SEWPCC Upgrading/Expansion
Conceptual Design Report

SECTION 18 - Controls Platform and Automation

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18.0 Controls Platform and Automation

18.1 INTRODUCTION

This section reviews the existing technology against new hardware and software for use in expansion of the process control system for new Input/Output (I/O) equipment, sub-systems and building as part of the SEWPCC Upgrading/Expansion Project.

The field controller hardware type and level of functions, but not a specific manufacturer, are required to determine the installation costs for the process control equipment and to determine which fieldbus and interface technologies are available for use in the detailed design.

The display and user interface platform, software and capabilities must be defined as part of the Conceptual Design so interfaces to external systems, process displays and the use of local operator terminals, remote access and mobile computing can be defined in the detailed design. A selection of a specific vendor is not required, only confirmation those specific functions will be available upon initiation of software configuration.

18.2 SYSTEM INFORMATION

Evaluation has confirmed that the current Bailey INFI 90 system is capable of meeting the technical requirements of the expanded and upgraded plant as defined in the Request for Proposal (RFP). The existing system can be expanded to provide additional controllers and I/O for new processes and buildings.

The existing control system can be divided into three layers:

1. A field layer, containing the controllers, I/O and bus technologies;
2. A data layer with I/O servers (if applicable), historians and interfaces;
3. A presentation layer with the plant displays on Human Machine Interface (HMI or Operator Stations).

The Bailey INFI 90 provides all three layers of the control system with components of the data layer combined with the field layer in the controller Central Processing Unit (CPU). The controller provides connections to the I/O card and generates tag data for use in the displays.

In a PLC based system, an intermediate server is present in the second layer; the I/O server or SCADA server polls the Programmable Logic Controller (PLC), Remote Terminal Unit (RTU) or other field controllers and makes this information available to the HMI. This is a separation of the first and third layers.

In addition to the UNIX based HMI Operator Interface, terminals are used with the UV PLC to directly display information from the PLCs. See Figure 18.1 - Current Control System Architecture.

18.3 FUNCTIONAL REQUIREMENTS - HMI

In the review of the existing system and from discussions with the end users, including plant operations, maintenance and management staff, the requirements for the Control System at the facility has exceeded the current functionality provided by the INFI 90 System.

Our discussions reviewed the capabilities of the current system, the expected expansion needs, and the operator requirements in order to assess the HMI software platform that should be identified in the Conceptual Design.

As a minimum, the Layer 2 and Layer 3 components of the control system user interface must support the following functions:

1. **System Redundancy**. Loss of a single server must not impact the operation of the facility.
2. **Open Architecture**. Open architecture for data integration at the Historian and Object Linking and Embedding (OLE) for Process Control (OPC) Server nodes.
3. **Display Creation.** Simple development of new graphics and displays for the system includes re-useable modules and macros and single name configuration for complex modules.
4. **Ad-Hoc Trending.** Operator generation of Ad-Hoc trends for up to one year of process data and the system response time to present the plot.
5. **System Diagnostics**. Automatic or configured diagnostic displays and functions must be available for field controller interfaces and HMI node, database server, historian and remote access server communications.
6. **Tag and Database Searches**. Ease of tag, display and configuration information searches within the configuration tools.
7. **Historian Tag Additions.** Simple additions or modification of historian points from the tag database.
8. **Alarm Displays.** Alarm displays that can be easily sorted, filtered and managed.
9. **System Display Navigation**. Simple navigation between displays and throughout the display hierarchy. Ability to get to any information or screen with a minimal number of actions (i.e. two clicks to any display).
10. **Remote Access.** Remote access for use at other facilities or by portable computing devices within the facility.

