



**REPORT TO THE CITY COUNCIL**

June 9, 2011

**FROM:** PATRICK N. WIEMILLER, Director  
Department of Public Utilities

**BY:** MARTIN A. QUERIN, PE, Assistant Director  
Department of Public Utilities – Water Division

**SUBJECT:** APPROVE AN AMENDMENT TO AGREEMENT WITH PARTNERS IN CONTROL, INC. FOR ADDITIONAL OPTIMIZATION PROGRAMMABLE LOGIC CONTROLLER (PLC) REPLACEMENT NECESSARY TO INTEGRATE THE NEW CITECTSCADA SYSTEM (WIRELESS COMMUNICATIONS THAT REDUCE ENERGY COSTS) WITH THE EXISTING OPTIMIZATION PLC IN THE AMOUNT NOT TO EXCEED \$93,486 AND A CONTINGENCY AMOUNT NOT TO EXCEED \$24,648 FOR OPTIONAL COMMISSIONING WORK AND AUTHORIZE THE DIRECTOR OF PUBLIC UTILITIES OR HIS DESIGNEE TO EXECUTE THE AMENDMENT TO AGREEMENT ON BEHALF OF THE CITY (CITYWIDE)

AGENDA ITEM NO. 1 I  
COUNCIL MEETING 6/9/2011

APPROVED BY

DEPARTMENT DIRECTOR

CITY MANAGER

**RECOMMENDATION**

Staff recommends that the City Council approve an Amendment to Agreement with Partners In Control, Inc. to provide additional optimization PLC replacement to integrate the new CitectSCADA system with the existing optimization PLC for the groundwater Supervisory Control and Data Acquisition (SCADA) upgrade project for the Department of Public Utilities Water Division in an amount not to exceed \$93,486 and a contingency amount not to exceed \$24,648 for optional commissioning work and authorize the Director of Public Utilities or his designee to execute the Amendment to Agreement on behalf of the City.

**EXECUTIVE SUMMARY**

In October of 2010, the Department of Public Utilities Water Division entered into an agreement with Partners In Control, Inc. dba Enterprise Automation to provide groundwater system CitectSCADA software integration. During the course of the upgrade, it was discovered that the Optimization PLC operation varies greatly from the originally assumed methodology of the current system. Due to the current optimization system limitations, Enterprise Automation developed several possible solutions, which would allow optimization to take place without the limitations of the current system. Enterprise Automation and the Water Division concur that replacing the Optimization PLC with CitectSCADA Cicode is the most advantageous option available. If approved, this Amendment to Agreement would add \$93,486 to the original contract cost of \$554,857 except for additional commissioning work, which will be a contingency amount not to exceed \$24,648 and is subject to City's appropriation of funds in its 2012 fiscal year and separate written authorization by City.

**BACKGROUND**

The current Water Division Groundwater Production and Distribution System consists of over 260 water production wells with multiple Programmable Logic Controllers (PLC) and both Digital and Analog Inputs/Outputs (I/O). This number of PLCs and I/O is consistently growing due to new development and increasing infrastructure (i.e. new production well construction). Each water production site communicates with the SCADA Human Machine Interface (HMI) via modbus over radio frequency.

## REPORT TO THE CITY COUNCIL

Amendment to Agreement with Partners In Control Inc.

June 9, 2011

Page 2

The Water Division Groundwater SCADA System is critical to the safe and efficient operation of the current and future water production wells. In addition, the SCADA System allows the Water Division to monitor water production sites that have water contamination treatment that are regulated by the California Department of Health Services.

The Water Division Groundwater SCADA System currently consists of HMI software running on Hewlet Packard hardware (implemented in 1999). This software and hardware are obsolete and are no longer supported. The Server Operating System is Windows.

