NEW KENT COUNTY
SCADA AND PLC SPECIFICATIONS

1 OVERVIEW

1.1 Purpose

The purpose of the document is to provide Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition (SCADA) control system design standards.
The use of proven techniques, approved equipment, and a functional commonality of hardware and software will result in overall benefits from the uniformity of control strategies, screen displays, reports and logs, process calculation and optimization, and improvement in overall efficiency.
The centralized control and monitoring increases the flexibility of operational resources and visibility of the operations in the integrated manner.

1.2 Scope

Whenever a new site is incorporated into the Utilities operations, or an existing site's control system is replaced or the majority of it modified, the control system shall be designed in accordance with the standards set out in this document.

1.3 Philosophy of Operation

This section defines the general control and monitoring philosophy for the control room. Basic guidelines for control system hierarchy from local equipment control methods to the top level of operator interface are defined.

1.3.1 Operation of Facilities

The control room will use SCADA system primarily for monitoring the status of remote pump stations. All the pump control strategy shall be executed at the remote pump station. The SCADA alarm paging interface will send designated alarm messages to on-call personnel 24 hours per day.

1.3.2 Control Hierarchy

Process control systems must be organized in a logical control hierarchy in order to provide a standard format for monitoring/control of the overall facility. This standard approach provides operators and maintenance staff a uniform interface which improves their understanding of how to monitor/control the equipment, the control modes the equipment can attain, and how to override the controls when necessary due to failures or when required for routine maintenance.

The control system hierarchy can be viewed as a pyramid structure with three layers:

- Field sensors and specific control devices (bottom layer).
- Local PLC control/monitoring.
- SCADA monitoring/control.

1.3.2.1 Field Sensors and Special Control Devices

All control and monitoring must originate and terminate at this level. All the components specified at this level can be interfaced with the local PLC.

1.3.2.2 Local PLC monitoring/control

All sewage pumps stations local PLC will be primarily used for monitoring only. In some instances especially on bigger pump stations it may be used for control and monitoring. PLC for pump station shall have the capability to control the pump station if required with minor changes. At all well/tank sites the PLC shall control the pumps and other equipment.

PLC's shall be furnished completely configured, programmed and tested providing the specified communication, monitoring, display, input/output, annunciation, computational and other requirements for operation of the SCADA system. Any additional components required for operation, whether specifically referenced herein or not, shall be provided.

The PLC system shall be based on a scalable modular multi-use open architecture platform that can be efficiently applied to perform the necessary functions at each location. Each controller/telemetry unit shall be a modular hardware style PLC consisting of a CPU with adequate memory and instructions, power supply, local and remote input/output modules, communications ports, and all other components required to make the unit perform all of the functions required in this specification.

The PLC system shall support true system open architecture allowing use of various hardware and software and full integration of other third party generic hardware/software devices. The architecture shall meet the requirements as herein defined and allow economical expansion of function and features based on new and evolving technologies. Systems using non-scalable and/or closed proprietary architectures shall not be acceptable.

1.3.2.3 SCADA Control

Control at this level shall be based on operators using SCADA to monitor and control the remote pump stations. At least one SCADA server/node shall be located in the Utilities Operation Team's office as a central point for the generation of alarm reports, historical data archiving and retrieval, scheduled reports, and system maintenance.

2 REMOTE STATION HARDWARE AND SOFTWARE

PLC system for water and wastewater SCADA system shall be based on an existing data concentrator PLC at utilities office and a PLC at each remote pump stations. Data concentrator PLC is an Allen Bradley SLC 5/05 PLC with Ethernet processor. The primary functions of data concentrator PLC is poll the remote sites over radio network or CDMA network and collect data from each site. This data typically includes wet well level, station flow, run time and run counts for all the pumps, power and generator status, alarms etc. Communication failure with remote PLC shall create an alarm for SCADA. Data concentrator PLC shall also synchronize PLC clocks at the remote pump stations.

2.1 PLC Panels

PLC Panels shall be NEMA 4X, fiber glass enclosures. Enclosures shall be provided with swing out panels to allow mounting the local operator interface units (OIT) inside the enclosure. PLC panels shall have individual circuit breakers for each device in the panel. PLC panels shall also be provided with uninterruptible power supplies (UPS) to back up the PLC and telemetry hardware for at least 1 hour of power loss.

2.2 PLC Hardware Requirements

PLC at remote sites shall be from Allen Bradley Micrologix family with adequate memory and instruction sets required to make the unit perform all of the functions required by this specification. It is required that the same model PLC device be used throughout the SCADA system providing a complete solution with one common technology. This is to insure complete system continuity, compatibility between like devices, enhancing overall system efficiency by the reduced need to learn, maintain, support and carry spare parts for multiple technologies.

All control signals, status signals, alarm and process variable data shall be transmitted and received between the central location and the remote sites via the radio network. The master and remote PLCs shall be capable of stand-alone control to maintain programmed logic. Remote pump stations PLC's shall be provided with 120 VAC discrete input modules and relay output modules. Analog input and output modules shall be provided with 4-20 mA range. Actual I/O count will vary from pump station to pump station.

2.3 PLC Communication Options

The PLC's shall be supplied with minimum two (2) RS-232 communication ports. The ports shall support DF1 and MODBUS protocol as minimum.

2.4 PLC software

PLC's shall be programmed with Allen Bradley RSLogix 500 software.