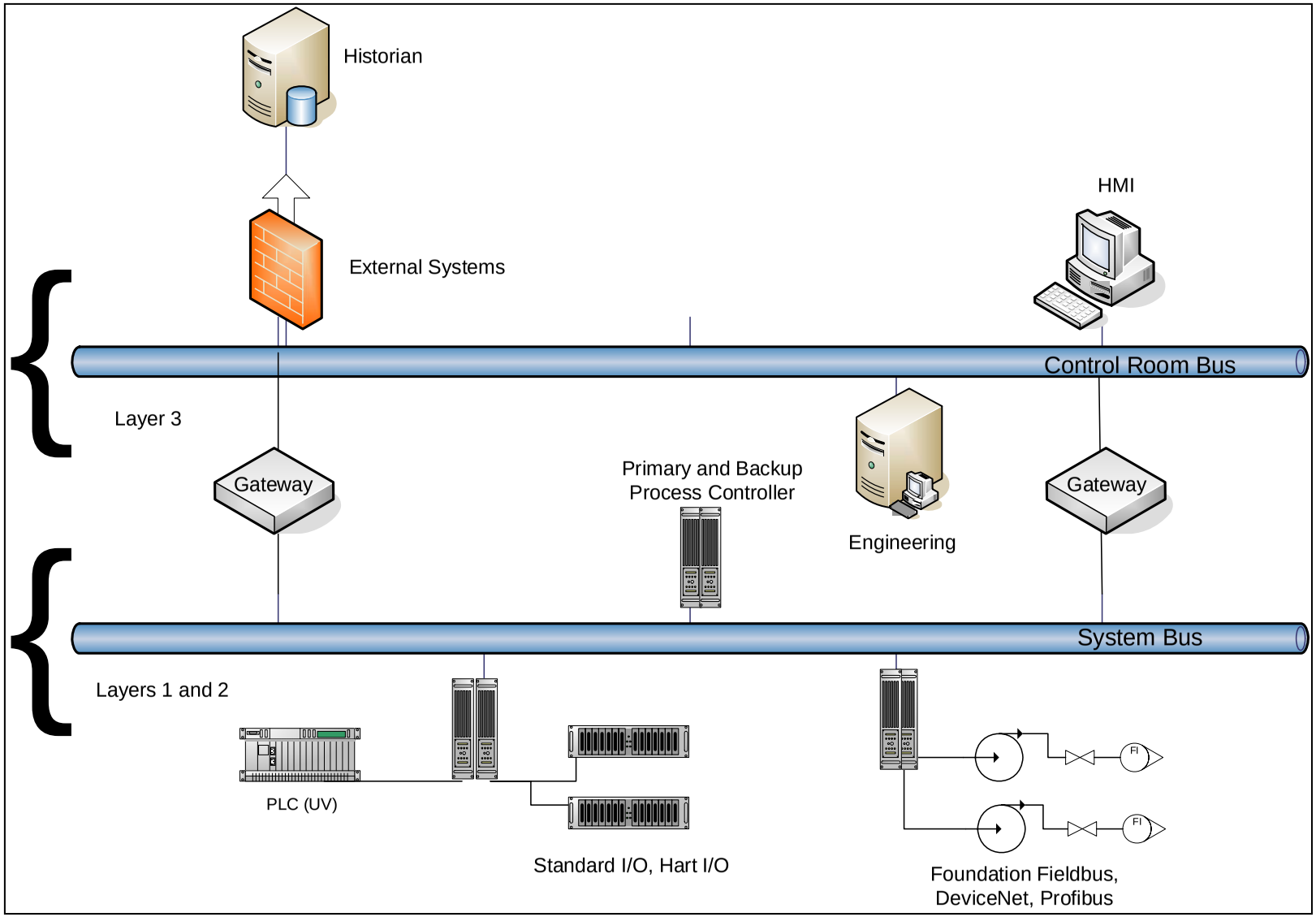

Figure 18.1: Current Control System Architecture

11. **Alarm Management**. The ability to prioritize, sort and group alarms. Alarm escalation and email, paging and audible alarm notifications.
12. **Change and Configuration Management.** Tracking changes in the system configuration for field controller programs, displays, modules, security, node configuration and users. This system must be auditable and secure.
13. **System Security**. Two Mode Authentication available for a node, individual password security for each display, tag and user.
14. **Plant Optimization Controls**. Pre-defined control offerings such as Economical Pump and Chemical Usage, Statistical Process Control and control tuning in the Control System environment.
15. **Historian and Data Analysis Tools**. Tools to provide statistical analysis, optimization, presentation and reporting functions. Ability to export to Microsoft Excel.
16. **3-D Trending Displays**. Presentation of multiple trends in a 3-D view to allow more pens to be displayed.
17. **Driver Compatibility.** Divers must be available to communicate with multiple PLC vendors and ease of development of new drivers for upgraded and new PLC and RTU offerings is required. Ability to communicate with Collection System field controllers and data sources.
18. **PLC Tag Auto-Discovery**. Obtain tag names and registry addresses from existing PLCs and PLC configuration programs. Populate a tag database with the information. Auto-Discovery of OPC Server tags.
19. **Integrated Asset Management**. Monitor runtime and asset condition points. Can generate predictive failure alarms. Can be interfaced with a Computerized Works Management System (SPL Synergen).
20. **Network Device Monitoring**. Use Simple Network Management Protocol (SNMP) (or other protocols and interfaces) to monitor network devices (switches and routers) and ports for failures. Notification and status displayed on the HMI and included in the alarm management system.
21. **Preconfigured Logic and Control Modules**. Pre-configured modules that include all logic, display, pop-up, calculation and historical configuration.
22. **Common Configuration Namespace**. A single location to configure all aspects of the system. Once a tag is defined it is available to all nodes in the system including controllers, HMI display, and historian. (Reduces configuration labor and errors).
23. **Alarm Management and Analysis Tools**. On-line alarm analysis and tools to reduce nuisance alarms. Provide recommendation to adjust alarm limits and alarm hysteresis. Provide EEMUA 191 key performance indicators.

