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Water Operations Tri-Annual Inspections Review

Prepared for
City of Rialto

November 2016

WEST YOST

ASSOCIATES
Consulting Engineers

619-20-15-13

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W A T E R W A S T E W A T E R S T O R M W A T E R

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Momcilo Savovic, P.E.

Date

QA/QC Review: Kristen Whatley, P.E.

Date





Table of Contents

| | |
|--|----|
| Executive Summary | 1 |
| Summary of Findings..... | 2 |
| 1.0 Introduction | 7 |
| 1.1 Tri-Annual Performance Review..... | 7 |
| 1.2 Water System Description | 7 |
| 1.2.1 General | 7 |
| 1.3 Primary Responsibilities of the Operator | 8 |
| 1.4 Primary Responsibilities of the Owner | 11 |
| 2.0 Review of Reference Data | 12 |
| 2.1 Referenced Information | 12 |
| 2.2 Operation and Maintenance Organization..... | 12 |
| 2.3 Operation and Maintenance Staffing Plan Implementation | 13 |
| 2.4 List of Subcontractors | 14 |
| 2.5 Interviews and Verbal Operations and Maintenance Information | 14 |
| 2.5.1 Water Facility Operations..... | 14 |
| 2.6 Maintenance Programs and Records..... | 14 |
| 2.6.1 Asset Management Practices | 15 |
| 2.6.2 Distribution System Maintenance | 15 |
| 2.6.3 Other Inspections | 15 |
| 2.7 Electrical Usage..... | 17 |
| 2.7.1 Electrical Usage in 2015 | 17 |
| 2.8 Reference Documents..... | 19 |
| 2.8.1 The City of Rialto Water Supply System O&M Manuals..... | 19 |
| 2.8.2 Emergency Preparedness Plan | 19 |
| 2.8.3 OSHA Compliance Program | 19 |
| 2.9 Renewal and Replacement Plans | 21 |
| 2.9.1 FIP Progress | 21 |
| 2.9.2 Major Maintenance, Repairs, and Replacements..... | 22 |
| 2.10 Laboratory Data Reporting Requirements..... | 22 |
| 3.0 Assessment of Major Equipment | 24 |
| 3.1 Operations | 24 |
| 3.2 Plant Supervisory Control and Data Acquisition (SCADA) System..... | 24 |
| 3.3 Wells | 25 |
| 3.3.1 City Well #2 | 26 |
| 3.3.2 City Well #4a | 26 |
| 3.3.3 Chino Well #2..... | 26 |
| 3.3.4 Rialto Well #5..... | 26 |
| 3.3.5 Rialto Well #3..... | 26 |
| 3.4 Reservoirs..... | 26 |
| 3.4.1 Cactus Reservoir..... | 26 |
| 3.4.2 Easton and Highland Reservoirs | 27 |
| 3.4.3 Cedar Reservoir #1 and #2..... | 27 |



Table of Contents

| | |
|---|----|
| 3.5 Booster Pumps | 27 |
| 3.5.1 Booster Pump 2 | 27 |
| 3.5.2 Booster Pump 3 | 27 |
| 3.5.3 Booster Pump 4 and 5 | 27 |
| 3.5.4 Booster Pumps 6 - 10 | 28 |
| 3.6 Buildings/Structures..... | 28 |
| 4.0 Regulatory Issues | 30 |
| 4.1 Regulatory Compliance Introduction | 30 |
| 4.2 Existing Regulatory Requirements or Standards and Pending Changes | 31 |
| 4.3 Summary of Regulatory Compliance..... | 31 |
| 4.3.1 Sampling and Analysis..... | 31 |
| 4.3.2 Regulatory Correspondence & Notices..... | 35 |
| 5.0 Billing and Customer Services | 40 |
| 6.0 Statement of Deficiencies | 41 |

List of Tables:

| | |
|--|----|
| Table ES-1. Overall Score Summary | 6 |
| Table 2-1. Rialto Water System Inspections | 16 |
| Table 2-2. 2015 Electrical Use in KWh (Veolia 2015 Annual report) | 18 |
| Table 2-3. Maintenance Activities (January 2016) | 22 |
| Table 3-2. Rialto Water System Buildings and Structures | 29 |
| Table 4-1. Analytical Sampling Results for Flow Characteristics and Key Permit Required Parameters | 32 |
| Table 4-2. Sample Analyses..... | 34 |
| Table 4-3. Source TDS Sample Data | 35 |
| Table 4-4. SWRCB Sanitary Survey Notes, November 2015 | 36 |

List of Figures

| | |
|---|----|
| Figure 1-1. Water System Schematic Diagram | 8 |
| Figure 2-1. Veolia Rialto Project Water and Wastewater Organization Chart | 13 |
| Figure 3-1. Proposed SCADA System | 25 |

List of Appendices:

| |
|--|
| Appendix A: 2015-2019 City of Rialto Water Infrastructure Capital Plan Reports |
| Appendix B: City of Rialto Water Infrastructure Facilities Photographs |
| Appendix C: Rialto Water System SCADA Report |



Table of Contents

List of Acronyms and Abbreviations

| | | |
|----------|---|----|
| AQMD | Air Quality Management District | 13 |
| BLF | Baseline Feeder | 32 |
| CA | Concession Agreement | 1 |
| CCR | California Code of Regulations | 32 |
| CCR | Consumer Confidence Report | 39 |
| CFR | Code of Federal Regulations | 31 |
| City | City of Rialto | 8 |
| CM | Construction Manager | 23 |
| CMMS | Computerized Maintenance Management Software | 4 |
| CRWQCB | California Regional Water Quality Control Board | 13 |
| CWA | Clean Water Act | 31 |
| CWC | California Water Code | 31 |
| DBP | Disinfection Byproduct | 39 |
| DDW | Division of Drinking Water | 37 |
| DLR | Detection Limit for Reporting | 34 |
| DSD | Detailed Statement of Deficiencies | 7 |
| EDT | Electronic Data Transfer | 37 |
| EHS | Employee Health and Safety | 22 |
| ELAP | Environmental Laboratory Accreditation Program | 23 |
| FIP | Facility Improvement Project | 4 |
| GIS | Geographic Information System | 5 |
| GPM | Gallons Per Minute | 27 |
| HAA5 | Total Haloacetic Acids | 35 |
| HP | Horse Power | 27 |
| kW | Kilowatts | 19 |
| MCC | Motor Control Center | 25 |
| MCL | Maximum Contaminant Level | 38 |
| MG | Million Gallons | 28 |
| mg/l | Milligrams per Liter | 34 |
| NA | Not Applicable | 34 |
| ND | Not Detected | 34 |
| NTU | Nephelometric Turbidity Unit | 38 |
| O&M | Operations and Maintenance | 9 |
| Operator | Veolia West Operating Services, Inc. | 1 |
| ORWTP | Oliver Roemer Surface Water Treatment Plant | 32 |
| OR&R | Operating Repairs and Replacement | 20 |
| OSHA | Occupational Safety and Health Act | 20 |
| OWAM | Oracle Utilities Work and Asset Management | 4 |
| P/A | Present of Absent | 34 |
| PCE | Perchloroethylene | 39 |



Table of Contents

| | | |
|-----------|--|----|
| PHG | Public Health Goal | 39 |
| Plan | Tri-Annual Inspection Review Plan | 1 |
| SBVMWD | San Bernardino Valley Municipal Water District | 8 |
| SCADA | System Control and Data Acquisition | 25 |
| TCE | Trichloroethylene | 39 |
| TDS | Total Dissolved Solids | 7 |
| TTHM | Total Trihalomethanes | 35 |
| ug/L | One Microgram per Liter | 31 |
| USEPA | The US Environmental Protection Agency | 52 |
| VOC | Volatile Organic Compound | 31 |
| West Yost | West Yost Associates | 2 |
| WVWD | West Valley Water District | 37 |

Water Operations Tri-Annual Inspections Review



EXECUTIVE SUMMARY

In 2012 the City of Rialto and Rialto Water Services/Veolia entered into a service contract known as the Concession Agreement (CA) for the design, construction, and financing of capital improvement upgrades and the operation and maintenance of the Rialto Utility Authority Wastewater Facility and Water Facility. The CA was signed into effect in May of 2012.

Section 11.1 (r) (Page 132 of CA) states “*Commencing upon the third anniversary of the Effective Date, and every third year thereafter during the Term, the Authority shall perform a full-scale inspection and review of the state of repair, working condition and performance capability of the Water Facility, including testing of equipment to determine its physical and operational conditions, and inspection of the general status of repairs of all equipment and structures, grounds, utility lines, spare parts, inventories, and operation, maintenance, repair and replacement records....*”. Tri-Annual Inspections Report is the acronym adopted to describe the activities in this section of the CA, and it is used throughout this report.

A Tri-Annual Inspection Review Plan (Plan) for the sewer and water utility operations and maintenance activities was prepared by the West Yost Associates (West Yost) and submitted to Veolia West Operating Services, Inc. (Operator) on January 18, 2016. The purpose of the Plan was to reach an agreement on a protocol for the Tri-Annual Inspection Review of the water facilities as provided for in Section 11.1 of the CA. The Plan is based on good industry standards and available public domain information for typical inspection procedures. A list of public domain publications is attached at the end of the Tri-Annual Inspections sewer report (the term “water report” is used throughout this report for the Tri-Annual Inspections water report and the term “sewer report” is used throughout this report for the Tri-Annual Inspections sewer report). The objectives of the review are to verify that the Operator has met the compliance requirements in the CA related to, operations, maintenance, renewal and replacements, spare parts and other compliance requirements.

The Plan developed the following tasks based on the terms and conditions of the CA:

- Full-scale inspection and review of the state of repair;
- Working condition and performance capability of the Water Facility, including visual equipment inspections to determine physical and operational conditions;
- Inspection of the general status of repairs of all equipment and structures, grounds, utility lines, spare parts, and inventories;
- Operation, maintenance, repair and replacement records and asset management practices to ascertain on a comprehensive and focused basis the extent to which the Water Facility is properly maintained, repaired and replaced in accordance with the CA; and,
- Concurrent review of all relevant data, records and reports.

Water Operations Tri-Annual Inspections Review



The Tri-annual Water Facilities Inspections report (water report) makes reference to following common sections or appendices in Tri-annual Sewer Facilities Inspections report (sewer report):

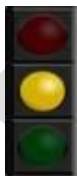
- Assumptions regarding CA and Contractor's performance of its responsibilities is in the Executive summary. Relevant assumptions apply for water infrastructure
- Asset management practices in Section 2.3.1
- Billing and customer services in Section 5
- Referenced Appendices from Tri-annual Sewer Facilities Inspections report
 - Appendix A: Final Asset Management Document Review Observations
 - Appendix B: The City of Rialto Tri-Annual Water and Sewer Infrastructure Review Plan DRAFT
 - Appendix C: Veolia Dropbox file folder screenshot
 - Appendix G: Operating Repair and Replacement Funds Report

This Tri-Annual Water Facilities Inspections Report was prepared in accordance with Section 11.1 (r) of the CA detailing deficiencies found and requiring of the Concessionaire to submit a plan of remediation. These recommendations can be found in "Section 6 Statement of Deficiencies" of this report.

Summary of Findings

A Summary of key findings has been extracted from the report for the ease of review. Key issues are identified based on a review of operational data, provided documentation including monthly and annual reports, verbal information shared during the field visits by Operator personnel and application of professional judgment as it relates to industry practices.

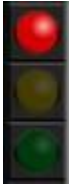
- **Overall Performance:**



During our inspection, West Yost found that the services the Operator has rendered to be in general conformance with all the requirements of the CA and with good industry practices except in the adoption and performance of asset management practices where they did not deliver the committed scope. The existing facilities are in varying degrees of age, but remain functional and are maintained and renewed on an as-needed basis with adequate field maintenance effort and maintenance management, except for the vandalized and inactive facilities which the Operator has the responsibility to adequately maintain depending on whether these facilities will be brought back into production at a later date. Based on our inspections and available operational data review, some of these sites that could be brought back into production and could be in a better condition than they currently are.



- **CA Implementation:**



A prudent operator who is entrusted with the responsibility of the operation, maintenance, and management of the Water Facility should have developed a project plan to enact all provisions of the CA based on good industry practices. Veolia did not provide a management plan to enact the CA.

- **Asset Management:**



For Years 2012 through 2014, West Yost reviewed the asset management program provided by the Operator and identified a number of issues summarized in Appendix A of sewer report.



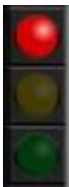
For Year 2015, West Yost reviewed the asset management program provided by the Operator and concluded Veolia started implementation of the major asset management program strategies required in the pertinent CA Articles and Schedules.

- **Maintenance Management Systems**



West Yost was provided access to the Oracle Utilities Work and Asset Management (OWAM) system only. Access to Info Net and other systems was not provided. We could not confirm OWAM and InfoNet Geographic Information System (GIS) based mapping systems communication and seamless integration. Some of the noted system functionalities were not proven to be within reasonable best management practices and what would be expected in a fully functional Computerized Maintenance Management Software (CMMS) system. Some of the report contents prepared using OWAM or other report writers such as Optimus did not confirm accurate and acceptable data transfer. Monitoring, documentation, and reporting appear to be lacking necessary technical information that would render the CMMS system as fully reliable. Recommendations are provided in Section 6 to address issues that warrant additional attention.

- **Capital Plan Implementation:**



For Years 2014 through 2015, West Yost Associates found that the development and implementation of an updated capital projects list, based upon the Operator's asset condition assessments are non-compliant. The Operator's 2014 through 2015 submittals adopted the Facility Improvement Projects (FIP) as identified in the CA and not a single Capital Improvement Project was included as part of the annual update of the Capital Plan. In addition, the submittals were combined for both water and wastewater. The CA requires a separate submittal for water.

Water Operations Tri-Annual Inspections Review



For Year 2016, West Yost Associates found that the development and implementation of an updated capital projects list, based upon the Operator's asset condition assessments are partially compliant. The meter replacement program implemented by the Operator is in compliance with the CA. Separate submittals for water and wastewater were provided.

- **Facility Improvement Project Implementation:**



The water FIP projects have not been completed except for W3 and W7.

- **Water Quality Sampling Services:**



West Yost concludes that the water quality sampling services provided by Veolia are generally performed in conformance with the terms of the CA and the applicable governing rules and regulations. The Operator is in compliance with local and state regulations. The operator shall confirm water laboratory certification update.

- **Structures and Site:**



West Yost found that the Water Facility buildings and structures are in a generally good condition and state of repair, except for the inactive sites such as City Well #5, City Well #3, Rialto Well #2, Rialto Well #1, City Well #6 and active sites such as Easton Reservoir. More information is provided in Table 3-2 in Section 3.6 of this report.

- **Distribution System Maintenance:**



West Yost found that the Operator's use and implementation of the distribution system maintenance program are updated and appropriate for the management of distribution system assets and maintenance. Service lines are being upgraded to copper, and meters and associated appurtenances are being replaced or repaired as deemed necessary. Valves were not exercised prior to 2015. However, they are now being exercised on a regular basis. Fire hydrants are being flushed according to an established schedule.

However, documentation pertinent to these underground assets were not captured in the InfoNet or OWAM systems based on vast street blocks depicted without service lines, meters, and fire hydrants, and thus documentation is incomplete.

- **Maintenance:**



West Yost found, based on the information reviewed with the Operator and the records provided, all of the water systems are generally being maintained in accordance with the requirements of the CA with a couple of exceptions that are listed below:



Identified maintenance issues include but are not limited to:

- The eye and hand wash stations at some sites were not functioning correctly.
- There was poor lighting at the Highland and Easton Reservoirs.
- Booster Pumps 1 and 2 were completely vandalized and in need of repair.
- Disinfection cabinets require painting.
- A valve exercise program must be fully and consistently implemented.
- Nameplates were missing on important equipment.
- The SCADA system was failing, and updates are not available.

- **Regulatory Compliance:**



West Yost did not identify any water quality issues. However, a sanitary survey conducted by the State Water Quality Control Board (SWQCB) found there were many sampling procedures required by regulations that had not been performed in the years 2013 and 2014. This is being addressed by the Operator and steps are being taken to remedy the situation.

- **Billing Services:**



West Yost found the billing services provided by the Operator to be managed consistent with good industry practices. West Yost found the data as represented to be up to date and the management of the billing database quality was being provided.

- **Payment Delinquency Program:**



West Yost found that the delinquency payment program implemented and managed by the Operator is managed well and consistent with good industry practices.

- **Customer Services:**



West Yost found the customer services provided by the Operator to be managed consistent with good industry practices. However, call center response time and measurements of response statistics should improve to match acceptable industry standards.

- **Emergency Preparedness Plan (CA Article XI (j))**



Not provided, except for the outline in the Annual Report.

Water Operations Tri-Annual Inspections Review



- OSHA Compliance Program (CA Article XI (k))



Not provided, except for the outline in the Annual Report.

| Table ES-1. Overall Score Summary | | |
|-----------------------------------|-------|------------|
| | Score | Percentage |
| | 6 | 33% |
| | 4 | 22% |
| | 8 | 45% |

Based on the Tri-Annual Inspection simple score summary above, it could be concluded that there is room for improvement in the CA implementation, asset management, and document updates. A Detailed Statement of Deficiencies (DSD) is provided in Section 6. The operator should address items identified in DSD Section 6 and provide a remediation plan as described in the CA as “*The remediation plan sufficient to reasonably demonstrate that, if implemented, the Water Facility will be promptly brought into compliance with the requirements of CA. If the Authority accepts the remediation plan, the Concessionaire shall thereupon correct all material deficiencies noted in accordance therewith.*” as outlined in CA Article XI, Section 11.1 (r).

Water Operations Tri-Annual Inspections Review



1.0 INTRODUCTION

1.1 Tri-Annual Performance Review

The initial term of the CA began on April 12, 2012, and the first Tri-Annual Inspection was due in early-2016.

Section 11.1 (r) of the CA states that the Authority (City of Rialto) or an independent consultant retained by the City, shall perform a full-scale inspection and review of the state of repair, working condition and performance capability of the Water Facilities. A description of Tri-Annual Inspections is provided in “Plan of Review, City of Rialto Infrastructure System Tri-Annual Inspection” attached in Appendix B of the sewer report.

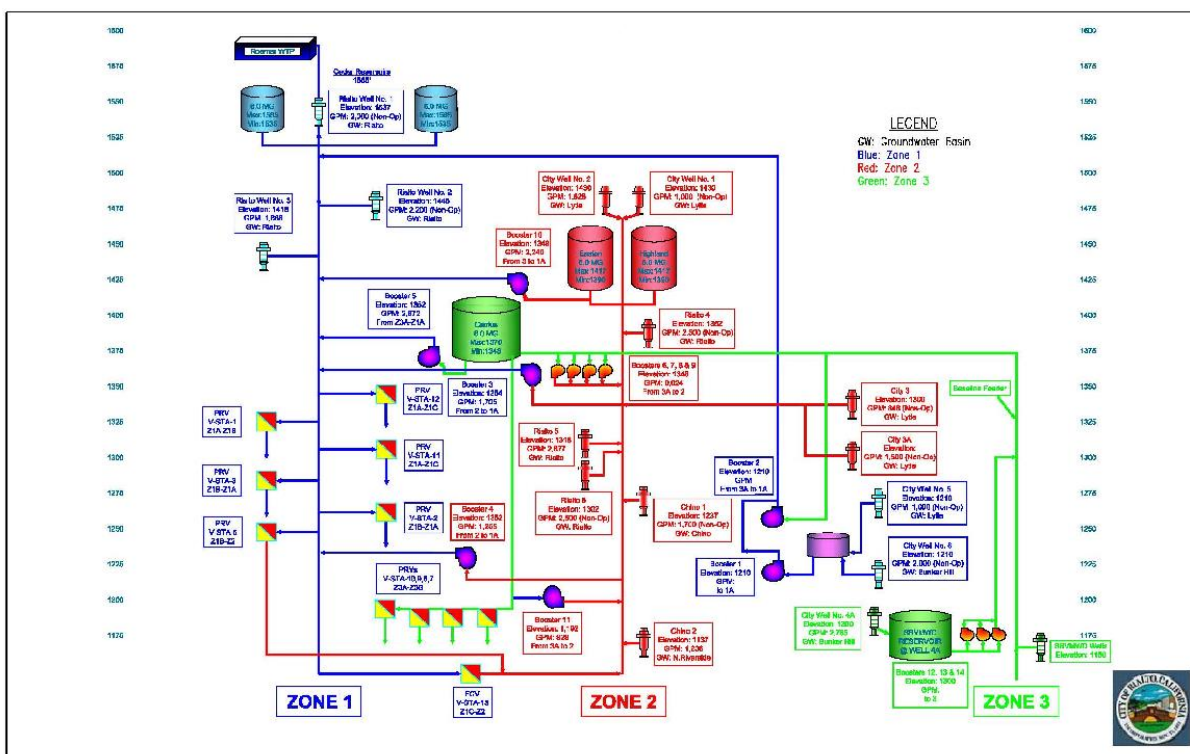
1.2 Water System Description

1.2.1 General

The City of Rialto (City) water system consists of groundwater wells, surface water from the Oliver Roemer surface water treatment plant, water delivered through the Baseline Feeder from the San Bernardino Valley Municipal Water District (SBVMWD), twelve booster pumps which pump water between zones, five reservoirs, and the distribution system. The City is divided into three pressure zones in order to avoid excessive pressure during delivery. Zone 1 is the highest in terms of elevation and Zone 3 is the lowest. Water is delivered by gravity storage and/or pressure reducing stations from Zone 1 to Zones 2 or 3 and from Zone 2 to Zone 3. Booster pumps deliver water from Zone 3 to Zones 1 or 2 and from Zone 2 to Zone 1 to provide flexibility in meeting peak demands from different source waters throughout the system. Figure 1-1 presents a schematic diagram of the system showing the relationships between the supplies, booster pumps, reservoirs, and pipelines.



Figure 1-1. Water System Schematic Diagram



1.3 Primary Responsibilities of the Operator

The Operator's primary responsibilities are as defined in the CA. Rialto Water Services is the Concessionaire. The Operator and CIP Program Manager, and their duties include the operation and maintenance of the City of Rialto Water Facilities and CIP implementation program management during the term of the CA.

Concessionaire, scope is defined in following Article of CA:

- ARTICLE XI CONCESSIONAIRE SCOPE OF WATER FACILITY SERVICES AND RESPONSIBILITIES OF PARTIES

Capital improvements are defined in following Article of CA:

- ARTICLE XII WATER FACILITY IMPROVEMENTS AND CAPITAL PROJECTS, Schedule B.9

Water Operations Tri-Annual Inspections Review



As identified in the CA Schedule B.3, The Concessionaire's O&M scope of services includes:

The Concessionaire will provide, on a continuous basis, the Services for the operation and maintenance of the Water Facility in accordance with the Agreement and prudent industry practices, and in compliance with applicable law. In furtherance thereof, the Concessionaire shall:

- Provide Services 24 hours per day, 7 days per week with respect to the Water Facility.
- Provide a certified operator(s) to attend at the Water Facility during normal business hours and supply other personnel as necessary to operate, maintain, and manage the Water Facility in compliance with the requirements of applicable law, including, but not limited to, management, field testing, routine maintenance, administration, reporting, and security. Provide a certified operator(s) who shall be on-call 24 hours per day, 7 days per week to respond to emergency conditions in respect of the operation of the Water Facility.
- Provide access for City and Authority personnel to the Water Facility. All City or Authority personnel that visit the Water Facility must notify the Concessionaire upon arrival and must comply with all of the Concessionaire's safety policies and procedures.
- Respond to and rectify normal problems and emergencies relating to the Water Facility.
- Arrange for the acquisition of required maintenance consumables, materials, machinery, equipment, fuel, electricity, chemicals, supplies, spare parts, replacement items, and other items necessary to operate and maintain the Water Facility.
- Supply and maintain sufficient inventory levels of all consumables necessary for the operation and maintenance of the Water Facility, including vehicles, paper products, fuels and lubricants, chemicals, cleaning products and solutions, telephone, fax, postage, courier, office supplies, printing, photocopying costs associated with report preparation.
- Provide all necessary training and continuing education for its personnel to ensure the continued safe and efficient operation of the Water Facility, in conformity with applicable law.
- Perform on-site and off-site laboratory monitoring, sampling, testing, laboratory analyses, and reporting as necessary for compliance with applicable law and prudent industry practices.
- Perform maintenance of the structures, buildings, and grounds that are part of the Water Facility. This Maintenance shall include cleanup of litter and debris as necessary in order to maintain a clean and orderly site, painting, and landscaping services.
- Provide safety for the Water Facility in compliance with applicable law.

Water Operations Tri-Annual Inspections Review



- Provide for the handling, loading, transport, and disposal of waste from the Water Facility at an approved waste disposal site in accordance with applicable law.
- Perform regularly scheduled inspections, including daily as required, to maintain the Water Facility, and to ensure effective and efficient operation thereof.
- Perform maintenance items as necessary to operate and maintain the Water Facility.
- Provide and maintain records of operations, maintenance, laboratory analysis, personnel, training, safety, process control, inspections, materials, and alarms.
- Maintain the security of all Water facilities by locking all fences, gates, and doors.
- In providing day-to-day operation and maintenance of the Water Facility, the Concessionaire shall:
 - Visually inspect all buildings, equipment, instruments and Water Facility.
 - Clean, calibrate (not certified) and maintain instrumentation, including the supply of maintenance consumables.
 - Calibrate (not certified) and perform routine maintenance of chemical metering systems.
 - Purchase and coordinate chemical supplies with chemical vendors.
 - Coordinate maintenance requirements with original equipment suppliers.
 - Check and respond to alarms as provided by Section 11.1(i) of the CA.
 - Maintain daily on-site logs and records, including process control log sheets; laboratory data log sheets, bypass report sheets, and routine checklists. The daily log book shall detail weather conditions, anomalies, complaints received unusual conditions and any other information relevant to the operation and maintenance of the Water Facility and are to be made available to the City, the Authority, or appropriate Governmental Agency for review.
 - Inspect diesel fuel tanks to ensure they are adequately filled, and coordinate the re-filling of same as required.
 - Perform such other duties as required and essential to the continuous operation of the Water Facility.
- Implement and utilize a water quality data management system, which shall record data related to the operation of the Water Facility, including measuring and recording pumping rates, flow rates, and total daily volumes of water in accordance with applicable law. All data shall be owned by the Authority and accessible by the Authority and shall record and trend information related to sampling and analytical results for the Water Facility.
- Exercise valves at the Water Facility in accordance with prudent industry practices.
- Conduct a routine lubrication program including greasing and oiling as more particularly specified in a lubrication schedule to be prepared by Concessionaire.
- Operate pump controls and valve controls for pumping of all process streams.

Water Operations Tri-Annual Inspections Review



- Maintain all manufacturers' warranties on new equipment and instruments purchased during the term of the CA and use commercially reasonable efforts to comply with existing equipment and instrument warranties.
- Provide the Authority with documentation demonstrating that Concessionaire is performing maintenance on equipment and instruments.

1.4 Primary Responsibilities of the Owner

The City of Rialto is the Owner of the wells, pump stations, reservoirs, and the distribution system. The City is responsible for overseeing the operating services being provided by the Concessionaire and for paying the service fees pursuant to the CA. The City has certain obligations and responsibilities under the CA.

Their principal responsibilities are specified in CA Section 19.3 City Representations and throughout CA.

Water Operations Tri-Annual Inspections Review



2.0 REVIEW OF REFERENCE DATA

2.1 Referenced Information

The following items were available to West Yost for review (documentation of files received from the Operator are provided in Appendix C of sewer report):

- Concession Agreement dated as of April 12, 2012;
- Monthly Operating Reports to the City dated August 2013 through December 2015;
- Annual Operations Reports to the City Fiscal Years 2013 to 2015;
- Operating Repair and Replacement Reports 2013 to 2015;
- Asset Investment Strategy 2013 to 2015;
- Capital Plan Report 2013 to 2015;
- Baseline Facility Records 2013 to 2015;
- California Regional Water Quality Control Board, Colorado River Basin, Regulatory Submittals (CRWQCB)(as a part of monthly reports);
- List of Capital Projects undertaken by the Operator since 2012;
- Operator Organization Chart;
- Copy of commencement date inventory;
- California State Environmental Laboratory Accreditation Program Branch, Certificate 2698,
- 2013 List of Rolling Stock;
- City of Rialto Flow Meter Testing Program;
- City of Rialto Backflow Testing Program dated May 26, 2016;
- OWAM Computerized Maintenance Management System Work Order Printout;
- The City of Rialto Water Master Plan;
- Copy of current inventory for City of Rialto Water Facilities;
- South Coast Air Quality Management District, Air Quality Permits for:
 - AQMD, ICE,-gasoline, Permit # F5727
 - AQMD, ICE-diesel, Permit # R-D20503

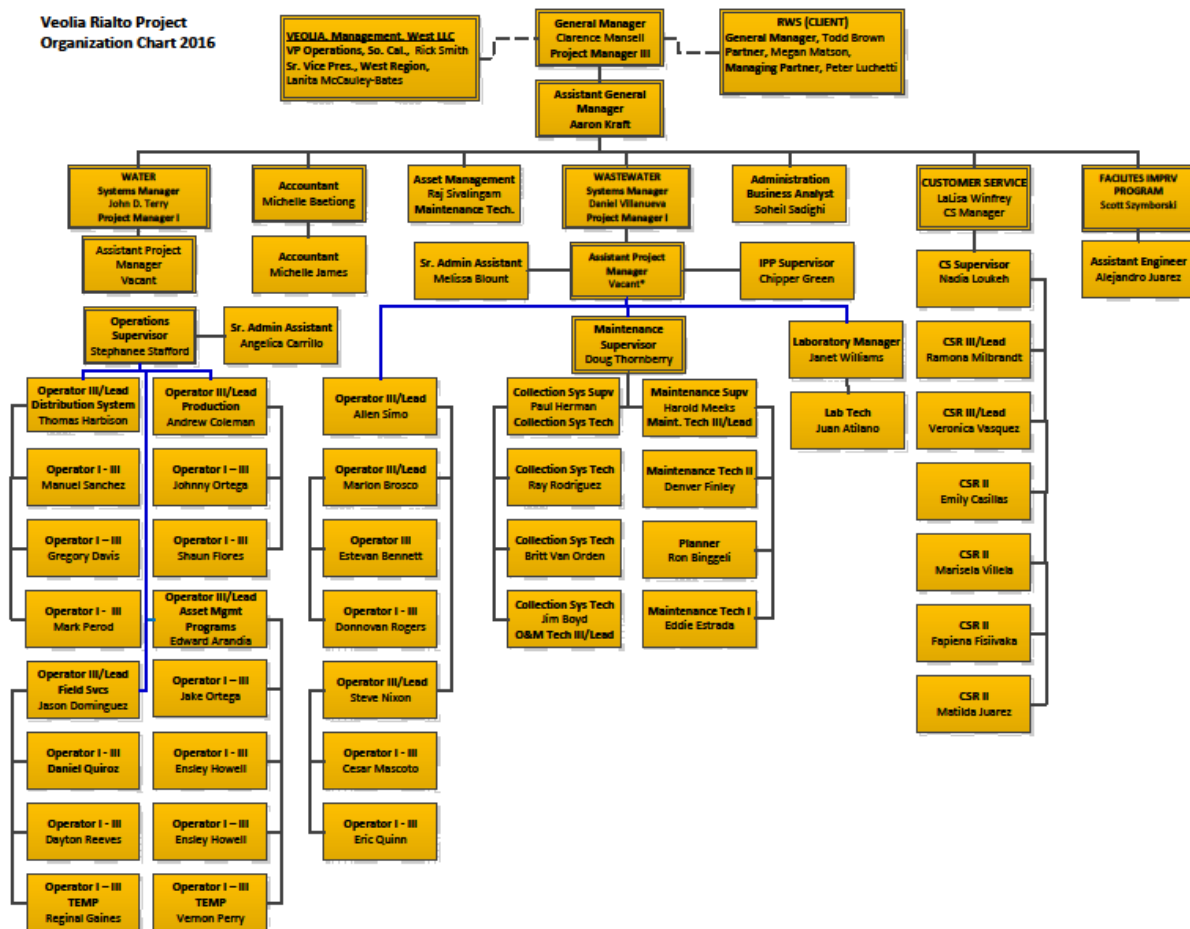
2.2 Operation and Maintenance Organization

Veolia provided a 2016 organization chart outlining the current organization for the operation and maintenance of the City of Rialto water distribution system shown in Figure 2-1.

Water Operations Tri-Annual Inspections Review



Figure 2-1. Veolia Rialto Project Water and Wastewater Organization Chart



2.3 Operation and Maintenance Staffing Plan Implementation

West Yost reviewed the information provided by the Operator, as referenced in Article XI Section 11.1(b) and Schedule B.3 of CA report to assess the conformance of their staffing plan. The Operator did not provide their organization chart for years 2013, 2014 and 2015. However, the current organization chart was provided in 2016. The Operator is not in compliance with the requirements of the CA Article and Schedule mentioned above as they did not provide the staffing plan for years 2013, 2014 and 2015.

For 2016, it was noted that the Concessionaire does staff the Water Facility with qualified personnel who meet the certification requirements of the State, as may be required to provide proper supervision and management of the operation and maintenance of the Water Facility in accordance with prudent industry practices and applicable law. The Concessionaire maintains an operations and safety training program for all employees providing services. Training includes basic water technology, process control, equipment maintenance, safety, right to know laws, and any training the Concessionaire deems necessary to operate and perform maintenance on the Water Facility. All employees are subject to security procedures and checks in place and utilized for City

Water Operations Tri-Annual Inspections Review



employees and are subject to security protocols followed by City employees (i.e. carrying City issued access badges, etc.).

In addition on Figure 2-1, one position is shown as vacant, and one employee appeared under multiple positions in the organization chart provided. This is not in compliance with the CA and should be changed.

2.4 List of Subcontractors

- BABCOCK Laboratories, Inc.- Water quality sample testing services

2.5 Interviews and Verbal Operations and Maintenance Information

West Yost reviewed the information provided by the Operator, as referenced in Section 11.1 of CA, in addition to interviewing the following Operations staff: the General Manager, Clarence Mansell, Jr., Assistant General Manager, Aaron Kraft, Asset Manager, Dave Coffman, Water Systems Manager, John D. Terry, Lead Water Operators, Andrew Coleman and Daniel Quiroz, Operations Supervisor, Stephanie Stafford, Scott Szymborski, and Customer Billing Services Manager, LaLisa Winfrey. A visual inspection of the above ground Water Facilities was conducted to determine if the current operations activities being performed by the Operator comply with the scope of work requirements set forth in the CA under Article XI, Section 11.1.