Enterprise Automation is currently integrating the new CitectSCADA system with the existing Optimization PLC. During the course of their investigation into the Optimization PLC operation, it was discovered that its operation varies greatly from the assumed methodology originally explained in the scope of work. The original project scope assumed a communications scenario where the Optimization PLC reads data from the FactoryLink system. Actually, communication functions in the opposite direction; the FactoryLink system sends data directly to the PLC, but through a set of arrays. The problem with this system arises when trying to commission the new CitectSCADA system. CitectSCADA and FactoryLink will need to function simultaneously. Each system will be communicating with a portion of the active sites and their associated zones. Simply stated, the Optimization PLC data array is not capable of handling communications from two SCADA systems. This Amendment to Agreement seeks to resolve this limitation.

Taking into consideration the current optimization system limitation, Enterprise Automation developed three possible options, which would allow optimizations to take place. 1) Custom coded optimization, 2) additional / new PLC based optimization and 3) CitectSCADA Cicode optimization. CitectSCADA Cicode option was considered the best option for its following advantages: 1) The system will be fully redundant (the current system is not), 2) optimization will not perform calculations on stale data (the current system does), 3) Cicode will handle up to 1000 sites (the current system will handle 320), 4) commissioning is not hampered by the coexistence of CitectSCADA and the Optimization PLC systems, 5) single points of failure on the SCADA system are reduced and 6) the network structure of the final system is greatly simplified.

Although the current system is obsolete and very limited, it saved the Water Division \$2,437,379 in energy costs, a thirty percent savings. Once the CitectSCADA Cicode optimization is online, the Water Division anticipates even greater savings.

The Agreement has been approved "as to form" by the City Attorney's Office.

The Council may approve the Amendment to Agreement in the amount of \$93,486 to Partners In Control, Inc. The amendment will add \$93,486 to the original contract compensation increasing the total compensation to \$648,343 and a contingency in an amount not to exceed \$24,648 for optional additional commissioning work. Any optional commissioning work will be subject to Council's appropriation of funds for the work in FY12 and written authorization to the Contractor by the Director of Public Utilities. If the amendment is not approved, the project will be suspended.

### **FISCAL IMPACT**

This project is funded out of the Water Enterprise through its Telemetry System Capital Improvement Fund (Fund). An appropriation for the Fund was established in FY11 in the amount of \$740,000. The recommended project award of \$93,486 falls within the FY11 appropriation. The project and its costs were contemplated in the current five-year plan.

## FIRST AMENDMENT TO CONTRACT

THIS FIRST AMENDMENT TO CONTRACT ("Amendment") made and entered into as of this \_\_\_\_\_ day of June, 2011 amends the Contract heretofore entered into between the CITY OF FRESNO, a municipal corporation, hereinafter called the "City," and Partners In Control, Inc. dba Enterprise Automation, a California corporation, hereinafter called the "Contractor."

### RECITALS

WHEREAS, City and Contractor entered into a contract, dated October 18, 2010, hereinafter referred to as "Contract," for DPU/Water Division Groundwater System CitectSCADA Software Integration; and

WHEREAS, during the course of the software integration it was discovered that the Optimization Programmable Logic Controller (PLC) operation varies from the originally assumed methodology of the current system; and

WHEREAS, due to current optimization system limitations, Contractor looked into possible solutions which would allow optimization to take place; and

WHEREAS, Contractor determined, and the City concurs, the best available option would be to replace the Optimization PLC with CitectSCADA Cicode; and

WHEREAS, the parties have negotiated an increase in compensation from \$554,857 to a total compensation not to exceed \$648,343 (an increase of \$93,486) for completion of work by Contractor under the Contract, except for additional commissioning work which will be a contingency amount not to exceed \$24,648 and is subject to City's appropriation of funds in its 2012 fiscal year and separate written authorization by City; and

WHEREAS, City now desires to expand the scope of work by requiring additional software integration services.