24. **Tag-Out Function**. The ability to Tag a Device as "Out of Service". This will prevent any operator actions and will provide a visual representation of the state. This will be included in an event log.

The current INFI 90 System was evaluated against three competing products, representing a cross section of the industry:

- The ABB 800xA. This is the migration platform for the INFI 90.
- Emerson DeltaV. A competing Distributed Control System (DCS) platform utilizing a dedicated system bus and Emerson DeltaV controllers. This system is analogous to the ABB and Bailey products.
- GE Proficy. A Commercial Off the Shelf (COTS) system designed to work with multiple PLC, RTU and DCS field controllers. The associated field controllers for the Proficy HMI are the RX3i and RX7i. For comparison purposes the RX3i processors are identified as they fill the I/O density, processing load and configuration requirements of the wastewater plant.

The availability of each function by vendor is summarized below in Table 18.1. The INFI 90 compliance is rated against the current configuration; additional functions could be implemented.

Table 18.1 - Vendor HMI Functionality Analysis

Function	INFI 90	ABB 800xA	Emerson DeltaV	GE Proficy
System Redundancy	X	X	X	X
Open Architecture	X	X	X	X
Simple Display Creation		X	X	X
Ad-Hoc Trending	X	X	X	X
System Diagnostics		X	X	X
Tag and Database Searches	X	X	X	X
Historian Tag Additions		X	X	X
Alarm Displays		X	X	X
System Display Navigation		X	X	X
Remote Access		X	X	X
Alarm Management		X	X	X
Change and Configuration Management				X

Function	INFI 90	ABB 800xA	Emerson DeltaV	GE Proficy
System Security	X	X	X	X
Plant Optimization Controls			X	
Historian and Data Analysis Tools		X	X	X
3-D Trending Displays		X	X	X
Driver Compatibility			X	X
PLC Tag Auto-Discovery				X
Integrated Asset Management		X		
Network Device Monitoring		X		X
Preconfigured Logic and Control Modules		X	X	X
Common Configuration Namespace	X	X	X	X
Alarm Management and Analysis Tools			X	
Tag-Out Function		X	X	X

18.4 FUNCTIONAL REQUIREMENTS – FIELD CONTROLLER HARDWARE

In determining the hardware platform to be utilized for the plant expansion, a number of new technologies will impact the decision as to which field controller will be installed for new equipment. In a number of locations the existing equipment will not be modified and will be retained in the process. For these instances, the Bailey INFI 90 system will be retained as the support organization is currently in place and a supply of replacement parts is guaranteed.

As a minimum the field controller used for the expansion must have the following features:

1. **Controller Redundancy**. An online "hot" backup system with auto-failover for the field controllers.
2. **I/O Redundancy**. Redundancy of I/O controllers. Hot Swap of I/O cards.
3. **Power Supply Redundancy.** Redundancy of Power Supplies.
4. **Programming Languages**. Programming package that is IEC 61131 compliant.
5. **Online Changes**. On-line programming changes and diagnostics.
6. **Fieldbus**. Interfaces for Profibus, Fieldbus and DeviceNet bus technologies.
7. **HART**. HART analog I/O interfaces.

8. **Controller Communications**. Availability of Peer-to-Peer communications between controllers.
9. **Local OIT**. Simple serial or TCP/IP interfaces for a local COTS Operator Interface Terminal (OIT). Use of common HMI development software.

The availability of each function by vendor is summarized below in Table 18.2.

Table 18.2 - Vendor Field Controller Functionality Analysis

Function	INFI 90	ABB 800xA	Emerson DeltaV	GE Fanuc PAC RX3i
Controller Redundancy	X	X	X	X
I/O Redundancy	X	X	X	X
Power Supply Redundancy	X	X	X	X
Programming Languages		X	X	X
Online Changes	X	X	X	X
FieldBus	X	X	X	X
HART	X	X	X	X
Controller Communications	X	X	X	X
Local OIT				X

18.5 FIELD CONTROLLER HARDWARE AND SOFTWARE EVALUATION

Based upon the Preliminary Design process selection, an expansion of 1,500 new I/O (almost 100%) was considered for the evaluation of technologies and hardware. With the current density of the Bailey INFI 90 cabinets this results in six new field controllers. Some of the I/O will be delivered as part of major equipment packages and will contain pre-configured PLCs and OITs. To allow for this, the evaluation of costs is based upon 5 new field controllers and 1,200 new I/O.

For the implementation of new field controllers expanding upon the Bailey INFI 90 system, the following options were considered:

1. INFI 90 hardware.
2. ABB 800xA.
3. DeltaV, a competing DCS system.

4. GE Fanuc PAC RX3i COTS PLC.

These systems are in place in wastewater facilities throughout North America. For the purposes of the evaluation of alternative systems, the DeltaV pricing and functions was used to consider a non ABB DCS solution; and the GE Fanuc pricing and functions are representative of GE, Allen-Bradley, Modicon, SquareD and Omron PLCs. The ABB 800xA is included as the migration product for the Bailey INFI 90 system.