2.5.1 Water Facility Operations

The CA states that the Concessionaire will provide on a continuous basis, the services for the operation of the Water Facility in accordance with the agreement and prudent industry practices, and in compliance with applicable law. Given the nature of the potable water system and the process control schemes for the water system, it is vital to optimize the source waters to control the Total Dissolved Solids (TDS) levels being delivered to the wastewater treatment plant.

At the time of the facility inspections, four wells were active, Rialto Well # 3, Chino Well # 2, City Well # 4a, and Rialto Well # 5. City Well # 2 was not being operated due to a broken well shaft. The Operations Manager reported that all operators are performing daily inspections of the facilities. These daily inspections include, but are not limited to, meter readings, checking water levels and oil levels for pumps and motors, and wiping down equipment. The Operator keeps a log of all activities performed at each site. Records show the wells are also tested annually for pump efficiencies.

Any repairs or necessary process changes require approval from the Water Project Manager, John David Terry.

2.6 Maintenance Programs and Records

West Yost reviewed the information provided by the Operator, as referenced in Section 2.1 of this report, in addition to interviewing the Project Manager for the Water Operations to determine if the current maintenance activities are being performed to comply with the scope of work requirements set forth in the Agreement Article XI, Section 11.1 (Maintenance Work) and Schedules B.3, B.4, B.5, and J.

Water Operations Tri-Annual Inspections Review



2.6.1 Asset Management Practices

Water infrastructure asset management practices evaluation is included in Section 2.6.1 of sewer report.

2.6.2 Distribution System Maintenance

West Yost did not perform any inspection of the underground facilities when conducting the audit of the distribution systems.

2.6.3 Other Inspections

The Operator prepares recommendations to the City based on their daily inspection observations. The City is required to follow-up with the Concessionaire regarding the implementation of any recommendations. Table 2-1 illustrates what inspections are being performed by the Operator and how often.

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Water Operations Tri-Annual Inspections Review



Table 2-1. Rialto Water System Inspections

| Facility Type | Inspection Description | Frequency | Notes |
|---------------------------------|--|--------------------------------------|--|
| Reservoir | Exterior – leakage and coating integrity | Daily | |
| | Interior – visual | Monthly | No diver inspections have been done |
| | Level Indicators – proper operation | Daily | Most reservoirs have transducers as well as indicators, Indicator at Cedar Reservoir broken |
| | Vent Screens | Monthly | |
| | Overflow | Checked on Alarm | Reservoirs are overflowed typically once a year to remove surface accumulation |
| | Hatches | Monthly | Reservoirs have stair guards in place to limit access to hatches |
| Booster & Well Pumps | Motors – SCE efficiency tests | Annual | Maintained based on the number of hours of operation |
| | Motors - Lubrication | Daily | Oil production readings are recorded |
| | Pumps – Seals & Vibration | Daily | |
| Water Treatment Plants | Pressure Gauges | Daily | Readings are recorded |
| | Desander | Daily | Accumulations are blown-off |
| | Bag Filters | Bi- monthly | Replaced every 2 months |
| | Ion Exchange Resin | | Changed every 1.5 to 2 years for Rialto Well 3, typically takes 3 weeks advance notice to treatment manufacturer |
| Air Release Valves | Exterior – leakage Interior - functionality | Checked when a problem is identified | No testing program is in place; valves are replaced when they leak or stick |
| Valves | Exercise | Large valves are exercised routinely | Valves in indoor booster stations are not exercised often (based on the master plan report) However, the routine exercise of valves in indoor booster stations activity was reported during our Tri-annual inspection. |
| Flow Meters | Calibration | Limited because of reduced staff | Large meters were last tested between 2005-2007 |
| Chemical Analyzers | Calibration | | Analyzers are replaced or adjusted if not functioning correctly |
| Chlorinators | Chemicals – Chlorine Tabs | Daily | Chlorine tabs are typically added on a daily basis |
| Backflow Valves | Testing | Annual | City valves are tested by water dept.; private valves are tested by others, and test reports are submitted to the water department. This activity was not confirmed in our Tri-annual inspection. |
| Fire Hydrants | Testing | Limited because of reduced staff | |
| Generators | Testing | | |

Water Operations Tri-Annual Inspections Review



2.7 Electrical Usage

2.7.1 Electrical Usage in 2015

Monthly meter readings by SCE for electrical consumption typically take place from the middle of the month to the middle of the following month. Meter readings for water production are entered on a calendar monthly basis. Therefore, electrical consumption and water production do not always trend with each other. Table 2-2 shows the electrical use for the individual Water Facilities in 2015. Power consumption reported in 2015 appears to be steady with expected seasonal variation. It was indicated that SCE Booster 3 billing errors were identified in 2015 by West Yost resulting in an SCE credit of \$25,856.73. A detailed electrical use and water production analysis was not part of Tri-annual inspection.

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Water Operations Tri-Annual
Inspections Review



| Table 2-2. 2015 Electrical Use in KWh | | | | | | | | | | | | | |
|---------------------------------------|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Address | | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 | Aug-15 | Sep-15 | Oct-15 | Nov-15 | Dec-15 |
| 1457 N. Linden Ave. | Rialto Well 3 | 24,872 | 17,063 | 29,129 | 36,331 | 43,936 | 73,841 | 45,518 | * | 97,135 | 110,263 | 224,673 | 146,906 |
| 706 Plant E | City Well 1 & 2 | 166,691 | 137,192 | 153,405 | 155,322 | 158,635 | 127,214 | 135,544 | * | 114,002 | 85,157 | 19,076* | 50,586 |
| 224 E. Easton Ave. | Highland Reservoir | 1,448 | 1,568 | 1,401 | 1,551 | 1,570 | 1,456 | 1,516 | * | 1,334 | 1,281 | 946 | 957 |
| 140 W. Easton Ave. | Easton Reservoir | 20 | 22 | 21 | 20 | 22 | 21 | 20 | 1,329 | 22 | 21 | 22 | 21 |
| 2610 N. Cedar Ave. | Cedar Reservoir | 87 | 96 | 117 | 118 | 97 | 89 | 87 | * | 95 | 90 | 96 | 90 |
| 1299 N. Riverside Ave. | Booster 3 | 21,081 | 20,174 | 24,510 | 34,075 | 34,904 | 38,121 | 44,284 | 30,960 | 44,338 | 38,406 | 56,179 | 57,180 |
| 780 W. Rialto Ave. | Chino Well 1 | 71 | 78 | 73 | 80 | 92 | 85 | 82 | * | 91 | 86 | 193 | 87 |
| 335 W. Rialto Ave. | Public Works | 6,411 | 7,071 | 7,468 | 7,527 | 8,039 | 10,103 | 10,135 | * | 12,809 | 12,017 | 9,871 | 7,772 |
| 440 N. Cedar Ave. | Foothill Regulator | 45 | 44 | 49 | 45 | 49 | 53 | 50 | * | 52 | 47 | 52 | * |
| 2600 N. Cedar Ave. | Res. Building | 197 | 212 | 215 | 186 | 208 | 180 | 183 | * | 198 | 156 | 200 | 197 |
| 725 W. Baseline Rd. | Booster 4 & 5 | 97,484 | 106,970 | 101,099 | 89,445 | 84,140 | 100,320 | 72,038 | * | 78,753 | 47,154 | 90,050 | 55,608 |
| 705 E. Easton Ave. | City Well 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | 0 | 0 |
| 303 W. Baseline Rd. | Booster 6-10 | 78,502 | 86,448 | 72,878 | 62,139 | 78,902 | 64,904 | 68,693 | * | 84,761 | 66,198 | 10,032 | 59,392 |
| 1985 W. 9th St. | City Well 4A | 239 | 180 | 194 | 171 | 162 | 30,018 | 106,055 | 160,903 | 179,702 | 62,705 | 443 | 16,320 |
| 225 Bloomington Ave. | Chino Well 2 | 59,703 | 129,867 | 116,076 | 105,155 | 93,812 | 91,221 | 130,446 | * | 158,958 | 33,331 | 69,292 | 145,159 |
| 640 W. Etiwanda Ave. | Rialto Well 5 | 837 | 1,183 | 1,170 | 1,150 | 840 | 1,089 | 900 | * | 1,025 | 66,742 | 1,555 | 1,087 |
| 2301 W. Baseline Rd. | City Well 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | 0 | 0 |
| 2161 W. Baseline Rd. | City Well 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | 0 | 0 |

Source: Adopted from 2015 Veolia Annual Report (subsequent reporting corrections)

Water Operations Tri-Annual Inspections Review



2.8 Reference Documents

Veolia provided reference water system documents in a drop box, and a screen shot of the file folder is attached in Appendix C of sewer report. Dropbox information was shared by the Operator on April 20, 2016 and updated on April 22, 2016, May 2, 2016, and May 22, 2016. In addition, some reference files were provided during the process of inspection. The following documents were reviewed in more detail by West Yost for compliance with the CA and good industry standards:

- Water Inventory 2014-2016 included in Veolia Submittals in Section 2.1
- OR&R Budget 2016 included in Appendix G of sewer report
- Schedule L staff plan included in Section 2.2
- Veolia org chart included in Section 2.2
- Water system insurance and business certificates shared for record purposes in Veolia Drop Box Submittals, Appendix C of the sewer report
- The City of Rialto Water System O&M Manual (Not provided)
- OSHA Compliance Program (Article XI , Section 11.1.(k), not provided except annual report summaries)
- Emergency Preparedness Plan (Article XI , Section 11.1.(j), not provided except annual report summaries)

2.8.1 The City of Rialto Water Supply System O&M Manuals

West Yost Associates has not received an O&M manual for the water system. It is recommended that Veolia submits a copy of the updated O&M manual for review.

2.8.2 Emergency Preparedness Plan

The Operator has not provided an Emergency Preparedness Plan that meets the requirements of the CA Article XI, Section 11.1 (j) in a shared documents Drop Box. West Yost recommends that the Emergency Preparedness Plan be provided with necessary updates. All outside phone numbers should be reviewed to determine they are still valid. The Emergency Preparedness Plan should include records of drills conducted at the site with facility staff.

2.8.3 OSHA Compliance Program

The OSHA Compliance Program per CA Article XI, Section 11.1 (k) was not available for review. Veolia included Health and Safety program descriptions in the 2014 and 2015 Annual Reports. However, the OSHA Compliance Program was not provided for review as required by CA Article XI Section 11.1(k).

The CA Article XI, Section 11.1 (k) states that *“the Operator shall be responsible for adopting and implementing an Occupational Safety and Health Act (“OSHA”) compliance program for all personnel employed by Veolia that will be involved with the operation and maintenance of the*

Water Operations Tri-Annual Inspections Review



Water Facility. Essential elements of any OSHA program will include regularly scheduled safety training sessions for all plant personnel, standard operating procedure for chemical handling and emergency response, and the care and use of proper safety equipment. All personnel involved in the operation and maintenance of the Water facility shall receive the complete training program and have an annual refresher course as required by OSHA.”

A typical site-specific Emergency Health and Safety Plan includes, but is not limited to, the following topics:

- Electrical Safety
- Emergency Action
- Excavation
- Fall Protection
- Fire Protection
- Ladders
- Hand Tools
- Hazard Communications
- Hearing Conservation
- Heat Stress
- Hot Work
- Housekeeping
- Injury and Illness Prevention
- Lock Out/Tag Out
- PPR
- Power Tools Industrial Trucks
- Respiratory Protection
- Used Oil
- Visitor Safety
- Blood Borne Pathogens
- Bulk Chemical Receiving
- Compressed Gasses
- Confined Spaces
- Contractor Safety
- Cranes and Slings

Water Operations Tri-Annual Inspections Review



According to the last annual report, the Operator's water department staff had no OSHA recordable accidents over the past 22 months. John D. Terry, the Operators Site Project Manager, indicated that in an effort to keep employee health and safety a top of mind concern for everyday activities, a safety topic is typically discussed in the morning staff meeting. There are also routine safety training topics discussed at regular intervals, and the Operator provides a monthly safety training presentation. In addition, supervisors are encouraged to monitor staff personnel during routine activities for any observed marginally safe activities, incidents, or any outright work safety standard violations. If any of these marginally unsafe activities or incidents are witnessed, they are used in safety topic or training session to clarify and correct workplace behaviors on a near real-time basis. If a violation is encountered, they are instructed to stop the work and to tell the employee about their observation and record incident information. The Operator reports corporate audits on the Employee Health and Safety (EHS) program every other year.

West Yost found the EHS program performance to be consistent with a state-of-the-industry EHS program based upon the following EHS program information:

- Information presented in the annual report,
- An interview with key EHS staff,
- Observed Operator employee work behaviors and site safety features,
- The extent of specific relevant EHS training of the site safety manager,
- The levels of ongoing staff training, and
- The means utilized to ingrain workplace safety into all everyday workplace activities.

An annual OSHA compliance report should be completed using appropriate OSHA form.

2.9 Renewal and Replacement Plans

The CA states that the Concessionaire shall perform Facility Improvement Projects (FIP's) as described in Schedule B.9. Schedule B.9 provides a list of water system Facility Improvement Projects. The asset management report provided a baseline condition of all equipment that is included in replacement model, and replacement costs were provided. However, the projected replacement costs were determined to be inaccurate. West Yost recommends that the replacement costs be reassessed.

2.9.1 FIP Progress

The 2015-2019 Capital Plan report (attached in Appendix A) is providing the list of FIP projects with current project status and an implementation schedule summary. West Yost found that only three Facility Improvement Projects have been completed or are on schedule for completion. According to the CA these include: W3: Booster 3 Improvements were completed in 2014 as part of OR&R due to equipment failure requiring emergency repairs, W7: Water Main and Valve Replacement on W. Baseline was completed as required in the CA, and progress on WA: Meter Replacement is on schedule as set forth in the CA.

Water Operations Tri-Annual Inspections Review



All other FIP projects have not been addressed yet including W1: SCADA System Upgrade which is identified as the top priority.

West Yost recommends that the Water Facility Improvement Projects provided in Schedule B.9 of the CA that have not yet been completed be addressed by the Concessionaire.

2.9.2 Major Maintenance, Repairs, and Replacements

Maintenance, repairs, and replacements are monitored and reported using a CMMS system based on an OWAM interface and a fully integrated asset management program. As shown in Table 2-3, the January 2016 maintenance data is provided as an illustration of typical monthly maintenance activities.

| Table 2-3. Maintenance Activities (January 2016) | |
|--|-------|
| Activity | Total |
| Preventive Work Orders Generated | 83 |
| Preventive Work Orders Completed | 83 |
| Corrective Maintenance Work Orders | 18 |
| Corrective Maintenance Work Orders | 15 |
| Aging Work Orders, Over 30 days | 5 |
| Aging Work Orders, Over 60 days | 0 |

Factors affecting PM and CM completion rates are reported by the Operator to include:

- Numbers generated by the KPI database occur at the 1st of the month to the end of the month.
- The staff is waiting for parts or material on order to arrive.
- Annual PMs which are assigned monthly have a 2-month timeframe for completion.
- Scheduling to secure, shut down or bypass process equipment for repairs.
- CMs assigned at the end of the month will show as not complete.
- Scheduling of outside vendors.

2.10 Laboratory Data Reporting Requirements

West Yost reviewed the management and operation of the sampling and laboratory service provided by the Operator.

The following information was reviewed by West Yost in conjunction with laboratory reporting requirements.

- Contract laboratory Environmental Laboratory Accreditation Program (ELAP) certifications;

Water Operations Tri-Annual Inspections Review



- Examples of Chain of Custody Records;
- Sample Log;

Laboratory tests requiring certification are performed by Babcock Laboratories. The test lab has a current California Environmental Laboratory Accreditation Certificate No. 2698 that expires on 5/31/2016.

West Yost found that the laboratory services provided by the Operator are generally performed in conformance with the terms of the CA and applicable governing rules and regulations except that certification expired in May 2016. An updated Lab Certificate should be provided for record purposes.

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3.0 ASSESSMENT OF MAJOR EQUIPMENT

3.1 Operations

As part of the Tri-Annual Inspection, a condition assessment of all facilities was performed. Momo Savovic and Peter Fox conducted site visits on January 18, 20, 21, 22, 26, 27; March 17 and 29 and April 1, 2016. The site visits consisted of a tour of the booster pump stations, wells, and the reservoirs. Momo Savovic and Peter Fox toured the sites with the Lead Operator and their Superintendent. The Operator's representatives were equipped with safety gear that allowed the West Yost team to inspect all Motor Control Center's (MCC) safely. Most of the MCC's were in good condition and did not require any attention unless otherwise noted in this section. On April 1, 2016, Momo Savovic, Stephen Dopudja and Peter Fox were given an overview of the Asset Management practices. Photos of the facilities were taken on the site visits. These photos are provided in Appendix B. During the site visits, West Yost also discussed water system operations and maintenance with the Operator's General Manager Clarence Mansell.

3.2 Plant Supervisory Control and Data Acquisition (SCADA) System

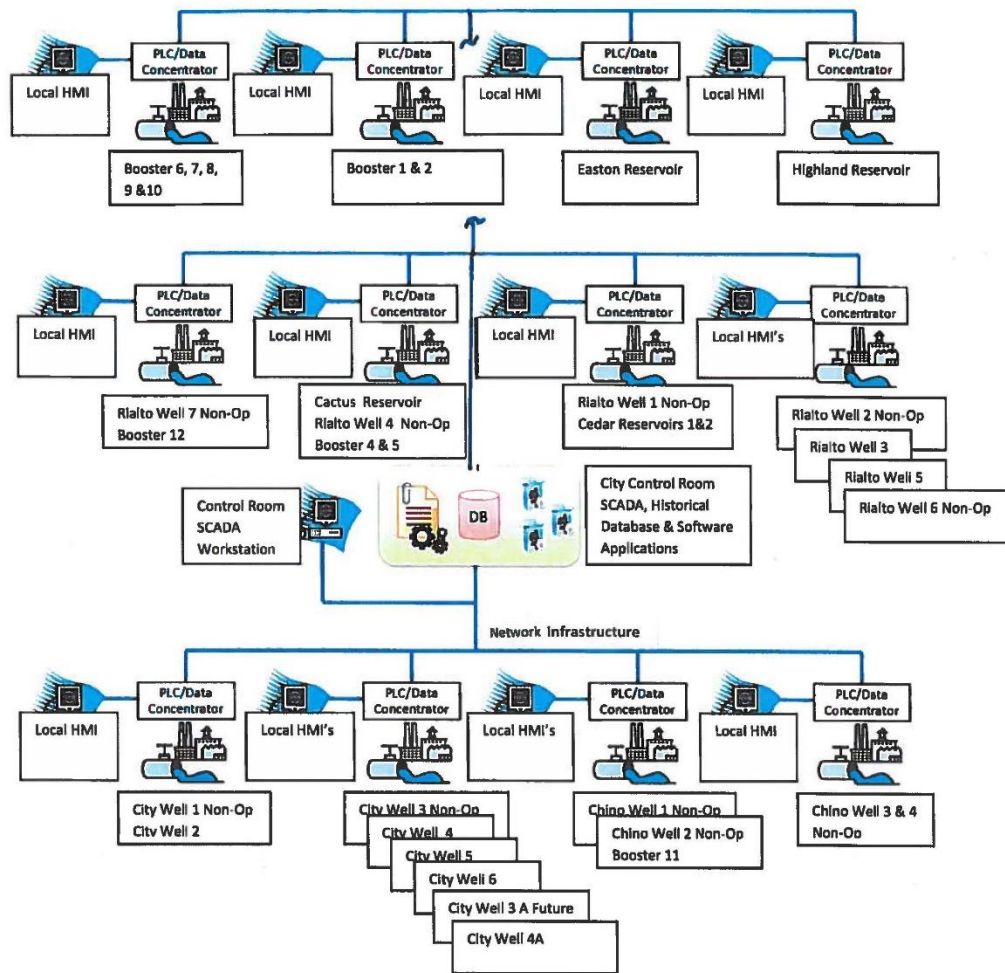
The current SCADA system was put together by TESCO in 1986 and has been maintained by the Operator ever since. However, TESCO discontinued production and maintenance of the line of products. Therefore, the reliability of the current SCADA system is nonexistent, and this was identified in the Master Plan and the CA as the top priority water FIP to be completed.

All three components of the City of Rialto Water Operations SCADA system are outdated and lack the capability of operating the system at a level that aligns with proper industry practices. All existing Remote Terminal Units (RTU) are obsolete and need replacement along with communication equipment and hardware. The existing radio communication is faulty and occasionally has transmission problems, which can throw the entire system off. The HMI software is no longer supported by the manufacturer which means that it cannot be updated. The system is failing and is not dependable. More details can be found in the report provided by Linkture attached in Appendix C.

West Yost recommends that the SCADA system is upgraded as outlined for FIP project W1 in Schedule B.9 of the CA.

Figure 3-1 illustrates the proposed architecture of the new system.

Figure 3-1. Proposed SCADA System



3.3 Wells

There are five active wells that currently serve the City of Rialto. Active wells include Rialto Well # 3, Chino Well # 2, City Wells # 2 and # 4a, and Rialto Well # 5. At the time of the inspection, City Well 2 was undergoing repairs due to a reported broken well shaft.

West Yost found most of the facilities at the active well sites to be in a generally good condition. There were housekeeping issues, however, at Chino Well #2 and City Wells #2 and #4a dust and spider webs had accumulated around certain electrical equipment which will shorten the life cycle of this type of equipment. The alarm systems at all the well sites were noted to be inadequate.

It is the responsibility of the Concessionaire to keep the inactive well sites maintained and provided general housekeeping. However, many of the inactive sites are in need of repair and/or refurbishment. The tri-annual water system Inspection team completed a site inspection field sheets. The tri-annual water system field visit daily reports are used as a basis of the water facilities condition assessment.

Water Operations Tri-Annual Inspections Review



3.3.1 City Well #2

City Well #2 is fully operational but in need of better housekeeping, repairs, and refurbishment. It is located in the Lytle Groundwater Basin and has a 300 horsepower (HP) pump with a design flow rate of 2,200 GPM. At the time the facility inspection was conducted, the well was being repaired due to a reported broken well shaft. The condition of the facilities, however, were generally found to be in good condition with some exceptions in regards to housekeeping. Dust and spider webs had not been cleaned out of the motor controllers inside the control cabinets which will shorten the life cycle of the electrical equipment. The outer building is just a thin structure that could be repaired and refurbished.

3.3.2 City Well #4a

City Well #4a is fully operational and in good condition. It is located in the Bunker Hill Groundwater Basin and has a 400 HP pump with a design flow rate of 3,900 GPM. West Yost found the well facility to be in generally good condition.

3.3.3 Chino Well #2

Chino Well #2 is fully operational but in need of better housekeeping. Well #2 is located in the North Riverside Groundwater Basin and has a 350 HP pump with a design flow of 2,000 GPM. The well facility was found in generally good condition at the time of our visit. However, the general housekeeping could be improved.

3.3.4 Rialto Well #5

Rialto Well #5 is fully operational and in good condition. Well #5 is located in the Rialto-Colton Groundwater Basin. Well # 5 is currently being used as a standby pump due to water levels being at an all-time low. It has a 350 HP pump with a design flow of 2,000 GPM. The well facility was found to be in good condition with good housekeeping inside the pump house.

3.3.5 Rialto Well #3

Rialto Well #3 is fully operational and in good condition. Well # 3 was found to be in good condition with good housekeeping. Rialto Well #3 is part of the remedy for the cleanup of the groundwater contamination in the Rialto-Colton Groundwater Basin. Rialto Well # 3 is one of three wells the County is using to capture and remove a perchlorate and TCE plume that was required by a cleanup order issued by the CRWQCB and the US Environmental Protection Agency (USEPA),

3.4 Reservoirs

3.4.1 Cactus Reservoir

Cactus reservoir is fully operational and in good condition, but needs housekeeping. The reservoir has a storage capacity of 6 million gallons (MG) and is the only reservoir that serves Zones 3A and 3B. The reservoir is located near the intersection of Baseline road, and Cactus Ave next to

Water Operations Tri-Annual Inspections Review



booster pumps 4 & 5. West Yost found the reservoir to be in generally good condition and did not require any obvious repairs.

3.4.2 Easton and Highland Reservoirs

Easton Reservoir is fully operational and in good condition. The reservoir is located next to Highland reservoir where Riverside Avenue crosses the 210 freeway. Both reservoirs have a capacity of 5 MG each and serve Zone 2.

The structures at Easton Reservoir appear to be in good condition. However, the surrounding grounds have not been properly maintained. The site requires cleaning and new paint.

Highland Reservoir is also in need of new paint. The paint on the inlet pipes from City Wells #1 & #2 is peeling, and the pipes are starting to show signs of rust.

3.4.3 Cedar Reservoir #1 and #2

Cedar Reservoir #1 is fully operational and in good condition. The reservoir has a storage capacity of 6 MG and serves Zones 1A, 1B, and 1C. It is the oldest reservoir in Rialto, but it was retrofitted to comply with seismic standards 12 years after its construction during the construction of Cedar Reservoir #2. There is a mechanical issue with the access hatch that requires repairs. There is spalling on the walls and corrosion issues on the overflow pipes that would also require repairs.

Cedar Reservoir #2 is located next to Cedar Reservoir #1 and has the same storage capacity at 6 MG. Similar to Cedar Reservoir #1; there is spalling on the walls and corrosion issues on the overflow pipes that require repairs.

3.5 Booster Pumps

3.5.1 Booster Pump 2

Booster Pump #2 is in poor condition as it was reported in the SAIC water master plan. The pump station is located at 2401 W Baseline Road and brings water from Zone 3A to Zone 1A. It is equipped with a 200 HP motor that can deliver 2,610 GPM.

3.5.2 Booster Pump 3

Booster Pump #3 is fully operational and in good condition. The pump station is located at 1299 Riverside Ave and pumps water from Zone 2 to Zone 1A. It is equipped with a 125 HP motor that delivers water at a rate of 1,705 GPM. West Yost found the site to be in generally good condition. The pump was recently refurbished and fitted with a new MCC and controls. The electric motor was also replaced on the pump. The general housekeeping was in good condition.

3.5.3 Booster Pump 4 and 5

Booster Pumps 4 and 5 are in a fair condition and in need of maintenance. The pump station is located at 725 Baseline Rd. Booster Pump 4 pumps water from Zone 2 to Zone 1A. It has a 75 HP motor that pumps at 1,255 GPM. Booster Pump 5 delivers water from Zone 3A to Zone 1A with a 200 HP motor at a rate of 2,872 GPM.

Water Operations Tri-Annual Inspections Review



Both of the pumps were found to be in fair condition. However, it was noticed there were corrosion issues. Also, it was noted that bus bar on the MCC was fully exposed which is a safety issue that needs to be addressed immediately.

3.5.4 Booster Pumps 6 - 10

Booster Pumps 6 - 10 are in good condition. The Pump station is located at 303 W Baseline Rd. Booster pumps 6 -# deliver water from Zone 3A to Zone 2 while Booster Pump 10 pumps water from Zone 2 to Zone 1A. They are all equipped with 50 HP motors that deliver between 2,000 and 2,500 GPM. During the inspection, the West Yost team was able to access the flow meters located in the valve vault outside the building. All booster pumps and a flow meter vault were found to be in good condition with general good housekeeping.

3.6 Buildings/Structures

West Yost found that most of the buildings and structures associated with the wells, booster pumps, and reservoirs to be in a generally good condition and state of repair. However, many of the buildings at inactive well sites were vandalized. These buildings are in need of housekeeping and maintenance repairs. In addition, the outer building at City Well #2 was in poor condition. Table 3-2 below contains further comments on each individual site.

Water Operations Tri-Annual Inspections Review



Table 3-2. Rialto Water System Buildings and Structures

| Booster Station/ Well Site | Location | Structure Condition | Active | Inactive | Vandalized |
|-------------------------------|-----------------------|------------------------|--------|----------|------------|
| Booster Pump Buildings | | | | | |
| Booster 1 & 2 | 2401 W. Baseline Rd. | Poor | | X | X |
| Booster 3 | 1299 Riverside | Good | X | | |
| Booster 4 | 725 Baseline | Fair | X | | |
| Booster 5 | 725 Baseline | Fair | X | | |
| Booster 6 | 303 W Baseline Rd | Good | X | | |
| Booster 7 | 303 W Baseline Rd | Good | X | | |
| Booster 8 | 303 W Baseline Rd | Good | X | | |
| Booster 9 | 303 W Baseline Rd | Good | X | | |
| Booster 10 | 303 W Baseline Rd | Good | X | | |
| Wells | | | | | |
| Rialto Well 1 | Rialto Basin | Good | | X | |
| Rialto Well 2 | Rialto Basin | Bad | | X | X |
| Rialto Well 3 | Rialto Basin | Good | X | | |
| Rialto Well 4 | Rialto Basin | Good | | X | |
| Rialto Well 5 | Rialto Basin | Good | X | | |
| Rialto Well 6 | Rialto Basin | Good | | X | |
| Chino Well 1 | North Riverside Basin | Good | | X | |
| Chino Well 2 | North Riverside Basin | Fair | X | | |
| City Well 1 | Lytle Basin | Fair | | X | |
| City Well 2 | Lytle Basin | Fair | X | | |
| City Well 3 | Lytle Basin | Bad | | X | X |
| City Well 3A | Bunker Hill Basin | Incomplete | | X | |
| City Well 4A | Bunker Hill Basin | Good | X | | |
| City Well 5 | Lytle Basin | Bad | | X | X |
| City Well 6 | Bunker Hill Basin | Bad | | X | X |
| Reservoirs | | | | | |
| Cactus | Zone 3 | Good | X | | |
| Easton | Zone 2 | Good | X | | |
| Highland | Zone 2 | Good | X | | |
| Cedar #1 | Zone 1 | Good | X | | |
| Cedar #2 | Zone 1 | Good | X | | |



4.0 REGULATORY ISSUES

4.1 Regulatory Compliance Introduction

The City of Rialto groundwater wells within the Rialto-Colton Groundwater Basin (Rialto Wells 1-4, 6) have been contaminated with perchlorate. Groundwater up gradient from these wells are known to be impacted by perchlorate and a variety of Volatile Organic Compound (VOCs). Perchlorate concentrations are significantly above the State's current MCL of 6 micrograms per liter ($\mu\text{g/L}$) and range from 310 $\mu\text{g/L}$ at the up gradient end of the plume in the vicinity of Mid Valley Sanitary Landfill, to 70 $\mu\text{g/L}$ at the southern end of the plume at a monitoring well (N-14) located approximately 250 feet up gradient of Rialto Well # 3. The concentration of TCE, the most notable VOC impact, range from 180 $\mu\text{g/L}$ at the up gradient end of the plume to 1.9 $\mu\text{g/L}$ near the southern end of the plume (N-14).

In addition to perchlorate and TCE, other VOCs that were detected above their laboratory quantitation limits (i.e. above trace level) include 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, cis-1,2-dichloroethene, trichlorofluoromethane, PCE, and 1,1,1-trichloroethane. City Well # 3A has been recently completed but is currently not in an operation reportedly due to arsenic contamination above the MCL.

A series of extraction wells were constructed across the width of the contaminated plume, which in combination with Rialto Well # 3, are pumped to contain the plume and prevent the contaminants from spreading.

VOCs have not been detected in samples taken from Rialto Well # 3. However, field investigations indicate that perchlorate and TCE are the primary threats to groundwater quality up gradient of the well. Sampling at the monitoring well (N-14) on March 10, 2009, indicate perchlorate concentration of 70 $\mu\text{g/L}$ and TCE concentration of 1.7 $\mu\text{g/L}$.

The source water quality must comply with applicable Federal, State of California, and local regulatory requirements. This section describes the regulatory framework and the criteria it must satisfy. Identified legal authorities are the Federal Clean Water Act (CWA), Code of Federal Regulations (CFR), US Environmental Protection Agency (USEPA), State Water Quality Control Board (SWQCB) and California Water Code (CWC). The Operator has submitted monthly water system reports and annual summaries on the Water System performance during the reporting period to the California Regional Water Quality Control Board (CRWQCB) Division of Drinking Water. During our period of review (last three years - July 2013 through January 2016), the water system has generally complied with regulatory permit limitations. However, a sanitary survey for the City of Rialto (System No 3610038) was submitted on November 12, 2015. The survey was completed based on the May 6 inspection by the Division of Drinking Water. The Division reported some deficiencies and other items that the Operator was asked to address which include: cross connection control program, compliance with permit conditions, wells, reservoirs, treatment facilities, monitoring, reporting, and system operations. The Operator is in the process of providing the required responses and clarifications to Sanitary Survey. More details are provided in Section 4.3.2 that follows.

Water Operations Tri-Annual Inspections Review



4.2 Existing Regulatory Requirements or Standards and Pending Changes

West Yost is not aware of any additional proposed changes in Federal and State water quality standards that are probable to affect the water operations.

The Concessionaire shall perform testing, sampling, and laboratory analysis of source water required by applicable laws and governmental approvals including but not limited to:

- California Code of Regulations (CCR) Title 22, Division 4, Chapter 15
- City of Rialto System Number = 3610038 in San Bernardino District 13. Current Monitoring Requirements are attached and can be found online at the link below.
<http://www.cdph.ca.gov/certlicdrinkingwater/Documents/Monitoringschedule/SanBernardinodistrict13.pdf>
- The South Coast Air Quality Management District's has issued a "Permit to Operate" for two Diesel Generators. These permits all require an annual renew but do not have a specific expiration date indicated.
- The City of Rialto WWTP NPDES permits effluent TDS limits and TDS limits in the source water.

