear network to provide the monitoring and control identified in the network block and routing diagrams, P&IDs, digital network tables, Control Strategies Specifications 17100 and 17101, and associated Electrical equipment Specifications. Electrical gear being network includes but is not limited to Motor Control Centers (MCC), Switchgear, Variable Frequency Drives (VFD), and Reduced Voltage Solid State Starters (RVSS), Uninterruptable Power Supplies (UPS), Generators, Distribution Panels (DP), and Lighting Panels (LP).

- Configuration of the valve actuator network to provide the monitoring and control identified in the network block and routing diagrams, P&IDs, digital network tables, Control Strategies Specifications 17100 and 17101, and Intelligent Actuator Specification 13448.
- Coordination with the Ozone vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, Specific Control Strategies Specification 17101 and Ozone equipment Specifications 11264A, 11264B, 11264C, 11264D, 11264F, 11264G, 11264H, 11264I, 11264J.
 - The Integrator shall attend two days of the three day ozone factory acceptance test located at the Ozone vendor's facilities.
- Coordination with the Air Scour Blower vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, Control Strategies Specifications 17100 and 17101, and Blower equipment Specification 11376E.
- Coordination with the Fire Alarm vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, and Fire Protection Specifications 13930A, 13930B, 13930C, 13930D, 13930E, 13930F, 13930G, 13930H.
- Coordination with the Video Wall System vendor and associated vendor control panel to provide the capabilities identified in the control block diagram and SCADA Computer Equipment Specification 17730.
- Coordination with the Corrosion Control vendor and associated vendor control panels to provide the monitoring and control identified in the P&IDs, and Corrosion Monitoring System Specification 13114.
- Business Network Configuration:
 - Coordinate with City IT department to configure secure access to the Fresno City Hall Network.
 - Coordinate with City IT department to configure switches, workstations, and printers on the business network.
 - Smart Motor Control Center Configuration: Provide programming and configuration of smart starter control and interlocks as described in the Specific Control Strategies Specification 17101.
- Radio communication configuration between SESWTF and Centralized Fresno SCADA Network. The Centralized Fresno SCADA Network is an existing network that provides high level monitoring of key assets throughout the City's water distribution system.
 - Assume a total of 20 I/O points will need to be communicated to and integrated into the
 - Centralized Fresno SCADA Network for monitoring.

Refer to the attached SESWTF contract documents for detail on the integration scope

specifically:

- Reference SESWTF electrical drawings:
 - GE-001 through 91-E-012.
- Reference SESWTF instrumentation drawings
 - GN-001 through 90-N-009.
- Reference SESWTF select specification
 - 11264A, 11264B, 11264C, 11264D, 11264F, 11264G, 11264H, 11264I, 11264J
 - 11376E
 - 13114
 - 13448
 - 13930A, 13930B, 13930C, 13930D, 13930E, 13930F, 13930G, 13930H
 - 16050, 16232, 16240, 16245, 16251, 16262, 16267, 16270, 16275, 16295, 16341, 16435, 16444, 16445
 - 17050 through 17950

9. KRP SYSTEM INTEGRATION

The KRP diversion structure consists of one PLC that will communicate via radio link to PLC panel, PCM- MAINT, located in the maintenance building of the SESWTF and a thin client Operator Interface Terminal (OIT), mounted on PCM-KING that will provide secure access to the SCADA HMI.

- The following is a list of the specific integration activities that the Integrator will be required to provide for the KRP:PLC Programming including:
 - PLC-KING mounted inside PCM-KING
 - I/O points indicated on KRP Pipeline P&IDs included the KRP Contract Documents. Excluding those specifically identified as being configured and programmed by Fresno Irrigation District (FID) integrator.
 - PLC programing in accordance with the Control Strategies Specification Sections 40_61_15 and 40_61_16 included in the KRP Contract Documents.
 - Coordination with the traveling screen vendor and vendor control panel to provide the monitoring and control identified in the P&IDs, Specific Control Strategies Specification 40_61_16 and Traveling Water Screen Specification 46_21_33 included in the KRP Contract Documents.
- SCADA Programming:
 - SCADA points indicated on KRP Pipeline P&ID drawings included in the KRP Contract Documents. Excluding those specifically identified as being configured and programmed by FID integrator.
 - SCADA servers and historian are located at the SESWTF and are common to

monitoring and control of both the SESWTF and the KRP facilities.