If new field controllers are introduced to the facility, this would extend the use of PLCs in the system from the UV area.

In addition to installation of new field controllers, specific vendors provide hardware to utilize the field wiring and I/O terminations of the Bailey systems. This technique can be used to replace the I/O cards and field controllers without removing the existing field wiring and cabinets. This option pricing has been identified and will be discussed in later sections. However, this alternative has not been included in the review of the new field controllers as the intent has been to retain the existing INFI 90 controllers wherever possible.

With the expansion of the plant and removal of equipment from the plant, a number of displays, tags and alarms must be added to the HMI, while other sub systems will be removed.

To provide the operator functionality, the existing INFI 90 HMI was compared against the following options:

1. Retain current INFI 90 HMI.
2. Upgrade to the ABB 800xA HMI.
3. Install a new DeltaV HMI, (a competing DCS system).
4. Install a GE Fanuc Proficy HMI, a COTS system.

These systems are well established in wastewater facilities throughout North America. For evaluation purposes, the DeltaV pricing and functionality is considered to evaluate a non ABB DCS solution, while the GE Fanuc Proficy pricing and functions are representative of GE, Rockwell and WonderWare SCADA Systems. The ABB 800xA is included as the migration product for the Bailey INFI 90 system.

If new field controllers and a new HMI are installed, the system will require multiple engineering systems, and will become a true hybrid with direct visualization of multiple PLC and INFI 90 controllers. This is shown in Figure 18.2 - Proposed Hybrid Control System Architecture.

The system evaluation was conducted during the Project Team workshop on June 25, 2008.