4.3 Summary of Regulatory Compliance

4.3.1 Sampling and Analysis

Samples are taken from all the active wells as well as the Baseline Feeder (BLF) and the surface water received from the Oliver Roemer Surface Water Treatment Plant (ORWTP) and tested for various water quality parameters. West Yost found that the water facility is generally in compliance with the applicable water permits. The following tables are adopted from January 2016 operations report and provide typical analytical sampling results for flow characteristics and key permit required parameters:



| Table 4-1. Analytical Sampling Results for Flow Characteristics and Key Permit Required Parameters | | | | | | | | | | | | | | |
|--|-------|--------|-----|-------------------|------------------|-------------------|---------------|--------------------|------------------|------------------|--------------------|-------------------|-------------------|-------------------|
| Sample Date – 01/30/16 | | | | City 2 Results | City 3 Result | City 4A Result | BLF Result | Rialto 3 Result | Miro 3 Result | Miro 2 Result | Rialto 5 Result | Chino 2 Result | Surface Result | Encanto Result |
| Microbiology | Units | DLR | MCL | | | | | | | | | | | |
| Total Coliform | P/A | | | | | A | A | A | | A | A | A | A | |
| E. Coli | P/A | | | | | A | A | A | | A | A | A | A | |
| Nitrate (NO3) | mg/L | 2.0 | 45 | | | 2.9 | 4.1 | 3.3 | | 2.3 | 3.6 | 2.9 | 1.1 | |
| Perchlorate (ClO4) | ug/L | 4.0 | 6 | | | | | | | | | <4.0 | | |
| Metals | | | | | | | | | | | | | | |
| Boron (B) | ug/L | 100 | | | | | | | | | | | | |
| Chromium (+6) | ug/L | 1.0 | | | | | | | | | | | | |
| Vanadium | ug/L | 3.0 | | | | | | | | | | | | |
| Volital Organic Analyses/1,2,3-TCP | | | | | | | | | | | | | | |
| 1,2,3 Trichloropropane | ug/L | 0.0050 | | | | | | | | | | | | |
| Volital Organic Analyses | | | | | | | | | | | | | | |
| Cis-1,3-Dichloropropene | ug/L | 0.5 | 0.5 | | | | | | | | | | | |
| Trans-1,3-Dichloropropene | ug/L | 0.5 | 0.5 | | | | | | | | | | | |
| 1,3-Dichloropropene (total) | ug/L | 0.5 | | | | | | | | | | | | |
| Dichlorodifluoromethane | ug/L | 0.5 | | | | | | | | | | | | |
| Ethyl Tert-Butyl Ether | ug/L | 3.0 | | | | | | | | | | | | |
| Tert-amyl Methyle Ether | ug/L | 3.0 | | | | | | | | | | | | |
| Tertiary Butyl Alcohol | ug/L | 2.0 | | | | | | | | | | | | |
| Surrogate: Bromofluorobenzene | % | | | | | | | | | | | | | |
| Surrogate: 1,2 Dichlororbenzene-d4 | % | | | | | | | | | | | | | |
| Inorganic Chemicals | | | | | | | | | | | | | | |
| Arsenic | ug/L | 2.0 | 1.0 | | | | | | | | | | | |
| Total Hardness | mg/L | | | | | | | | | | | | | |
| Calcium | mg/L | | | | | | | | | | | | | |
| Magnesium | mg/L | | | | | | | | | | | | | |
| Sodium | mg/L | | | | | | | | | | | | | |
| Potassium | mg/L | 1.0 | | | | | | | | | | | | |
| Total Alkalinity | mg/L | | | | | | | | | | | | | |
| Hydroxide | mg/L | | | | | | | | | | | | | |
| Carbonate | mg/L | | | | | | | | | | | | | |
| Bicarbonate | mg/L | | | | | | | | | | | | | |
| Sulfate | mg/L+ | 0.5 | | | | | | | | | | | | |
| Chloride | mg/L+ | | | | | | | | | | | | | |
| Fluoride | mg/L | 0.1 | | | | | | | | | | | | |



| Table 4-1. Analytical Sampling Results for Flow Characteristics and Key Permit Required Parameters | | | | | | | | | | | | | | |
|--|-------------|-----|------|-------------------|------------------|-------------------|---------------|--------------------|------------------|------------------|--------------------|-------------------|-------------------|-------------------|
| Sample Date – 01/30/16 | | | | City 2 Results | City 3 Result | City 4A Result | BLF Result | Rialto 3 Result | Miro 3 Result | Miro 2 Result | Rialto 5 Result | Chino 2 Result | Surface Result | Encanto Result |
| Inorganic Chemicals (cont.) | | | | | | | | | | | | | | |
| pH | Std. Units- | | | | | | | | | | | | | |
| Specific Conductance | Umho/cm- | | | | | | | | | | | | | |
| TDS | mg/L+ | | | | | 280 | 300 | 200 | | 190 | 220 | 210 | 270 | |
| Color | units | | | | | | | | | | | | | |
| Odor | TON | 1.0 | | | | | | | | | | | | |
| Turbidity | NTU | | 5 | | | | | | | | | | | |
| MBAS | mg/L+ | | 0.5 | | | | | | | | | | | |
| Aluminum | ug/L | 50 | 1000 | | | | | | | | | | | |
| Antimony | ug/L | 6.0 | 6 | | | | | | | | | | | |
| Barium | ug/L | 100 | 1000 | | | | | | | | | | | |
| Beryllium | ug/L | 1.0 | 4 | | | | | | | | | | | |
| Cadmium | ug/L | 1.0 | 5 | | | | | | | | | | | |
| Total Chromium | ug/L | 1.0 | 50 | | | | | | | | | | | |
| Copper | ug/L+ | 50 | 1000 | | | | | | | | | | | |
| Iron | ug/L+ | 100 | | | | | | | | | | | | |
| Lead | ug/L | 5.0 | 15 | | | | | | | | | | | |
| Manganese | ug/L+ | 20 | | | | | | | | | | | | |
| Mercury | ug/L | 1.0 | 2 | | | | | | | | | | | |
| Nickel | ug/L | 10 | 100 | | | | | | | | | | | |
| Selenium | ug/L | 5.0 | 50 | | | | | | | | | | | |
| Silver | ug/L+ | 10 | 100 | | | | | | | | | | | |
| Thallium | ug/L | 1.0 | 2 | | | | | | | | | | | |
| Zinc | ug/L | 50 | 5000 | | | | | | | | | | | |
| Cyanide | ug/L | 100 | | | | | | | | | | | | |
| Nitrite as N | ug/L | 100 | 1000 | | | | | | | | | | | |
| Organic | | | | | | | | | | | | | | |
| Trichloroethene | ug/L | 0.5 | 5 | | | | | | | | | | | |
| Source: Adopted from Veolia January 2016 Monthly Report | | | | | | | | | | | | | | |

NA – Not Applicable
ND – Not Detected
P/A – Present or Absent
mg/L – Milligrams per Liter
ug/L – Part per Billion
DLR – Detection Limit for Reporting

Water Operations Tri-Annual Inspections Review



Table 4-2. Sample Analyses

| Sample Date – 12/01/15 | Units | Limit | MCL |
|---------------------------------------|-------|-------|-----|
| Trihalomethanes Analyses | | | |
| Bromodichloromethane | ug/L | 1.0 | |
| Bromoform | ug/L | 1.0 | |
| Chloroform (Trichloromethane) | ug/L | 1.0 | |
| Dibromochloromethane | ug/L | 1.0 | |
| Total Trihalomethanes (TTHM) | ug/L | 1.0 | 80 |
| Surrogate: Bromofluorobenzene | % | | |
| Surrogate: 1,2 Dichlorobenzene- d4 | % | | |
| Haloacetic Acid Analyses | | | |
| Dibromoacetic Acid | ug/L | 1.0 | |
| Dichloroacetic Acid | ug/L | 1.0 | |
| Monobromoacetic Acid | ug/L | 1.0 | |
| Monochloroacetic Acid | ug/L | 1.0 | |
| Trichloroacetic Acid | ug/L | 1.0 | |
| Total Haloacetic Acids (HAA5) | ug/L | 1.0 | 60 |
| Surrogate s,3 0 Dibromopropionic Acid | % | | |

Source: Adopted from Veolia January 2016 Monthly Report

Water Operations Tri-Annual Inspections Review



Table 4-3. Source TDS Sample Data

| January 2016 | Acre/Ft. | Lab TDS | FC | Wt/Avg. |
|-----------------------|---------------|---------|------------------|-----------------|
| Chino 1 | | | 0 | |
| Chino 2 | 160.16 | 210 | 33633.60 | |
| Chino 3 | | | 0 | |
| Chino 4 | | | 0 | |
| City 1 | | | 0 | |
| City 2 | 0 | | 0 | |
| City 3 | | | 0 | |
| City 4 | 112.34 | 280 | 31455.20 | |
| City 5 | | | 0 | |
| City 6 | | | 0 | |
| Rialto 1 | | | 0 | |
| Miro 3 | 0.17 | | 0 | |
| Rialto 3 | 72.40 | 200 | 14480.00 | |
| Rialto 4 | | | 0 | |
| Rialto 5 | 0.04 | 220 | 8.80 | |
| Rialto 6 | | | 0 | |
| BLF | 59.68 | 300 | 17904.00 | |
| OPRP | 93.45 | 270 | 25231.50 | |
| Total Acre/Ft. | 498.24 | | 122713.10 | 246.2932 |

Source: Adopted from Veolia January 2016 Monthly Report

4.3.2 Regulatory Correspondence & Notices

West Yost is unaware of any water quality violations. However, in May 2015, a sanitary survey was conducted by the State Water Resource Control Board (SWRCB) Division of Drinking Water (DDW). The DDW found there were many sampling procedures required by regulations had not been performed in the years 2013 and 2014. SWRCB also had found many of the City's inactive wells were never placed on the inactive list at SWRCB. The Operator has taken corrective measures to fix these deficiencies. A list of inactive wells was submitted, and the SWRCB has approved the list. Testing for Total Trihalomethanes (TTHM) and Haloacetic Acids (HAA5) was located for all applicable years and submitted to the State Board. However, a Public Health Goal (PHG) report was never submitted to the State Board.

SWRCB provided final recommendations to the Operator in November 2015. The May 2016 Veolia monthly operations water report included SWRCB recommendations and responses in their report. Figure 5-1 below shows SWRCB final recommendations and Veolia responses; In summary, SWRCB sanitary survey report identified 18 issues and included the corrective measures that have been taken to date.



Table 4-4. SWRCB Sanitary Survey Notes, November 2015

| Item | | Corrective Action |
|--|--|--|
| Cross Connection Control Program | | |
| 1 | The City has not been implementing a thorough cross-connection control program. The Number of devices tested has dropped significantly. The City should submit a plan for all devices to be tested within the next 12 months and also submit a progress report on the implementation of the plan no later than June 1, 2016. | All test notices have been mailed. A progress report will be submitted to the Divisions of Drinking water (DDW) for review in April. A written program plan is in the final stages. Total notices 544 mailed as of May. Total received as a completed 306. Emailed DDW on May 31, 2016 with a status of the Backflow Program. On-going program. |
| Compliance with Permit Conditions | | |
| 2 | Monitoring wells M-1, M-2, M-3, M-4, M-5, M-6 and N-14 require at least semi-annual monitoring for perchlorate and volatile organic chemicals (VOCs). However, the frequency of monitoring reported to the DDW's database does not meet this requirement. | An email was sent to Ralph Murphy with Geo-Logic on November 18, 2015. Ralph has confirmed that these samples were taken and he will ensure that the laboratory data is submitted to the DDW's database via electronic data transfer (EDT). Veolia will verify. Met with Ralph Murphy on December 10, 2015. He anticipates notifying DDW by December 11, 2015. Lab states that the samples were submitted but they are not yet showing up on the DDW website. On January 14, 2016 asked Ralph to have his lab send a confirmation notice to Veolia for each sample report sent to DDW. Left a message with DDW on the subject waiting for a response. An email with a template from Geo-Logic lab was sent for Veolia review and was accepted. Veolia will monitor the process to ensure that this requirement has been met. Veolia has been receiving correspondence form Geo-Logics Lab for EDT. Ongoing program. |
| 3 | Miro Well 2 requires three additional consecutive quarterly monitoring for VOC's and radioactivity for compliance determination. | On November 20, 2015 Stephanie and I met with Robin Glenney, Regulatory Supervisor at West Valley Water District (WVWD) regarding sampling at Miro 2. Andrew will take the quarterly VOC's and radionuclides starting in December 2015. Ongoing program. |
| Wells | | |
| 4 | Rialto Well 1, Rialto Well 4, City Well 1, City Well 5, City Well 6, and Chino Well 1 are classified as inactive and physically disconnected form the distribution system. If there is not future use, inactive wells should be destroyed. | Veolia is in the process of determining which wells can be destructed with final approval for the City of Rialto. Recommendation City Well #1. Still in discussion. |
| Reservoirs | | |
| 5 | The City's reservoir cleaning and/or interior inspection should be improved. Interior inspection should be performed at least every five years. | Veolia will schedule one reservoir per year with a goal to complete five reservoirs in 60 months. Inspection documents shall be kept at the water yard. Written schedule should be developed. One reservoir per year starting in September 2016. |



Table 4-4. SWRCB Sanitary Survey Notes, November 2015

| Item | | Corrective Action |
|-----------------------------|--|---|
| Treatment Facilities | | |
| 6 | WVWD should get a copy of the operations plans for the Rialto 3 treatment plant and the Chino 2 treatment plant. | Located O&M plan for Rialto Well 3. Need to develop a written plan for Chino 2. Working with West Valley on obtaining an O&M manual from their identical IX system. |
| 7 | Provide DDW with the most current system schematics for Rialto Well 3. | On November 23, 2015 John Terry emailed Tracy with DDW the most current system schematics. Completed. |
| 8 | Analytical data for the plant effluent for Chino Well 2 has not been submitted to the Division via electronic data transfer (EDT). Please provide the PS Code to the contracted laboratory to submit all future water quality data. | On November 18, 2015 Stephanie Stafford emailed Rob Glenney with WVWD. Robin stated she will correct the PS code for Chino 2 treatment effluent. Completed. |
| Monitoring | | |
| 9 | Chino Well 2 had a nitrate sample result of 44 mg/l on December 2013. This is very close to the MCL. If the well exceeds the nitrate MCL it must be taken offline until an approved nitrate treatment is provided. | We are monitoring the nitrate results at Chino Well 2 and will take the well offline if there is a nitrate sample result of 45 mg/l or higher. Understood completed. December N03 12 mg/l. |
| 10 | City Well 2 had an arsenic sample result of 17 ug/L, which exceeds the MCL of 10 ug/L, on March 14, 2014. The average of four consecutive quarterly results was 4.5, which is below the MCL. The City is allowed to go back to the routine arsenic monitoring frequency (one sample every three years) for this well. | If or when the well is returned to service then arsenic sampling will be performed as mentioned (4 quarters). The well is currently out of service. Understood completed. |
| 11 | City Well 3 had a turbidity sample collected on January 19, 2011 with a result of 51.0NTU, which exceeds the secondary MCL of 5 NTU. When the well is returned to service quarterly turbidity monitoring is required. If the running annual average of four quarterly samples does not exceed the MCL, the City can go back to the routine monitoring frequency. | City Well 3 is out of service. All required samples will be taken when the well is put back in service. Understood completed. |



Table 4-4. SWRCB Sanitary Survey Notes, November 2015

| Item | | Corrective Action |
|------------------|--|--|
| 12 | Miro Well 3 had a turbidity sample collected on October 9, 2014 with a result of 5.5 NTU, which exceeds the secondary MCL of 5 NTU. This turbidity exceedance triggers quarterly sample for compliance determination. If the running annual average of four quarterly samples does not exceed the MCL, the City can go back to the routine monitoring frequency. | Quarterly general physical samples will begin in the first week of December 2015 at Miro Well 3. Quarterly samples will be taken until the DDW sends notification that we can go back to the routine monitoring frequency for this well. First quarterly sample taken in December. Ongoing program. |
| 13 | The City did not comply with Stage 1 DBP monitoring requirements since there were no quarterly data for TTHM and HAA5 data for the first quarter of 2006, four quarters of 2007 and 2008. | DDW has requested that we begin Stage 1 DBR and collect samples for 8 sites every 60 days for one year. February 24th started. |
| 14 | Please prepare and submit a proposed Stage 2 DBP monitoring plan to the Davison for review and approval. | A Stage 2 DBP monitoring plan has been drafted and will be submitted for approval on November 24, 2015. Sent plan and waiting on approval. Will develop and submit a plan after completion of Stage 1 in 2017. |
| Reporting | | |
| 15 | Due to the detections of several constituents such as arsenic, TCE, and PCE above their Public Health Goal (PHG), the City is required to complete the PHG report for the years 2010-2012 and hold a public hearing approving the Report by 2013. However, there is not record of the 2013 PHG report. The City has to prepare a 2016 PHG report, which covers years 2013-2015, and hold a public hearing in 2016 to comply with the requirements. | PHG public hearings for both 2015 and 2013 to be held during April 2016 Utility Commission meeting. Collecting data for report. Veolia had completed collecting data from the City of Rialto water system, waiting on imported water data. Completed. |
| 16 | The 2014 Consumer Confidence Report (CCR) and the certification were submitted to the Division on August 31, 2015. Please submit to the Division a copy of the CCR by July 1 every year and the certification by October 1 every year to comply with the requirements | In the future Veolia will submit a copy of the CCR to DDW by no later than July 1. Final report had been completed ready for presentation. |
| 17 | Please submit the quarterly report of the results for chlorine residual, TTHM and HAA5 to the Division within 10 days from the end of each quarter | All quarterly samples will be taken the first week of the month due. This will ensure lab results are received before the end of the month. Samples taken 12/8/015. Completed. Ongoing program. |



Table 4-4. SWRCB Sanitary Survey Notes, November 2015

| Item | | Corrective Action |
|------|--|---|
| 18 | The valve exercise program needs to be improved to ensure routine valve exercises in a timely manner and all valves are functioning as required. | Program was initiated in September with a goal of exercising approximately 60 to 80 valves per month. A plan was developed starting in January and valve exercising has been started. |

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5.0 BILLING AND CUSTOMER SERVICES

The billing and customer services Section and relevant appendices are included in Section 5 of the Tri-Annual Report Wastewater Facilities.

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6.0 STATEMENT OF DEFICIENCIES

In the course of our inspection review, West Yost witnessed a number of deficiencies that are being presented to the City and the Operator as recommendations for consideration. The following recommendations are summarized from the body of this report for ease of consideration:

CA Implementation: West Yost recommends that the Operator develop and submit a project plan to enact all provisions of the CA based on industry best practices.

Asset Management: West Yost recommends that the Operator should provide a fully functional asset management CMMS program with technical specifications for all process elements and other noted deficient items included in Section 2.6.1 of sewer tri-annual inspection report.

Facility Improvement Projects: West Yost recommends that the Operator implement projects described in Schedule B.9 of the CA. Specifically, FIP project W1: SCADA Improvement should be the top priority.

Replacement Cost: West Yost recommends that the Operator reevaluate the projected replacement costs given in the Baseline Facility Records.

O&M Manual: West Yost recommends that the Operator submit an updated O&M Manual for the water system.

Emergency Preparedness Plan: CA Article XI, Section 11.1 (j) West Yost recommends that an updated Emergency Health and Safety Plan be submitted and recertified by the Concessionaire as required, and thereafter be updated annually only as needed. The annual update should include, at a minimum, the section that validates that relevant contact names and phone numbers are current on the date recorded for that update.

OSHA Compliance Program - CA Article XI, Section 11.1 (k): West Yost Associates recommends that the OSHA Compliance Program be provided for review, updated and recertified by the Operator as required and after that be updated annually only as needed. Concessionaire shall be responsible for adopting and implementing an OSHA compliance program for all personnel employed by Concessionaire who will be involved with the operation and maintenance of the Water Facility. Essential elements of any OSHA program will include regularly scheduled safety training sessions for all plant personnel, standard operating procedures for chemical handling, and emergency response, and the care and use of proper safety equipment. All personnel involved in the operation and maintenance of the Water Facility shall receive the complete training program and have an annual refresher course as required by OSHA.

Veolia provided 2014 and 2015 annual reports with the OSHA compliance program outline. The CA requires OSHA Compliance Program submittals for review. The annual update should include, at a minimum, a section that validates that relevant contact names and phone numbers are current on the date recorded for that update.

Water Operations Tri-Annual Inspections Review



Condition of Facilities: West Yost recommends that the Operator address the issues described below:

- Electrical equipment in the well and booster pump stations should be kept dust and spider web free.
- Landscaping around the reservoir and booster pump station sites should be kept clean and all weeds removed.
- Repair or replace alarm systems at all the active well sites that were found to be inadequate.
- Water Sample Analysis Lab Certification: Provide valid certification with a current expiration date for the lab.

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APPENDIX A

Rialto Water and Wastewater Facilities
2015-2019 Capital Plan Reports

Rialto Water and Wastewater Facilities 2015-2019 Capital Plan Report

List of Proposed Capital Projects (with status):

Concession Agreement

W1 Water Project – SCADA Improvements (Water Only)
W2 Water Project – Chino Well 1 Nitrate Blending -
W4 Water Project – Booster 4 / 5 Improvements Including Cactus Reservoir Piping
W5 Water Project – Seismic Improvements to Cedar Reservoir No. 1
W6 Water Project – City Wells 1 and 2 Improvements1
W7 Water Project W7 – Water Main and Valve Replacement on W. Baseline and N. Riverside,
Phases II and III (5,070 feet total)
WA Water Project – Meter Replacement
WB Water Project – Service Line Replacement
WC Water Project – Small Diameter / Galvanized Main
WD Water Project – Dead End Main Replacement
WE Water Project – Valve Replacement
WG Water Project – Engineering Studies (Master Plan and Regulatory Related)

Proposed Projects

W8 Water Project – Booster 1 and 2 Improvements
W9 Water Project – Rialto Well 4 Pump Improvements
W10 Water Project – Rialto Well 1 Pump Improvements

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

W1 Water Project – SCADA Improvements (Water Only)

Project No. / Ranking: W1 (Part of Concession Agreement)

Name of Project: SCADA Improvements (water only)

Problem or Opportunity: The existing SCADA system was installed in 1986 and does not currently perform adequately or reliably. Remote signal response times are as long as 45 minutes.

Recommended Solution: Replace all existing equipment, including the radios, and standardize on a single PLC vendor with a single HMI Platform. System to be integrated with wastewater SCADA system. Tie in with the American Water Enterprises Operations Service Center in O'Fallon, MO via T1 line.

Measurable Benefits: Reduce remote signal response time to < 60 seconds. Assure that all major/critical remote equipment is remotely monitored.

Basis of Recommendation: Field investigations performed by Contractor and discussions with operations staff.

Assumptions / Risks: Adequate radio licensing exists. Radio survey exists which recommended change from wide band to narrow band frequency. Normal construction risks associated with retrofit projects exist.

Primary Driver: Asset Renewal

Cost Allowance: \$1,679,000

Project Period: 2015

Method of Delivery: Design/Bid/Build

Status: In 30% design phase as of 4th QTR 2014

| W1 Capital Project | | | | | | |
|--|---|----------|-------------|-----------|-------------|----------|
| System | Asset Repair or Replacement | Decision | Yrs. Remain | Condition | Criticality | Cost |
| Booster 1-2 Controls and Power System | PANEL, PLC, BOOSTER 1 & 2 | Replace | -10 | 3.0 | 5 | \$15,000 |
| Booster 3 Controls and Power System | PANEL, PLC, BOOSTER 3 | Replace | -25 | 2.5 | 1 | \$15,000 |
| Booster 3 Pumping System | PANEL, RELAY, PRESSURE, BOOSTER 3 | Replace | -25 | 3.5 | 1 | \$5,000 |
| Booster 6-10 Controls and Power System | PANEL, PLC, BOOSTERS 6-9 | Replace | -10 | 3.0 | 5 | \$15,000 |
| Highland Controls and Power System | PANEL, PLC, HIGHLAND RESERVOIR | Replace | 0 | 2.0 | 3 | \$15,000 |
| Highland Reservoir System | PANEL, RELAY, LEVEL, HIGHLAND RESERVOIR | Replace | 0 | 3.3 | 3 | \$5,000 |

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

| | | | | | | |
|--|--|---------|-----|-----|---|------------------|
| Easton Controls and Power System | PANEL, PLC, RELAY, LEVEL, EASTON RESERVOIR | Replace | -12 | 5.0 | 1 | \$5,000 |
| City 1 and 2 Controls and Power System | PANEL, PLC, CITY 1 & 2 | Replace | -37 | 3.0 | 5 | \$15,000 |
| City 3 Controls and Power System | PANEL, PLC, CITY 3 | Replace | -15 | 5.0 | 2 | \$15,000 |
| City 4A Controls and Power System | PANEL, PLC, CITY 4A | Replace | -8 | 2.0 | 3 | \$15,000 |
| Chino 1 Controls and Power System | PANEL, PLC, CHINO 1 | Replace | -10 | 3.0 | 1 | \$15,000 |
| Chino 2 Controls and Power System | PANEL, PLC, CHINO 2 | Replace | -7 | 3.0 | 5 | \$15,000 |
| Rialto 1 Controls and Power System | PANEL, PLC, RELAY, LEVEL, CEDAR RESERVOIRS | Replace | -35 | 3.0 | 1 | \$5,000 |
| Cactus Controls and Power System | PANEL, PLC, CACTUS RESERVOIR | Replace | -9 | 2.7 | 5 | \$15,000 |
| Rialto 5 Controls and Power System | PANEL, PLC, RIALTO 5 | Replace | -5 | 2.0 | 5 | \$15,000 |
| Rialto 7 Controls and Power System | PANEL, PLC, RELAY, PRESSURE, RIALTO 7 | Replace | -8 | 2.5 | 1 | \$5,000 |
| Water Center SCADA System | UPS, SCADA WORKSTATION | Replace | 3 | 3.5 | 3 | \$300 |
| Water Center SCADA System | WORKSTATION, SCADA | Replace | -2 | 3.5 | 3 | \$1,500 |
| PROJECT TOTAL: | | | | | | \$191,800 |

W2 Water Project – Chino Well 1 Nitrate Blending

Project No. / Ranking: W2 (Part of Concession Agreement)

Name of Project: Chino Well 1 Nitrate Blending

Problem or Opportunity: Nitrate levels in Chino Well 1 (approximately 46 mg/L as nitrate) exceed the current MCL (45 mg/L as nitrate).

Recommended Solution: Blend the discharge from Chino Well 1 with system water. Provide adequate mixing, and possibly a VFD on the well pump.

Measurable Benefits: Blended discharge from Chino Well 1 will be < 45 mg/L as nitrate.

Basis of Recommendation: Recommended by the City of Rialto. Confirmation via site visits and discussions.

Assumptions / Risks: Regulatory approval of the blending plan will be needed. Normal construction risks associated with retrofit projects exist. Perchlorate treatment equipment currently on site will be removed by others.

Primary Driver: Regulatory Compliance

Cost Allowance: \$240,000

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

Project Period: 2015

Method of Delivery: Design/Bid/Build

Status: Preliminary design

W4 Water Project – Booster 4 / 5 Improvements Including Cactus Reservoir Piping

Project No. / Ranking: W4 (Part of Concession Agreement)

Name of Project: Booster 4 / 5 Improvements including Cactus Reservoir Piping Improvements

Problem or Opportunity: The mechanical and electrical equipment is aged, worn, unsafe, and not operating efficiently. Hydraulic limitations exist at the tank inlet.

Recommended Solution: Replace the booster pumps, motor control centers, and other associated mechanical and electrical equipment. Add VFDs. Reconfigure the tank inlet piping (possibly a candy cane).

Measurable Benefits: Minimal booster downtime except for routine scheduled maintenance. No hydraulic limitations at the tank inlet under current demands.

Basis of Recommendation: Recommended by the City of Rialto. Confirmation via site visits and discussions.

Assumptions / Risks: Equipment will need to be replaced in its existing location and performed in an off peak season. Normal construction risks associated with retrofit projects exist. No work required at Rialto Well 4 which is on the same site. Perchlorate treatment equipment currently on site will be relocated by others.

Primary Driver: Asset Renewal

Cost Allowance: \$407,300

Project Period: 2015

Method of Delivery: Design/Bid/Build

Status: Final design phase as of 4th QTR 2014

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

| W4 Capital Project | | | | | | |
|---------------------------------|--|----------|------------|-----------|-------------|------------------|
| System | Asset Repair or Replacement | Decision | Yrs Remain | Condition | Criticality | Cost |
| Cactus Booster 4 Pumping System | METER, FLOW, PADDLE, 6", BOOSTER 4 PUMP, CACTUS RESERVOIR | Replace | -64 | 2.5 | 1 | \$4,000 |
| Cactus Booster 4 Pumping System | PIPING GROUP, RIALTO 4 BOOSTER PUMP SYSTEM | Replace | -59 | 2.5 | 1 | \$10,000 |
| Cactus Booster 4 Pumping System | PUMP, BOOSTER 4, CACTUS RESERVOIR | Replace | -59 | 2.3 | 1 | \$125,000 |
| Cactus Booster 4 Pumping System | TRANSMITTER, PRESSURE, INTER-ZONE, CACTUS RESERVOIR | Replace | -69 | 2.5 | 1 | \$2,000 |
| Cactus Booster 4 Pumping System | VALVING GROUP, RIALTO 4 BOOSTER PUMP SYSTEM | Replace | -64 | 3.0 | 1 | \$1,000 |
| Cactus Booster 5 Pumping System | METER, FLOW, PADDLE, 12", BOOSTER 5 PUMP, CACTUS RESERVOIR | Replace | -4 | 2.5 | 5 | \$10,000 |
| Cactus Booster 5 Pumping System | PIPING GROUP, RIALTO 5 BOOSTER PUMP SYSTEM | Replace | 1 | 2.5 | 5 | \$10,000 |
| Cactus Booster 5 Pumping System | PUMP, BOOSTER 5, CACTUS RESERVOIR | Replace | 1 | 2.5 | 5 | \$250,000 |
| Cactus Booster 5 Pumping System | VALVING GROUP, RIALTO 5 BOOSTER PUMP SYSTEM | Replace | -4 | 2.5 | 5 | \$2,000 |
| | PROJECT TOTAL: | | | | | \$414,000 |

W5 Water Project – Seismic Improvements to Cedar Reservoir No. 1

Project No. / Ranking: W5 (Part of Concession Agreement)

Name of Project: Seismic Improvements to Cedar Reservoir No. 1

Problem or Opportunity: The 48-year old tank does not meet current International Building Code seismic design standards.
Recommended Solution: Tie the reservoir structure to the foundation by constructing a curb inside the reservoir around the perimeter with shear bars and/or seismic cables.

Measurable Benefits: Compliance with the current International Building Code.

Page 5 of 14

Prepared 10/31/2016



2015 Capital Plan Report

Rialto Water and Wastewater Facilities

Basis of Recommendation: Evaluation performed by the tank manufacturer, DYK.

Assumptions / Risks: Pending tank inspection could reveal additional structural defects which may warrant additional improvements or possible complete replacement of the tank. Normal construction risks associated with retrofit projects exist.

Primary Driver: Asset Renewal

Cost Allowance: \$810,000

Project Period: 2015

Method of Delivery: Design/Bid/Build

Status: Final design phase as of 4th QTR 2014

| W5 Capital Project | | | | | | |
|----------------------------------|-------------------------------|----------|-------------|-----------|-------------|------------------|
| System | Asset Repair or Replacement | Decision | Yrs. Remain | Condition | Criticality | Cost |
| Rialto 1 Cedar Reservoirs System | RESERVOIR 1, CEDAR RESERVOIRS | Repair | 0 | 2.0 | 5 | \$300,000 |
| | PROJECT TOTAL: | | | | | \$300,000 |

W6 Water Project – City Wells 1 and 2 Improvements

Project No. / Ranking: W6 (Part of Concession Agreement)

Name of Project: City Wells 1 and 2 Improvements

Problem or Opportunity: The mechanical and electrical equipment is aged, worn, and not operating efficiently.

Recommended Solution: Replace the pumps, motor control centers, and other associated mechanical and electrical equipment, and piping. Provide adequate enclosure around City Well 2.

Measurable Benefits: Minimal downtime except for routine scheduled maintenance.

Basis of Recommendation: Recommended by the City of Rialto. Confirmation via site visits and discussions.

Assumptions / Risks: It is assumed that the well boreholes themselves are adequate. Capacity does not need to be increased. Normal construction risks associated with retrofit projects exist.

Primary Driver: Asset Renewal

Cost Allowance: \$2,940,000

Project Period: 2015

Method of Delivery: Design/Bid/Build

Status: Final design phase as of 4th QTR 2014

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

| W6 Capital Project | | | | | | |
|--|---------------------------------------|----------|-------------|-----------|-------------|------------------|
| System | Asset Repair or Replacement | Decision | Yrs. Remain | Condition | Criticality | Cost |
| City 1 Well Pumping System | WELL, CITY 1 | Replace | -40 | 3.0 | 1 | \$75,000 |
| City 1 and 2 Controls and Power System | MCC, STATION, WATER, CITY 1 & 2 | Replace | -27 | 3.0 | 5 | \$150,000 |
| City 1 and 2 Building and Grounds System | ENCLOSURE, STATION, CITY 1 | Replace | -2 | 3.0 | 3 | \$15,000 |
| City 1 and 2 Building and Grounds System | FENCE AND GATE, CITY 1 & 2 | Replace | -32 | 3.5 | 3 | \$10,000 |
| City 1 Well Pumping System | PIPING GROUP, CITY 1 WELL SYSTEM | Replace | -27 | 3.0 | 1 | \$10,000 |
| City 1 Well Pumping System | PUMP, WELL CITY 1 | Replace | -27 | 2.1 | 1 | \$300,000 |
| City 1 Well Pumping System | VALVING GROUP, CITY 1 WELL SYSTEM | Replace | -32 | 2.0 | 1 | \$2,000 |
| City 2 Well Pumping System | METER, FLOW, PADDLE, 12", CITY 2 WELL | Replace | -32 | 2.5 | 5 | \$10,000 |
| City 2 Well Pumping System | PIPING GROUP, CITY 2 WELL SYSTEM | Replace | -27 | 2.5 | 5 | \$10,000 |
| City 2 Well Pumping System | PUMP, WELL CITY 2 | Replace | -27 | 2.1 | 5 | \$300,000 |
| City 2 Well Pumping System | VALVING GROUP, CITY 2 WELL SYSTEM | Replace | -32 | 2.0 | 5 | \$2,000 |
| City 1 Well Pumping System | METER, FLOW, PADDLE, 10", WELL CITY 1 | Replace | -32 | 5.0 | 1 | \$10,000 |
| | PROJECT TOTAL: | | | | | \$894,000 |

W7 Water Project W7 - Water Main and Valve Replacement on W. Baseline and N. Riverside, Phases II and III

Project No. / Ranking: W7 (Part of Concession Agreement)

Name of Project: Water Main and Valve Replacement on W. Baseline and N. Riverside, Phases II and III (5,070 feet total).

Problem or Opportunity: Mains are in poor condition.

Recommended Solution: Replace 400' of 14" on W. Baseline with 14", and 4,670 of 24" on N. Riverside with 24". This is the final phase of a multi-phase project.

Measurable Benefits: Reliable main with minimal potential for leakage or failure.

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

Basis of Recommendation: Requested by the City of Rialto. RW beck hydraulic modeling confirmed that the existing diameters are adequate.

Assumptions / Risks: Normal construction risks associated with unknown underground conditions exist.

Primary Driver: Asset Renewal

Cost Allowance: \$266,900

Project Period: 2015

Method of Delivery: Design/Bid/Build

Status: Final construction work authorization phase. Went to council on 11/25/2014 for approval.