- Configuration of thin client OIT-KING mounted on the door of PCM-KING.
- SCADA development in accordance with Control Strategies Specification Sections 40_61_15 and 40_61_16 included in the KRP Contract Documents.
- Coordination with the traveling screen vendor and vendor control panel to provide the monitoring and control identified in the P&IDs, Specific Control Strategies Specification 40_61_16, and Traveling Water Screen Specification 46_21_33 included in the KRP Contract Documents.
- Radio communication configuration between KRP and SESWTF. The physical radio path study and antenna orientation will be performed by the Contractor.
- Configuration of PLC and SCADA network between KRP and SESWTF.

Refer to the attached KRP Contract Documents for detail on the integration scope including:

- Reference KRP electrical drawings:
 - 00-GE-001 through 09-E-003
- Reference KRP Pipeline instrumentation drawings
 - 00-GN-001 through 09-N-002
- Reference KRP Pipeline select specification
 - 40_05_57.23
 - 40_61_00 through 40_96_15
 - 46_21_33

10. CONTRACTOR COORDINATION AND MEETINGS

In accordance with the SESWTF and KRP Contract Documents the SESWTF and KRP contractor will be responsible for the following coordination with the Integrator:

- Shipping and receiving timeline and requirements:
 - The Contractor shall ship the following SCADA computer system, PLC, and networking equipment to the Integrator's testing facility within 175 days after Notice to Proceed is issued to the Contractor:
 - PLCs to be programmed by Integrator, including all chassis, power supplies, CPUs, IO modules, cables, programming software, and related equipment.
 - All network communications equipment and cables less than 10 feet in length.
 - All SCADA computer system equipment and related components.
 - The Integrator shall be allowed to keep the above equipment for a minimum of 180 calendar days and additionally until 30 days prior to the start of the factory test for the applicable PLC control panels. The Contractor shall allow sufficient time in the project schedule for this 180-day requirement. The Contractor is responsible to obtain necessary submittal reviews, order equipment, and allow sufficient delivery time to

comply with this requirement.

- The Contractor shall also supply, for the use of the Integrator, samples of any devices or equipment that will communicate to the programmed PLCs using Modbus, Modbus TCP, or any other digital network. These samples must be shipped to the Integrator's facility and remain there for a minimum of 90 days prior to the PLC panel factory tests.
- The Contractor shall be responsible for shipping the above equipment from the Integrator's facility. At the designated time for shipment of the above equipment to the factory test site, the Contractor shall send personnel to the Integrator's office to package and ship the equipment to the factory test site. The Contractor shall have sole responsibility to package and ship the equipment, including packing materials and shipping charges. Prior to packaging and shipping, the Contractor shall examine and test all equipment, as needed, and shall certify, in writing, that the equipment appears to be in proper working order, and shall deliver the certification to the Integrator, who will forward copies to the City.
- The Integrator shall attend the following Contractor run meetings:
 - System Configuration Meetings:
 - Preliminary meeting: Meet before configuration work has begun on any PLCs is programmed. Contractor shall provide a list of each PLC and other programmable devices that will interface to the rest of the SCADA system, including make, model, and a description of the interface; provide contact information for each individual responsible for programming each said PLC and device; and provide a listing of the submittals that will contain SCADA interface information with a schedule for when each submittal will be provided. Format of the vendor provided PLC memory maps shall be developed.
 - Intermediate review meeting: Held after approximately one-half of the interface submittals have been submitted. Individuals responsible for programming PLCs and other programmable devices supplied by Contractor shall attend this meeting. Meet to discuss SCADA interface submittals and requirements. Draft vendor provided PLC memory maps shall be reviewed for each vendor PLC.
 - Final review meeting: Held after all SCADA interface submittals have been submitted. Meet to discuss SCADA interface submittals and requirements. Final vendor provided PLC memory maps shall be reviewed for each vendor PLC.
 - SCADA Computer Equipment Review Meeting:
 - Prior to the SESWTF Contractor's submittal of the SCADA computer equipment, the SESWTF Contractor will hold a SCADA Equipment Review Meeting with the Engineer, City, and Integrator to review the SCADA computer equipment requirements and coordinate on the required components. Topics for the meeting will include:
 - ♦ Review specified SCADA computer equipment.