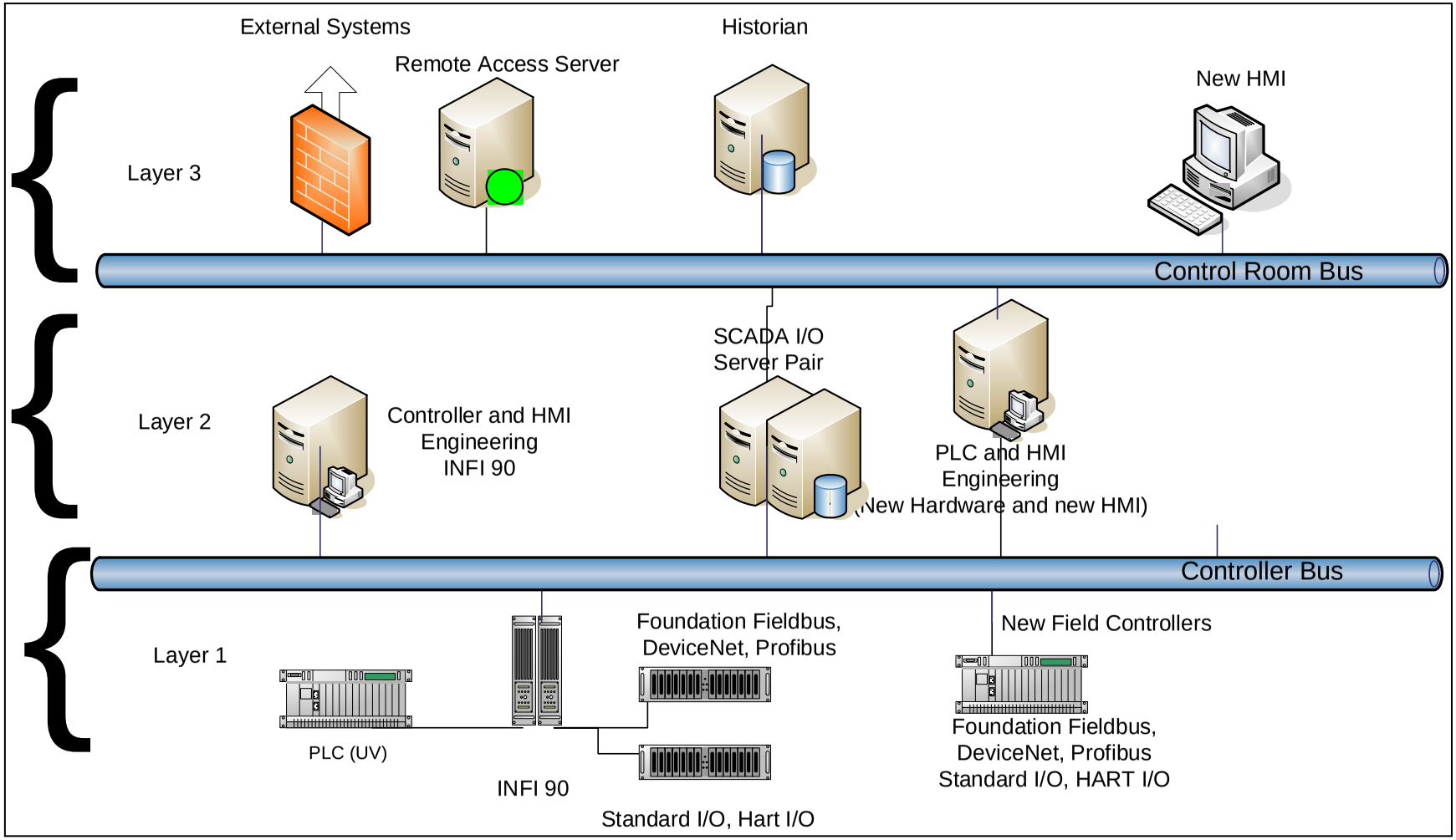

Figure 18.2: Proposed Hybrid Control System Architecture

During the workshop, the direction and scope provided in the RFP to expand the INFI 90 hardware for the plant upgrade was reviewed and with the agreement of the Project Team, this direction will not be pursued. This leaves the ABB 800xA and the PLC and COTS SCADA System as the two systems for comparison.

The system evaluation was conducted utilizing the following criteria:

1. **Best Functionality and Meets the Plants Requirements**. Does the system meet the technical requirements of the plant? Rate the system for best functionality.
2. **Installed Cost.** Installed cost of the hardware including the processors, power supplies, I/O cards, communication cards, engineering work stations, operator stations, historians and interfaces.
3. **Support:**
   a) Availability of support and level of expertise of internal staff.
   b) Availability of vendor and Winnipeg area for support and engineering functions. Level of support from vendor via telephone, email and web site.
4. **Staff Training**. The time associated with, and cost associated with staff training.
5. **Spare Parts and System Commonality**. The availability of spare parts in the Winnipeg area and the level of commonality between the South, North and West plants.
6. **Staff Support**. The time and cost associated with staff training.
7. **Integration to INFI 90 PCUs**. The ability to integrate and the functionality provided to interface the HMI with the existing and retained INFI 90 PCUs at the SEWPCC.
8. **Integration to Embedded PLCs**. The ability to integrate and functionality provided to interface embedded PLCs into the HMI.
9. **Diagnostics and System Health**. The availability of functions to identify system failures and health at a communications (between nodes and controllers) and granular level (between I/O Cards and virtual components).
10. **OIT Integration**. A common integration package allowing tags and graphics developed for the controllers and HMI to be available for the OITs.

In the review of the two systems the following comments were identified:

ABB 800xA

1. **Best Functionality and Meets the Plants Requirements.** The ABB provides functionality that meets the plant needs and provides Maintenance Views and functionality. The 800xA system provides Foundation Fieldbus and Profibus Interfaces.

2. **Installed Cost.** The installed hardware cost of the 800xA system is roughly equivalent to a PLC system based upon the 1,500-2,000 I/O points identified for the SEWPCC expansion when compared with the overall cost of the project.
3. **Support.** The current DCS support staff will be suitably trained on the new software and will be able to provide support on the retained INFI 90 Hardware and Software. ABB support in the local Winnipeg area is limited by the staff located at the local office.
4. **Staff Training.** All DCS support staff and the Operations and Maintenance staff will be trained on the new system.
5. **Spare Parts and System Commonality.** The amount of spare 800xA parts available within Winnipeg is limited by the ABB supply. If all three systems, the south, north and west plants are upgraded to a common hardware platform (replacement of the PCUs with new AC 800M processors) then the software will be common and processes and displays will be available at other plants.
6. **Staff Support.** To provide the needed level of troubleshooting resident at the facility, the SEWPCC Operations and Maintenance staff must be trained on the 800xA system. The separation of DCS and PLC support would not be maintained.
7. **Integration to INFI 90 PCUs.** The 800xA system can integrate directly to the 800xA system with a gateway module. This provides the greatest level of ease of integration to a new HMI.
8. **Integration to Embedded PLCs**. The 800xA system provides a Communications server to interface with PLCs. In some cases an OPC driver is the only interface available, requiring two part integration.
9. **Diagnostics and System Health.** The 800xA provides diagnostics at a granular level for the new 800xA controllers and I/O. An OPC interface to a PLC will provide interfaces for any tag assigned value
10. **OIT Integration.** The 800xA system configuration software does not integrate with commercial OIT manufacturers.

PLC and COTS HMI

1. **Best Functionality and Meets the Plants Requirements.** A PLC and COTS HMI solution will provide the functionality to meet the requirements. Programmable Automation Controller and full function HMI and Historian system provides full user functionality and the ability to integrate FieldBus, DeviceNet, HART, Modbus and other complex I/O types directly into the field controller.
2. **Installed Cost.** The installed hardware cost of the PLC/HMI system is roughly equivalent to an 800xA system based upon the 1,500-2,000 I/O points identified for the SEWPCC expansion when compared with the overall cost of the project.