WA Water Project – Meter Replacement

Project No. WA (Part of Concession Agreement)

Name of Project: Meter Replacement

Problem or Opportunity: Customer meters have an expected life of 15 years.

Recommended Solution: Change out approximately 800 meters per year. Utilize smaller 5/8" meters to maximize registration at low flows, and touch read type to minimize meter reading costs.

Measurable Benefits: No meter in service longer than 15 years.

Basis of Recommendation: Existing City of Rialto practice. In line with prudent industry practices.

Assumptions / Risks: Existing meter pits and piping configuration will be adequate to accommodate new style meter. Proposed receptacles not compatible with AMR or AMI but meters themselves are compatible. Contractor assumed program in second half of 2012 to maintain continuity.

Primary Driver: Asset Renewal

Cost Allowance: \$620,300

Project Period: Reoccurring

Method of Delivery: Design/Bid/Build

Status: Construction started with ~75 meters replaced as of 4th QTR 2014.

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

WB Water Project – Service Line Replacement

Project No. WB (Part of Concession Agreement)

Name of Project: Service Line Replacement

Problem or Opportunity: Many service lines are polybutylene which has a high failure rate.

Recommended Solution: Change out approximately 235 service lines per year.

Measurable Benefits: Continued reduction of polybutylene services remaining in the system.

Basis of Recommendation: Existing City of Rialto practice. In line with prudent industry practices.

Assumptions / Risks: Extent of scope currently unknown. Contractor assumed program in second half of 2012 to maintain continuity.

Primary Driver: Asset Renewal

Cost Allowance: \$2,434,000

Project Period: Reoccurring

Method of Delivery: Design/Bid/Build

Status: Planning for approval from City as of 4th QTR 2014.

WC Water Project – Small Diameter / Galvanized Main Replacement

Project No. WC (Part of Concession Agreement)

Name of Project: Small Diameter / Galvanized Main Replacement

Problem or Opportunity: Small diameter mains (which are often galvanized steel) typically restrict fire flow and have a high potential for leakage.

Recommended Solution: Identify and replace mains as necessary.

Measurable Benefits: Continued reduction of small diameter / galvanized mains remaining in the system.

Basis of Recommendation: Requested by the City of Rialto. In line with prudent industry practices.

Assumptions / Risks: Extent of scope currently unknown. Contractor to initiate program in second half of 2013 after identification and evaluation of program scope.

Primary Driver: Asset Renewal

Cost Allowance: \$2,077,600

Project Period: Reoccurring

Method of Delivery: Design/Bid/Build

Status: Initial preliminary design as of 4th QTR 2014.

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

WD Water Project – Dead End Main Replacement

Project No. WD (Part of Concession Agreement)

Name of Project: Dead End Main Replacement

Problem or Opportunity: Dead end mains can restrict flow, and often result in stagnant water which leads to water quality complaints.

Recommended Solution: Identify and replace mains as necessary.

Measurable Benefits: Continued reduction of dead end mains remaining in the system.

Basis of Recommendation: Requested by the City of Rialto. In line with prudent industry practices.

Assumptions / Risks: Extent of scope currently unknown. Contractor initiated program in second half of 2013 after identification and evaluation of program scope.

Primary Driver: Asset Renewal

Cost Allowance: \$386,400

Project Period: Reoccurring

Method of Delivery: Design/Bid/Build

Status: Initial preliminary design as of 4th QTR 2014.

WE Water Project – Valve Replacement

Project No. WE (Part of Concession Agreement)

Name of Project: Valve Replacement

Problem or Opportunity: Valve failures can occur prior to the main failing.

Recommended Solution: Identify and replace valves as necessary.

Measurable Benefits: As identified, inoperable valves replaced within 90 days.

Basis of Recommendation: Requested by the City of Rialto, primarily for large valves. In line with prudent industry practices.

Assumptions / Risks: Extent of scope currently unknown. Some of the work will be identified via emergencies. Contractor assumed program in second half of 2012 for emergency work, then initiated full program in the second half of 2013 after identification and evaluation of program scope. Assume that there is no current backlog of inoperable valves.

Primary Driver: Asset Renewal

Cost Allowance: \$440,000

Project Period: Reoccurring

Method of Delivery: Design/Bid/Build

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

Status: Initial preliminary design as of 4th QTR 2014.

WF Water Project – Hydrant Replacement

Project No. WF (Part of Concession Agreement)

Name of Project: Hydrant Replacement

Problem or Opportunity: Hydrant failures can occur prior to the main failing. Vandalism or damage to hydrants can also occur to these above ground assets.

Recommended Solution: Identify and replace hydrants as necessary.

Measurable Benefits: As identified, inoperable hydrants replaced within 60 days.

Basis of Recommendation: Recommended by Contractor (not identified in the RFP). In line with prudent industry practices.

Assumptions / Risks: Extent of scope currently unknown. Some of the work will be occur via emergencies. Contractor assumed program in second half of 2012 for emergency work, then initiated full program in the second half of 2013 after identification and evaluation of program scope. Assume that there is no current backlog of inoperable hydrants.

Primary Driver: Asset Renewal

Cost Allowance: \$2,200,000

Project Period: Reoccurring

Method of Delivery: Design/Bid/Build

Status: No longer a priority for the City of Rialto, Put on Hold

WG Water Project – Engineering Studies (Master Plan and Regulatory Related)

Project No. WG (Part of Concession Agreement)

Name of Project: Engineering Studies (Master Plan and Regulatory Related)

Problem or Opportunity: Master planning should be performed every 5 years. Other types of engineering studies related to regulatory requirements could be expected to occur over a 5 year period.

Recommended Solution: Provide funding for both Master Planning and as a placeholder for currently unidentified studies.

Measurable Benefits: None

Basis of Recommendation: Recommended by Contractor.

Assumptions / Risks: Funding not provided for growth related studies. Since scope is unknown, proposed funding is a placeholder.

Primary Driver: Reliability and Quality of Service.

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

Cost Allowance: \$571,000

Project Period: Reoccurring

Method of Delivery: Design/Bid/Build

Status:

W8 Water Project (PROPOSED) – Emergency Power Improvements

Project No. / Ranking: W8

Name of Project: Emergency Power improvements

Problem or Opportunity:

Recommended Solution:

Measurable Benefits:

Basis of Recommendation:

Assumptions / Risks:

Primary Driver: Asset Renewal

Cost Allowance: \$

Project Period: 2017

Method of Delivery: Design/Bid/Build

Status: City currently meets CDPH requirements for max day demand and fire flow with current storage capacity. Placed on Hold

W9 Water Project (PROPOSED) – Rialto Well 4 Pump Improvements

Project No. / Ranking: W9

Name of Project: Rialto Well 4 Pump Improvements

Problem or Opportunity: The pump is aged, worn, and has an elevated risk for failure.

Recommended Solution: Replace the pump and other associated equipment as necessary.

Measurable Benefits: Minimal downtime except for routine scheduled maintenance.

Basis of Recommendation: Recommended based on Expected End of Life.

Assumptions / Risks: Due to site constraints, equipment will need to be replaced in its existing location, and performed in an off peak season. Normal construction risks associated with retrofit projects exist.

Primary Driver: Asset Renewal

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

Cost Allowance: \$400,000

Project Period: 2018

Method of Delivery: Design/Bid/Build

Status:

| W9 Capital Project | | | | | | |
|------------------------------|---------------------------------------|----------|------------|-----------|-------------|------------------|
| System | Asset Repair or Replacement | Decision | Yrs Remain | Condition | Criticality | Cost |
| Rialto 4 Well Pumping System | PUMP, WELL RIALTO 4, CACTUS RESERVOIR | Replace | -59 | 3.0 | 1 | \$300,000 |
| | PROJECT TOTAL: | | | | | \$300,000 |

W10 Water Project (PROPOSED) – Rialto Well 1 Pump Improvements

Project No. / Ranking: W10

Name of Project: Rialto Well 1 Pump Improvements

Problem or Opportunity: The pump is aged, worn, and has an elevated risk for failure.

Recommended Solution: Replace the pump and other associated equipment as necessary.

Measurable Benefits: Minimal downtime except for routine scheduled maintenance.

Basis of Recommendation: Recommended based on Expected End of Life.

Assumptions / Risks: Due to site constraints, equipment will need to be replaced in its existing location, and performed in an off peak season. Normal construction risks associated with retrofit projects exist.

Primary Driver: Asset Renewal

Cost Allowance: \$400,000

Project Period: 2019

Method of Delivery: Design/Bid/Build

Status:

| W10 Capital Project | | | | | | |
|------------------------------|-----------------------------|----------|------------|-----------|-------------|------------------|
| System | Asset Repair or Replacement | Decision | Yrs Remain | Condition | Criticality | Cost |
| Rialto 1 Well Pumping System | PUMP, WELL RIALTO 1 | Replace | -25 | 2.6 | 1 | \$300,000 |
| | PROJECT TOTAL: | | | | | \$300,000 |

2015 Capital Plan Report

Rialto Water and Wastewater Facilities

APPENDIX B

City of Rialto Water Infrastructure Facilities Photographs

APPENDIX B

Photographs



The City of Rialto Water facilities were inspected on April 1, 2016. The inspections included photographing the facilities and equipment. The photographs are presented on the following pages.



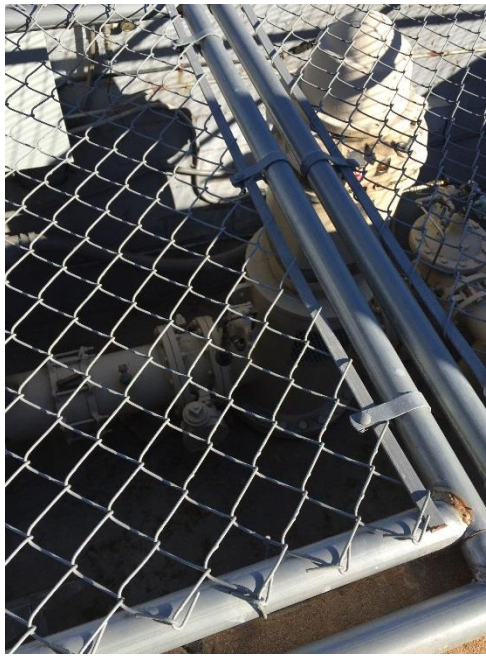
Booster PS #3 Layout



Booster PS #3 Pump Layout

APPENDIX B

Photographs



Booster PS #3 Chain Link Fence Cover



Booster PS #3 Chain Link Fence Cover Details

APPENDIX B

Photographs



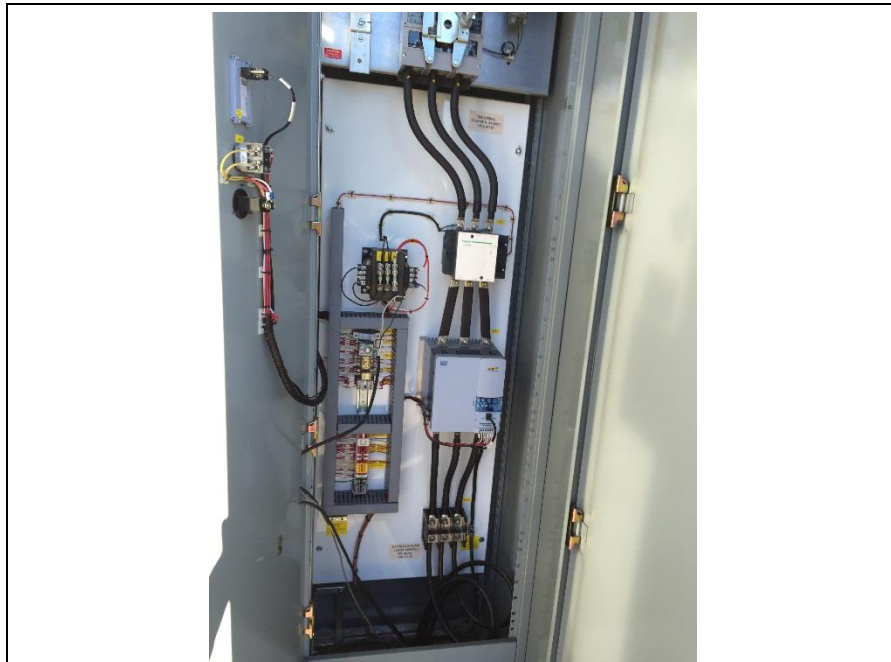
Booster PS #3 MCC Enclosure



Booster PS #3 Drain Pipe Details

APPENDIX B

Photographs



Booster PS # 3 Interior Condition Assessment (1)



Booster PS # 3 Interior Condition Assessment (2)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 (1)



Booster 4 & 5 and Rialto Well #4 (2)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 (3)



Booster 4 & 5 and Rialto Well #4 (4)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 (5)



Booster 4 & 5 and Rialto Well #4 (6)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 (7)



Booster 4 & 5 and Rialto Well #4 (8)

APPENDIX B

Photographs



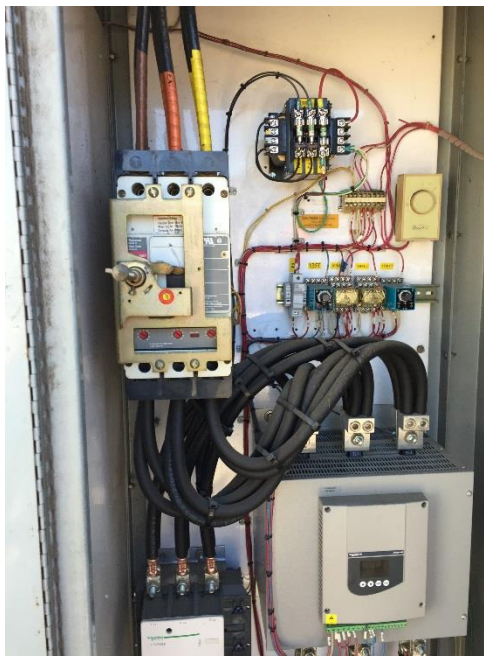
Booster 4 & 5 and Rialto Well #4 (9)



Booster 4 & 5 and Rialto Well #4 (10)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 (11)



Booster 4 & 5 and Rialto Well #4 (12)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 Bypass & Control Valve (1)



Booster 4 & 5 and Rialto Well #4 Bypass & Control Valve (2)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 Communications Tower (1)



Booster 4 & 5 and Rialto Well #4 Communications Tower (2)

APPENDIX B

Photographs



Booster 4 & 5 and Rialto Well #4 Filter Units



Booster 4 & 5 and Rialto Well #4 Flow Meter Details (1)

APPENDIX B

Photographs



Booster PS #6 - #10 (1)



Booster PS #6 - #10 (2)

APPENDIX B

Photographs



Booster PS #6 - #10 (3)



Booster PS #6 - #10 (4)

APPENDIX B

Photographs



Booster PS #6 - #10 (5)



Booster PS #6 - #10 (6)

APPENDIX B

Photographs



Booster PS #6 - #10 (7)



Booster PS #6 - #10 (8)

APPENDIX B

Photographs



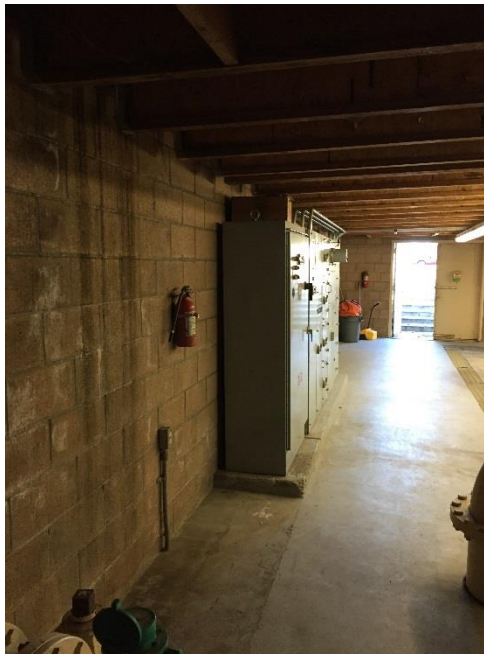
Booster PS #6 - #10 MCC (1)



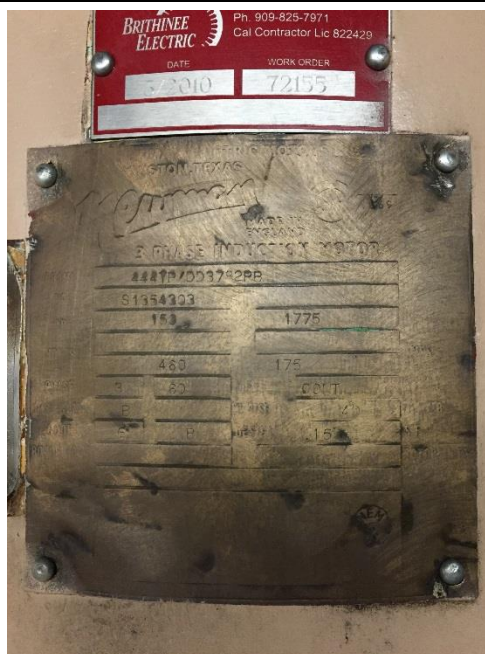
Booster PS #6 - #10 MCC (2)

APPENDIX B

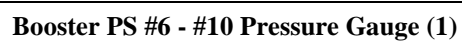
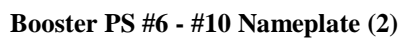
Photographs



Booster PS #6 - #10 MCC (3)



Booster PS #6 - #10 Nameplate (1)



APPENDIX B

Photographs



Cactus Reservoir Side Walls (1)



Cactus Reservoir Side Walls (2)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Rialto Well #1 (1)



Cedar Reservoirs 1 & 2 Rialto Well #1 (2)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Rialto Well #1 (3)



Cedar Reservoirs 1 & 2 Rialto Well #1 (4)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Rialto Well #1 (5)



Cedar Reservoirs 1 & 2 Wall Condition (1)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Wall Condition (2)



Cedar Reservoirs 1 & 2 Wall Condition (3)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Walls and Damage (1)



Cedar Reservoirs 1 & 2 Walls and Damage (2)

APPENDIX B

Photographs



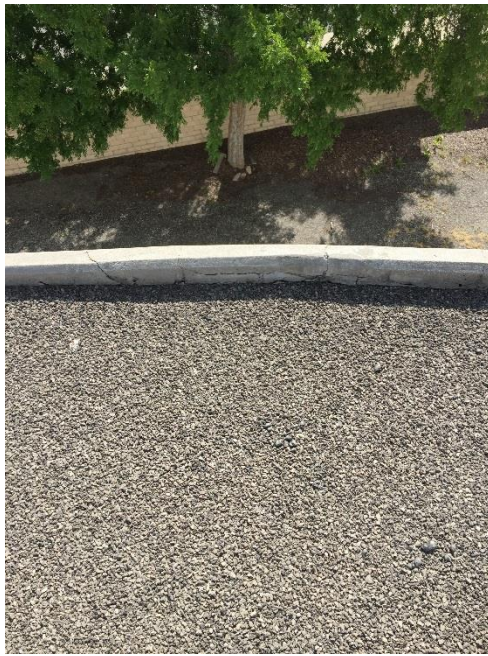
Cedar Reservoirs 1 & 2 Well #1 Pump House Building (1)



Cedar Reservoirs 1 & 2 Top of Reservoir Cover (1)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Top of Reservoir Cover (2)



Cedar Reservoirs 1 & 2 Top of Reservoir Cover (3)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Top of Reservoir Cover (4)



Cedar Reservoirs 1 & 2 Top of Reservoir Cover (5)

APPENDIX B

Photographs



Cedar Reservoirs 1 & 2 Access Hatch Condition (1)



Cedar Reservoirs 1 & 2 Access Hatch Condition (2)

APPENDIX B

Photographs



Chino PS #1 Discharge Pipeline (1)



Chino PS #1 Discharge Pipeline (2)

APPENDIX B

Photographs



Chino PS #1 Discharge Pipeline (3)



Chino PS #1 Discharge Pipeline (4)

APPENDIX B

Photographs



Chino PS #1 Discharge Pipeline (5)



Chino PS #1 Discharge Pipeline (6)

APPENDIX B

Photographs



Chino PS #1 MCC Cabinet (1)



Chino PS #1 MCC Cabinet (2)

APPENDIX B

Photographs



Chino PS #1 MCC Cabinet (3)



Chino PS #1 MCC Controls Cabinet (1)

APPENDIX B

Photographs



Chino PS #2 MCC (1)



Chino PS #2 MCC (2)

APPENDIX B

Photographs



Chino PS #2 MCC (3)



Chino PS #1 Chlorination Tablet Storage

APPENDIX Photographs



Chino PS #2 Communications Antenna



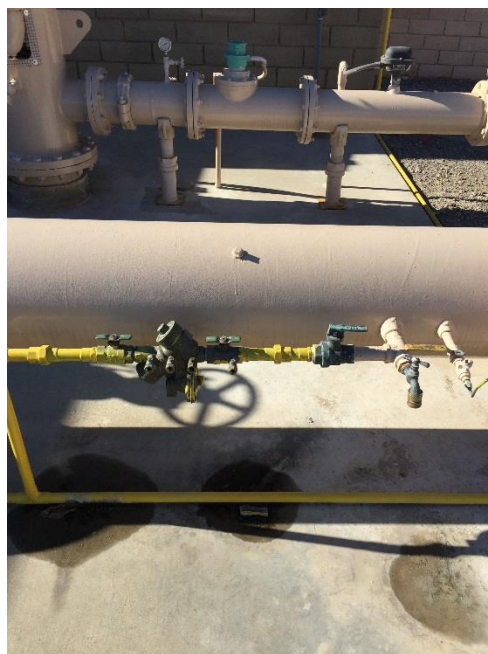
Chino PS #2 Controls Cabinet

APPENDIX B

Photographs



Chino PS #2 Flow Meter



Chino PS #2 Pipeline Connections

APPENDIX B

Photographs



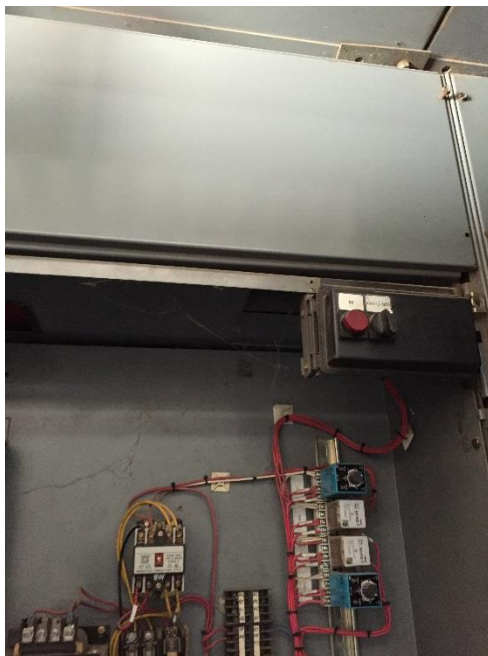
City Well #1 MCC Cabinet (1)



City Well #1 MCC Cabinet (2)

APPENDIX B

Photographs



City Well #1 MCC (2)



City Well #1 MCC (3)

APPENDIX B

Photographs



City Well #1 Control and Power Room



City Well #1 Well Fence (1)

APPENDIX B

Photographs



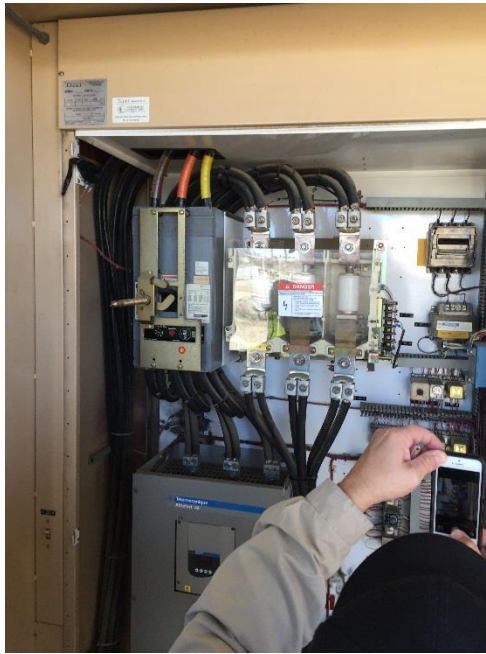
City Well #2 Pump House (1)



City Well #2 Pump House (2)

APPENDIX B

Photographs



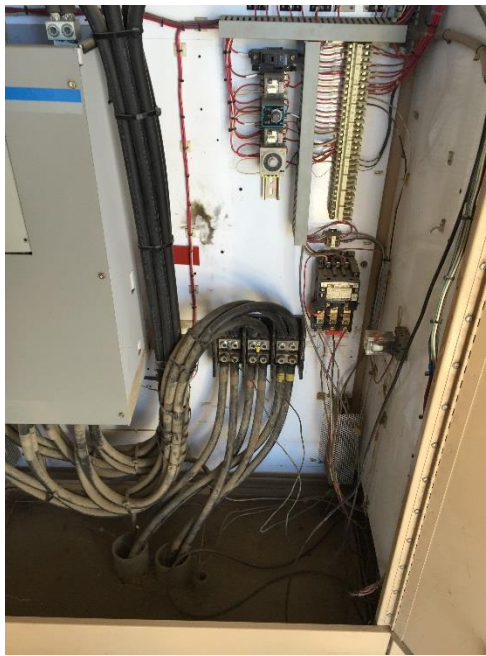
City Well 4A MCC (1)



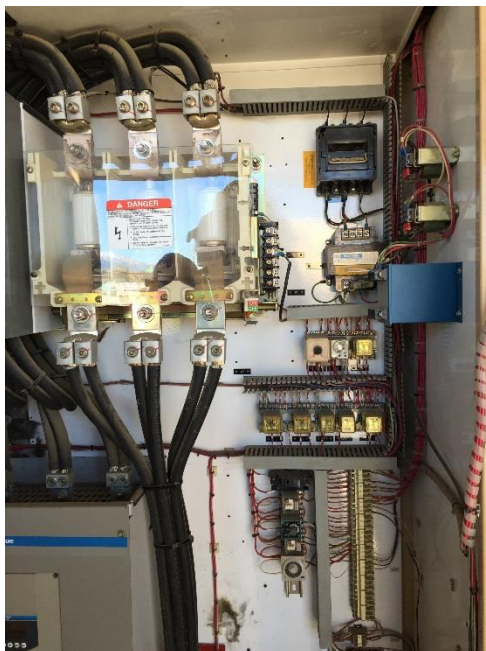
City Well 4A MCC (2)

APPENDIX B

Photographs



City Well 4A MCC (3)



City Well 4A MCC (4)

APPENDIX B

Photographs



City Well 4A Pressure Gauges



City Well 4A Transformer Power Supply

APPENDIX B

Photographs



City Well 4A Disinfection (2)



City Well 4A Chemical Dose

APPENDIX B

Photographs



City Well #5 Discharge Reject Line



City Well #5 Vandalized MCC

APPENDIX B

Photographs



City Well #5 Well Pump



City Well #5 Well Pump Force Main

APPENDIX B

Photographs



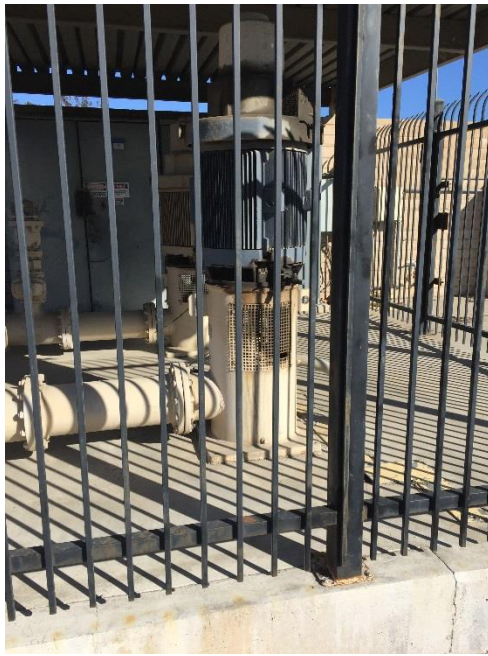
City Well #6 Site



City Well #6 Site Access Platform

APPENDIX B

Photographs



City Well #6 Site Security Cage (1)



City Well #6 Site Security Cage (2)

APPENDIX B

Photographs



Easton Reservoir Top (2)



Easton Reservoir Top (3)

APPENDIX B

Photographs



Easton Reservoir Sides



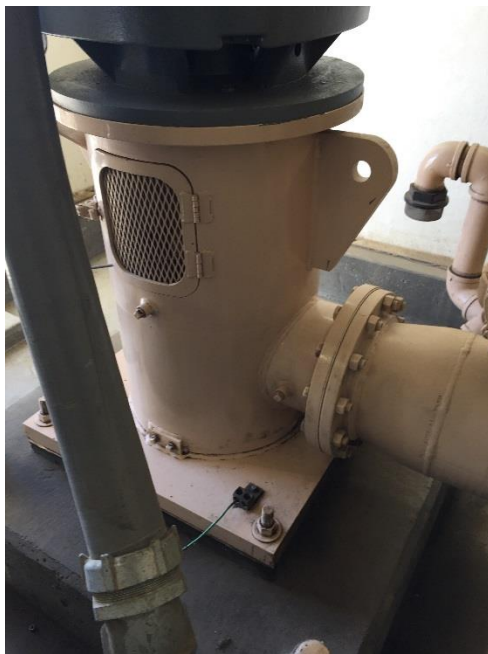
Easton Reservoir Communication Antenna

APPENDIX B

Photographs



Miro #3 Well Pump



Miro #3 Well Pump Details (1)

APPENDIX B

Photographs



Miro #3 Well Pump Details (2)



Miro #3 Well Pump Details (3)

APPENDIX B

Photographs



Rialto Well #2 Pipe Condition Assessment (2)



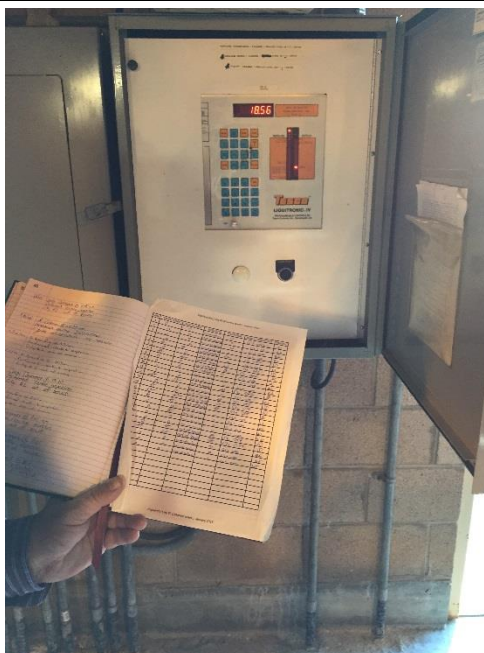
Rialto Well #2 Pipe Condition Assessment (3)

APPENDIX B

Photographs



Rialto Well #2 Pipe Condition Assessment (4)



Rialto Well #2 Daily Log Book

APPENDIX B

Photographs



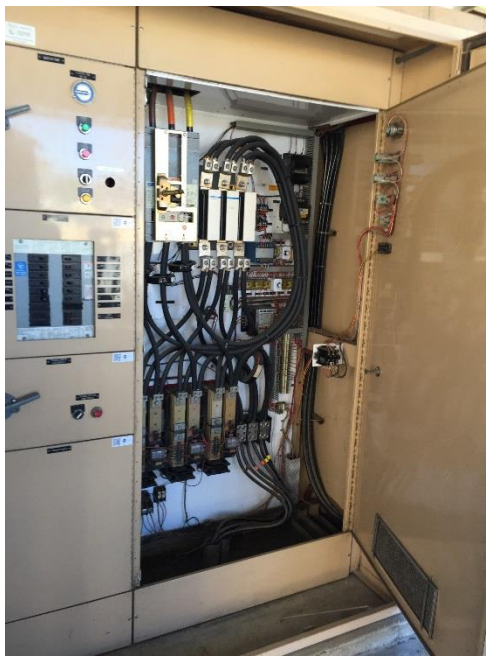
Rialto Well #2 Controls and Electrical



Rialto Well #2 Disinfection System

APPENDIX B

Photographs



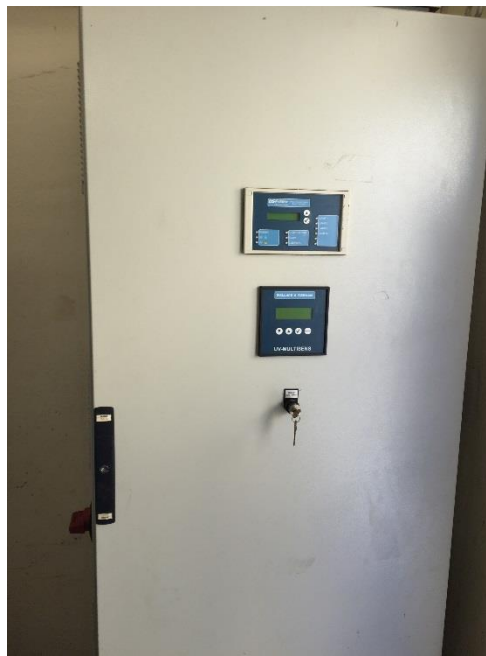
Rialto Well #3 MCC (4)



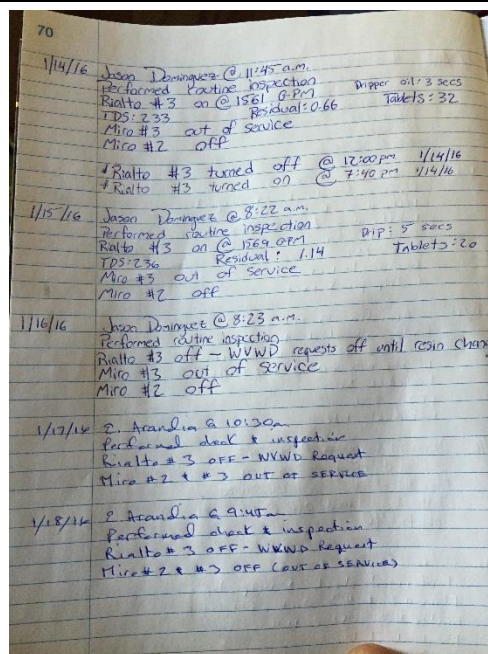
Rialto Well #3 MCC (5)

APPENDIX B

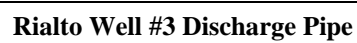
Photographs



Rialto Well #3 MCC



Rialto Well #3 Daily Report Sample (1)



APPENDIX B

Photographs



Rialto Well #3 Filter Unit



Rialto Well #3 Pipe Wall Penetration

APPENDIX B

Photographs



Rialto Well #3 PS Interior



Rialto Well #3 Reservoir Site

APPENDIX B

Photographs



Rialto Well #3 UV Disinfection



Rialto Well #3 Yard Piping

APPENDIX B

Photographs



Rialto Well #5 MCC (1)



Rialto Well #5 MCC (2)

APPENDIX B

Photographs



Rialto Well #5 MCC (3)



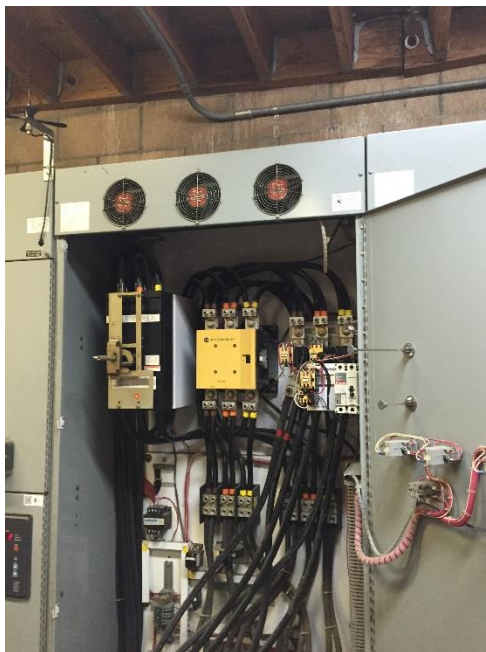
Rialto Well #5 MCC Schedule (1)

APPENDIX B

Photographs



Rialto Well #5 MCC Schedule (2)



Rialto Well #5 MCC Schedule (3)

APPENDIX B

Photographs



Rialto Well #5 Communication Antenna



Rialto Well #5 Controls

APPENDIX B

Photographs



Rialto Well #6 Well Pump



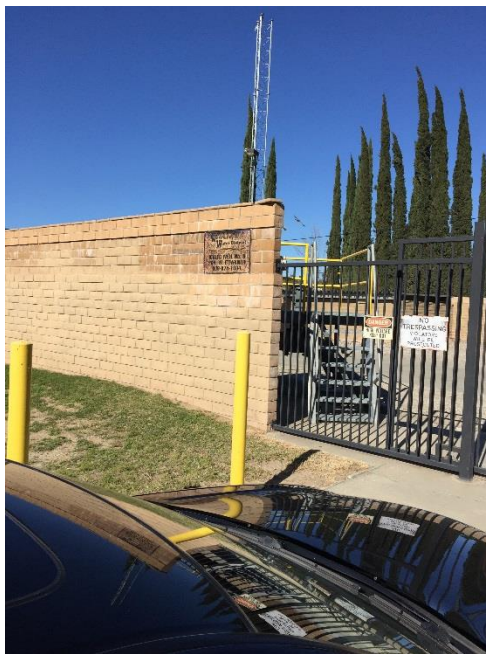
Rialto Well #6 Details

APPENDIX B

Photographs



Rialto Well #6 Site Layout



Rialto Well #6 Site Gate

APPENDIX B

Photographs



Rialto Well #6 Water Filter (1)



Rialto Well #6 Water Filter (2)

APPENDIX B

Photographs



Sample Abandoned Booster PS Mechanical Equipment (1)



Sample Abandoned Booster PS Mechanical Equipment (2)

APPENDIX C

Rialto Water Systems SCADA Report



September 9, 2014

Mr. Peter Fox
Plant Manager
Veolia Water West Operating Services, Inc.
325 West Rialto Avenue
Rialto, CA 92376

Subject: SCADA System Conceptual Design Report

Dear Mr. Fox:

Linkture is happy to submit the attached final Conceptual Design Report for the assessment of Rialto Water System SCADA system and recommended conceptual design.