- ♦ Review Integrator's recommendation for SCADA computer equipment.
 - ♦ Review discrepancies between the SCADA computer equipment required in the contract documents and the Integrator's recommended SCADA computer equipment.
 - ♦ After identifying discrepancies between contract documents and Integrator's recommendations, develop a SCADA Computer Equipment List for the Contractor to utilize in developing the submittal.
 - ♦ Review the components that will be covered with the SCADA Computer Equipment Allowance.
- Vendor Equipment Meetings:
- The Contractor shall coordinate with the SESWTF and KRP Contractors to facilitate meetings and/or information exchanges with each equipment supplier of equipment with a PLC and/or HMI. Meetings and/or information exchanges can take place either in person, by tele-conference, or by other communications methods as necessary and convenient to discuss the following minimum agenda items:
 - ♦ Tag Naming Conventions.
 - ♦ PLC to PLC global data mapping.
 - ♦ All PLCs to SCADA tags mapping.
 - ♦ HMI screen colors and navigation.
 - ♦ Interlock and Permissive definitions.
 - ♦ Communication Methods.
 - ♦ Standard code blocks for common control functionality.
 - ♦ Alarms – clearing, formats, colors and status.
- Monthly Integration Coordination Meetings:
- The Integrator shall meet with the SESWTF and KRP Contractor and City once a month to discuss integration progress, schedule, and coordination needs. The monthly meetings can take place either in person, by tele-conference, or by other communications methods as necessary and convenient to all parties. Contractor shall assume that eight (8) monthly meetings will take place in Fresno, California.

Commented [HR3]:

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11. TESTING, AND START UP SERVICES

The Integrator shall furnish qualified technical personnel to perform all testing and verification. The test personnel are required to be familiar with the project and the equipment, software, and systems before being assigned to the test program.

The Integrator shall fully review the testing requirements included in the SESWTF and KRP Contract Documents for testing coordination required between the Integrator and

Contractor.

The Integrator shall provide the following testing and start up services:

- The Integrator shall provide Software Acceptance Testing (SAT) prior to the Factory Acceptance Testing (FAT). SAT shall include:
 - System configuration test:
 - Demonstrate and test the setup and configuration of all operator stations, servers, development stations, and peripherals.
 - Demonstrate all utility software and functions, such as virus protection, backup, optical drive burning, network monitoring, etc.
 - Demonstrate the proper operation of all peripheral hardware.
 - Demonstrate all general SCADA functions.
 - Demonstrate proper operation of log-on and other access security functions.
 - Demonstrate the proper operation of all historical data storage, trend, display, backup, and report functions.
 - Test automatic fail over of redundant equipment.
 - Demonstrate the proper operation of the alarm display and acknowledgement functions.
 - Control logic test:
 - The purpose of this test is to verify that all software functions and logic work as specified, along with any hardwired logic.
 - Testing requirements:
 - ♦ Demonstrate each function described in the control strategies included in the SESWTF and KRP Contract Documents. Demonstrate in detail how each function operates under a variety of operating scenarios. Test to verify the application of each general control strategy function to each specific control strategy or loop description.
 - ♦ Demonstrate the proper operation of the programming and configuration for each control strategy or loop description. Test each strategy or loop description on a sentence by sentence and function by function basis. Loops with similar or identical logic must each be tested individually.
 - ♦ Demonstrate the proper operation of all digital communication links and networks.
 - ♦ Verify each digital communication I/O point.
 - ♦ Failure testing: In addition to demonstrating correct operation of all specified features, special effort shall be made to demonstrate how the system responds to and recovers from abnormal conditions including, but not limited to: equipment failure, operator error, communications

subsystem error, communications failures, simulated/forced software lockups, power failure (both utility power and power to SCADA hardware), process equipment failure, and high system loading conditions.

- SAT Test forms:

- ♦ For each test, list the function demonstrated, and provide a description of the function.
- ♦ List the specific tests and steps to be conducted.
- ♦ For each function, list all of the different sub-functions or ways the function can be used, and provide a test check-off for each:
- ♦ Include signature and date lines.
- ♦ Include the fully revised and approved control strategy for the loop being tested.
- ♦ Identify the cause and effect as each I/O point is toggled through the simulator. Check boxes shall be provided to track proper and/or improper operation of the loop.
- ♦ Any deficiencies or operational changes shall be noted on the forms for correction and documentation:
- ♦ Include signature and date lines.

- The Integrator shall assist the Contractor with the Preliminary Functional Acceptance Testing (pre- FAT). Refer to Section 17950 included in the SESWTF Contract Documents for pre-FAT description and requirements.
- The Integrator shall assist the Contractor with the Factory Acceptance Testing (FAT) to be located at the Contractors facility. Refer to Section 17950 included in the SESWTF Contract Documents for FAT description and requirements.
- The Integrator will be required to be on site during the Loop Check/Validation Testing to assist and witness the procedure and documentation.