NOW, THEREFORE, the parties agree that the Contract be amended as follows:

1. Contractor shall provide additional software integration services for the CitectSCADA system as outlined in **Attachment A**, except 1.4 Commissioning work (under "Scope of Work" section on page 5 of **Attachment A**) which shall constitute optional additional work. The City may add the optional work by written authorization to the Contractor by City's Director of Department of Public Utilities ("Director"), provided City's governing body has appropriated sufficient funds for the work in its 2012 fiscal year. Contractor shall not perform such Commissioning work, and this Amendment shall not be a contract for such Commissioning work, until further performance is authorized in writing by the Director. It shall, however, remain Contractor's offer to perform this optional additional work. In the event Contractor performs work without City's prior written authorization, Contractor will not be entitled to compensation for such work.

2. The maximum monetary consideration amount of "five hundred fifty-four thousand eight hundred fifty-seven dollars and no cents (\$554,857.00)" set forth in Section 2 of the Contract is amended to read "six hundred forty-eight thousand three hundred forty-three dollars and no cents (\$648,343.00)." In addition, there is added a contingency amount not to exceed \$24,648 for any optional additional work rendered pursuant to Section 1 above and authorized in writing by the Director.

3. The services of Contractor, as described in this Amendment, shall commence upon execution of this Amendment. Work related to the Contract and this Amendment shall be undertaken and completed in such sequence as to assure expeditious completion.

4. Each exhibit and attachment referenced in this Amendment is, by the reference, incorporated into and made a part of this Amendment.

5. In the event of any conflict between the body of this Amendment and any Exhibit or Attachment hereto, the terms and conditions of the body of this Amendment shall control and take precedence over the terms and conditions expressed within the Exhibit or Attachment. Furthermore, any terms or conditions contained within any Exhibit or Attachment hereto which purport to modify the allocation of risk between the parties, provided for within the body of this Amendment, shall be null and void.

6. Except as otherwise provided herein, the Contract entered into by City and Contractor, dated October 18, 2010, remains in full force and effect.

IN WITNESS WHEREOF, the parties have executed this Amendment at Fresno, California, the day and year first above written.

ATTEST:  
REBECCA E. KLISCH  
City Clerk

CITY OF FRESNO,  
a municipal corporation

By: \_\_\_\_\_  
Deputy

By: \_\_\_\_\_  
Patrick N. Wiemiller, Director  
Department of Public Utilities

APPROVED AS TO FORM:  
JAMES C. SANCHEZ  
City Attorney

PARTNERS IN CONTROL, INC. dba  
Enterprise Automation,  
a California corporation

By:  5/13/11  
Nancy A. Algier Date  
Senior Deputy

By:  5/13/2011  
Joshua Riley Date  
Vice President

By:  5-13-11  
Scott Pickford Date  
President

c. City of Fresno  
Attention: Chris Carroll Water System Supervisor  
1910 E. University Avenue  
Fresno, CA 93703-2988  
Ph.: (559) 621-5325  
FAX: (559) 457-1182

## Attachment A Scope of Work

### Background

Enterprise Automation is currently working on the Groundwater SCADA Upgrade project. The scope of work includes integrating the new CitectSCADA system with the existing Optimization PLC. The scope of work also explained how it was assumed the Optimization PLC functioned.

“It is assumed that communications to the Optimization PLC will be configured in CitectSCADA with a standard PLC driver, and that only operator setpoint entries are transferred from CitectSCADA to the Optimization PLC. It is also assumed that the Optimization PLC is communicating directly with the sites (i.e. data will not be passed back through the CitectSCADA system in order to reach the sites).”

During the course of the investigation by Enterprise Automation into the Optimization PLC operation, it was discovered that its operation varies greatly from the assumed methodology. The following diagrams illustrate the general operation of the current system.