Should you have any questions please do not hesitate to call me at (949) 589-1909 x116.

Sincerely,

LINKTURE CORP.

A handwritten signature in blue ink, appearing to read "Opty Fernandez", is written over the company name.

Opty Fernandez, PE

Project Manager

ONF:afr

Supervisory Control and Data Acquisition (SCADA) CONCEPTUAL DESIGN REPORT

For

Rialto Water Systems

City of Rialto, CA

September 2014



**Rialto Water Systems and Veolia Water Company
325 West Rialto Avenue
Rialto, CA 92376**



**15 Flagstone
Trabuco Canyon, CA 92679**

Table of Contents

| | |
|--|----|
| I. Background | 3 |
| II. Existing SCADA System | 3 |
| III. Proposed SCADA Master Station Improvements | 4 |
| IV. Remote Access to SCADA | 6 |
| V. Proposed Remote Site Remote Terminal Unit (RTU) | 6 |
| A. Basic Work Requirement at each Remote Site | 7 |
| B. Commonality for Typical Sites: | 7 |
| C. RTU 1 - Rialto Well 1 & Cedar 1 & 2 Reservoirs | 8 |
| D. RTU 3 - Rialto Well 3 (Airport Well) | 9 |
| E. RTU 4 - Bypass 2 (Rialto Well 7) | 10 |
| F. RTU 6 - Cactus Reservoir and Booster Pumps 4 & 5 and Bypass | 11 |
| G. RTU 7 - City Wells 1 & 2 | 11 |
| H. RTU 8 - City Well 3 | 12 |
| I. RTU 9 - City Well 4A | 13 |
| J. RTU 12 - San Bernardino Park PRV | 14 |
| K. RTU 15 - Highland Reservoir | 14 |
| L. RTU 16 - Easton Reservoir | 15 |
| M. RTU 17 - Booster Pump 3 | 15 |
| N. RTU 20 - Booster Pumps 1 & 2 | 16 |
| O. RTU 23 - Booster Pumps 6-10 & Bypass | 16 |
| P. RTU 24 - Chino Well 2 | 18 |
| Q. RTU 27 - Rialto Well 5 | 18 |
| VI. Master Station Upgrade Design | 19 |
| VII. Communication System Design | 19 |
| VIII. Cost Estimate | 20 |
| IX. Exhibits | |
| A. Proposed SCADA Architecture and Components | 23 |
| B. RTU Sample Design and Major Component Cut Sheets | 25 |
| C. FCC Radio Station Authorization (License) | 80 |
| D. Radio Survey Report | 82 |
| E. Remote Sites I/O List | 89 |
| F. Cost Opinion | 97 |

I. Background

The City of Rialto desires to replace the existing Supervisory Control and Data Acquisition (SCADA) system with a fully redundant Master Station to enhance service and reliability for their customers. These improvements must be cost-effective and designed for simplicity in maintenance and support which will focus on the replacement of all existing data concentrators (PLC), radios, servers, workstations, software and monitors. The RTU design will utilize a standardized PLC design with off-the-shelf equipment most commonly used in the water and wastewater industry, a single redundant Master Station with HMI platform all supported by the majority of local system integrators. The water SCADA system not will be integrated with the existing City of Rialto wastewater SCADA system as there is no foreseen benefits.

II. Existing SCADA System

A Supervisory Control and Data Acquisition (SCADA) is basically composed of three main components: a) the remote station, b) the communication system, and c) the master station. Each of the three main components of the City of Rialto existing SCADA system is obsolete, in disrepair, lacks reliability and vendor support and not fully functional.

1. Remote Sites

The remote sites are a variety of function or a combination of functions. There are sites that have only reservoirs, some are a combination of reservoirs and wells, others are booster pumps only and still others are a combination of booster pumps and reservoirs to name a few. The SCADA Remote I/O List lists all the sites and the instruments required at each facility.

The remote sites are also in various state of conditions. Some sites are well maintained and in good condition and other are in state of disrepair. The objective of this project is to rehabilitate the SCADA system including the field instruments. Some sites may require a complete over haul but this project is limited to the improvement of the SCADA system only. At some facilities the field instruments may be damaged, non-functional and/or disconnected or never been tied to the Remote Terminal Unit (RTU). These instruments need to be replaced with a new one and connected to the RTU.

The existing RTUs are compose of antiquated Liquidtronic IV controller which is no longer carried or supported by the manufacturer, Tesco Controls.

2. Radio Communication System

The existing radio communication system uses a licensed radio communication and has exhibited some transmission problems especially at the wash and where vegetation has grown and interferes with the radio signal. Applied Technology evaluated the existing radio system and surveyed the radio path using a more current radio model. By using the latest model of MDS radio they were able to establish a good connection without having to resort to repeaters using unlicensed radios. The details of their report is attached as [Exhibit D](#).

The current license limits the antenna height of the remote sites to 6.1 meters and the master site to 15.2 meters. The maximum antenna gain for the remote sites is limited to 10dB. The study recommended a 60-foot antenna height at some of the remote site and a gain of 12 dB. Contractor shall modify the FCC license to reflect these changes.

3. Master Station

The existing Master Station which compose of the master radio, data concentrator, servers, and workstation are also obsolete. The HMI software, Factory Link, is no longer supported by its manufacturer. The servers are failing and the software program cannot be upgraded. The existing omni antenna and coax cable are old and need to be replaced. There are unused antennas and cables on the mast which needs be removed.

SCADA System

The SCADA system shall comply with the requirements of California Department of Public Health.

III. Proposed SCADA Master Station Improvements

The existing SCADA servers and software are obsolete and not in good service. All the hardware, software and programming shall be replaced with a complete SCADA system as illustrated on [Exhibit A](#). The master station shall be fully redundant. The servers, master radio, UPS, managed switch and other associated equipment shall be installed in the server room. The work station, printer and the 42" screen shall be installed in the work station room.

The master station shall consist of the following:

1. Main Dell Transaction, Data & Historian Server:
 - a. Quad Core Xeon 2.93 GHz or faster
 - b. 64-bit processor
 - c. 16GB RAM
 - d. (2) 1TB (RAID1) Transaction Hard-Drive
 - e. (3) 1TB (RAID5) Data Hard-Drive
 - f. Redundant Power Supply
2. Backup Server - Same as above
3. Server and Client Software:
 - a. MS SQL 2008 R2 SP1 64 bit or MS SQL 2012 SP1 OS
 - b. Wonderware System Platform Application Server 2014 (Components: Bootstrap, IDE & GR) 2 Client Conc 5K I/O/500 History RDS
 - c. Wonderware InTouch 2014 with Historian Client (v11.0)
 - d. Wonderware InTouch 2014 with Historian Client (v11.0) RDS
 - e. Wonderware Customer Support for one year
4. Licenses:
 - a. Wonderware Application Server
5. Operator Workstation Hardware:
 - a. Dell PC with dual 2.4 GHz or faster processor
 - b. 4 GB or greater RAM (with 64-bit OS)
 - c. 1TB Hard-Drive
 - d. 27" Dell UltraSharp U2713HM monitor or equal
 - e. Sharp PN-U423 - 42" LED-backlit LCD flat panel display

6. MDS SDxP or P20 Master Radio
7. Backup NAS Drive - Synology RS10613xs+, 8GB RAM, (2) 3TB drives, RAID 5
8. Andrew DB589-Y Omni Antenna
9. Modicon Quantum Data Concentrator
10. Managed Switch
11. Uninterrupted Power Supply



Figure 1 Rialto Water Systems Master SCADA Site



Figure 2 - Existing SCADA Servers and Workstation in Workstation Room

The existing SCADA main station radio and data concentrator PLC are both obsolete. Replace the master radio with a MDS P20 (SD9P) or if available install a MDS SD radio with built-in two power supplies and two transceiver boards which will fault to the second radio and also be hot swappable in lieu of the MDS P20.

The Servers, NAS backup drive, radio, switch, and UPS shall be installed on a 19" rack in the server room. The room will be prepared and organized to accommodate the rack and the existing telephone system by the current construction contract for the building. Similarly, the operator WorkStation room will be prepared to accommodate the equipment.

IV. Remote Access to SCADA

The SCADA shall be remotely accessed via tablets. The tablet shall have wifi and cellular access. Install and configure all necessary software to access the SCADA for remote monitoring and control. Access shall be password protected and encrypted with 128-bit encryption.

Required Equipment:

1. iPad Air with 64GB capacity.
2. Contract with Verizon Wireless or other cellular provider for 3 years each user.
3. Wonderware RDS InTouch for Apple OS, 3 users.



Figure 3 - SCADA Master Station Data Concentrator and Radio in new Server Room

V. Proposed Remote Site Remote Terminal Unit (RTU)

City of Rialto water distribution system consists of reservoirs, wells, booster pumps, connections to West Valley and San Bernardino Municipal Water District, bypass connections, and pressure reducing stations. In some site a combination of reservoirs, wells, booster pumps and/or bypass connections. All the existing RTUs are obsolete and need replacement. Replace the RTUs with the following:

For sites with discrete inputs and outputs and analog inputs and output the RTU shall have the following PLC.

1. Modicon M340, Allen-Bradley Compact Logix PLC or Tesco L3000 PLC
 - a. CPU with (1) Ethernet and (1) serial communication port
 - b. 8 or more slot rack, number of slots as required
 - c. 8 input 24VDC Digital Input card - quantity as required
 - d. 8 relay output Digital Output card - quantity as required
 - e. 4 input Analog Input card - quantity as required
 - f. 4 output Analog Output card - quantity as required
 - g. PLC Power Supply
 - h. The above rack shall have with minimum of 20% spare slots and the I/O card shall also have a minimum of 20% spare I/O points.
2. 8" TFT Color Touch Panel, Maple Systems, Operator Interface Terminal (OIT)
3. MDS SD Series Long Range IP/Ethernet & Serial Radio
4. Andrew Surge Suppressor, Coax Cables and Connectors
5. 900 MHz Optimized Yagi Antenna, gain as recommended by the radio survey
6. NEMA 4 wall mounted Hoffman steel cabinet, size are required.
7. 24VDC PULS Power Supply
8. Ethernet 100baseT switch
9. Batteries & Charger
10. Other miscellaneous items for a complete RTU system

See [Exhibit B](#) for an example of RTU design.

For sites where two or less I/O cards are required a 4 slot rack PLC is acceptable. The rest of the components listed above shall remain the same.

A. Basic Work Requirement at each Remote Site

At all remote sites the RTU and antenna will be replaced. Install the new RTU at the same location as existing where possible. If RTU is installed at a different location provide the necessary unspliced wiring. All the existing instruments will be reconnected to the RTU unless noted otherwise. Some of the existing instruments are not currently connected or the wiring has been damage. Provide new conduit and wiring to these instruments, Contractor to field verify. Where the instruments listed on the attached SCADA Remote I/O List does not exist or broken install a new one. The pump status inputs such as HOA switch contacts, relay contacts, etc. were not field verified but are assumed to exist and functional. Contractor shall field verify such condition exist and allow in bid for replacement or addition if required.

Currently power usage is not being monitored at any of the sites. Southern California Edison shall be contacted and request for the pulse output from their meter and connect to the digital input of the PLC.

The existing antenna mast will be reused unless identified to be replaced on the Radio Site Survey Report.

B. Commonality for Typical Sites:

Most of the sites have many items in common. For example, most well sites have pump I/O's, system discharge I/O's, chlorine system I/O's, intrusion alarm I/O's, and power I/O's. Provide

two typical RTU design so that one design will accommodate any site. Even if a well site does not have a chlorine system, for example, provide I/O points in the PLC and also provide the necessary programming but turn off the addresses or program rungs where not needed. Where commonality occurs all installations, programming, addressing, etc. shall be alike with the worst condition being the typical design. Where a site is unusually different from the rest of the sites as in Boosters 6-10 a third RTU design shall be implemented.

At all sites where a chlorine system exists install a PVC flow switch on the chlorine discharge piping and wire to the RTU.

Where a propeller type flow meter exist which has no output or output is not 4-20 mA replace with a Water Specialties flow meter with 4-20 mA output. Pipe size and flow rate shall be determined during the design.

Each remote sites current condition is analyzed below and the recommended actions. At all the remote site it is recommended that the RTU be replaced with state-of-the-art open architecture equipment as noted above.

C. RTU 1 - Rialto Well 1 & Cedar 1 & 2 Reservoirs

Rialto Well 1 and Cedar Reservoirs Plant is located at 2610 N. Cedar Avenue near the intersection of Persimmon. The RTU is obsolete and needs replacement. It is located in the control building and controls the well pump, monitors the flow from both the reservoirs, reservoir levels, flow from the surface water treatment plant from a valve in front of the plant, and flow rate from Rialto Well 1. All the instruments and wiring on this site will be reused with the exception of the well.

The well is not currently in use but there is plan to reuse it. Provide a new wall mounted remote I/O unit and wiring at the well site and connects all the I/O's including the MCC inputs and control. Mount the remote I/O on a steel mounting frame next to the MCC. The flow meter and the check valve limit switch need to be replaced. Provide a new flow meter with a 4-20 mA output signal for the discharge flow.

Provide intrusion alarm switch at the entrance door of the building and at each control panel and MCC and connect to the PLC. Each intrusion alarm shall be monitored independently.

Provide a new antenna mast mounted on the side of the control building with antenna mounted at 17 feet above finish grade.

Provide a new 10dB gain yagi antenna.

Provide a new weather station with wind speed, precipitation and temperature monitoring capability. Mount the weather station on the south side of the control building adjacent to the antenna mast.



Figure 4 - Cedar Reservoir and Control Building



Figure 5 - Propeller Flow Transmitter

D. RTU 3 - Rialto Well 3 (Airport Well)

Rialto Well 3 is located at 1457 N. Linden Avenue near the intersection of Miro Way. This site requires the replacement of the RTU, antenna and reconnection of the instruments and I/O points from the pump motor controller. Reuse the existing antenna mast. The chlorination system is not connected to the RTU. Provide a flow switch and connect all the I/O points from the chlorination system to the RTU with new conduits and wires.

The existing antenna height of approximately 24 feet is adequate. Provide a new yagi antenna with a 10dB gain.

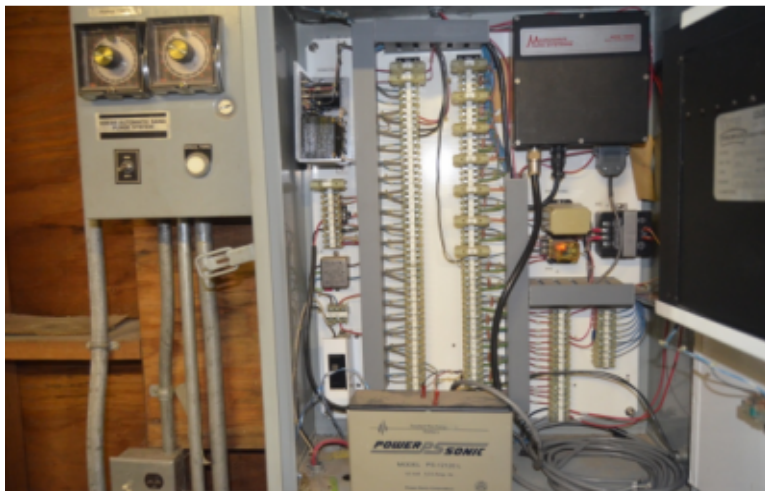


Figure 6 - RTU Panel at Rialto Well 3



Figure 7 Chlorination Equipment to be Monitored.

E. RTU 4 - Bypass 2 (Rialto Well 7)

Bypass 2 is located at 440 N. Cedar near the intersection on Foothill.

Rialto Well 7 is no longer operational but the station is being used as a bypass. The RTU is old and needs to be replaced. Some of the instruments are disconnected or non-functional. Replace only the differential transmitter and orifice plate for measuring the flow rate and rewire to the new RTU.

The existing antenna height of approximately 15 feet is adequate but the yagi antenna needs to be replaced with a new 10dB gain yagi antenna.



Figure 8 - Bypass 2 View of RTU to the Left and Control Panels Ahead

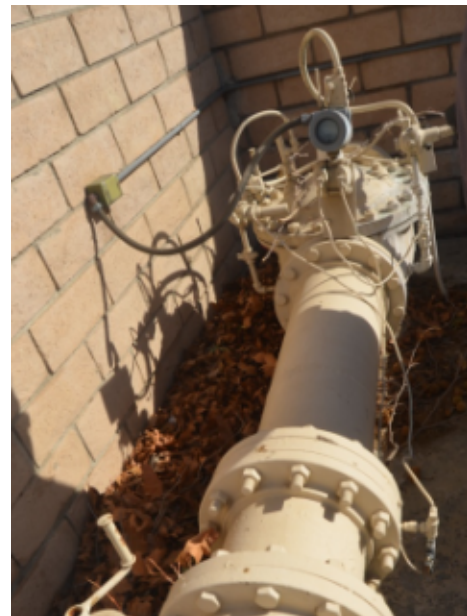


Figure 9 - Differential Pressure Transmitter & Orifice plate

F. RTU 6 - Cactus Reservoir and Booster Pumps 4 & 5 and Bypass

Cactus Reservoir and Booster Pumps 4 and 5 plant is located at 725 W. Baseline Avenue near the intersection of Cactus Avenue.

Rialto Well 4 is also located on this site but is no longer active because of perchlorate contamination. Booster 4 draws water from Easton Reservoir and pumps to Cedar Reservoir. Booster 5 draws water from Cactus Reservoir and/or West Valley Water District (WVWD) and also pumps Cedar Reservoir.

The propeller flow meters at Boosters 4 and 5 need to be connected to the new RTU. No wiring is installed but spare conduits are available. Booster 5 check valve position switch needs to be provided, installed and wired to the RTU.

A control valve located inside a vault which controls the flow from WVWD to Cactus reservoir needs to be wired to the RTU and provide power to control the motorized operator. The valve position needs to be monitored with a limit switch. Patch the flow rate from WVWD's RTU.

The existing antenna height of approximately 15 feet is adequate but the yagi antenna needs to be replaced with a new 10dB gain yagi antenna.



Figure 10 - Boosters 4 & 5



Figure 11 - Instruments to be Replaced

G. RTU 7 - City Wells 1 & 2

City Wells 1 and 2 are located at Lytle Creek Wash near North Country Club. City Wells 1 & 2 discharge to Easton Reservoir. These two wells are scheduled for rehabilitation by 2015. The MCC and the RTU will be new and the I/O's are per the SCADA Remote I/O List. The existing building will remain which houses the MCC and the RTU. All the instruments, MCC and RTU will be new but on a separate capital project.



Figure 12 - City Well 1



Figure 13 - City Well 2

H. RTU 8 - City Well 3

City Well 3 is located at 705 East Easton Street near the intersection of Eucalyptus. This site is in fair condition but some maintenance is needed. The instruments are in good condition but is

lacking some instruments listed on the SCADA Remote I/O List. Provide the missing instruments and connect to the new RTU.

Provide a new antenna mast mounted on the existing sports field netting wood pole just west of the site. The wood pole is approximately 40 feet high and the antenna is recommended to be at 60 feet. A 12dB gain yagi antenna is also recommended.



I. RTU 9 - City Well 4A

City Well 4A is located at West 9th Street near the intersection of Pennsylvania.

The well pump station is in good condition but the RTU is obsolete. The flow meter is new but is not connected to the RTU. Connect to new flow meter using existing conduit and new wires. Add the new instruments as called out on the SCADA Remote I/O List on [Exhibit C](#).

The antenna is recommended to be mounted at 60 feet high using a 12dB gain yagi antenna.



Figure 14 City Well 4A



Figure 15 Existing Flow Meter to be Connected to PLC

J. RTU 12 - San Bernardino Park PRV

Zone 4 PRV is located at San Bernardino Park. Replace existing RTU with Type 1 RTU and connect pressure and flow transmitters. The existing antenna height of approximately 26 feet is adequate but the yagi antenna needs to be replaced with a new 10 dB gain yagi antenna.

K. RTU 15 - Highland Reservoir

Highland Reservoir is located at 100 W. Easton St. near the intersection of Riverside. The RTU is housed inside a small building along with the chlorination system. The building intrusion switch needs replacement. The chlorination system is not connected to the RTU and a chlorine discharge flow switch needs to be installed.

The existing antenna height of approximately 40 feet is adequate. A new 10 dB gain yagi antenna is recommended.



Figure 16 Highland Reservoir

L. RTU 16 - Easton Reservoir

Easton Reservoir is located at 140 W. Easton St. near intersection of Riverside. The RTU is located outdoors on a wooded backboard just in front of the reservoir. The RTU and the support frame need replacement. Currently the RTU is monitoring only the reservoir level.

The existing antenna height of approximately 25 feet is adequate. Provide a new yagi antenna with a 10dB gain.



Figure 17 Easton Reservoir

M. RTU 17 - Booster Pump 3

Booster 3 is located at 1299 N. Riverside Blvd. near the intersection of Baseline.

The instruments and the RTU have reached their life expectancy and shall be replaced. But for this contract only the RTU will be replaced and defer the replacement of the instruments. Connect all the existing instruments to the new RTU. The motor control center is old and trips when wet. It is being evaluated and will most likely be replaced in the near future.

Install a new 15-foot antenna mast with a 10dB gain yagi antenna.



Figure 18 Booster Pump 3

N. RTU 20 - Booster Pumps 1 & 2

Booster Pumps 1 and 2 are located at 2301 W. Baseline Ave. near Lassen.

Use San Bernardino Valley Water District's antenna mast for mounting the Yagi antenna but provide at least 10 feet spacing between antennas. The antenna is recommended to be mounted at 60 feet using a 12dB gain yagi antenna. Remove existing antenna mast.

Wiring to the instruments are either missing or damaged. All instruments need rewiring.

Provide a new Water Specialties flow meter in existing vault and connect to PLC.



Figure 19 Boosters 1 & 2



Figure 20 Wiring to instruments are disconnected and need rewiring.

O. RTU 23 - Booster Pumps 6-10 & Bypass

Booster Pumps 6 – 10 and Bypass is located at 303 W. Baseline Rd. near the intersection of Willow.

There is an issue with the WVWD antenna as reported on the radio study performed by Applied Technologies. Antennas should be at least 10 feet apart but WVWD mounted their antenna approximately a foot above City of Rialto's antenna. In addition, the tree at the adjacent

apartment complex just south of the site is blocking the signal path to the master station. It is recommended the foliage be trimmed at a regular basis.

WVWD monitors and controls the flow rate of the Baseline Feeder. Patch the flow rate from WVWD's RTU to the PLC.

Boosters 6-9 is pumps to the Baseline system and Booster 10 pumps from Zone 2 to Zone 1. The MCC is in good condition but the RTU is obsolete. All the existing instruments are in good condition and are all connected to the RTU.

The existing antenna height of approximately 25 feet is adequate. Provide a new yagi antenna with a 10dB gain.



Figure 21 Booster Pumps 6-10



Figure 22 Motor Control Center for Boosters 6-10

P. RTU 24 - Chino Well 2

Chino Well 2 is located at 225 W. Bloomington near the intersection of Riverside. This site is in good condition and the well pump is currently in maintenance. The MCC is in good condition but the RTU is obsolete. The instruments are in good working condition and are all wired to the RTU.

The existing chlorinating system is not being monitored. Provide the necessary instruments and connections to its control panel and wire to the new PLC.

The existing antenna height of approximately 22 feet is adequate. Provide a new yagi antenna with a 6dB gain.



Figure 23 Chino Well 2 and Booster 11



Figure 24 Existing Chlorination System

Q. RTU 27 - Rialto Well 5

Rialto Well 5 is located at 648 W. Etiwanda near the intersection of Yucca. It pumps to Cactus and Easton Reservoirs. There is a bypass control valve on the transmission line to the Cactus Reservoir which can be opened or closed from the SCADA.

The well pump and the MCC/RTU is housed inside a block wall building. The MCC is in good condition but the RTU is obsolete. The instruments are more complete and there is no need for additional instruments except for a well depth level transmitter. The instruments are in good condition and are all wired to the existing RTU.

The existing chlorinating system is not being monitored. Provide the necessary instruments and connections to its control panel and wire to the new PLC.

The existing antenna height of approximately 15 feet is adequate. Provide a new yagi antenna with a 6dB gain.



Figure 25 Rialto Well Pump 5

VI. Master Station Upgrade Design

The new Master Station Unit (MTU) of the SCADA is represented by the Block Diagram and supporting equipment list and Catalog Cut Sheets for the SCADA Master Station hardware and network equipment. The hardware and software specified will include SCADA servers, Historian, HMI software, Alarming, and Reporting Tools. Network equipment will include switches for SCADA network control. Virtual Private Network (VPN) shall be used for remote monitoring and control. This remote communication protocol is secure and is a very common method of remote access to the network.

Alarm notification shall be implemented at the workstation via email, text, phone and pager in the order or hierarchy as determined by Veolia. Alarm notification shall initiate every 15 minutes until it is acknowledged. Historian shall record the name of the individual acknowledging the alarm as well as the individual clearing the alarm. Alarm shall not be allowed to clear unless the cause of the alarm has been corrected and logged.

Only certain alarms require immediate notification. Determine with Veolia the type of each alarm and how they are implemented.

VII. Communication System Design

The existing radio communication system the City of Rialto Water System utilizes a licensed radio in the frequency of 952.48125 for the Master radio and 928.48125 for the remote radios.

At the remote sites the maximum antenna height is listed at 6.1 meters and the maximum antenna gain is 10.0 dBi. Revise the license to reflect the recommended maximum height and antenna gain. See [Exhibit E](#) for a copy of the license.

A radio survey was performed to determine the quality of the radio link between the remote site and master station. The survey was performed by Applied Technology on January 28 and March 5 & 6, 2014. Applied Technology also performed the radio survey in 2005 for the same communication system. See [Exhibit D](#) for a copy of the survey report.

VIII. Cost Estimate








The preliminary construction cost estimate has been prepared and is attached as [Exhibit F](#). The estimated cost of the RTUs for 16 remote sites, the Master Station including the hardware, software, and programming, the new field instruments, minor modifications to existing motor control center or motor controller and field wiring is \$1,284,000.

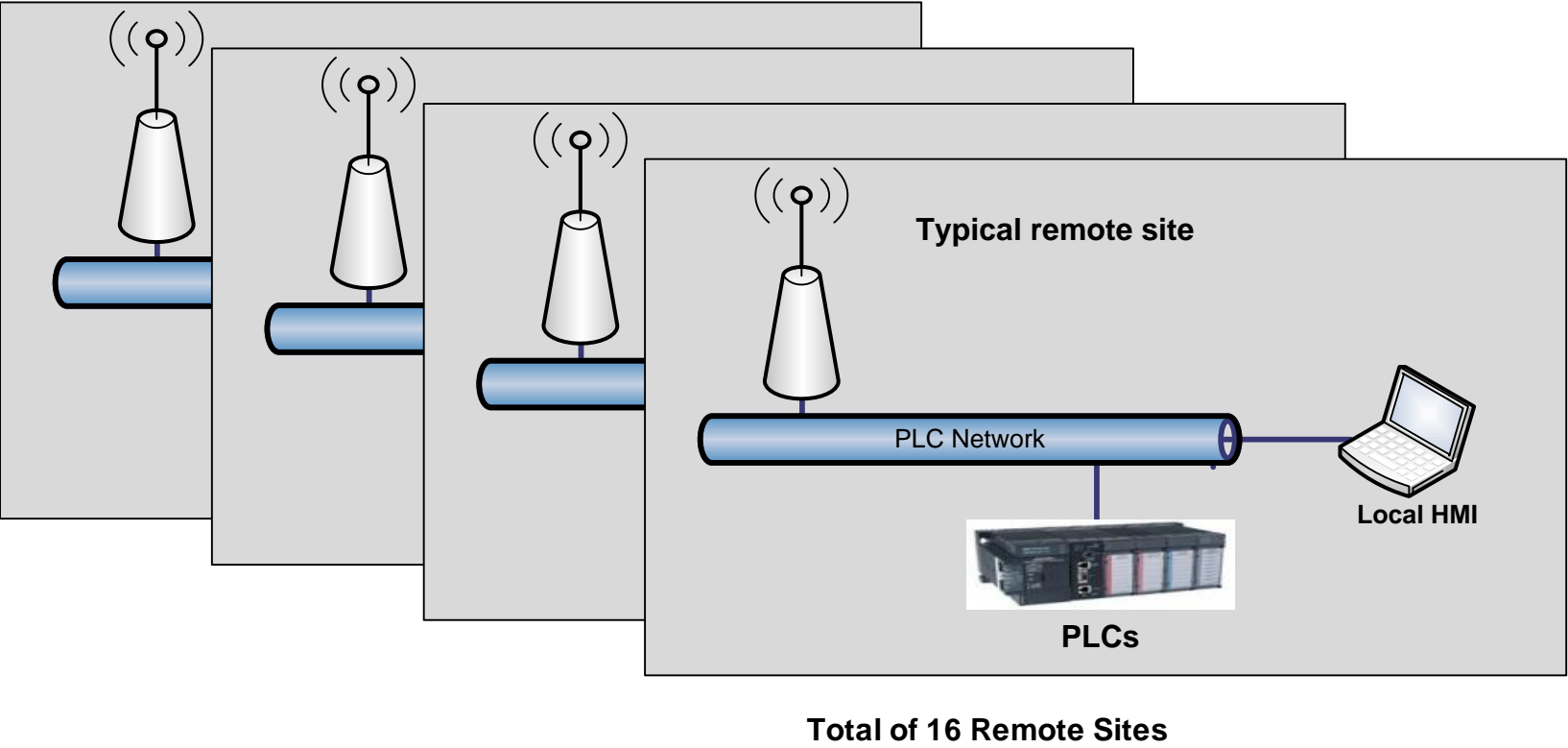
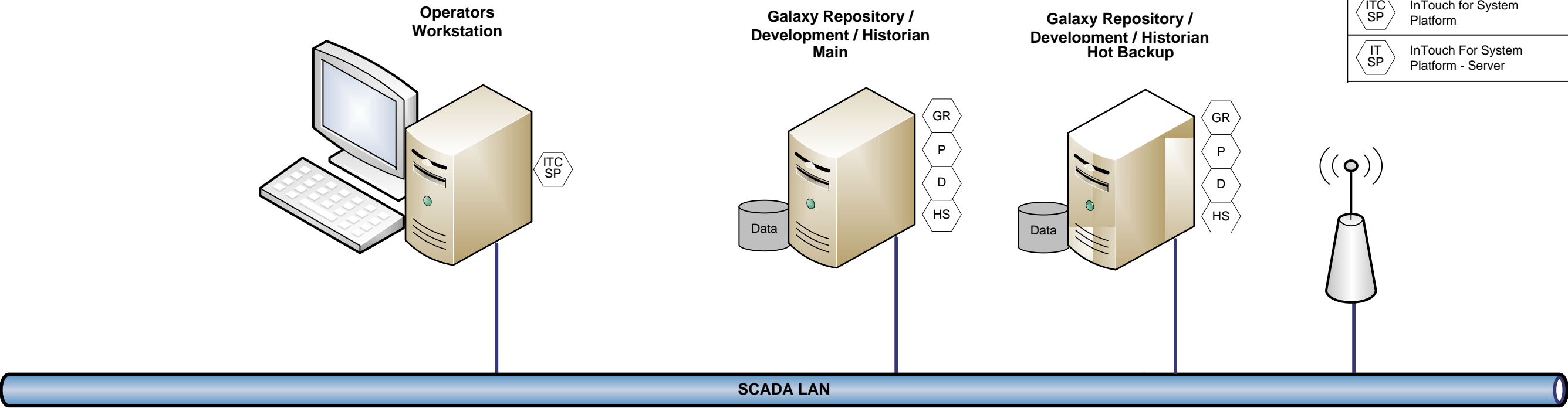
IX. Exhibits




Exhibit A

Proposed SCADA System Architecture and Components

Rialto – Proposed Architecture

| Legend | | Description |
|---|--|---|
|  | Configuration database for SCADA | System Platform licensed for a 1K I/O configuration database |
|  | Platform to be deployed to this computer | A platform is required for each PC or server that is a member of the system |
|  | Wonderware Development. Studio | Integrated Development Environment (IDE) for data collection system configuration |
|  | Device Integration | Wonderware DAServer PLC Communication Server Suite |
|  | Historian Server | Historian Server |
|  | InTouch for System Platform | Client to InTouch for System Platform |
|  | InTouch For System Platform - Server | Server-based InTouch for SP with Historian Client |



| | | |
|--|------------------------------------|---|
| <div>Legend</div> <div><div>Workstation</div><div></div></div> <div><div>Server</div><div></div></div> | | <div></div> <div><div>Linktuture Corp.</div><div>15 Flagstone</div><div>Trabuco Canyon, CA 92679</div><div>www.linktuture.com</div><div>(949) 589-1909</div></div> |
| <div>TITLE:</div> <div><div>Rialto Waste Water Project</div><div>PROPOSED SYSTEM ARCHITECTURE</div></div> | | |
| <div>DATE:</div> <div>April 7, 2014</div> | <div>Drawing:</div> <div>1/2</div> | <div>REVISION:</div> <div>A</div> |

Recommended Hardware and Software Requirements for
Wonderware System Platform

Galaxy Repository (GR) / Engineering workstation / Historian

Operating System:

Microsoft Windows 2008 Server R2 SP1

Hardware:

Processor: Quad Core Xeon® 2.93 GHz or faster 64-bit processor

RAM: 16GB (see Wonderware Historian Installation Guide for recommendations)

OS and Transaction Hard-drive: (2) 73GB (RAID1) 15k RPM (see Wonderware Historian Installation Guide for capacity recommendations)

Data Hard-drive: (3+) 146GB (RAID5) 15k RPM (see Wonderware Historian Installation Guide for capacity recommendations)

Power Supply: Redundant

Installed software:

MS SQL 2008 R2 SP1 64 bit or MS SQL 2012 SP1

Wonderware Application Server 2014 (Components: Bootstrap, IDE & GR)

InTouch 2014 (v11.0)

Wonderware Historian 2014 (v 11.0)

Historian Client 2014 (v11.0)

Dream Report 4.5 R2

Licenses:

Wonderware Application Server

Development Studio

Dream Report

Operator Workstation

Operating System:

Microsoft Windows 7 Professional 64 bit.