The Integrator shall perform the Pre-Commissioning (or Functional Testing) for PLCs programmed by the Integrator in coordination with the SESWTF and KRP Contractor. The purpose of the function test is to test the logic programmed in the SCADA system, to test alarm and other set points, and to perform PID loop tuning. The Functional Testing shall be conducted to demonstrate proper operation of all systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible. The Functional Testing shall include:

- Control logic operational validation:

- The purpose of control logic validation is to field test the operation of the complete control system, including all parts of the SCADA system, all control panels (including vendor control panels), all control circuits, all control stations, all monitored/controlled equipment, and final control elements.

- Demonstrate all control functionality shown on the P&IDs, control schematics, and other drawings, and specified in the loop descriptions, control strategies, and equipment specifications.
 - Thoroughly test all hardware and software functions:
 - ♦ Including all hardwired and software control circuit interlocks and alarms.
 - Test final control elements, controlled equipment, control panels, and ancillary equipment under startup, shut down, and steady-state operating conditions to verify all logic and control is achieved.
 - Control logic validation tests to include, but not limited to: a repeat of all control logic tests from the FAT, modified and expanded to include all field instruments, control panels, circuits, and equipment.
- Loop Tuning
- Optimally tune all electronic control stations and software control logic incorporating proportional, integral, or derivative control. Apply control signal disturbances at various process variable levels and adjusting the gain, reset, or rate settings as required to achieve proper response.
 - Verify the transient stability of final control elements operating over the full range of operating conditions, by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations and making necessary controller adjustments as required to eliminate excessive oscillatory amplitudes and decay rates. As a minimum, achieve 1/4 wave amplitude decay ratio damping (subsidence ratio of 4) under the full range of operating conditions.
 - If excessive oscillations or system instability occur, as determined by the City, continue tuning and parameter adjustments, or develop and implement any additional control algorithms needed to achieve satisfactory control loop operation.
- The Integrator shall assist the Contractor as required during the 60 day Performance testing. Refer to Sections 01756 and 17050 of the SESWTF Contract Documents for the performance testing requirements.
 - Make all revisions necessary to the control system software, as directed by the City. It is understood that the Integrator knows and agrees that changes will be required in the control system software during the Source Testing, Functional Testing, Process Operational Period, Process Start-up, and during the Project Correction Period.
 - The Integrator shall provide a 1 year Program Warranty Service after Final Completion to correct latent defects, errors, and faulty coding in the Integration Programs at all levels: PLC Programming, SCADA Programming, Business Network Configuration, Smart Motor Control Center Configuration, and Radio Communication Configuration for both the SESWTF and KRP projects. The fact that these latent defects, errors, and faulty coding are not discovered during the various specified tests

does not absolve the Integrator from correcting them during the Program Warranty Service period.

12. CITY TRAINING

The Integrator shall provide City training courses as described below:

Course Title	Minimum Course Length (hours per session)	Personnel (Estimated Number of Students)	Minimum Number of Sessions
System Overview	8	10	1
Operator Training	16	10	2
Computer Equipment Maintenance	16	4	1
HMI Software	40	4	1
Historian System Training	24	4	1
Reports Training	8	10	2
PLC Software	32	4	1
Network Equipment	16	4	1
Follow-up Training	8	4	5

Training course requirements:

- System overview training:
 - Furnish training courses that give the City's supervisory level personnel an overview of all elements of the SCADA and PLC system that focus on the overall functional aspect of elements of the control system and provide an understanding of the interaction of the various components.
- Operator training:
 - Furnish training courses that instruct system operators in the efficient operation of all aspects of the PLC and SCADA system that include not only the general operation of the control system but also the operation of specific system features.
- Computer equipment maintenance training:
 - Furnish training courses that will enable maintenance technicians to perform troubleshooting and repair of all system computer equipment. Include the theory of operation of the system as a whole, including related operating system and utility software.
- HMI software training:
 - Furnish training courses that will enable the City's staff to develop and maintain all aspects of the operator interface system applications.
 - Include topics:
 - Operating systems and utilities such as virus protection software.
 - Point (tag) database development and modification.
 - Graphic screen creation and editing.