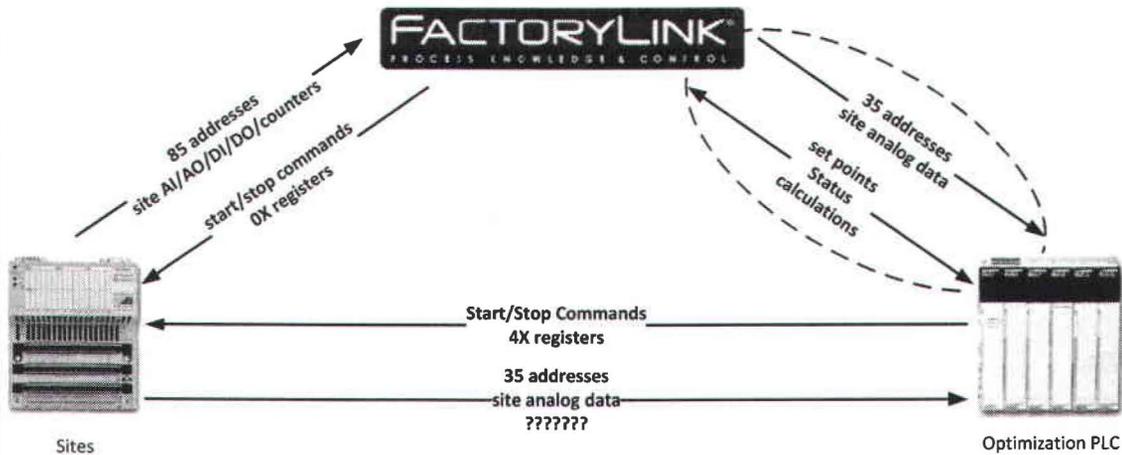


Figure 1 - Data Flow

Figure 1 shows an overview of how data flows between the sites, FactoryLink and the Optimization PLC. At first glance the data seems to flow as explained in the original scope of work.

Investigation reveals that the brown line indicating data flow from the sites directly to the Optimization PLC does not function under normal operating conditions. Instead, the Optimization PLC relies on FactoryLink to transfer data read from the sites to the Optimization PLC.

It makes sense that the Optimization PLC does not poll the sites independent of the FactoryLink system. Communications to the sites is over radios that have major speed/bandwidth limitations. If both systems polled the site PLCs, it would cause site communication update times to double.

The original Groundwater SCADA Upgrade project scope assumed a worst case scenario for communications, where the Optimization PLC reads data from the FactoryLink system. As it turns out, communications actually function in the opposite direction. The FactoryLink system sends data directly to the PLC, but through a set of arrays. Figure 2 shows how FactoryLink transfers data to/from the Optimization PLC.

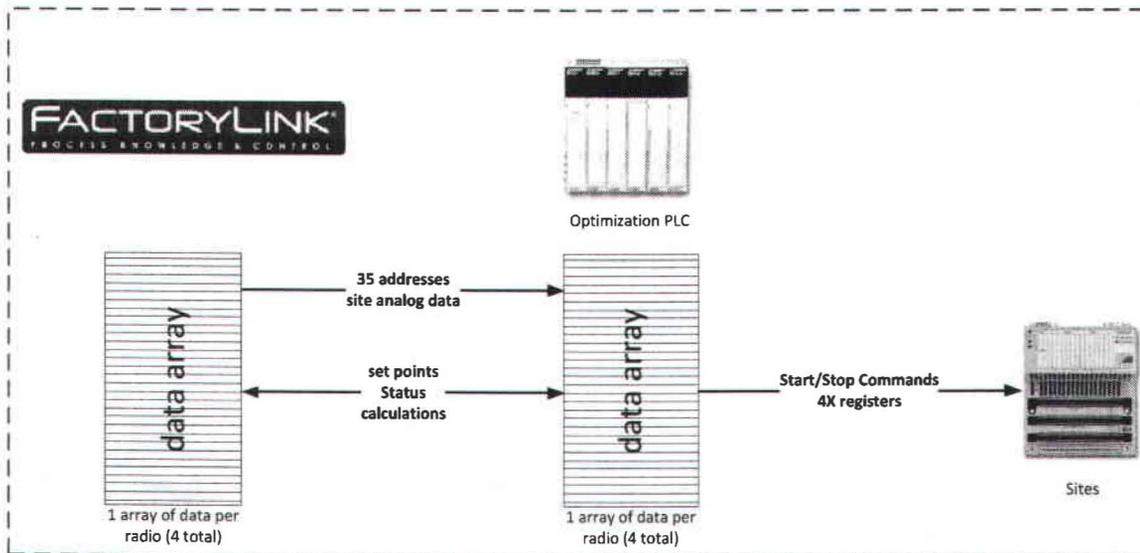


Figure 2 - Array Data

FactoryLink and the Optimization PLC have been setup with matching data arrays. Each system has four data arrays representing each of the four radios systems. FactoryLink populates its communications data array with data from each of the 320 sites, one at a time. A 'handshake' system is used to index the two systems through each of the sites.