Hardware:

Processor: Dual 2.4 GHz or faster processor

RAM: 4GB or greater (with 64-bit OS)

Hard-drive: 80 GB

Super VGA (1024 x 768) or higher resolution video adapter and monitor

Installed software:

Wonderware Application Server 2012R2 (Components: Bootstrap)

InTouch 2012R2 (v10.6)

Historian Client 2012R2 (v10.1)

Licenses:

InTouch for System Platform with Historian Client


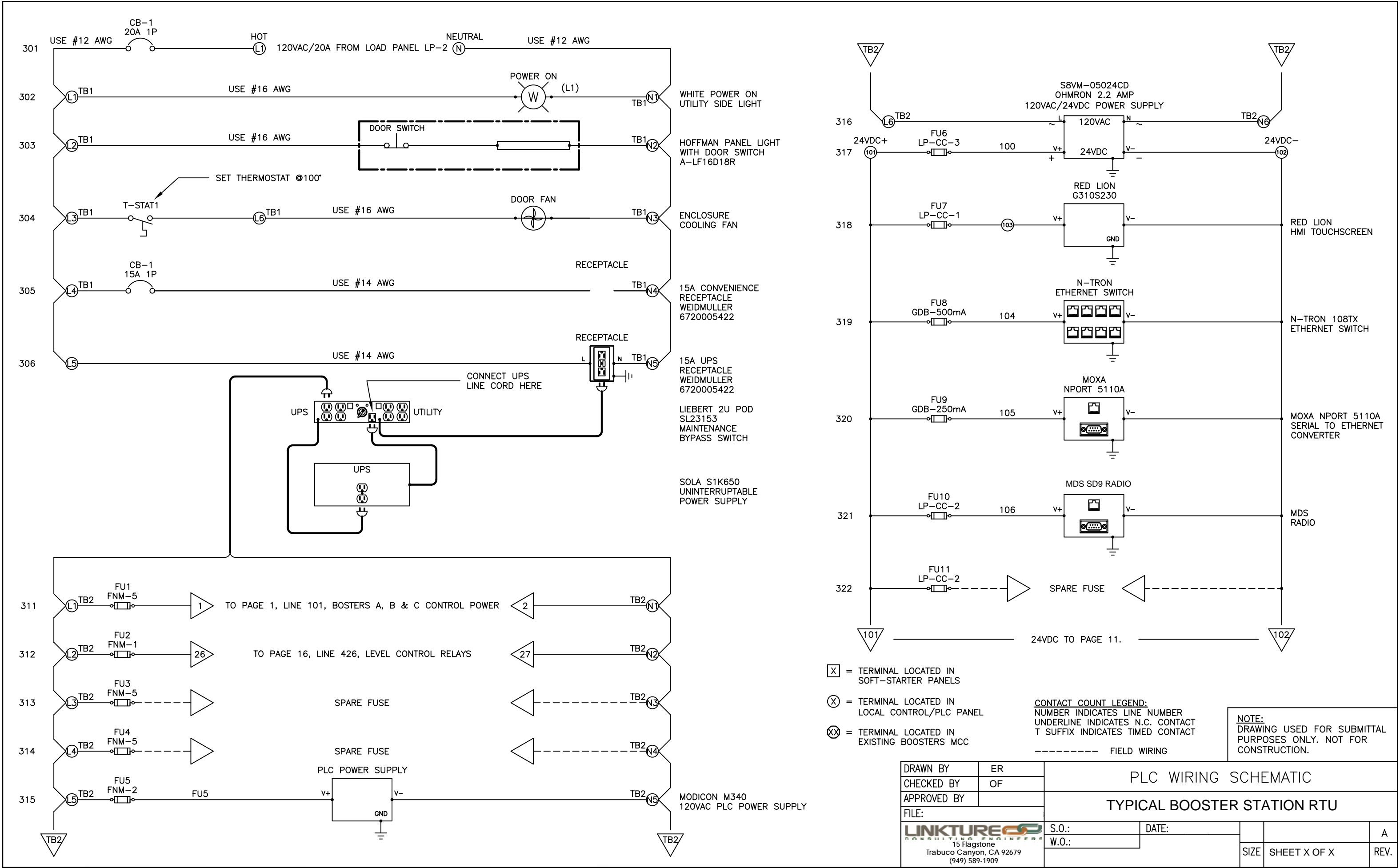
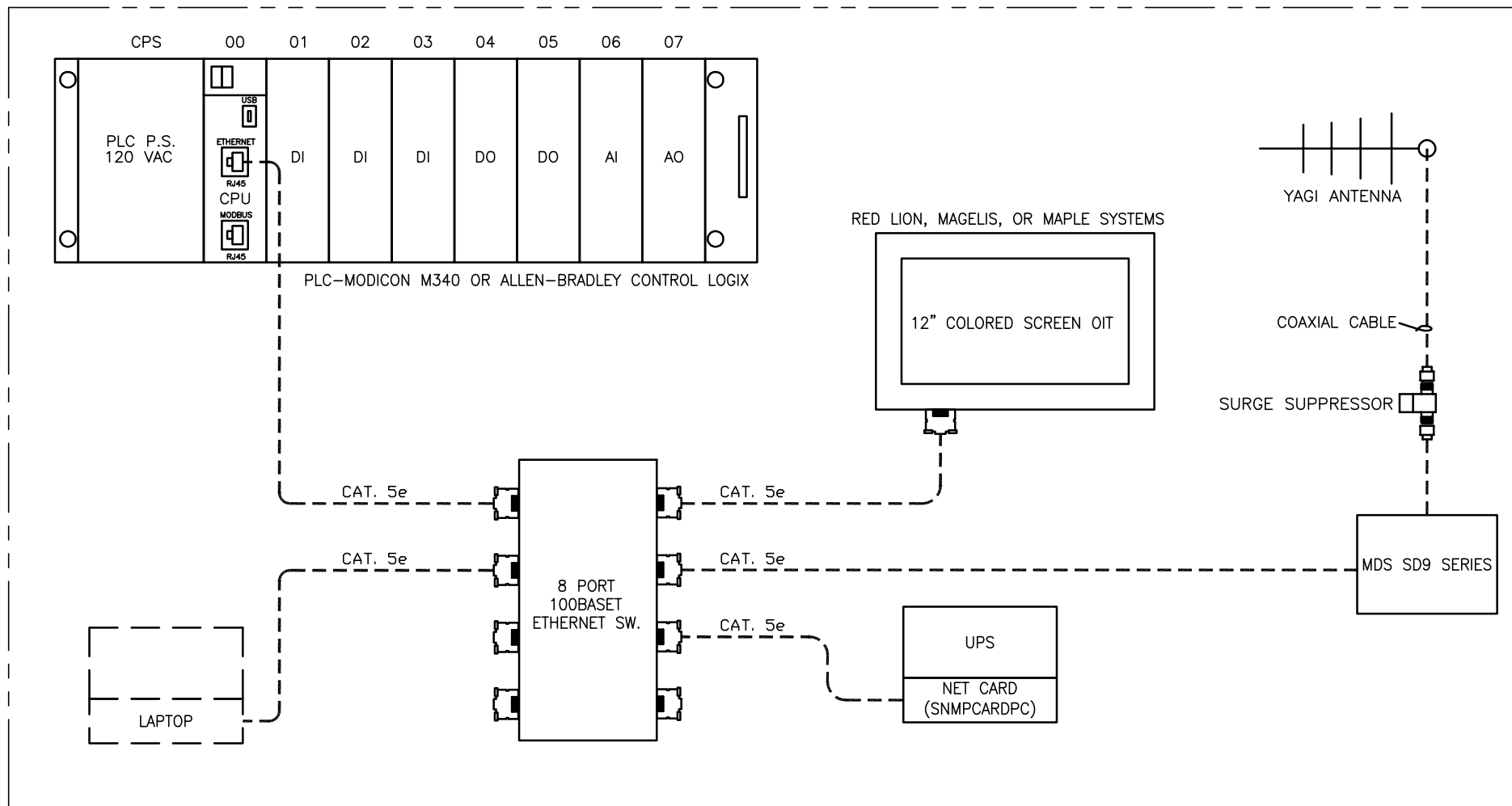
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|  | | <p>Linkture Corp. 15 Flagstone Trabuco Canyon, CA 92679 www.linkture.com (949) 589-1909</p> | |
| <p>TITLE:</p> <p>Rialto Waste Water Project</p> <p>PROPOSED SYSTEM ARCHITECTURE</p> | | | |
| DATE: | April 7, 2014 | Drawing: 2/2 | REVISION: A |

Exhibit B

RTU Sample Design and Major Component Cut Sheets





RTU COMMUNICATION LAYOUT

| | | | | | |
|---|----|------------------------------|-------|--------------|------|
| DRAWN BY | ER | PLC COMMUNICATION LAYOUT | | | |
| CHECKED BY | OF | | | | |
| APPROVED BY | | TYPICAL REMOTE TERMINAL UNIT | | | |
| FILE: | | | | | |
| LINKTURE CONSULTING ENGINEERS 15 Flagstone Trabuco Canyon, CA 92679 (949) 589-1909 | | S.O.: | DATE: | | A |
| | | W.O.: | | SIZE | REV. |
| | | | | SHEET X OF X | |

Automation solution *Modicon® M340 & Ethernet* The winning association



Simply Smart!

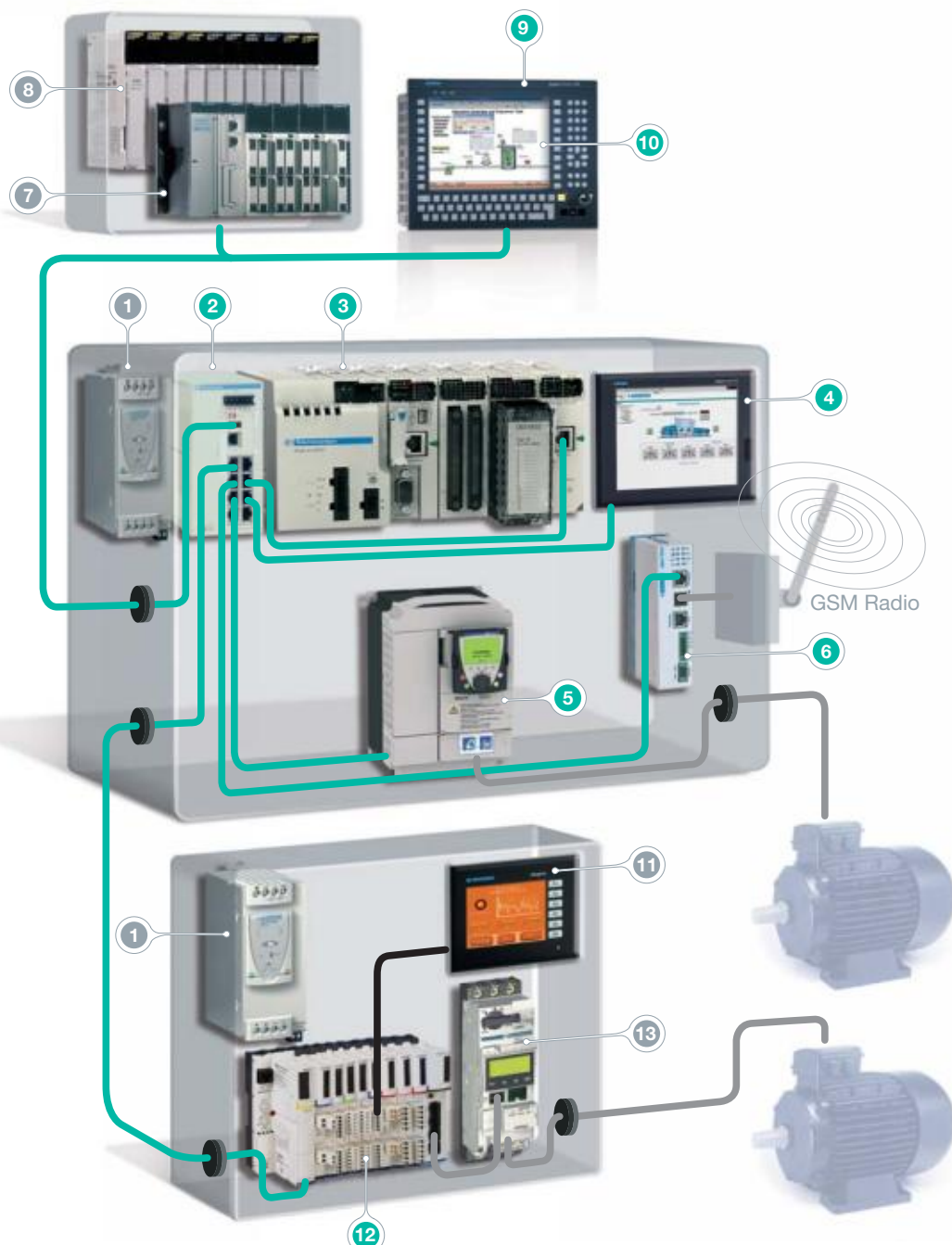
Leveraging
ingenuity
and intelligence
for **ease of use**

Modicon® M340 & Ethernet *Simple, economical and universal*

Ethernet TCP/IP is a fast and upgradable universal communication standard, with services adapted to industrial automation systems. The many possibilities of Modbus® on Ethernet TCP/IP messaging and the reliability of exchanges enable creation of modular architectures with management of the equipment at the heart of the automated system.

The capabilities of Ethernet architectures enable connection of a wide range of equipment, such as supervisors, programmable controllers, distributed local processing modules and remote I/Os. Ethernet is particularly designed for production of modular machines with distributed control and for infrastructure applications.

- 1 Power supply
Phaseo®
- 2 Wiring system
ConneXium™
- 3 Programmable controller
Modicon® M340
- 4 Industrial PC
Magelis® Smart iPC
- 5 Variable speed drive
Altivar® 71
- 6 Remote management module
W@de
- 7 Programmable controller
Premium™
- 8 Programmable controller
Quantum™
- 9 Industrial PC
Magelis Modular iPC
- 10 Supervision software
SCADA Vijeo Citect
- 11 Operator terminal
Magelis
- 12 IP20 distributed I/Os
Advantys™ STB
- 13 Starter-controller
TeSys U-Line



Modicon M340 & Premium/Quantum Advantages

- *Easy installation of communication between programmable controllers*
Automatic global data exchange.
- *Installation upgradability*
Programmable controller easily added to a configuration.



Modicon M340 & ConneXium Advantages

- *A complete wiring system for all IP20 and IP67 infrastructure types*
Association of hubs, switches and transceivers using prefabricated cables enables installation of varied star, delta and ring architectures.

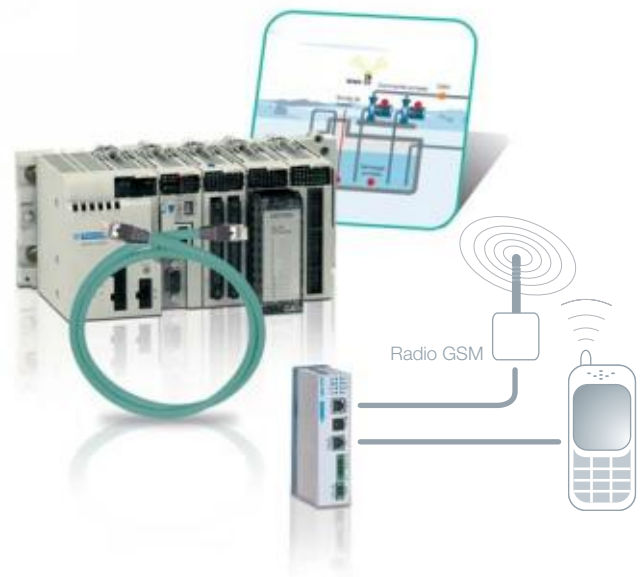


Modicon M340 & W@de Advantages

- *Efficiency of monitoring and control remote maintenance*
The module timestamps and stores installation events and can automatically call a monitoring station.

Modicon M340 & Ethernet I/O Advantages

- *Long-distance peripherals distribution*
Ethernet I/O accepts up to 128 distributed units over several kilometers.
- *Complete catalog of equipment to meet installation demands*
Extensive range of STB, OTB modular input/output modules, Altivar 61/71 variable speed drives, Ositrack identification systems and many other Schneider Electric products.
- *Centralized configuration management for simplified maintenance*
A device replaced in the configuration automatically recovers its parameters without intervention from server.



Modicon M340 & Compact Magelis Smart iPC Advantages

■ *Real time programmable controller information on Magelis*

The programmable controller provides predefined Web pages and the user can customize pages for installation operation and maintenance.



Modicon M340 & Vijeo Citect + Magelis Modular iPC Advantages

■ *Solution configuration productivity*

Data entered in either Unity Pro or the supervisor is automatically updated in the other software.



Application types

■ Industry

Medium-size packaging machines, modular machines, assembly machines, assembly lines, warehouse small sorting machines

■ Infrastructures

Water treatment, drinking water distribution, wastewater treatment, pumps, petroleum and gas distribution, medium voltage electrical distribution

■ Buildings/services

Electrical distribution, sorting systems, buildings intelligent automation systems



Ethernet

The universal communication standard

3 Modicon® M340 programmable controller

- Compactness: digital modules 16 to 64 I/O; mixed module 16 I + 16 O
- Compactness and flexibility: processors with two integrated ports for CANopen, Ethernet or Modbus®
- Functions: multifunction fast counting, low level and multi-range analog modules
- Two Ethernet communication ports per programmable controller
- Ethernet services: Modbus® on TCP/IP messaging, Global data, I/O scanner
- Remote access via Ethernet: WEB server embedded in programmable controller; user Web pages

2 ConneXium Ethernet infrastructure

- Connection-ready ConneXium™ wiring system with switches, hubs and transceivers for 10/100BASE-TX networks

12 Distributed I/Os

- Advantys™ STB and OTB modular I/Os
- Wide range of digital and analog interface modules
- Fast counting
- Tego Power and TeSys® U-Line specialized motor starter connection modules

5 Altivar motion control

- Altivar® 71 variable speed drives for asynchronous motors up to 500kW
- Altivar 61 variable speed drives for pump and fan control motors up to 630kW

6 W315/320/330 W@de remote management module

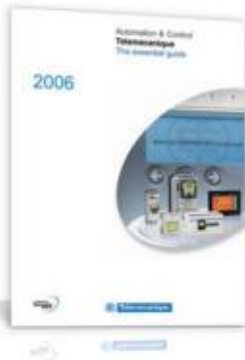
- Data measurement, recording, processing and archiving
- Communication between sites and with supervisor or Web server
- Operator direct warnings
- DNP3 and RTU protocol management (IEC 8705-101/104)

4 9 Magelis Smart/Modular iPC industrial PCs

- Magelis Smart iPC with 12 or 15" color screen as light client for access to equipment-embedded servers
- Magelis Compact and Modular iPC as host station for upgradable supervision, highly adaptable to application requirements and with simplified maintenance

10 VijeoCitect SCADA

- All-in-one supervision software for extended and complex installations with redundancy capability
- Dynamic link between Unity Pro and Vijeo Citect for data management



Discover the full range of Telemecanique products with **the Essential Guide**
DIA1ED2040506EN-US



Find out more about **Modicon® M340**
in the promotional brochure
8000BR0704

The efficiency of **Telemecanique®** branded *solutions*

Used in combination, Telemecanique products provide quality solutions, meeting all your **Automation & Control** application requirements.



A **worldwide** presence

Constantly available

- More than 5,000 points of sale in 130 countries.
- You can be sure to find the range of products that are right for you and which complies fully with the standards in the country where they are used.

Technical assistance wherever you are

- Our technicians are at your disposal to assist you in finding the optimum solution for your particular needs.
- Schneider Electric provides you with all necessary technical assistance, throughout the world.

www.us.telemecanique.com

Simply Smart!

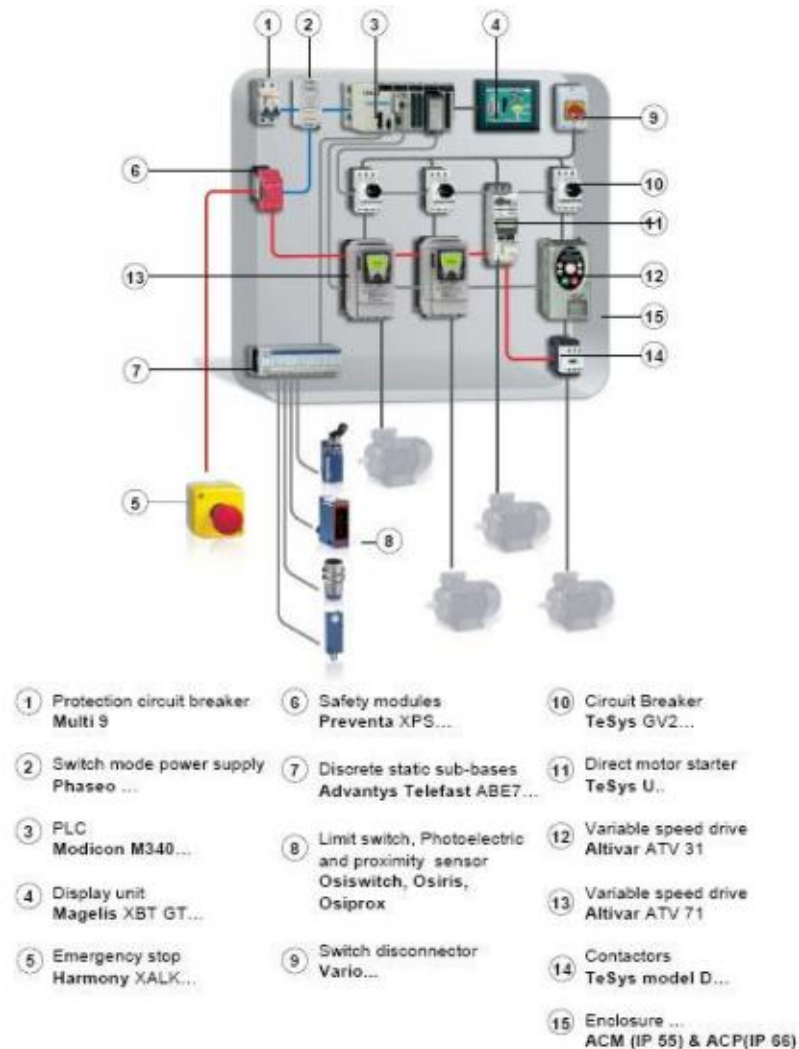
Schneider Electric - North American Operating Division

1415 S. Roselle Road
Palatine, IL 60067
Tel: 847-397-2600
Fax: 847-925-7500
www.us.telemecanique.com

Advantages of Modicon M340 Architectures

**Compact
Performance
Architecture**

(AIOP)



1. Compact and easy to install

The high-density modules and wide choice of Advantys Telefast sub-bases make this architecture compact and safe to wire.

2. High productivity from the Design phase through to Maintenance

Support throughout the life of the product with high-performance Unity Pro, Vijeo Designer and PowerSuite tools

3. Centralized diagnostics

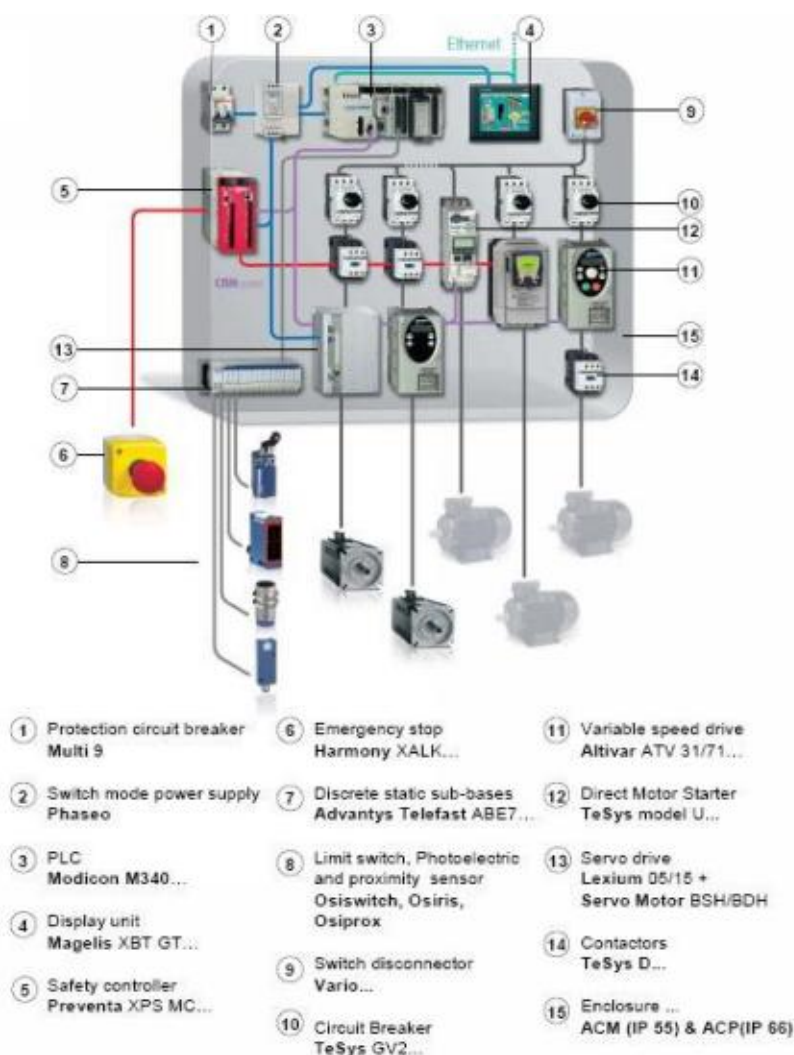
With the Magelis XBT GT display of fault information, there is no need for any additional programming

4. Remote maintenance

Access to the complete configuration via the Ethernet TCP IP port integrated in the CPU, the Web server embedded in the CPU and the predefined maintenance pages

**Compact
Performance
Evolutive
Architecture**

(AIOP)



1. Flexibility of the solution

The high-density modules and wide choice of Advantys Telefast sub-bases make this architecture compact and safe to wire.

2. Simple setup of axis control

The Motion Tree Manager (MTM) functions and the Motion Function Block (MFB) library enable quick, simple programming with Unity Pro

3. High productivity from the Design phase through to Maintenance

Support throughout the life of the product with high-performance Unity Pro, Vijeo Designer and PowerSuite tools

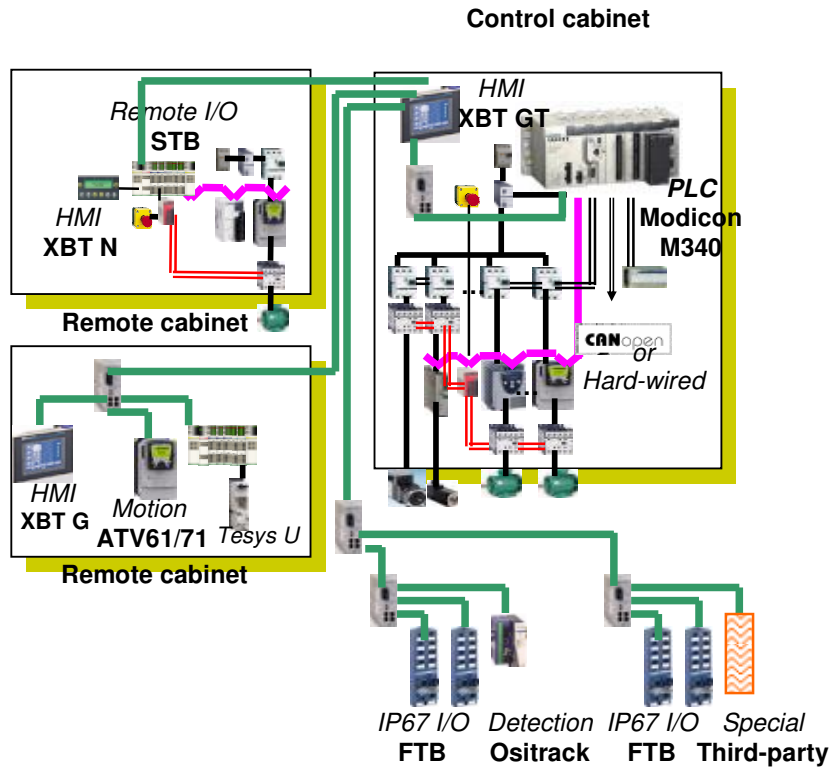
4. Centralized diagnostics

With the Magelis XBT GT display of fault information, there is no need for any additional programming

5. Remote maintenance

Access to the complete configuration via the Ethernet TCP IP port integrated in the CPU, the Web server embedded in the CPU and the predefined maintenance pages

Ethernet Openness



1. Highly modular and flexible

With the combination of the Advantys STB, modular I/O, distributed HMI, drives, etc. on Ethernet, the distribution of the automation functions is even easier and provides the most suitable solution for the machine structure. In addition, with all the network components, Ethernet enables an infinite number of different architectures to be created, over very long distances.

2. Distributed HMI

Web services and Factory Cast HMI enable the Human-Machine interface to be distributed with total transparency and offer a high level of access to the control part of the machine

3. Simple setup of axis control

The Motion Tree Manager (MTM) functions and the Motion Function Block (MFB) library enable quick, simple programming with Unity Pro

4. High productivity from the Design phase through to Maintenance

Support throughout the life of the product with high-performance Unity Pro, Vijeo Designer and PowerSuite tools

5. Centralized diagnostics

With the Magelis XBT GT display of fault information, there is no need for any additional programming

6. Remote maintenance

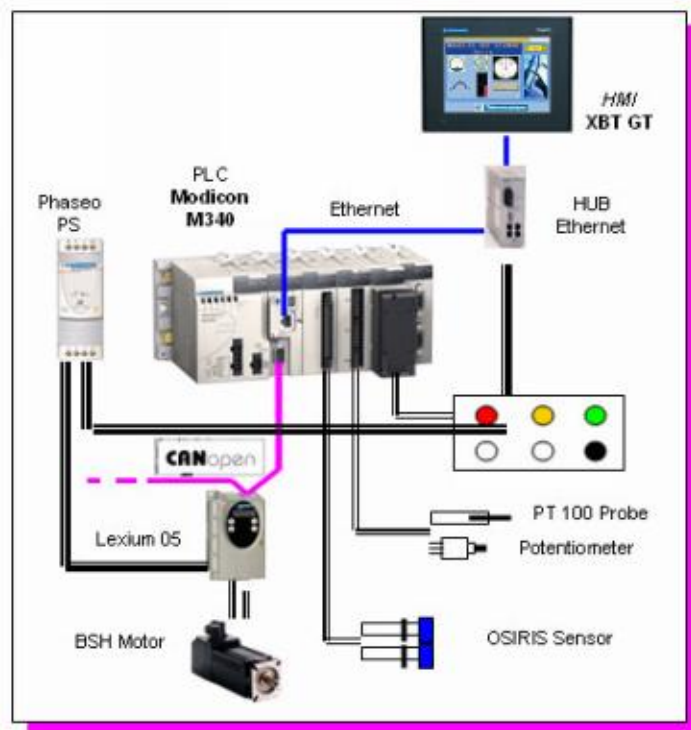
Access to the complete configuration via the Ethernet TCP IP port integrated in the CPU, the Web server embedded in the CPU and the predefined maintenance pages
+ Faulty Device Replacement (FDR) for an even faster response.

Similarity Between the Architectures Presented and the Democase

Based on **CANopen** technologies for controlling the servo drive and **Ethernet** for the HMI connection, the architecture of this Democase is **Compact** when all the components are in the same panel and/or **Distributed** when the components are distributed in a number of panels or on the machine.

