Lake Elmo, MN
SCADA System Summary

Functional System Description

General Information

The licensed radio communication Supervisory Control and Data Acquisition (SCADA) system described herein was supplied and installed to enable the City of Lake Elmo to monitor and control the city's water supply and distribution system as well as monitor the wastewater lift pump station(s) from a "Master" location.

The system provides:

- Well pump, chemical feed pump and hydropneumatic tank air add / vent control
- Monitoring of the:
  - control & operation of the well and chemical feed pumps
  - discharge flow rate of each well pump
  - level in the elevated water storage towers
  - water level in the well No.2
  - hydropneumatic tank level & pressure
  - number of starts and the run time for each pump (well & wastewater lift pump)
  - radio communication failure counts between the "Master" location and the well/tower & lift station locations
- Alarm annunciation and logging (with date / time stamp) for each specific system alarm condition
- Data logging and trend displays for the elevated water storage tower levels, the well No.2 water level, the hydropneumatic tank water level, the well pump discharge flow rates and the radio communication failures

A "Master" polling system panel identified as "CPPW", is provided at the Public Works Building / City Maintenance Garage. The CPPW panel contains a programmable logic controller (PLC) that communicates via fiber optic cable to panel CPWT2 that is installed in the base of the Water Tower 2.

Panel CPWT2 communicates with the remote system sites (CPW1, CPW2 & CPLS1) via licensed radio transceivers at each location. SCADA system panels are provided at the following sites in the City:

Site	Panel
Public Works Building	CPPW
Elevated Water Tower No. 2	CPWT2
Well No. 1 / Elevated Water Tower No. 1 RTU*	CPW1
Well No. 2 RTU*	CPW2
Lift Station No.1 RTU*	CPLS1

* RTU – Remote Transceiver Unit

SCADA system "Master" at the City Public Works Building

The SCADA system equipment that is located at the Public Works Building consists of the following items:

A. SCADA Panel - CPPW

The SCADA panel CPPW is installed in the Electrical Room of the Public Works building. This panel includes a PLC and associated input / output (I/O) modules. This panel provides Ethernet communication with the PC in the Superintendent's Office and provides fiber optic communication with Panel CPWT2 as previously mentioned. SCADA communication software automatically interrogates (polls) the remote system sites to provide automatic system control and alarm / status monitoring.

B. Graphical User Interface (GUI)

The GUI is a PC-based system installed in the Superintendent's Office. A color-graphic monitor is provided for display of the water distribution system and wastewater pump station parameters included in the SCADA System. The graphic screen displays provide real-time system control, status and alarm information.

C Fiber Optic Pullbox and Patch Panel

Fiber optic pullbox and patch panels are installed in the Electrical Room.

The GUI includes a security system to prevent unauthorized operator set-point and SCADA system parameter manipulation. Password access is required for control changes and for operator reset of pump run times and pump start counters. All screens are available for viewing without security access.

The operator interface is programmed to provide graphic display of all system parameters. Each screen includes a link on the left side of the display to allow navigation to the other system screens.

Water Tower No. 2 Data Communication Panel - CPWT2

The SCADA system's master radio transceiver is installed in panel CPWT2. The panel is installed in the base of the Water Tower 2. This panel communicates with the RTU site locations via its radio transceiver and an Omni-directional antenna installed at the top of Water Tower 2. The panel also includes fiber optic modules that communicate all system information received by radio as well as the locally sensed tower No.2 level & 120VAC input power failure to panel CPPW via fiber cable.

A tower head pressure sensing level transmitter provides a 4-20 maDC level linearized input signal to CPWT2. The tower level signal is used in the SCADA system water storage, pump control and abnormal level alarm algorithms. CPWT2 includes a door mounted digital meter that displays the water level in the storage bowl of Water Tower 2.