The problem with this system arises when trying to commission the new CitectSCADA system. CitectSCADA and FactoryLink will need to function simultaneously. Each system will be communicating with a portion of the active sites and their associated zones.

As an example, one of the first steps in commissioning CitectSCADA will be to get a single site communicating and then all the other sites in its zone. At that point it would be necessary to turn optimization on for the newly commissioned zone. In order for optimization to occur, CitectSCADA would need to inject the necessary site data and setpoints into the Optimization PLC array. The problem is there is no mechanism for this to take place. The FactoryLink system is constantly cycling through site data arrays. It does not stop talking to the Optimization PLC when a site is not optimized. It writes its data with a bit that is set to stop optimization, but the

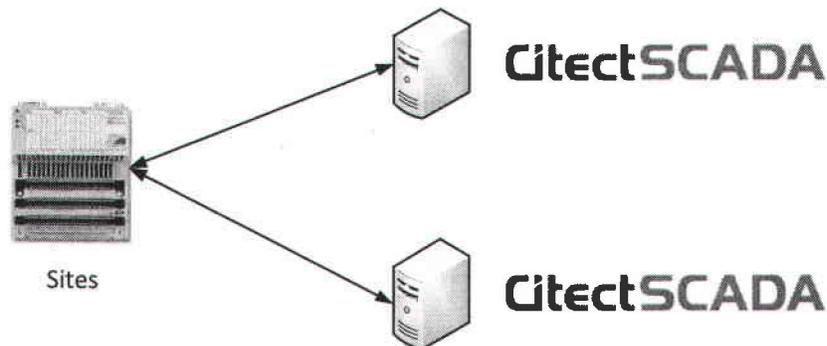
array data is still written. Since the FactoryLink system is always writing data to the Optimization PLC array, there is no way for CitectSCADA to insert data. Simply stated, the Optimization PLC data array is not made to handle communications from two SCADA systems.

In addition, the current system also has the following limitations.

- The Optimization PLC is currently only configured for 320 sites. (The new CitectSCADA system is being made to handle 1000 sites.)
- The Optimization PLC does not have enough memory to accommodate 1000 sites.
- The Optimization PLC is not redundant.
- The Optimization PLC relies on FactoryLink for proper operation.
  - From the information Enterprise Automation has gathered, the Optimization PLC does not directly poll the sites if FactoryLink is turned off.
  - If FactoryLink is turned off without disabling optimization first, and then turned back on, a large amount of disturbances are caused in the distribution system. The exact reason for this is not understood at this time.

#### CitectSCADA Cicode Optimization Solution:

CitectSCADA has a programming language called Cicode. It is similar to Visual Basic. Cicode can be used for many different purposes. In this case it was evaluated as a method to program district wide site optimization. The architecture would look like this:



Replacing the Optimization PLC with CitectSCADA Cicode has the following advantages:

- The system is fully redundant. CitectSCADA has a built in redundancy for Cicode.
- The CitectSCADA optimization Cicode will not perform calculations on data that is 'stale'. CitectSCADA has timeouts and retries associated with data quality. This allows the optimization code to decide how to compute for optimization based on data quality.
- The optimization Code will handle 1000 sites.

- Commissioning is not hampered by the coexistence of CitectSCADA and the Optimization PLC. A particular zone can have optimization turned off within FactoryLink and the Optimization PLC, and turned on within CitectSCADA without interference.
- The single points of failure on the SCADA system are reduced. See Figure 3.
- The network structure of the final system is greatly simplified. See Figure 3.