The architecture of this democase is based on the "Compact Performance Evolutive" "Preferred Implementation" with "Ethernet openness".

Architecture of the Democase



Advantages of the Architecture

- **Compactness** of the PLC with the communication ports integrated in the CPU
- **Hardware modularity** of the solution based on fieldbus
- **Safety and reliability** with the CANopen fieldbus
- **Easy to upgrade and maintain** thanks to fieldbus technology and Unity Pro
- **Easy to debug** using Unity Pro and the integrated functions

A complete "Schneider Electric" solution

This democase combines components from a **single supplier** which gives the proposed solution the following advantages:

- **Single source of supply**
- **Functional safety**
- **Optimized performance**
- **Appropriate debugging and diagnostic tools**

Presentation of the Demonstration Case

Photo of the Democase



Description

The Democase is based on the **Compact Performance Evolutive** architecture. It uses the following main components:

- The **Modicon M340** PLC with **CANopen and Ethernet** ports, an 8 input/8 output module, a fast counter module, and an analog module
- A **Magelis XBTGT** connected via Ethernet
- An **Ethernet HUB** for ease of extensions on the Ethernet network (this is not essential for our application, as the connection could be made directly, but it makes it easy to connect the programming terminal to the system via Ethernet)
- A **Lexium 05** servo drive and a BSH055 brushless motor
- An additional **Phaseo 24 V** power supply
- **Osiris XUAH0515** optical sensors
- A **PT100** temperature probe

A specific application is used to operate the assembly and highlight the strengths of each product and their use together.

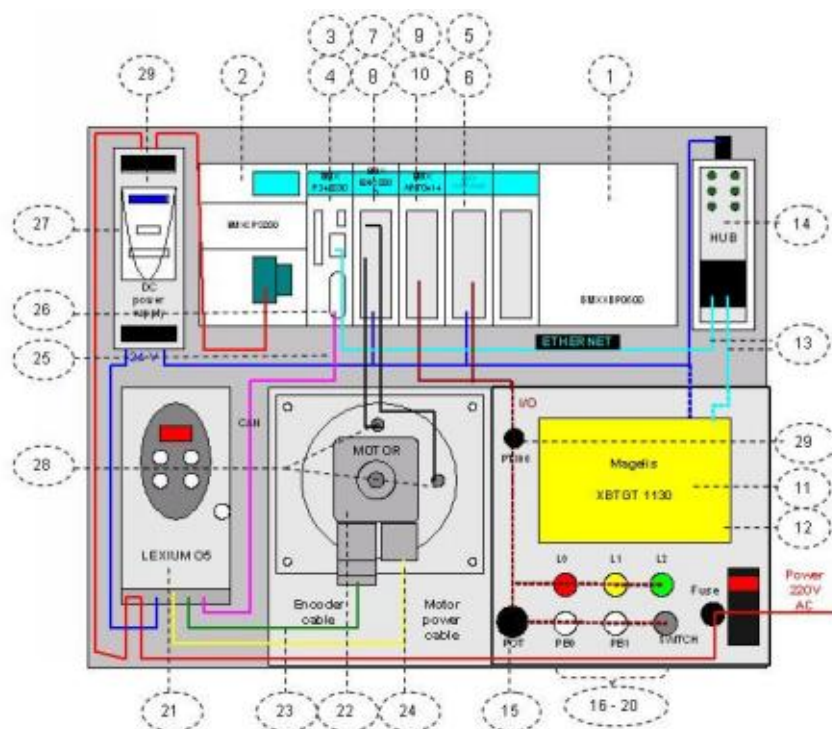
The Obvious Benefits

- Clarity and ease of wiring
- Compactness of the solution
- Complete Schneider offer

Demonstration Case User Guide



Page 15/84



Optimize Your Pump Applications with High-End Control from a Mid-Range Automation Platform



***What makes the
Modicon M340 PLC
the ideal choice for
your pump applications?***



Schneider Electric's Modicon M340® PLC™ establishes a new standard for performance by being the first to combine innovative new features into a mid-range automation platform. As a result, it economically provides the reliability, durability and expandability that are critical to the success of pump applications such as those used in water and wastewater, irrigation and oil and gas.

It's Rugged and Reliable

The Modicon M340 PLC requires no batteries and exceeds IEC requirements for temperature, shock and vibration standards. This translates into more mounting options, continuous operations at remote locations such as pump stations and systems, as well as the security that programming won't be lost during power outages.

It's Small

At 4" tall and 3.7" deep, the Modicon M340 PLC is smaller than comparable PLCs, allowing it to fit easily into 6" deep enclosures. It also has high density 64 point I/O cards that are only 1.25" wide for even greater flexibility.

It's Smart

New memory cards enable the Modicon M340 PLC to "Hot Swap" modules without rebooting the PLC for faster access and responsiveness. In addition, 4Mb of memory (expandable to 16Mb) improves the sharing of data by storing drawings, bills of materials and cut sheets right inside the PLC's memory as well as using Faulty Device Replacement (FDR) to store configurations and load them into replacement devices such as drives.

It's Web Friendly

The Modicon M340 PLC features an embedded web browser which utilizes Schneider Electric's Transparent Ready® web-based connectivity platform for remote monitoring and troubleshooting. This includes enabling the creation of pump specific web pages using data that can be maintained separately from the application to reduce risk of corruption.

It's Connectable

Implementation and connectivity have never been easier as the Modicon M340 PLC embeds Modbus® Master serial protocol and Ethernet on the same processor. In addition, installation costs and wiring errors are reduced by utilizing a CANopen network, preterminated cables with flying leads and standard USB cabling to link to your programming PC.

It's Compatible

The Modicon M340 PLC is designed to evolve from and with your current applications to provide a simple and easy migration path to serve your immediate and future needs. Existing toolkits and conversion software streamline the replacement of legacy products and the use of the Unity™ software allows you to standardize on a single programming tool.

Unity Improves Performance for Pump Applications

Schneider Electric's Transparent Ready web-enabled power and control platform extends this coordination to include other Square D and Telemecanique brand products critical to pump applications such as drives, NEMA contactors and breakers, panelboards and others.

The diagram illustrates a Modicon industrial network topology. At the top left, a computer monitor displays the 'Citect' software interface. Below it, a 'Vijeo' logo is shown. The network is represented by a green line. A 'Firewall' is connected to the network at the top right. A 'Router' is connected to the network on the right side. The network is divided into two segments by a central switch. The top segment includes a 'Magelis HMI' and a 'Model 6 MCC'. The bottom segment includes a 'Modicon Quantum PLC' and a 'Modicon Premium PLC'. The 'Modicon Quantum PLC' is connected to 'Advantys I/O' modules. The 'Modicon Premium PLC' is connected to 'Altivar 61/71 Drives' and a 'Modicon M340 PLC'.

**Transparent
Ready®**
Web-enabled Power & Control

Schneider Electric understands that pump applications are highly specialized, with demanding specifications that require a specific background to interpret, understand and manage successfully. We know this from our experience in the field and have assembled a seasoned team of experts who are dedicated to providing complete solutions, from co-design to implementation to support. Their background with equipment as OEMs, system integrators, consultants and contractors enable them to apply their unique combination of expertise to developing solutions to help you succeed.

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MDS™ SD Series

Long Range IP/Ethernet & Serial SD1, SD2, SD4 & SD9

Data Acquisition | Ethernet and Serial

The MDS SD Series are industrial wireless solutions that provide long distance communications over licensed radio bands, allowing users to interface to both Ethernet and serial devices such as PLCs, RTUs and meters with host monitoring and control systems.

The SD Series is the latest generation of MDS licensed narrowband wireless devices providing exceptional communication performance and reliability to meet demands for IP/Ethernet services as well as support for multiple devices and host systems. The SD is compatible with previous generations allowing for a smooth and controlled migration for existing systems.

Key Benefits

- High speed, up to 65 Kbps in 50 KHz channel in SD2 and SD9
- Operate IP/Ethernet and serial communication on a single network
- Connect multiple host systems to a single Access Point radio
- Connect multiple devices to a single remote radio
- Implement push communication and report by exception from remote devices
- Simple, intuitive web based configuration and maintenance
- Easy migration path from serial to IP/Ethernet
- Backward compatible with existing MDS x710 networks

Application Specific Wireless Solution



Oil & Gas

- Remote data collection from meters and flow devices
- Monitor and transmit wellhead performance and status data collected by RTUs



Energy

- Remote control of IEDs and controllers at distribution substations
- Condition monitoring for pole-top circuit breakers and capacitor banks



Water & Wastewater

- Monitor lift stations across multiple sites from control room
- Communicate with remote PLCs controlling tank levels and water flow



Heavy Industrial

- Activation of perimeter gates based on detection of vehicle
- Monitor and control remote pumps and compressors



Industrially Hardened

- Operational temperature range from -40°C to 70°C
- CSA Class I, Div. 2 groups A,B,C,D for Hazardous Locations
- IEEE1613, IEC 61850-3 and EN61000 for electric substation environments

Application Flexibility

- Supports two serial ports and an IP/Ethernet port simultaneously
- Broad coverage flexibility over distances up to 50 miles
- Extend Communication paths using single radio Store and Forward
- Supports Ethernet Bridging, IP to serial and serial to serial communications
- Low power consumption with sleep mode for solar and battery powered applications
- Fast-serial features with embedded terminal server functions for serial to IP/Ethernet encapsulation

Reliable & Scalable

- Exclusive, non-shared licensed band operation
- High performance Media Access Control for asynchronous polling and exception reporting
- Collision detection and avoidance insures data arrives at destination without lost messages
- High receive sensitivity for long distance communications
- Compatible with multiple industry protocols including Modbus, Modbus TCP, and DNP3

Secure

- AES 128-bit data encryption
- Password protected access
- VLAN data segregation



Long Range Communications

The MDS SD Series of industrial-strength radios offer secure, reliable, long distance transmission of data for your mission critical applications. The SD Series combines 5 Watt transmit power and exceptional receive sensitivity to support wide coverage areas and maximum performance when difficult terrain or obstructions such as trees and buildings limit the effectiveness of other wireless devices. The SD Series operates in the 100 MHz (SD1), 200 MHz (SD2), 400 MHz (SD4) and 900 MHz (SD9) frequencies and allows users to select the channel size and modulation option best suited to their unique requirements. The combination of these features results in the ideal data acquisition product for error free, long distance communication.

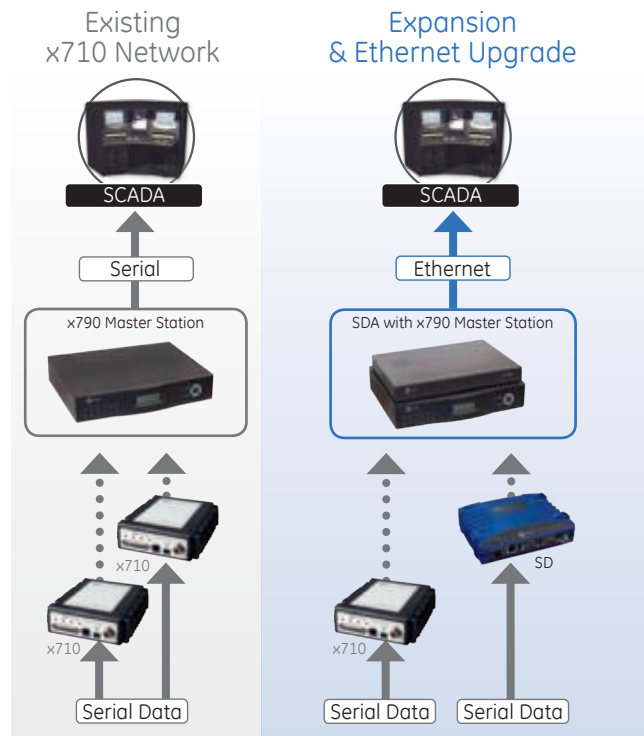
Exceptional Network Performance

The performance of a wireless network is more than a measurement of speed. It also includes the efficiency of the radio system in mediating over-the-air channel access. This is particularly important for operating IP/Ethernet in narrow licensed channel sizes. The SD Series implements several features designed to provide maximum performance. The SD's Media Access Control (MAC) is optimized to reduce Ethernet overhead and preserve bandwidth for higher usable data speed. The IP Payload feature removes unneeded Ethernet frames to shrink messages and improve throughput.

The SD Series automatically controls over-the-air communication between host systems and remote devices to insure that data collisions are detected and avoided. The result is exceptional performance for networks requiring connections to multiple host systems, multiple device types connected to a single remote radio, or a mix of Ethernet and serial devices. The SD also insures maximum reliability for systems implementing unsolicited communication and exception reporting from remote devices and RTUs, which is particularly important for non-pollled protocols such as DNP3.

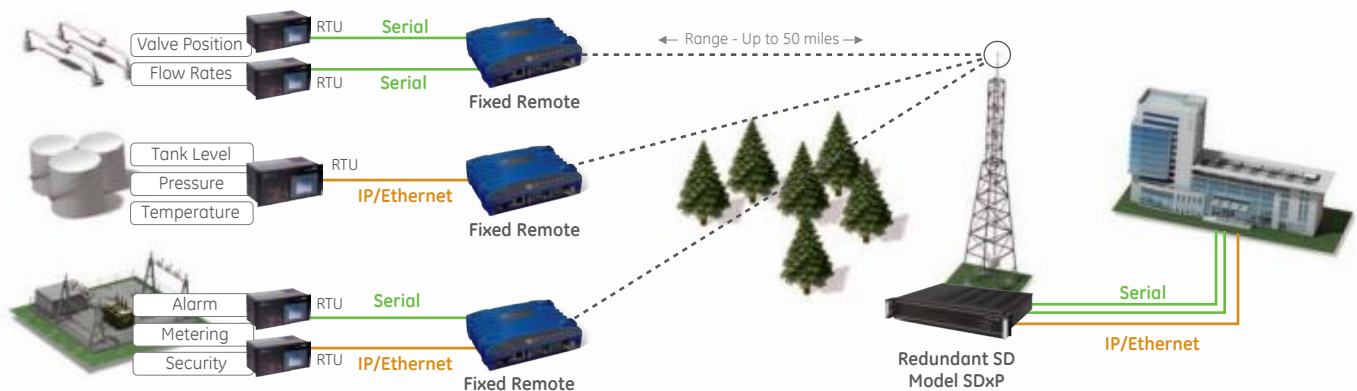
Backward Compatibility

MDS SD Series radios can be directly added to existing MDS x710 and x790 systems, providing both "drop-in" compatibility for expansions and replacements, and adding Ethernet support. Backward compatibility preserves your investment and allows a smooth transition from a serial based SCADA infrastructure to IP/Ethernet without disrupting day-to-day operations.



SD Series Application Advantages

Remote Data Acquisition



Unmatched Connectivity

- Connect multiple RTUs and controllers to a single remote radio
- Operate serial and Ethernet devices concurrently on the same network
- Implement exception reporting and pushed communication initiated by remote devices.

Highest Network Performance

- SD Media Access Control reduces network overhead, prevents data collisions and insures successful data delivery.
- High transmit power and exceptional receiver sensitivity maximizes performance over significant distances and challenging terrains

Flexible System Communications

- Provides IP/Ethernet and serial communication for multiple hosts and asynchronous polling
- Embedded terminal server functions support serial & Ethernet connections without adaptors.
- Secure AES 128 encryption for IP/Ethernet UDP, TCP Client and TCP Server and serial.

Low Power Consumption

The SD Series low power consumption and sleep mode make it ideal for applications requiring solar power operation. The SD Series requires less energy resulting in lower costs for solar panels and batteries.

Simple Intuitive Configuration

Use the web based SD Device Manager for easy configuration of all SD Series parameters including transmit and receive frequencies, channel size and modem speed. SD Device Manager is also used to access important performance and maintenance information.

The SD Series supports 3 Virtual Radio Channels (VRC) that allow users to assign communication to specific serial ports or IP addresses and ports when multiple devices or systems are connected.

SD Series configuration and maintenance can also be performed using Telnet and HyperTerminal sessions.



SD Series Remote

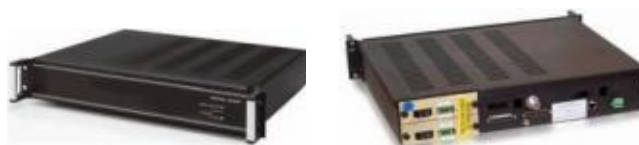
The SD1 radio operates in the 100 MHz frequency band, SD2 operates in the 200 MHz frequency band, SD4 operates in the 300 MHz, 400 MHz and 500 MHz frequency bands and SD9 operates in the 800 MHz and 900 MHz frequency bands. Choose between models that support both Ethernet and serial, or only serial interface.

The SD Series handles concurrent Ethernet and serial traffic using built-in terminal server plus industry- standard TCP or UDP protocols.



SDxP Redundant/Protected Models

The SDxP is used when applications demand no single point of failure for the communications system. The MDS SDxP incorporates two MDS SD transceivers and power supplies with automatic or manual switchover capability. On detection of a failure, the MDS SDxP switches immediately to the standby transceiver. The switchover occurs for selectable transceiver alarm conditions. Switchover also occurs when no valid packets are received in a programmable time frame of 1 to 30 minutes, or upon loss of power to the operating radio. An internal back-up battery is provided in AC-powered models for continued operation during a loss of primary power.



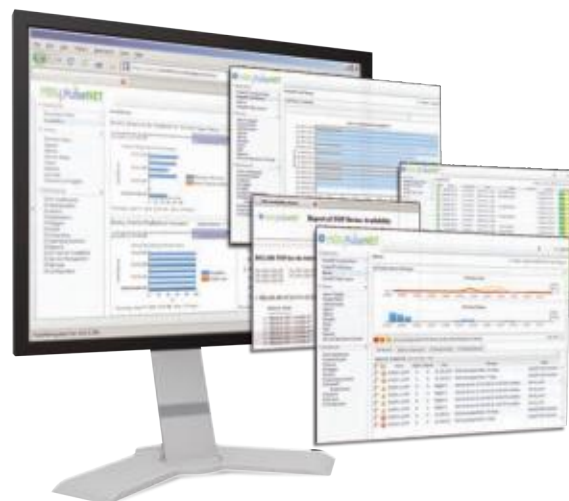
SDA Adaptor for 4790/9790 Radios

The SDA adaptor is used with 4790 and 9790 Master Stations to add IP/Ethernet connectivity. The SDA can be ordered with new Master Stations or easily added to equipment already installed. Once connected to a 4790/9790, one (1) serial port and one (1) Ethernet port are available for connection to external systems or devices.



Comprehensive Network Management

Manage your SD network using PulseNET™ NMS. PulseNET is purpose-built for industrial communications and includes sophisticated and meaningful pre-built workflows along with intuitive graphical representations of the network at your fingertips.



Specifications

SD1

| | |
|-----------------------------|---|
| RF Data Rate & Channel Size | 3,200 bps @ 6.25 kHz 9,600 & 19,200 bps @ 12.5 kHz 19,200 & 38,400 bps @ 25 kHz |
| Frequency bands | 150-174 MHz |

SD2

| | |
|-----------------------------|--|
| RF Data Rate & Channel Size | 3,200 bps @ 5 kHz 4,800 bps @ 6.25 kHz 9,600 & 19,200 bps @ 12.5 kHz 19,200 & 38,400 bps @ 25 kHz 65,000 bps @ 50 kHz (Band D) |
| Frequency bands | 216 - 220 MHz 220 - 235 MHz |

SD4

| | |
|--------------------------|---|
| RF data rate & bandwidth | 4,800 bps @ 6.25 kHz 9,600 & 19,200 bps @ 12.5 kHz 19,200 & 38,400 bps @ 25 kHz |
| Frequency bands | 300 - 360 MHz 350 - 400 MHz 400 - 450 MHz 450 - 512 MHz |

SD9

| | |
|--------------------------|--|
| RF data rate & bandwidth | 9,600 & 19,200 bps @ 12.5 kHz 19,200 & 38,400 bps @ 25 kHz 65,000 bps @ 50 Khz |
| Frequency bands | 820-870 MHz 880-915 MHz 850-860/926-936 MHz 928-960 MHz |

GENERAL

| | |
|-------------------|----------------------|
| Frequency | Configurable |
| Operational modes | Simplex, half-duplex |
| Modulation | Digital, CPFSK |
| Range | Up to 50 miles |

TRANSMITTER

| | |
|------------------------|-----------------------------|
| Frequency Stability | +/- 0.5 ppm |
| Carrier power | 0.1 to 5 Watts Programmable |
| Carrier power Accuracy | Normal +/- 1.5 dB |
| Duty Cycle | Continuous |
| Output Impedance | 50 Ohms |

RECEIVER

| | |
|----------------------------|--|
| Type | Double Conversion Superheterodyne |
| Sensitivity | -112 dBm typical @ 1x10 ⁻⁶ BER, -104 dBm (SD2 Band D) -100 dBm (SD9 Band D) |
| Selectivity | >70dB |
| Adjacent Channel Rejection | 40 dB nominal |

INTERFACES

| | |
|-------------|---------------------|
| Serial COM1 | RS-232, DB-9 |
| Serial COM2 | RS-232, RS-485 DB-9 |
| Ethernet | 10/100 BaseT, RJ 45 |
| Antenna | TNC Female |

MANAGEMENT

MDS PulseNET NMS, MDS InSite software,
MDS Radio Configuration Software

ENVIRONMENTAL

| | |
|-------------|--------------------------------------|
| Temperature | -40°C to +70°C (-40°F to +158°F) |
| Humidity | 95% @ 40°C (104°F) non-condensing |

ELECTRICAL

| | |
|---------------|-------------------------|
| Tx Current | 2.2A Typical at 5 Watts |
| Rx Current | <125 mA |
| Sleep mode | 9 mA nominal |
| Primary power | 10 Vdc to 30 Vdc |

MECHANICAL

| | |
|------------|---|
| Case | Rugged die-cast aluminum |
| Dimensions | 1.5 H x 6.5 W x 4.625 D in (3.81 H x 16.51 W x 11.75 D cm) |
| Weight | 0.55 kg (1.22 lbs) |

AGENCY APPROVALS

CSA Class 1 Div 2 for hazardous locations
IEEE 1613, IEC 61850-3, EN61000 for electric substation environment
Industry Canada & ENTELA
FCC Part 90: SD1, SD2, SD4, SD9
FCC Part 80: SD2
FCC Part 95: SD2
FCC Part 101: SD9
CE, ETSI: SD1, SD4

Ordering

SD1 Remote

| | | | |
|---------------|---|----|---------------------|
| SD01MD | * | ** | -NNSNN |
| Subband | B | | 150-174 MHz |
| Model | | SS | Serial |
| | | ES | Ethernet and Serial |
| | | MS | 9710 Emulation |

SD2 Remote

| | | | |
|---------------|---|----|----------------------------|
| SD02MD | * | ** | -NNSNN |
| Subband | A | | 216-220 MHz |
| | B | | 220-222 MHz |
| | C | | 220-235 MHz |
| | D | | 216-220 MHz/50 KHz Channel |
| Model | | SS | Serial |
| | | ES | Ethernet and Serial |

SD4 Remote

| | | | |
|---------------|---|----|---------------------|
| SD04MD | * | ** | -NNSNN |
| Subband | A | | 350-400 MHz |
| | B | | 400-450 MHz |
| | C | | 450-512 MHz |
| | D | | 300-360 MHz |
| Model | | SS | Serial |
| | | ES | Ethernet and Serial |
| | | MS | 4710 Emulation |

SD9 Remote

| | | | |
|---------------|---|----|--------------------------------------|
| SD09MD | * | ** | -NNSNN |
| Subband | A | | 820-870 MHz |
| | C | | 928-960 MHz |
| | D | | 928-960 MHz/50 Khz Channel |
| | E | | 880-915 MHz |
| | F | | 880-915 MHz / 50 kHz Channel |
| | G | | 850-860 / 926-936 MHz, Transmit Low |
| | H | | 850-860 / 926-936 MHz, Transmit High |
| Model | | SS | Serial |
| | | ES | Ethernet and Serial |
| | | MS | 9710 Emulation |

Order Code Example

SD01MD-BES-NNSNN

- Remote radio
- 150 - 174 MHz
- Ethernet & serial communications
- Standard mounting brackets
- No special assembly

Order Code Example

SD02MD-AES-NNSNN

- Remote radio
- 216 - 220 MHz
- Ethernet & serial communications
- Standard mounting brackets
- No special assembly

Order Code Example

SD04MD-CSS-NNSNN

- Remote radio
- 450 - 512 MHz
- Serial only communication
- Standard mounting brackets
- No special assembly

Order Code Example

SD09MD-CES-NNSNN

- Remote radio
- Ethernet and Serial
- Standard mounting brackets
- No special assembly

Accessories for the SD Series

Fixed Remote Kits with Yagi

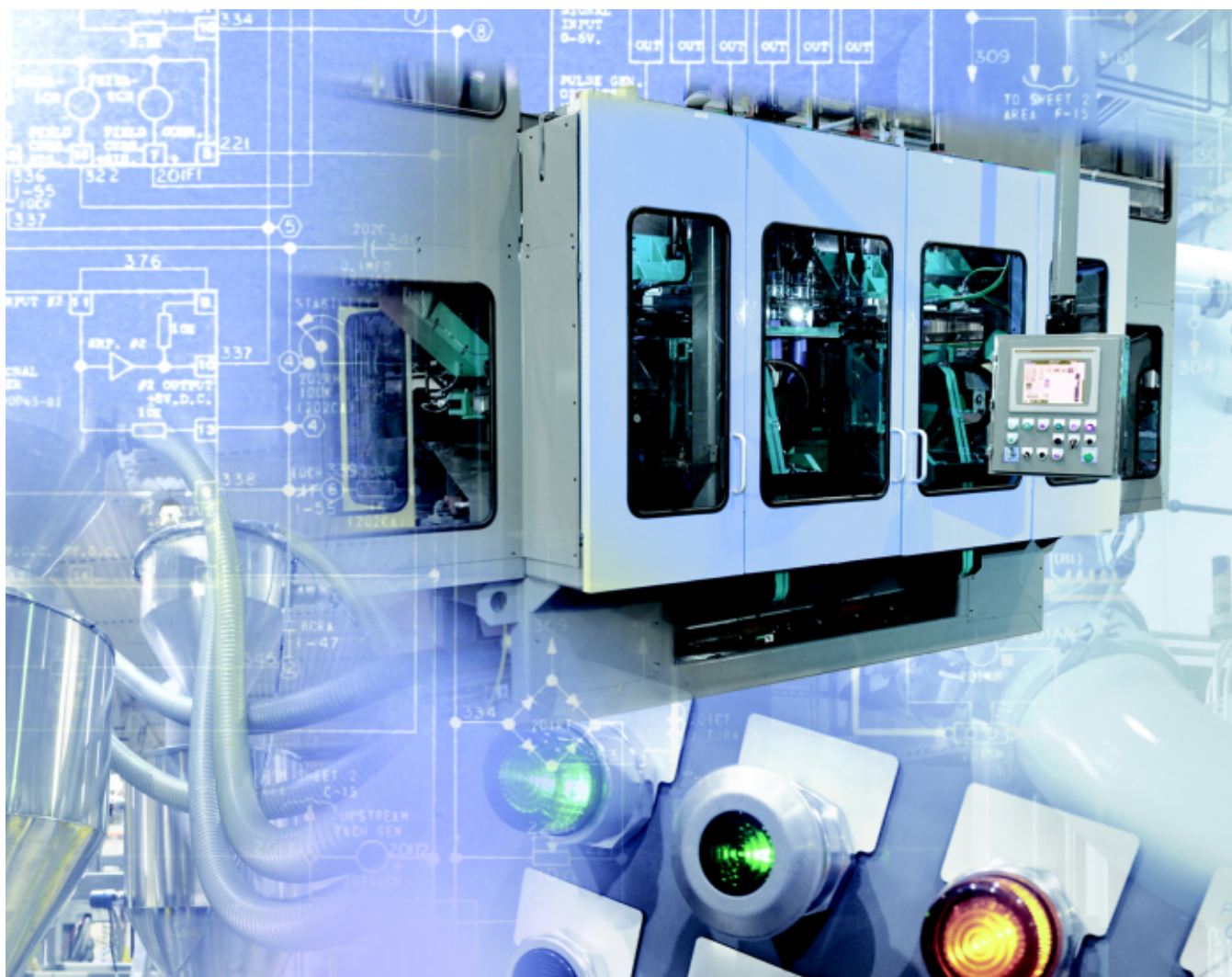
KFR-S04-C1 (406-430 MHz)
KFR-S04-C2 (430-450 MHz)
KFR-S04-C3 (450-470 MHz)
KFR-S09-D1 (900 MHz)
KFR-S02-A (216-235 MHz)

Visit GEDigitalEnergy.com/SDSeries to:

- Buy SD through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

CompactLogix System

Catalog Numbers 1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B, 1769-L24ER-QB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B, 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM, 1769-AENTR, 1768-L43, 1768-L43S, 1768-L45, 1768-L45S



LISTEN.
THINK.
SOLVE.

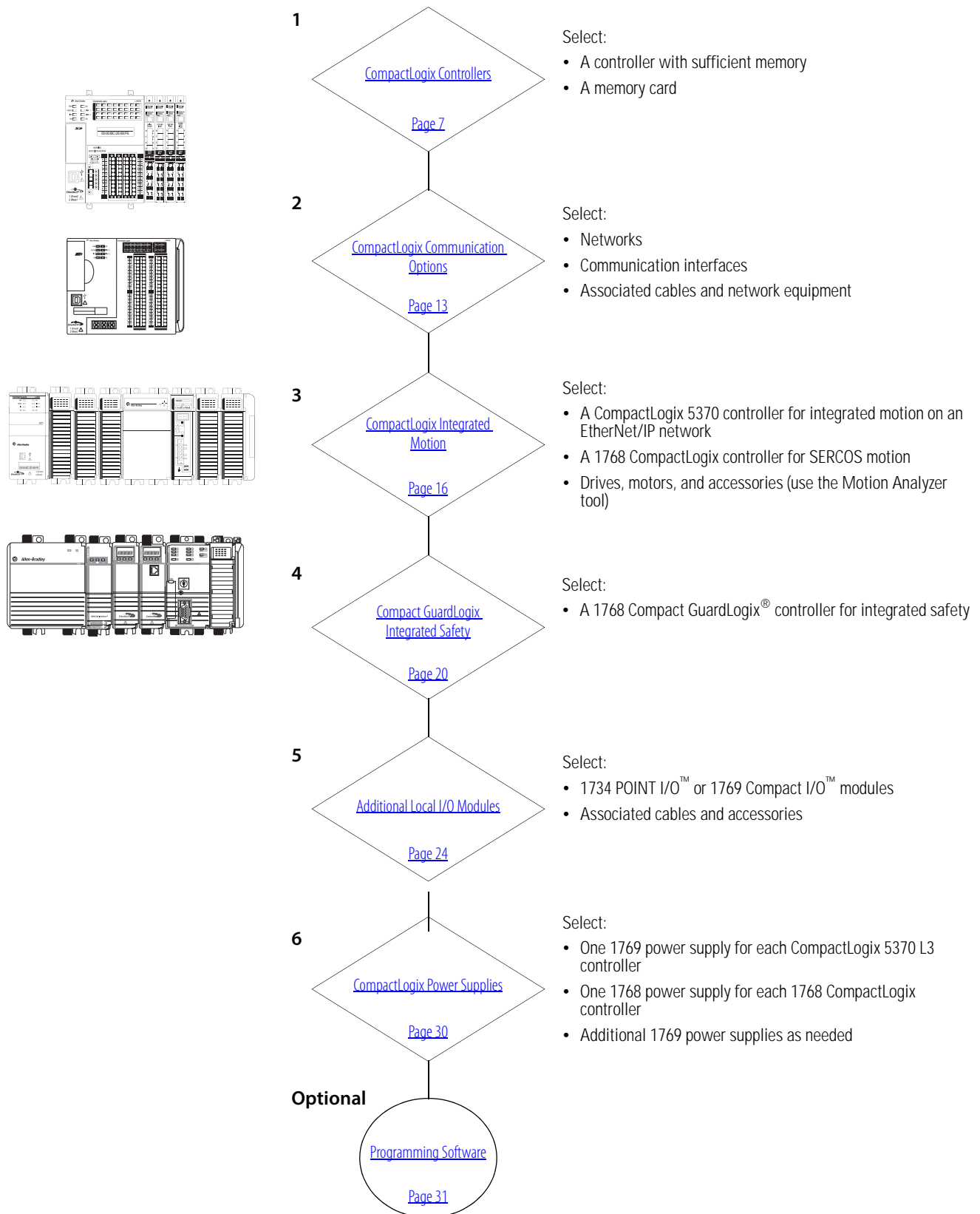
[1734 POINT I/O Modules](#)
[1769 Compact I/O Modules](#)
[1768 Integrated Motion Modules](#)
[1768 and 1769 Communication Modules](#)
[1768 and 1769 CompactLogix Controllers](#)
[1768 and 1769 Compact Power Supplies](#)

Logix Controllers Comparison

| Characteristic | ControlLogix 1756-71, 1756-L72, 1756-L73, 1756-L73XT, 1756-L74, 1756-L75 GuardLogix 1756-L72S, 1756-L73S, 1756-L73SXT | CompactLogix 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM, 1769-L33ER, 1769-L33ERM, 1769-L36ERM | CompactLogix 1769-L24ER-BB1B, 1769-L24ER-QBFC1B, 1769-L27ERM-QBFC1B | CompactLogix 1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B | CompactLogix 1768-L43, 1768-L45 Compact GuardLogix 1768-L43S, 1768-L45S | SoftLogix 5800™ 1789-L10, 1789-L30, 1789-L60 |
|---|---|---|---|---|--|---|
| Controller tasks: • Continuous • Periodic • Event | 32; 100 programs/task | 32; 100 programs/task | 32; 100 programs/task | 32; 100 programs/task | • 1768-L43: 16; 32 programs/task • 1768-L45: 30; 32 programs/task | 32; 100 programs/task |
| Event tasks | All event triggers | All event triggers | All event triggers | All event triggers, plus embedded inputs | All event triggers | All event triggers, plus outbound and Windows events |
| User memory | <ul style="list-style-type: none"> 1756-L71: 2 MB 1756-L72: 4 MB 1756-L72S: 4 MB + 2 MB safety 1756-L73, 1756-L73SXT, 1756-L73XT: 8 MB 1756-L73S: 8 MB + 4 MB safety 1756-L74: 16 MB 1756-L75: 32 MB | <ul style="list-style-type: none"> 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM: 1 MB 1769-L33ER, 1769-L33ERM: 2 MB 1769-L36ERM: 3 MB | <ul style="list-style-type: none"> 1769-L24ER: 750 KB 1769-L27ERM: 1 MB | <ul style="list-style-type: none"> 1769-L16ER: 384 KB 1769-L18ER, 1769-L18ERM: 512 KB | <ul style="list-style-type: none"> 1768-L43: 2 MB 1768-L43S: 2 MB + 0.5 MB safety 1768-L45: 3 MB 1768-L45S: 3 MB + 1 MB safety | <ul style="list-style-type: none"> 1789-L10: 2 MB; 1 controller; no motion 1789-L30: 64 MB; 3 controllers 1789-L60: 64 MB; 6 controllers |
| Memory card | Secure Digital | Secure Digital | Secure Digital | Secure Digital | CompactFlash | None |
| Built-in ports | 1 USB | 2 EtherNet/IP 1 USB | 2 EtherNet/IP 1 USB | 2 EtherNet/IP 1 USB | 1 RS-232 | Depends on personal computer |
| Communication options | <ul style="list-style-type: none"> EtherNet/IP (standard and safety) ControlNet (standard and safety) DeviceNet (standard and safety) DH+ Remote I/O SynchLink | <ul style="list-style-type: none"> Dual-port EtherNet/IP⁽¹⁾ DeviceNet | <ul style="list-style-type: none"> Dual-port EtherNet/IP⁽¹⁾ DeviceNet | <ul style="list-style-type: none"> Dual-port EtherNet/IP⁽¹⁾ | <ul style="list-style-type: none"> EtherNet/IP (standard and safety) ControlNet (standard and safety) DeviceNet (standard) | <ul style="list-style-type: none"> EtherNet/IP ControlNet DeviceNet |
| Controller connections | 500 | 256 | 256 | 256 | 250 | 250 |
| Network connections | Per module: <ul style="list-style-type: none"> 128 ControlNet (CN2/B) 40 ControlNet (CNB) 256 EtherNet/IP; 128 TCP (EN2x) 128 EtherNet/IP; 64 TCP (ENBT) | <ul style="list-style-type: none"> 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM: 256 EtherNet/IP; 120 TCP 1769-L33ER, 1769-L33ERM: 256 EtherNet/IP; 120 TCP 1769-L36ERM: 256 EtherNet/IP; 120 TCP | <ul style="list-style-type: none"> 1769-L24ER: 256 EtherNet/IP; 120 TCP 1769-L27ERM: 256 EtherNet/IP; 120 TCP | <ul style="list-style-type: none"> 1769-L16ER: 256 EtherNet/IP; 120 TCP 1769-L18ER, 1769-L18ERM: 256 EtherNet/IP; 120 TCP | Per module: <ul style="list-style-type: none"> 48 ControlNet 128 EtherNet/IP; 64 TCP | Per module: <ul style="list-style-type: none"> 48 ControlNet 128 EtherNet/IP; 64 TCP |
| EtherNet/IP nodes in a single Logix Designer application, max | N/A | <ul style="list-style-type: none"> 1769-L30ER, 1769-L30ER-NSE, 1769-L30ERM: 16 1769-L33ER, 1769-L33ERM: 32 1769-L36ERM: 48 | <ul style="list-style-type: none"> 1769-L24ER: 8 1769-L27ERM: 16 | <ul style="list-style-type: none"> 1769-L16ER: 4 1769-L18ER, 1769-L18ERM: 8 | N/A | N/A |
| Controller redundancy | Full support | Backup via DeviceNet | Backup via DeviceNet | — | Backup via DeviceNet | — |
| Integrated motion | <ul style="list-style-type: none"> Integrated motion on an EtherNet/IP network SERCOS interface Analog options | Integrated motion on an EtherNet/IP network | Integrated motion on an EtherNet/IP network | Integrated motion on an EtherNet/IP network | SERCOS interface | <ul style="list-style-type: none"> SERCOS interface Analog encoder input |
| Programming languages | <ul style="list-style-type: none"> Standard task: all languages Safety task: relay ladder, safety application instructions | <ul style="list-style-type: none"> Relay ladder Structured text Function block SFC | <ul style="list-style-type: none"> Relay ladder Structured text Function block SFC | <ul style="list-style-type: none"> Relay ladder Structured text Function block SFC | <ul style="list-style-type: none"> Standard task: all languages Safety task: relay ladder, safety application instructions | <ul style="list-style-type: none"> Relay ladder Structured text Function block SFC External routines (C/C++) |

(1) CompactLogix™ 5370 controllers have two EtherNet/IP ports to connect to an EtherNet/IP network. The ports carry the same network traffic as part of the controller's embedded switch. The controller uses only one IP address.