2.5 Local Operator Interface Unit (OIT)

Each remote station shall have local operator interface unit (OIT's). These units shall be Allen Bradley Panelview 300 or higher. For wastewater pump stations OIT's shall display wet well level, station flow, pump run times and pump run counts. OIT's for wastewater stations shall allow full control of pumps and other auxiliary equipments, entering various

process setpoints, pump status, run times and run counts etc. OIT's shall also display current alarms and alarm history. Operator can delete the alarm history.

2.6 Telemetry

Data concentrator PLC at Utilities office shall communicate with remote site over radio network. Radio network at New Kent County is formed using MDS TRANSNET radios. The MDS TRANSNET utilizes FHSS (Frequency Hopping Spread Spectrum) in the ISM Band of 902 – 928 MHz to provide reliable long range data transportation at up to 115.2 kbps. The TRANSNET provides transparent data communications for nearly all SCADA/Telemetry protocols.

3 SCADA SOFTWARE

At present New Kent County is using iFix 5.0 software for water and wastewater SCADA system. iFIX is a powerful Client/Server based HMI/SCADA solution that provides process visualization, data acquisition and supervisory control over manufacturing and production processes. iFIX gives Operators and Process Engineers the power and security to precisely monitor and control every aspect of their process, equipment and resources. The result is a faster response to production issues, with improved quality, and reduced waste.

The SCADA system is based on PCs running Windows XP as the operating system. iFIX software is very suitable for implementation of *client-server* architectures. Any remote client workstations will also run Windows as the operating system, and client functions will be provided by means of client software from iFIX. Networking at the plant will be accomplished by means of an Ethernet Local Area Network (LAN). This new system will allow the County to expand the system to add new sites with ease.

The existing architecture of SCADA software includes redundant head-end servers. This will ensure that failure one server will not impact operations and continue to provide real time data, historical data and alarms. In addition to redundant servers there are three

iFix clients that will display data received from servers as requested by operators. the redundant servers will collect data from data concentrator PLC over Ethernet network.

New Kent County also utilizes Proficy Historian at the Parham Landing WWTP. Proficy Historian from GE Intelligent Platforms is a powerful, enterprise-wide data historian that collects archives and distributes tremendous volumes of real-time production information at extremely high speeds. Proficy Historian improves visibility, provides context to raw data, and aggregates islands of information-resulting in better and faster decisions, increased productivity and reduced costs across your enterprise.

Any new PS added at New Kent County shall be added to the existing SCADA system. Following additions shall be provided for each new pump stations:

- Graphical display screen indicating status of pump stations. For wastewater pumping stations the screens typically show the instantaneous station flow, wet well level, pump run times, pump run counts, pump status etc., power status, generator status etc. For water tank and well sites typical information displayed shall be pump status, pump run times and counts, other instrumentation values, power and generator status, process setpoints etc. Running pump status shall be shown in red color and stopped pump status shall be shown in green color. Open valves shall be shown in red color and close valves shall be shown in green color.
- SCADA shall be configured to display real time trends of various parameters. For wastewater pumping stations such parameters shall typically include wet well level and station flows. For water tanks and well sites such data shall typically include tank levels, system pressures, chlorine analyzers etc. A minimum of four variables may be trended in the Trend window at a time. All the real time data shall also be achieved for producing historical trends. The operator shall be able to scroll backwards and forwards in time for the complete period of data storage without entering dates and times, etc. Data for historical trends shall be stored for minimum 6 months.
- SCADA shall display process and systems alarms read from data concentrator PLC. Each of these alarms shall be prioritized in the SCADA as per their importance. For example high wet well level or station power failure shall have

highest priority. Alarm screen shall have soft button for operator to acknowledge alarms. Active, Inactive, Acknowledge and Unacknowledged alarms shall be identified with different colors. Following is a typical list of alarms for wastewater pump stations:

- Starter Panel Power Failed
- Generator Failed
- Pump 1 Run Failure
- Pump 2 Run Failure
- Wet well level high
- Wet well level low
- Pump1 over temperature
- Pump2 over temperature
- Pump1 seal failure
- Pump2 seal failure
- Pump1 overload tripped
- Pump2 overload tripped
- Pump station communication failed
- ATS position

Following is list of typical alarms for well sites:

- Booster pump 1 failed to run
- Booster pump 1 failed to stop
- Booster pump 2 failed to run
- Booster pump 2 failed to stop
- Well pump failed to run
- Well pump failed to stop
- Discharge pressure low
- Chlorine level low
- Chlorine level high
- Main power loss
- Local tank high level

- Local tank low level
- Generator Failed
- ATS position

- SCADA system shall display telemetry status for every pump station. Any communication failures shall display be displayed on the telemetry screen and shall create alarm in SCADA. SCADA will display and archive the up time and down time of each site for at least 3 years.
- SCADA system shall have the capability to log important pump station data in ODBC compliant database such as MS SQL Server. SCADA system shall provide reports of pump station data as per the requirements of operators.

4 SCADA MODIFICATIONS

The system integrator shall create new SCADA screens for the new pump stations. Screens shall be similar in nature to the existing screens. Graphic screen shall implement graphical display of all setpoint, instrument readings, and equipment status and control states. Update any automatically generated reports or trends affected by the addition of the new Pumping Station to the SCADA system. This also includes any update to the SCADA software.

The Systems Integrator shall provide the RTU and associated components.

The Systems Integrator shall be:

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