3. **Support.** The current DCS support staff will be suitably trained on the new software and will be able to provide support on the retained INFI 90 Hardware and Software and the new hardware. Numerous organizations within the Winnipeg area can supports off the shelf hardware and software.
4. **Staff Training.** All DCS support staff and the Operations and Maintenance staff will be trained on the new system.
5. **Spare Parts and System Commonality.** The amount of spare PLC parts will be determined by the selection of a specific vendor. As the parts are widely used and distributed the local parts availability and vendor availability will be high. If all three systems, the south, north and west plants are upgraded to a common hardware platform (replacement of the PCUs with new Programmable Automation Controller (PAC) processors) the software will be common and processes and displays will be available at other plants.
6. **Staff Support.** To provide the needed level of troubleshooting resident at the facility, the SEWPCC Operations and Maintenance staff must be trained on the new system. The separation of DCS and PLC support would not be maintained.
7. **Integration to INFI 90 PCUs.** The new PLC system can interface with an INFI 90 PCU as demonstrated within the UV system. The HMI software can monitor and control the INFI 90 system directly through drivers.
8. **Integration to Embedded PLCs**. The COTS HMI system provides native driver interface to the embedded PLCs.
9. **Diagnostics and System Health.** The HMI and PLC system will provide diagnostics at a device, rack, card, channel and memory level for integrated PLCs. For embedded or any other PLC, INFI 90 DPC or RTU Data Source, any registry that can be monitored from the HMI can be displayed and alarmed in the HMI.
10. **OIT Integration.** If a common PLC, HMI and OIT vendor is selected, specific models will provide interoperability and integration of tags and displays.

18.6 RECOMMENDATIONS

The ABB 8700xA and the PLC and COTS HMI were evaluated and scored during the June 25, 2008 workshop. Through this evaluation by the Project Team, the PLC solution was scored at 58.5 total points and the ABB system at 58.

For the new field controller hardware and HMI it is recommended that PLC and COTS HMI be selected. This solution provides the functionality and reliability required for the expansion, and at a reduced price compared to the other alternatives. This choice also provides for a cabinet by cabinet migration of the existing INFI 90 hardware in a future migration plan when that equipment has reached the end of its useful life. The selection of the PLC Hardware and HMI

Software must be finalized and in place by the completion of the Detailed Design in order to allow for the configuration of new tags and displays for the expansion. The PLC hardware must be defined for inclusion into the construction contracts as embedded PLC hardware for delivery by equipment vendors, and as field controller panels to interface with the new FieldBus instruments, actuators and standard I/O devices.

The PLC hardware platform offers a number of significant advantages and strengths.

The hardware can be sourced from multiple vendors allowing savings in the procurement costs for the initial equipment and for the provision of replacement parts in the future. The PLC hardware installed to support the additional I/O should be specified to match the embedded PLC controllers supplied by equipment vendors as components of their delivery. This will standardize the expansion hardware into a single platform, reducing training and inventory costs. By maintaining a single field controller PLC platform in the expansion, the plant maintenance staff can be trained on a single configuration and troubleshooting package allowing efficient troubleshooting and configuration. This reduces the need for any assistance external to the facility and the dependence upon a centralized support group.

The PLC and COTS HMI platform can be easily supported and expanded by numerous system integrators and consultants within the City and the surrounding areas. Consultants and integrators are recognized partners for configuration, installation and distribution of the hardware and software. This provides for a larger community to bid on future upgrades, migrations and expansions of systems at the SEWPCC and other plants.

COTS HMI systems are by their nature flexible and open. Although specific integrations with PLC hardware from the same vendor offer significant advantages in configuration effort and functions (GE FANUC Proficy and GE FANUC PACs, Rockwell Automation Factory Talk and ControlLogix PAC), HMI systems are designed to communicate natively with a large number of PLC and DCS hardware types. The systems are designed with an open architecture to make use of the largest possible customer base.

The Water and Wastewater industry is moving to more Open System and Off the Shelf solutions for their control needs. The trend is also prevalent in other industries previously utilizing distributed control systems, such as pharmaceutical, pulp and paper, mining and power generation. Discrete manufacturing and the automotive sector have traditionally used PLC field controls but have significantly expanded the use of visualization systems beyond simple touch screen and local displays for plant wide monitoring and management information systems.

Through our experience working with numerous water and wastewater facilities, municipalities and water authorities, the continuing use of PLCs and the migration to PACs from legacy control systems is evident.

The PLC and COTS HMI vendors maintain extensive installation bases and provide vertical industry specific solutions for their water and wastewater clients. This installation base provides significant funding for research and development of future systems and greater availability of products for the wastewater industry. The largest three suppliers of HMI and PLCs have significant consumer bases, GE Fanuc iFIX has over 100,000 licenses active with over 25,000 of these with water and wastewater users (Appendix N, Solutions for the Water and Wastewater Industry, Page 3), WonderWare has over 450,000 installed licenses (Appendix O, Vertical Focus and Future Direction Within Water Wastewater Market, Page 2) while the Rockwell Automation A-B PLC 5 has over 450,000 units installed worldwide and numerous migration paths for DCS systems (Appendix P, ARC Whitepaper). These three vendors will provide a superior development and support structure due to their larger distribution networks, support facilities and research budgets. Use of a major HMI and PLC based system will ensure the product viability and the greatest level of continuous improvement over the lifecycle of the SEWPCC upgrade.