System information specific to panel CPWT2 displayed on the SCADA Master GUI includes:

- Water tower No.2 bowl storage level (in feet and tenths of feet)
- Tower No. 2 level responsive well pump control set-points
- Tower abnormal level alarm set-points
- Tower high and low level alarms
- Fiber communication failure
- Radio communication failure
- 120 VAC incoming power failure

Well No.1 RTU Panel - CPW1

Radio RTU CPW1, located at Well House No.1, has an integral PLC that provides pump start/stop control, station alarm & monitoring as well as Tower No. 1 water level radio transmission to panel CPWT2.

The SCADA system's well pump No.1 "pump required" signal activates a PLC output contact that is wired to the "Auto" input of the well pump motor starter's Hand-Off-Auto selector switch pilot control circuit. An auxiliary contact installed on the pump's motor starter provides "Well Pump Running" status feedback to the PLC / RTU.

A head pressure sensing tower level transmitter provides a 4-20maDC analog input signal to the PLC/RTU. A well pump discharge flow meter provides a 4-20maDC analog input signal to the PLC/RTU.

Well Pump No.1 / Tower No. 1 Alarm / Status / Control functionality provided on the SCADA Master GUI includes:

- Water tower bowl storage level (in feet and tenths of feet)
- Tower level responsive well pump control set-points
- Tower abnormal level alarm set-points
- Tower high and low level alarms
- Well pump "required" & "running"
- Well pump "failed to start" alarm
- Well pump software H-O-A selector switch
- Well pump run time (operator resettable)
- Well pump start counter (operator resettable)
- Well pump discharge flow rate (GPM) and total
- RTU 120 VAC incoming power failure
- UPS fault
- Radio communication failure

Well No.2 RTU Panel – CPW2

Radio RTU CPW2, located at Well House No.2, operates in conjunction with a separate PLC based automatic well pump control panel (CP100) that has a door mounted operator interface terminal (OIT) to provide pump start/stop control, station alarm & monitoring locally and / or from the SCADA system Master at the Public Works building via panel CPWT2.

The SCADA system's well pump No.2 "pump required" signal activates a PLC output contact that is wired to the "Auto" input of the well pump motor starter's Hand-Off-Auto selector switch pilot control circuit. An auxiliary contact installed on the pump's motor starter provides "Well Pump Running" status feedback to the PLC / RTU.

Well Pump No.2 / Hydropneumatic Tank building Alarm / Status / Control functionality provided on the SCADA Master GUI includes:

- Well pump "required" & "running"
- Well pump "failed to start" alarm
- Well pump software H-O-A selector switch
- Well pump pre-lube "required" (with flow / no-flow indication)
- Well pump run time (operator resettable)
- Well pump start counter (operator resettable)
- Well draw down level (in feet)
- Well draw down level alarm set-points
- Well draw down level high and low alarms
- Well pump discharge check valve "open" / "closed"
- Well pump discharge flow rate (GPM) and total
- Well pump discharge flow alarm set-points
- Well pump discharge flow high and low alarms
- Chlorine booster pump "required" & "running"
- Chlorine tank weight (for each of two tanks)
- Chlorine "re-order" set-point
- Well house gas detector (PPM & tenths)
- Air compressor "running" & "off"
- Hydropneumatic tank system pressure (PSI)
- Hydropneumatic tank system pressure control and alarm set-points
- Hydropneumatic tank air add & vent solenoid valve "required-to-open"
- Hydropneumatic tank system pressure high and low alarms
- Hydropneumatic tank level (in feet and tenths of feet)
- Hydropneumatic tank level well pump control & alarm set-points
- Hydropneumatic tank high and low level alarms
- Utility power voltage / phase failure
- Low compressed air supply alarm
- Radio communication failure alarm

Lift Station No.1 RTU Panel – CPLS1

Radio RTU CPLS1, located at Lift Station No.1, has an integral PLC that provides pump run time monitoring and station alarm transmission via the radio transceiver to panel CPWT2.

The Lift Station Alarm and Status Information displayed at the SCADA Master GUI includes:

- Lift Pump No.1 running
- Lift Pump No.2 running
- High Wet Well level alarm
- Common pump fault alarm
- 120 VAC incoming power failure
- UPS battery failure
- Radio communication failure