



Milwaukee Metropolitan Sewerage District

SCADA MASTER PLAN

M03112P01

FINAL | October 2024



EXECUTIVE SUMMARY

ES.1 Background

The following is an executive summary for the Supervisory Control and Data Acquisition (SCADA) Master Plan as part of the Milwaukee Metropolitan Sewerage District's (MMSD) – Instrumentation and Control (I&C) Master Plan Project.

MMSD currently has several needs with the infrastructure and support systems for its water reclamation SCADA System. The following are key SCADA/I&C considerations:

- Accurate documentation.
- Robust security.
- Standardization across facilities.
- Complete asset management.
- Data integration across systems.
- Robust infrastructure.
- Up-to-date software integration.
- Alarm priority/management.

Failing to address the above needs may result in security risks, unsafe situations, loss of efficiency, exceeding permit limits, and increased training expenditures. MMSD engaged Carollo Engineers, Inc. (Carollo) to develop and deliver a SCADA/I&C Master Plan to address the above needs. Carollo and its subconsultants will be referred to as the Consultant for the remainder of this report.

MMSD's ultimate goals for this SCADA master planning effort were the following:

- Develop a long-term vision and goal that MMSD can use to develop and implement projects for I&C, SCADA, and information collection.
- Identify, analyze, and document MMSD's SCADA needs, aspirations, and priorities.
- Maximize SCADA system reliability.
- Minimize the impact that external sources can have on SCADA systems.
- Evaluate and improve MMSD's security posture for SCADA and I&C assets.
- Maximize benefits the SCADA systems can provide.

Success of this SCADA master plan will be measured by the following metrics, as observed after implementation:

- Enhanced system performance and uptime through the replacement of end of lifecycle equipment, infrastructure, and outdated software.
- Transitioned from sporadic review of network assets and activity to continuous real-time monitoring of critical data for network health and security.
- Enhances process, standards, and document management.
- Control system with integrated software, hardware, and oversight that enables maintenance staff to shift from reactive maintenance to scheduled maintenance.
- Implemented a standard alarm system, in accordance with International Society of Automation (ISA) guidelines, that eliminates nuisance alarms and enhances situational awareness, enabling appropriate operational responses.
- Increased security posture implemented through a security policy managed by a dedicated team.

ES.2 Process

MMSD and the Consultant started the project by collaborating to create a visioning document. The following major steps were taken to create the visioning document:

- Document gathering.
- Review of existing documentation.
- Interviews and surveys with key stakeholders.
- Establishment of critical success factors.
- Review of current SCADA/I&C standards.
- Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and collaboration with key SCADA users.

The result of the visioning phase was MMSD's realization that SCADA is to be utilized for enhancing operations and decision making. The visioning phase also set the basis for the remainder of the master planning activities. Following the visioning phase, the focus was on other aspects of the water reclamation SCADA components, such as security, instrumentation, controls, hardware, software, and other miscellaneous elements. The following technical memoranda (TMs) document these master planning activities:

- TM 1 – Long-Term Vision.
- TM 2 – Security.
- TM 3 – I&C Elements.
- TM 4 – Other Elements.
- TM 5 – SCADA Network, Hardware, and Software.

At the end of the above activities, MMSD and the Consultant established individual standards for each of the major SCADA components. The next steps were to produce detailed implementation plans for MMSD's SCADA/I&C infrastructure for all existing systems. The existing systems are divided into two major categories: conveyance and water reclamation facilities (WRFs).

TM 6 – Conveyance Implementation Plan and TM 7 – WRF Implementation Plan document the I&C/SCADA upgrade implementation plans for conveyance and the WRFs and were used as the basis for the projects and cost estimates in Section 8.

The overall SCADA goal for the systems is to have secure and standardized hardware, software, and infrastructure.

ES.3 Outcome

ES.3.1 WRF

The WRF SCADA/I&C elements were divided into seven components – software, network, hardware, data management, backup power, security, and safety. The needs, recommendations, and project tasks for each of the WRF I&C/SCADA elements are discussed in TM 7. The project tasks also include project costs for each of the tasks for a complete WRF implementation plan.