- Scripting.
- I/O servers, drivers, etc.
- PLC interface functions and software.
- Displays, scripts conventions, and documentation.
- Trending.
- Alarms and events.
- System security, access levels, and areas of responsibility.
- General system maintenance, including backups, history data archive, version control, file naming and cataloging conventions, and system file housekeeping.
- Address not only the procedures associated with the control system's standard software packages, but in addition include material explaining the specific conventions used in developing the Project's system applications (graphics, PLC interface, scripts, control strategies, trends, etc.). In addition, provide instruction in the use of techniques for developing and maintaining current, comprehensive documentation for all installed system applications.
- Historian system training:
 - Furnish the following training:
 - Introduction to relational databases.
 - Introductory training on the specific relational database program used for the historian server.
 - How to set up points for historian logging.
 - How to develop, edit, and print custom reports, in detail.
 - Introduction to use of the query language.
 - System maintenance.
 - Interface to networks outside of the control system.
- Report training:
 - Furnish training courses that will enable the City's staff to develop and maintain all aspects of reports.
 - Include topics:
 - Generation of a developed report.
 - Generation of a new report.
 - Modification and editing of reports.
 - Formatting reports.

- Manual entry and automatic entry of data from a database.
- PLC software training:
 - Furnish training on PLC software.
 - Two types of training are required, basic and project-specific:
 - Basic PLC software training covers the principles of PLC programming and the specific features and function of the PLC products used on this Project, provided by one of the PLC manufacturer's certified trainers.
 - Project-specific PLC software training covers the programming conventions, new standardized software modules, specific control strategy programs, and documentation created for the Work performed under this Contract. This training includes the specific knowledge needed to modify, expand, duplicate, troubleshoot, and repair the PLC programs provided under this Contract, provided by a qualified individual who is thoroughly familiar with the delivered system, and is one of the senior Integrators who programmed the PLCs for the project.
- Network equipment training:
 - Furnish basic training on all network hardware, switch and router configuration and software, and network monitoring software.
 - Include a detailed description and explanation of the installed network architecture, media, and functions.
 - Furnish an overview of the function and operation of each piece of network equipment.
 - Furnish training on network maintenance troubleshooting and repair.
 - Furnish training on how to install spare or off-line backup equipment.
- Follow-up training:
 - Provide a series of on-site follow-up training classes beginning after process start-up of the process control system. The intent for these classes is to provide the City's personnel the opportunity for a review and "refresher" of the training topics and material after they have had some experience using the system.
 - Mutually schedule and develop the content of these classes with the City no later than 1 month before the beginning of the first session.
 - Schedule at the City's discretion on non-consecutive days spaced out over the process start-up and warranty period.

Provide qualified training instructors for technical training with demonstrated expertise in not only control system functionality but also professional training techniques: Instructor qualifications are subject to the approval of the City. Furnish training instructors thoroughly familiar with the process control system, who are members of the implementation team. One

of the individuals conducting the training course must be the same individual responsible for the majority of the programming that was performed for the project.

Furnish training manuals and other materials for training courses. Manuals are to be professionally written to present the course material in a format that is easy to comprehend. The manuals are to serve as teaching aids during presentation of the training classes. Manuals are to serve as reference material after the training has been completed.

Coordinate with the City at least 3 weeks before the start of the class: schedule training classes Monday - Friday between 7:30 AM and 3:30 PM.

The Integrator shall record all training sessions. Produce audio-visual presentations by recording the actual training sessions of the City's personnel. Furnish digital video disk (DVD) format. These disks become the property of the City and cover, in detail, the training for the specific hardware and software of all the systems provided for the project. Provide all the necessary cameras and recording equipment.

Training shall be provided on-site (City of Fresno Water Division).

13. SUPPLEMENTAL SERVICES

The purpose of this section is to provide Supplemental Services that are not specifically defined in Sections 1 through 11 or as General Condition requirements. City and Integrator shall jointly identify such services and shall agree level of effort and cost prior to expenditure of the effort on any task. City's approval is required prior to Integrator incurring any compensable costs for Supplemental Services.

Integrator will be compensated for approved Section 12 – Supplemental Services tasks on a cost reimbursable basis according to the agreed level of effort and the Integrator's rates provided in the Cost Proposal. Integrator's invoice shall provide a breakdown of labor effort and expenses on a task by task basis and copies of Air Fare and Rental Car travel receipts. Alternatively, payment can be made on the basis of an agreed lump sum amount for each individual task. A not to exceed budget of \$100,000 is provided for Section 12 – Supplemental Services tasks