18.7 HARDWARE PROCUREMENT

For hardware procurement a detailed technical specification is required. The technical specification will be required for the embedded PLCs that will be delivered by the equipment manufacturers and for the field controllers that will interface the remaining I/O into the system.

18.7.1 Technical Specifications

The technical specification will include a make and model numbers ensuring the communication protocol and driver utilized by all new PLCs will be consistent and all registries and points identified in the P&ID drawings will be available for display and control on the HMI.

18.7.2 Field Controller Hardware Selection

The field controller hardware specification for embedded PLC applications is also recommended for use for the new I/O installed under the construction contracts. These field controllers will interface with the new HMI and provide monitoring and control for Fieldbus and traditional I/O devices. The selection of a specific make and model will require a review of the technical functionality provided by each vendor. This process can be completed in a number of methods:

1. Select a vendor based upon demonstrations and existing installation base. At this point the make and model would be first named and sole sourced for the embedded PLCs and field controllers. The price paid for each unit is determined by the vendor or re-sellers and is not considered part of the construction implementation.
2. Conduct an evaluation of the functions and price of suitable vendors. Following vendor demonstration, a Request for Information would be released for the estimated quantities of field controllers in the system. At this point the vendors can be evaluated against both

3. technical specification and price. The vendor providing the greatest value can be identified as the sole acceptable make and model for all embedded PLCs and field controllers. Pricing will be competitive assuming the equipment manufacturers and electrical contractors receive similar discounts and reductions.
4. As above, a request can be made to the vendors and distributors. In place of a RFI, a Request for Quotation would allow for the purchase of all field controllers. This would allow the City of Winnipeg to eliminate the markup on the hardware, but would require the storage of the materials and parts, potentially reducing the warranty period of the equipment after start-up. The successful make and model would then be used for all embedded PLC specifications.

18.8 HMI PROCUREMENT

To reduce the disruptions to operations and maintenance staff at the SEWPCC, it is suggested that the HMI system be upgraded prior to the initiation of major construction within the facility. It is strongly recommended that the HMI selection process be completed as soon as possible, such that the HMI system can be designed, developed and implemented prior to the first construction contract. Proceeding in this manner reduces the training duration as training would only be required for new equipment during construction. Training and commissioning of the new display/control interfaces would already be completed prior to construction of new processes. A possible procurement plan is identified below.

18.8.1 Request for Information

The selection of a new HMI system will require the review of the technical and user specification identified within this document. These specifications can then be released to the industry as a Request for Information. The RFI must include the following items:

- Functional Specifications.
- Product Installation Base Information.
- Product lifecycle.
- Vendor financial stability.
- References for Large Wastewater Plant Installations.
- Initial and recurring licensing costs.
- Location of Support offices and response times.

By reviewing and evaluating the responses against the functional specifications and requirements identified above, systems that are not suitable for use at the SEWPCC can be easily rejected from further consideration.

The Request for Information should be prepared and released as soon as possible. This is absolutely critical to allow proper evaluations and to complete the HMI system design and upgrade prior to the initiation of construction of the SEWPCC treatment system upgrades.

18.8.2 Vendor Presentations

Following the review and evaluation of the proposed HMI systems, vendors meeting the City's requirements will present their systems and functions to all stakeholders. This will allow the end users to review the look and feel of the systems and to identify any additional functional and/or technical requirements. Each vendor will be asked to perform a specific script or series of operations and configuration tasks. This will demonstrate the real world use of the software. In some cases the inclusion of a specific function may limit the ability of a specific vendor to propose.

The new functions and the system architecture requirements will form the Request for Proposal. If only a single vendor meets the needs of the plant and City, a sole source could be issued.

The vendor presentation must be completed as soon as possible to allow for the RFP to be generated.

18.8.3 Request for Proposal

The request for proposal can be issued only to those vendors who met the requirements of the RFI. The RFP and the associated evaluation must be completed by early Q1 2009 to allow for contract negotiations and procurement of the system for the development of the software.

18.8.4 Software Standards

Following the selection of the HMI software, Software Standards can be defined and produced. Development of the software modules and standards will follow a workshop approach where end users contribute to the decisions regarding configuration of the system (tagging, displays, and alarm behavior). This interaction ensures that the end users have buy-in and will accept the product and the configuration. This exercise is expected to be completed in six months, allowing configuration of the new system to begin in earnest in Q3 2009.