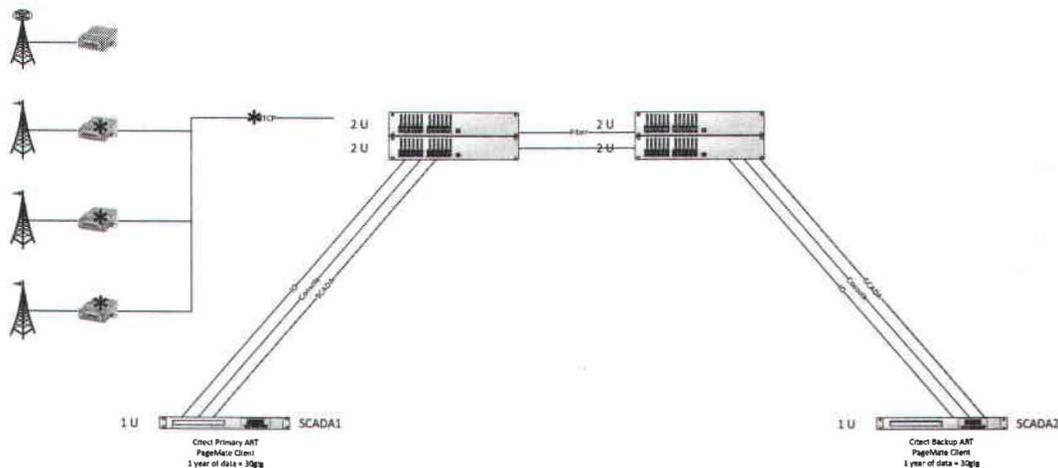


Figure 3 - Proposed System Structure *without* Optimization PLC

## Scope of Work

### 1.1 Specification

The Optimization PLC does not have an operational specification. Optimization is a critical portion of the system and an accurate specification is vital. Enterprise Automation will review the 984 ladder logic in the Optimization PLC and create a specification based on its functionality. (Only the optimization code will be reviewed. Communications logic is not being reviewed.)

Once a draft specification has been created a workshop will be held at the City of Fresno. Enterprise Automation and district staff will review the specification to ensure it is accurate before any coding begins.

The addition of optimization code to the CitectSCADA system will require some of the existing CitectSCADA standards to be updated. This includes additional tag standards for the new optimization tags, updates to genies and super genies to 'talk' to internal tags instead of PLC tags, and the addition of new alarm categories.

All optimization code will be specified and documented within the CitectSCADA system. This specification and standard will be developed and delivered to the City as as-built documentation.

## **1.2 Configuration**

Configuration of the optimization code within the CitectSCADA system will require some rework to the screen templates and alarm filtering. A new set of tags will be created and used of optimization calculations. The majority of time will be spent setting up the optimization code within the CitectSCADA system. Features of the code are:

- If a new site is created within an existing zone, and optimization is turned on, the site will automatically be optimized. (no code modifications will be necessary)
- If a new site is created in a new zone, and optimization is turned on, the site will automatically be optimized. (no code modifications will be necessary)
- CitectSCADA assigns quality data to every tag in the system. The optimization code will have a set of rules defined to decide how to calculate a zone when site data has a bad quality. (a determination will be made how to handle data that is stale or bad quality)
- A number of current zones have custom optimization calculations. This customization will be retained.
- The code will optimization a maximum of 50 zones.

## **1.3 Testing**

Enterprise Automation will create optimization code test documentation. The documentation will be a series of checklists that programmers will use to test the optimization code for each of the existing 25 zones. At the completion of internal testing, City of Fresno staff will take part in testing to ensure the system is functioning as specified.

## **1.4 Commissioning (optional additional work subject to separate written authorization from City)**

The upfront specification, programming methodologies and pretesting that is performed help to ensure the commissioning phase of this project goes smoothly. Enterprise Automation will validate and commission the optimization code at the same time as the Groundwater SCADA Upgrade project, including as part of the migration workshop.