TM 7 discusses in detail the recommended implementation tasks for the WRF systems. The summation of these tasks was the identification of the following primary projects necessary for the continued functionality of the WRF sites:

- Replace obsolete or aging programmable logic controller (PLC) hardware with new PLCs. During this process, other miscellaneous replacement of aging or obsolete parts within the PLC cabinets should be performed.

- Develop and implement new human machine interface (HMI) screens on a new SCADA platform, to be selected by MMSD.
- Deploy wireless business networks for MMSD staff and the operation and maintenance contractor.
- Complete implementation of the fiber backbone replacement at both sites.
- Complete development and implementation of the support network, which segregates the network traffic for security, wireless communication, and building management from SCADA.
- Upgrade existing control rooms for a more effective and efficient operating environment.
- Deploy asset tracking, management, and security software.
- Develop cybersecurity policies and implement new security practices.
- Upgrade fire alarm systems.
- Conduct global process hazardous analyses (PHAs) and level of protection analyses (LOPAs) to assure compliance with National Fire Protection Agency (NFPA) standards.

ES.3.2 Conveyance

With over 400 remote Conveyance sites, MMSD and the Consultant organized all Conveyance sites based on two major categories – service type and subsystem. Furthermore, the overall Conveyance SCADA/I&C elements were divided into six components – software, network, hardware, backup power, security, and safety. The needs, recommendations, and project tasks for each of the Conveyance I&C/SCADA elements are discussed in TM 6. The project tasks also include proposed start date, estimated project duration, and project costs for each of the tasks for a complete Conveyance implementation plan.

TM 6 discusses in detail the recommended implementation tasks for the Conveyance system. The summation of these tasks, was the identification of the following primary projects necessary for the continued functionality of the Conveyance sites:

- Develop detailed standards for Conveyance system, similar to those already developed for the WRFs, based on final selection of hardware and software.
- Replace existing PLC hardware and software with new PLCs, to be selected by MMSD. During this process, other miscellaneous replacement of aging or obsolete parts within the PLC cabinets should be performed.
- Develop and implement new HMI screens on a new SCADA platform, to be selected by MMSD.
- Replace aging cellular modems throughout the Conveyance sites.
- Conduct site security evaluations and implement recommendations.

ES.3.3 Projects

The Consultant met with MMSD staff to group the individual tasks identified in TMs 6 and 7 into shared projects. During this process nine (9) projects were formed to cover forty-seven (47) tasks for improving the SCADA systems. The nine (9) projects that were identified and their associated costs are summarized in Table ES.1.

Table ES.1 Recommended Project Summary

Project Priority	Project Description	Target Timeline	External Planning & Consultation	Design (10%) & ESDC (5%)	Programming & Implementation Costs	Construction Costs	Contingency (30%)	Total Costs	Internal Labor Hours
1	SCADA Standards & Conveyance Upgrades	2024-2029	\$760,000	\$2,883,000	\$4,789,000	\$13,399,000	\$6,555,000	\$28,386,000	1,880
2	Cybersecurity Phase 1 & WRF SCADA Physical Security	2025-2028	-	\$226,000	\$684,000	\$820,000	\$520,000	\$2,250,000	560
3	SCADA Management Programs	2026-2028	\$78,000	-	\$30,000	-	\$33,000	\$141,000	3,880
4	WRF SCADA Upgrades	2026-2032	\$106,000	\$4,424,000	\$22,849,000	\$16,282,000	\$13,101,000	\$56,762,000	5,700
5	Cybersecurity Phase 2	2031-2034	-	\$115,000	\$766,000	-	\$265,000	\$1,146,000	480
6	WRF UPS Replacement	2032-2034	\$59,000	-	-	\$495,000	\$167,000	\$721,000	400
7	WRF PHAs & LOPAs	2034-2035	\$20,000	-	\$180,000	-	\$60,000	\$260,000	400
8	WRF Fire Alarm Network	2034-2036	-	\$212,000	-	\$1,405,000	\$486,000	\$2,103,000	200
9	Cybersecurity Phase 3	2035-2037	-	\$45,000	\$294,000	-	\$102,000	\$441,000	380
Total - All Tasks			\$1,023,000	\$7,905,000	\$29,592,000	\$32,401,000	\$21,289,000	\$92,210,000	13,880