18.8.5 Software Implementation

Upon completion of the software standards, migration of the displays to the new system can be initiated. The creation of the Tag Database and basic displays can be started upon delivery of

the software. The displays, pop-ups and alarm functions cannot be finalized until the Software Standards are complete. The base configuration of the system can be completed and system communications and driver testing can be executed. Once operational, the system can be run in parallel with the existing Bailey INFI 90 during the migration. This will allow for the implementation of the system to start during the software standards definition phase thereby ensuring that the overall system configuration and testing can be completed prior to construction. With staff fully trained on the system and software, there will be no impediments to the commissioning of new equipment as part of the construction contract. If the HMI is implemented at the same time as the construction activities the additional burden of a system upgrade will impact the operation of the facility during this critical time period.

18.9 NEWPCC REMOTE MONITORING

To ensure continuous monitoring of the system from the NEWPCC, when the new HMI is implemented at the SEWPCC, monitoring and control of the system must be implemented at the NEWPCC control room.

This will require either a dedicated Operator Station at NEWPCC running the new HMI software, or access to a Remote Access Server located at the SEWPCC. The remote access server can provide either monitoring or control capable displays through a Terminal Server or Web Server. The current SEWPCC Plant Control System Network Wide Area Connection must be upgraded to accept the higher bandwidth Ethernet Connection.

To provide a common architecture for the NEWPCC and WEWPCC plants, the HMI at each location could be upgraded along with the SEWPCC. This would provide a uniform operating environment for all three facilities and would reduce troubleshooting and training discrepancies between the plants. In some cases the implementation of a new HMI can be paired with a replacement of the INFI 90 controllers.

By implementing the new HMI at all three plants, the standard software modules developed for use at the SEWPCC can be utilized at the other two facilities. This will greatly reduce the conversion effort and time and will provide a uniform system for operators. The troubleshooting and training requirements will also be reduced as the HMI software is standardized in all locations.

The INFI 90 controllers can be replaced either through the installation of a new controller, implementation of a gateway between a new controller and the existing INFI 90, or replacement of the Controller and I/O systems retaining the terminations to reduce the labor and testing requirements.

In Appendices L, M, N and P, quotations are provided for the implementation of new Software and Hardware for the SEWPCC; prices are extended for the NEWPCC and WEWPCC plants to provide a common Controller Hardware and HMI Software Platform.

Implementation of a new HMI software platform and Field Controller platform will provide for a common architecture at all three facilities and will provide the new HMI and hardware functionality throughout the City. This will also provide the ability to easily remotely monitor and control the systems through a single HMI platform.

18.9.1 Migration Plan

18.9.1.1 Hardware Migration Plan

Given the implementation of new Field controllers at the SEWPCC as part of the plant upgrade, the migration of the remaining INFI 90 controllers can be scheduled in a migration plan. This Migration Plan should be developed following the completion of the SEWPCC upgrade project. As constrained by the operations budget, controllers can be migrated on a cabinet by cabinet basis.

Following the completion of the SEWPCC Upgrade the remaining PCUs can be converted or interfaced with the new Field Controller Hardware. This will provide for a uniform system within the facility.

It is recommended to migrate the PCUs in a serial basis. A new panel or sub-assembly can be manufactured and Factory Acceptance Tested while the Software is in review and testing. The SAT for the Panel can then be completed prior to the initiation of the second panel. This approach will limit the impact upon plant operations and maintenance and can be scheduled to reduce the yearly capital costs over a number of years. With the identified end of support for the current INFI 90 platform, the implementation plan can be developed to replace the PCUs by the end of the INFI 90 lifecycle.

When the new hardware platform is identified, it can be utilized for expansion and new equipment installations at the NEWPCC and WEWPCC facilities. As with the SEWPCC, the hardware implementation plan can replace the existing INFI 90 PCUs on a step by step basis to complete the system migration by the INFI 90 product end date.

If the PCU hardware is replaced or interfaced in the short term to facilitate the new HMI an implementation plan will not be required.

18.9.1.2 Software Migration Plan

When a new HMI platform is selected for the SEWPCC, this platform could be extended to the

NEWPCC and WEWPCC (refer to Section 18.9). The schedule for the implementation should allow for the completion of the Software Standards and the Standard Software Modules at the SEWPCC. To ensure this methodology is accepted and supported at the NEWPCC and WEWPCC, the operations, maintenance and process control system support staff from all locations must participate in the development of the standards and modules.

When the standards are defined and the SEWPCC is completed, the NEWPCC could be migrated. This plant monitors the SEWPCC outside of regular business hours so delivering a standard platform and look and feel at this location proves beneficial over the WEWPCC. The WEWPCC could follow the upgrade of the NEWPCC.

Given the amount of staff involvement it is not recommended to start an upgrade of all three plants as operations, maintenance and PCS support input is required for the development of the standards and displays. It is recommended to focus on the development of the Standards and Modules first, and then implement the SEWPCC system to meet the construction schedule constraints. Following this, staff will have more availability to support migration of the NEWPCC and WEWPCC.