Select a CompactLogix System

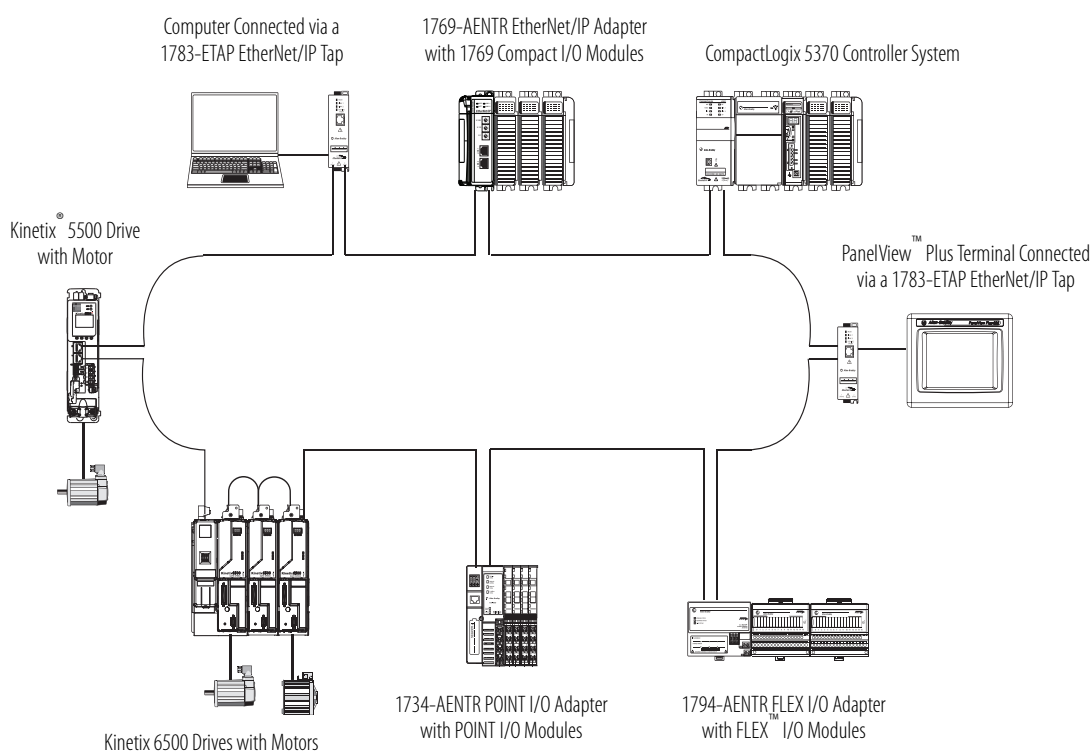


CompactLogix Controllers Overview

The CompactLogix system is designed to provide a Logix solution for small and mid-size applications. Typically, these applications are machine-level control applications. A simple system can consist of a standalone controller with a single bank of I/O modules and DeviceNet communication. In a more complex system, add other networks, motion control, and safety control. As part of the Integrated Architecture™ system, the CompactLogix controllers use the same programming software, network protocol, and information capabilities as all Logix controllers, providing a common development environment for all control disciplines.

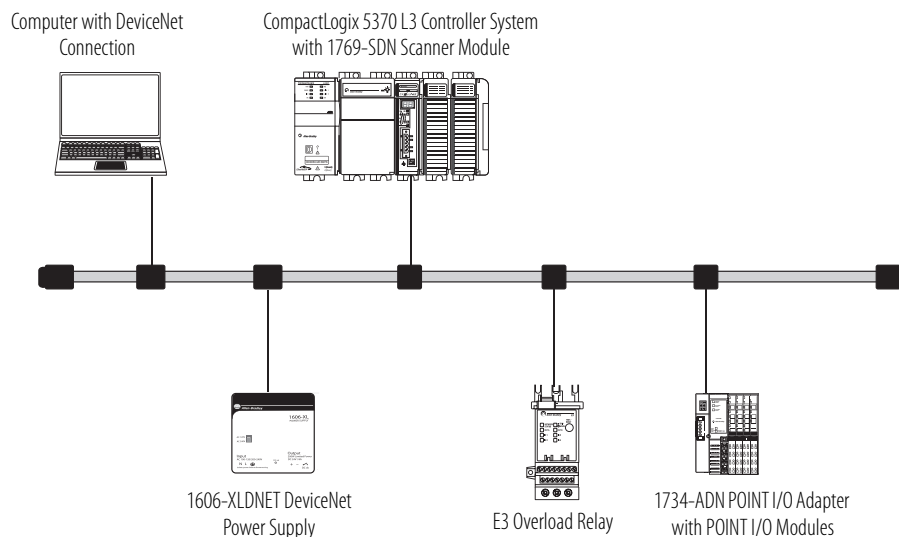
- The CompactLogix 5370 L3 controllers deliver scalable, affordable control ideal for applications from small standalone equipment to high-performance indexing tables, process skids, case packers and erectors, and packaging. The CompactLogix 5370 L3 controllers also provide a truly integrated motion solution.
- The CompactLogix 5370 L2 controllers combine the power of the Logix architecture with the flexibility of Compact I/O modules. From small standalone equipment to higher performance applications, these controllers are ideal for assembly machines, hoisting systems, process skids, indexing tables, and packaging.
- The CompactLogix 5370 L1 controllers combine the power of the Logix architecture with the flexibility of POINT I/O. Ideal for small to mid-size machines, these controllers offer value to customers looking for the benefits of Integrated Architecture in a lower cost system.

CompactLogix 5370 System on an EtherNet/IP Network



The CompactLogix 5370 L2 and L3 controllers support DeviceNet connectivity.

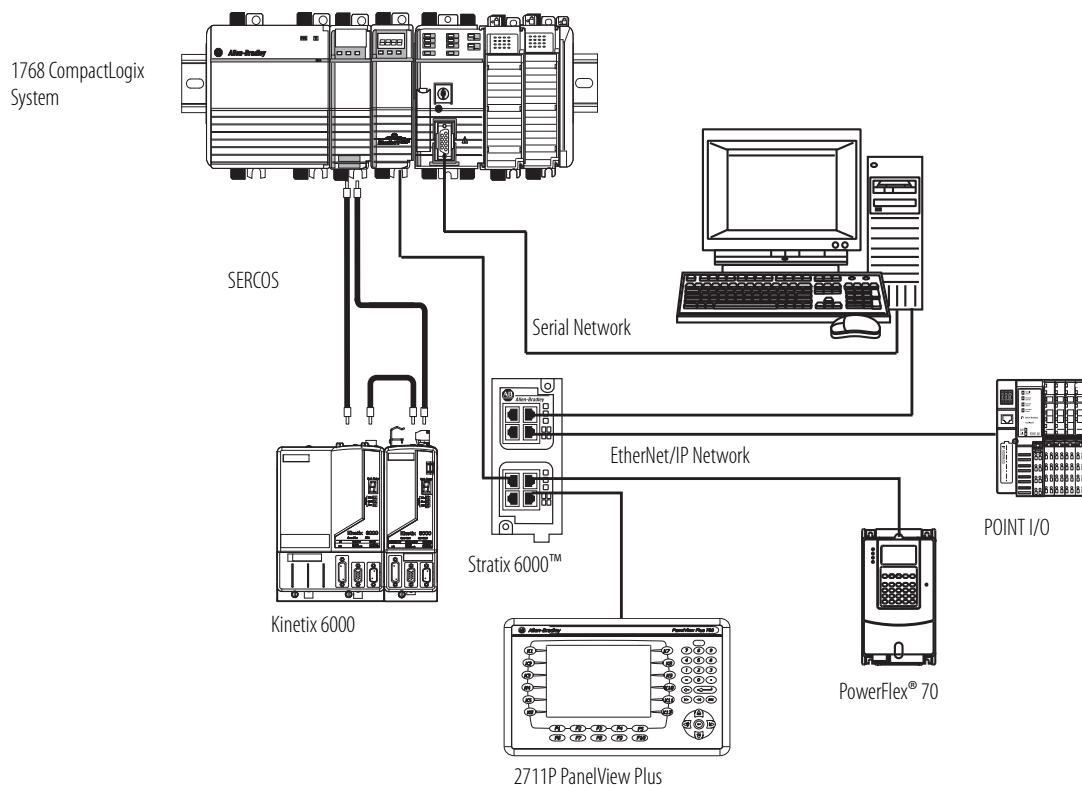
CompactLogix 5370 System on an DeviceNet Network



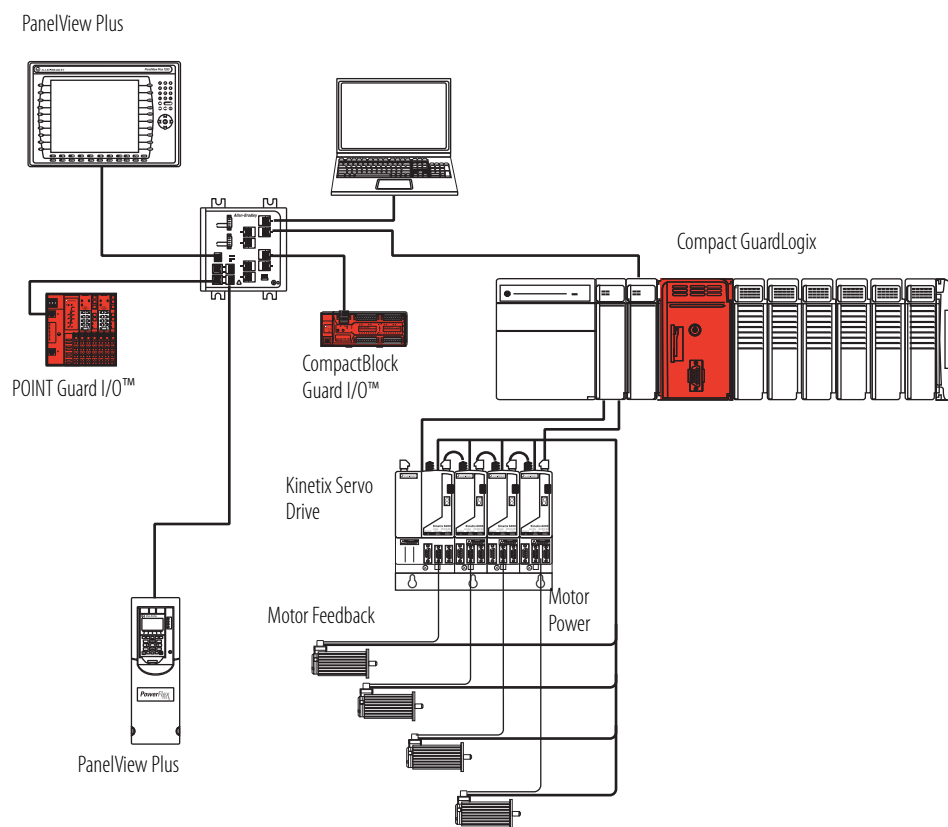
1768 CompactLogix System

The 1768 CompactLogix system combines a 1768 backplane for communication and motion support and a 1769 backplane for I/O support. The 1768 controller is designed for integrated motion, integrated safety, and more complex communication requirements than the other CompactLogix controllers. The 1768 controller has one serial port. Add 1768 modules for motion control, EtherNet/IP communication, and ControlNet communication.

1768 CompactLogix System on an EtherNet/IP Network



1768 Compact GuardLogix Safety System



CompactLogix Controllers

The CompactLogix platform brings together the benefits of the Logix platform— common programming environment, common networks, common control engine—in a small footprint with high performance. Combined with Compact I/O modules, the CompactLogix platform is perfect for tackling smaller, machine-level control applications, with or without simple motion, with unprecedented power and scalability. A CompactLogix platform is ideal for systems that require standalone and system-connected control over EtherNet/IP, ControlNet, or DeviceNet networks.



For detailed specifications, see CompactLogix Controllers Specifications Technical Data, publication [1769-TD005](#).

| Characteristic | CompactLogix 5370 L1 Controllers | CompactLogix 5370 L2 Controllers | CompactLogix 5370 L3 Controllers | 1768 Controllers |
|------------------------|--|--|--|--|
| Controller application | Small applications Embedded 1734 I/O modules | Small applications Embedded 1769 I/O modules | General purpose | Integrated safety Integrated SERCOS motion |
| Controller tasks | 32; 100 programs/task | 32; 100 programs/task | 32; 100 programs/task | <ul style="list-style-type: none"> 1768-L43: 16; 32 programs/task 1768-L45: 30; 32 programs/task |
| Event tasks | Consumed tag, EVENT instruction, embedded inputs, remote I/O, axis, and motion event triggers | Consumed tag, EVENT instruction, remote I/O, axis, and motion event triggers | Consumed tag, EVENT instruction, remote I/O, axis, and motion event triggers | Consumed tag, EVENT instruction, remote I/O, axis, and motion event triggers |
| User memory | <ul style="list-style-type: none"> 1769-L16ER-BB1B: 384 KB 1769-L18ER-BB1B, 1769-L18ERM-BB1B: 512 KB | <ul style="list-style-type: none"> 1769-L24ER-QB1B, 1769-L24ER-QBFC1B: 750 KB 1769-L27ERM-QBFC1B: 1 MB | <ul style="list-style-type: none"> 1769-L30ER, 1769-L30ERM, 1769-L30ER-NSE: 1MB 1769-L33ER, 1769-L33ERM: 2 MB 1769-L36ERM: 3 MB | <ul style="list-style-type: none"> 1768-L43: 2 MB 1768-L43S: 2 MB + 0.5 MB safety 1768-L45: 3 MB 1768-L45S: 3 MB + 1 MB safety |
| Built-in ports | <ul style="list-style-type: none"> 2 EtherNet/IP⁽¹⁾ 1 USB | <ul style="list-style-type: none"> 2 EtherNet/IP⁽¹⁾ 1 USB | <ul style="list-style-type: none"> 2 EtherNet/IP⁽¹⁾ 1 USB | <ul style="list-style-type: none"> 1 port RS-232 serial (DF1 or ASCII) |
| Communication options | <ul style="list-style-type: none"> Dual-port EtherNet/IP | <ul style="list-style-type: none"> Dual-port EtherNet/IP DeviceNet | <ul style="list-style-type: none"> Dual-port EtherNet/IP DeviceNet | <ul style="list-style-type: none"> EtherNet/IP (standard and safety) ControlNet (standard and safety) DeviceNet (standard) |

(1) CompactLogix 5370 controllers have two EtherNet/IP ports to connect to an EtherNet/IP network. The ports carry the same network traffic as part of the controller's embedded switch. The controller uses only one IP address.

For information on estimating memory requirements for you application, see Logix5000 Controllers Execution Time and Memory Use Reference Manual, publication [1756-RM087](#).

CompactLogix 5370 L1 Controllers with Embedded POINT I/O Modules



The CompactLogix 5370 L1 controller comes with:

- a built-in, 24V DC nonisolated power supply.⁽¹⁾
- dual EtherNet/IP ports for ring topologies.
- USB port for firmware download and programming.
- embedded digital I/O (16 DC inputs, 16 DC outputs).

| Characteristic | 1769-L16ER-BB1B | 1769-L18ER-BB1B | 1769-L18ERM-BB1B |
|---|--|--|--|
| Available user memory | 384 KB | 512 KB | 512 KB |
| Memory card | <ul style="list-style-type: none"> • 1784-SD1 (1 GB), shipped with controller • 1784-SD2 (2 GB) | | |
| Communication ports | <ul style="list-style-type: none"> • 2 EtherNet/IP • 1 USB | | |
| Embedded I/O | <ul style="list-style-type: none"> • 16 sinking 24V DC digital input points • 16 sourcing 24V DC digital output points | | |
| EtherNet/IP connections | <ul style="list-style-type: none"> • 256 EtherNet/IP • 120 TCP | <ul style="list-style-type: none"> • 256 EtherNet/IP • 120 TCP | <ul style="list-style-type: none"> • 256 EtherNet/IP • 120 TCP |
| EtherNet/IP nodes in a single Logix Designer application, max | 4 | 8 | |
| Integrated motion on an EtherNet/IP network | — | — | Supports up to 2 axes |
| Module expansion capacity | 6 POINT I/O modules | 8 POINT I/O modules | 8 POINT I/O modules |
| Battery | None | | |
| Embedded power supply | 10...28.8V DC 24V DC nominal | | |
| Programming software support | <ul style="list-style-type: none"> • RSLogix™ 5000 software, version 20 - For controllers that use firmware revision 20.xxx. • Logix Designer application, version 21 or later - For controllers that use firmware revision 21.xxx or later. | | |

(1) For more information on connecting a 24V DC power source to the CompactLogix 5370 L1 controller's 24V DC nonisolated power supply, see the CompactLogix 5370 Controllers User Manual, publication [1769-UM021](#).

CompactLogix 5370 L2 Controllers with Embedded Compact I/O Modules



The CompactLogix 5370 L2 controller comes with:

- a built-in, 24V DC power supply.
- dual EtherNet/IP ports for ring topologies.
- USB port for firmware download and programming.
- a combination of embedded digital, analog, and high-speed counter I/O.
- a 1769-ECR right-end cap.

| Characteristic | 1769-L24ER-QB1B | 1769-L24ER-QBFC1B | 1769-L27ERM-QBFC1B |
|---|---|---|--|
| Available user memory | 0.75 MB | 0.75 MB | 1 MB |
| Memory card | <ul style="list-style-type: none"> • 1784-SD1 (1 GB), shipped with controller • 1784-SD2 (2 GB) | | |
| Communication ports | <ul style="list-style-type: none"> • 2 EtherNet/IP • 1 USB | | |
| Embedded I/O | <ul style="list-style-type: none"> • 16 sinking/sourcing 24V DC digital input points • 16 sourcing 24V DC digital output points | <ul style="list-style-type: none"> • 16 sinking/sourcing 24V DC digital input points • 16 sourcing 24V DC digital output points • 4 universal analog input points • 2 analog output points • 4 high-speed counters | |
| EtherNet/IP connections | <ul style="list-style-type: none"> • 256 EtherNet/IP • 120 TCP | <ul style="list-style-type: none"> • 256 EtherNet/IP • 120 TCP | <ul style="list-style-type: none"> • 256 EtherNet/IP • 120 TCP |
| EtherNet/IP nodes in a single Logix Designer application, max | 8 | | 16 |
| Integrated motion on an EtherNet/IP network | — | — | Supports up to 4 axes |
| Module expansion capacity | 4 1769 modules | | |
| Battery | None | | |
| Embedded power supply | 24V DC | | |
| Programming software support | <ul style="list-style-type: none"> • RSLogix 5000 software, version 20 – For controllers that use firmware revision 20.xxx. • Logix Designer application, version 21 or later – For controllers that use firmware revision 21.xxx or later. | | |

These controllers replace previous catalog numbers.

| New Controller | Replaces Previous Controller ⁽¹⁾ | Differences |
|--------------------|---|--|
| 1769-L24ER-QBFC1B | 1769-L23-QBFC1B 1769-L23E-QBFC1B | <ul style="list-style-type: none"> • Additional memory • Integrated motion on EtherNet/IP support (1769-L27ERM-QBFC1B) • USB port instead of RS-232 port • Dual-port EtherNet/IP support • SD card support addition • Support for additional expansion I/O modules |
| 1769-L24ER-QB1B | 1769-L23E-QB1B | |
| 1769-L27ERM-QBFC1B | 1769-L23E-QBFC1B | |

(1) These catalog numbers are still available for sale, see [page 11](#) for details. Please contact your local Rockwell Automation sales office for ordering information.

CompactLogix 5370 L3 Controllers

In a CompactLogix 5370 L3 controller system, the 1769 I/O modules can be placed to the left and the right of the power supply. As many as eight modules can be placed on each side of the power supply. The CompactLogix 5370 L3 controller comes with:



- dual EtherNet/IP ports for ring topologies.
- USB port for firmware download and programming.

| Characteristic | 1769-L30ER | 1769-L30ERM | 1769-L30ER-NSE | 1769-L33ER | 1769-L33ERM | 1769-L36ERM |
|---|--|---|---|---|---|---|
| Available user memory | 1 MB | 1 MB | 1 MB No capacitor | 2 MB | 2 MB | 3 MB |
| Memory card | 1784-SD1 (1 GB), shipped with controller 1784-SD2 (2 GB) | | | | | |
| Communication ports | <ul style="list-style-type: none">• 2 EtherNet/IP• 1 USB | | | | | |
| EtherNet/IP connections | <ul style="list-style-type: none">• 256 EtherNet/IP• 120 TCP | <ul style="list-style-type: none">• 256 EtherNet/IP• 120 TCP | <ul style="list-style-type: none">• 256 EtherNet/IP• 120 TCP | <ul style="list-style-type: none">• 256 EtherNet/IP• 120 TCP | <ul style="list-style-type: none">• 256 EtherNet/IP• 120 TCP | <ul style="list-style-type: none">• 256 EtherNet/IP• 120 TCP |
| EtherNet/IP nodes in a single Logix Designer application, max | 16 | | | 32 | | 48 |
| Integrated motion on an EtherNet/IP network | — | Supports up to 4 axes | — | — | Supports up to 8 axes | Supports up to 16 axes |
| Module expansion capacity | 8 1769 modules 1 bank of modules | | | 16 1769 modules 2 banks of modules | | 30 1769 modules 3 banks of modules |
| Battery | None | | | | | |
| Power supply distance rating | 4 modules | | | 4 modules | | 4 modules |
| Programming software support | <ul style="list-style-type: none">• RSLogix 5000 software, version 20 - For controllers that use firmware revision 20.xxx.• Logix Designer application, version 21 or later - For controllers that use firmware revision 21.xxx or later. | | | | | |

These controllers replace previous catalog numbers.

| New Controller ⁽¹⁾ | Replaces Previous Controller ⁽²⁾ | Differences |
|---|---|---|
| 1769-L30ER 1769-L30ERM 1769-L30ER-NSE | 1769-L31 1769-L32C ⁽³⁾ 1769-L32E | <ul style="list-style-type: none"> • Additional memory • Integrated motion on EtherNet/IP support (1769-L30ERM, 1769-L33ERM, 1769-L36ERM) • USB port instead of RS-232 port • Dual-port EtherNet/IP support • SD card instead of CompactFlash card |
| 1769-L33ER 1769-L33ERM | 1769-L35CR ⁽³⁾ 1769-L35E | |
| 1769-L36ERM | Any previous 1769-L3x controller | |

(1) IMPORTANT: Typically, you can use any of the new controllers listed in each row as replacements for any of the previous controllers listed in the corresponding cell to the right. For example, you can replace a 1769-L32E with a 1769-L30ER, 1769-L30ERM, or 1769-L30ER-NSE controller.

In some rare cases, system configuration prevents controller replacement as shown above. For example, if your system uses a 1769-L32E controller with 12 expansion modules, you cannot replace that controller with a 1769-L30ER, 1769-L30ERM, or 1769-L30ER-NSE controller. Those controllers support no more than 8 expansion modules. You must replace the 1769-L32E controller with a 1769-L33ER, 1769-L33ERM, or 1769-L36ERM controller.

We recommend that before you upgrade your controllers, consider your application requirements to verify that the replacements listed above apply.

(2) These catalog numbers are still available for sale, see [page 12](#) for details. Please contact your local Rockwell Automation sales office for ordering information.

(3) Requires converting from ControlNet connections to EtherNet/IP connections.

1768 CompactLogix Controllers

The 1768 CompactLogix controller combines both a 1768 backplane and a 1769 backplane. The 1768 backplane supports the 1768 controller, the 1768 power supply, and a maximum of four 1768 modules. The 1769 backplane supports 1769 modules.



| Characteristic | 1768-L43 | 1768-L43S | 1768-L45 | 1768-L45S |
|---------------------------------|---|--------------------------------|----------|------------------------------|
| Available user memory | 2 MB | 2 MB standard 0.5 MB safety | 3 MB | 3 MB standard 1 MB safety |
| Memory card | 1784-CF128 (128 MB) | | | |
| Communication options | <ul style="list-style-type: none">• EtherNet/IP (standard and safety)• ControlNet (standard and safety)• DeviceNet (standard) | | | |
| Serial communication port | 1 RS-232 port | | | |
| Number of 1768 modules, max | 2 | | 4 | |
| Number of 1769 I/O modules, max | 16 | | 30 | |
| Number of I/O banks, max | 2 | | 3 | |
| Battery | None | | | |
| Programming software support | RSLogix 5000 software, version 20 or earlier | | | |

1769-L23x Packaged CompactLogix Controllers with Embedded I/O

The 1769-L23x controllers provide the following functionality:

- Built-in power supply
- Either two serial ports or one serial and one EtherNet/IP port, depending on controller catalog number
- Combination of embedded digital, analog, and high-speed counter I/O modules
- 1769-ECR right-end cap

| Characteristic | 1769-L23-QBFC1B | 1769-L23E-QB1B | 1769-L23E-QBFC1B |
|------------------------------|---|---|---|
| Available user memory | 512 KB | 512 KB | 512 KB |
| CompactFlash card | None | | |
| Communication ports | 2 RS-232 ports (isolated DF1 or ASCII; only nonisolated DF1) | 1 EtherNet/IP port 1 RS-232 serial port (DF1 or ASCII) | 1 EtherNet/IP port 1 RS-232 serial port (DF1 or ASCII) |
| Embedded I/O | <ul style="list-style-type: none"> 16 DC inputs 16 DC outputs 4 analog inputs 2 analog outputs 4 high-speed counters | <ul style="list-style-type: none"> 16 DC inputs 16 DC outputs | <ul style="list-style-type: none"> 16 DC inputs 16 DC outputs 4 analog inputs 2 analog outputs 4 high-speed counters |
| Module expansion capacity | 2 1769 modules | 3 1769 modules | 2 1769 modules |
| Embedded power supply | 24V DC | | |
| Programming software support | RSLogix 5000 software, version 20 or earlier | | |

1769-L3x Modular CompactLogix Controllers

In a 1769-L3x controller system, the 1769 I/O modules can be placed to the left and the right of the power supply. As many as eight modules can be placed on each side of the power supply.

| Characteristic | 1769-L31 | 1769-L32C | 1769-L32E | 1769-L35CR | 1769-L35E |
|------------------------------|--|---|--|---|--|
| Available user memory | 512 KB | 750 KB | 750 KB | 1.5 MB | 1.5 MB |
| CompactFlash card | 1784-CF128 | | | | |
| Communication ports | 2 RS-232 ports (isolated DF1 or ASCII; only nonisolated DF1) | 1 ControlNet port 1 RS-232 port (DF1 or ASCII) | 1 EtherNet/IP port 1 RS-232 port (DF1 or ASCII) | 1 ControlNet port 1 RS-232 port (DF1 or ASCII) | 1 EtherNet/IP port 1 RS-232 port (DF1 or ASCII) |
| Module expansion capacity | 16 1769 modules | | | 30 1769 modules | |
| Power supply distance rating | 4 modules | | | | |
| Programming software support | RSLogix 5000 software, version 20 or earlier | | | | |

Controller Memory Use

These equations provide an estimate of the memory needed for a CompactLogix controller. These numbers are rough estimates.

| | | | |
|--|---------------|---|------------------------------|
| Controller tasks | _____ * 4000 | = | _____ bytes (minimum 1 task) |
| Digital I/O points | _____ * 400 | = | _____ bytes |
| Analog I/O points | _____ * 2600 | = | _____ bytes |
| DeviceNet modules ⁽¹⁾ | _____ * 7400 | = | _____ bytes |
| Other communication modules ⁽²⁾ | _____ * 2000 | = | _____ bytes |
| Motion axes | _____ * 8000 | = | _____ bytes |
| FactoryTalk® alarm instruction | _____ * 1000 | = | _____ bytes (per alarm) |
| FactoryTalk subscriber | _____ * 10000 | = | _____ bytes |

(1) The first DeviceNet module is 7400 bytes. Additional DeviceNet modules are 5800 bytes each.

(2) Count all the communication modules in the system, not just those in the local chassis. This includes device connection modules, adapter modules, and ports on PanelView terminals.

Reserve 20...30% of the controller memory for future expansion.

CompactLogix Communication Options

You can configure your system for information exchange between a range of devices and computing platforms and operating systems. Select a CompactLogix controller with integrated communication or the appropriate communication module.

For detailed specifications, see:

- CompactLogix Controllers Specifications Technical Data, publication [1769-TD005](#).
- CompactLogix Communication Modules Specifications Technical Data, publication [1769-TD007](#).

EtherNet/IP Communication Options

The Ethernet Industrial network protocol (EtherNet/IP) is an open industrial-networking standard that supports both real-time I/O messaging and message exchange. The EtherNet/IP network uses off-the-shelf Ethernet communication chips and physical media.

Dual-port EtherNet/IP support embeds switch technology directly in the controller to so the controller can operate on star, linear, or ring EtherNet/IP topologies.

| Cat. No. | Description | Communication Rate | Logix Resources ⁽¹⁾ | TCP/IP Connections |
|------------------------------------|--|--------------------|---|--------------------|
| 1769-L16ER-BB1B, | CompactLogix 5370 L1 controller with integrated EtherNet/IP dual-port, POINT I/O form factor | 10/100 Mbps | 4 nodes 256 EtherNet/IP connections | 120 |
| 1769-L18ER-BB1B, 1769-L18ERM-BB1B | | | 8 nodes 256 EtherNet/IP connections | |
| 1769-L24ER-BB1B, 1769-L24ER-QBFC1B | CompactLogix 5370 L2 controller with integrated EtherNet/IP dual-port, Compact I/O form factor | 10/100 Mbps | 8 nodes 256 EtherNet/IP connections | 120 |
| 1769-L27ERM-QBFC1B | | 10/100 Mbps | 16 nodes 256 EtherNet/IP connections | |
| 1769-L30ER, 1769-L30ERM | CompactLogix 5370 L3 controller with integrated EtherNet/IP dual-port | 10/100 Mbps | 16 nodes 256 EtherNet/IP connections | 120 |
| 1769-L33ER, 1769-L33ERM | | | 32 nodes 256 EtherNet/IP connections | |
| 1769-L36ERM | | | 48 nodes 256 EtherNet/IP connections | |
| 1769-AENTR | 1769 EtherNet/IP adapter | 10/100 Mbps | 128 EtherNet/IP connections | 96 |
| 1768-ENBT | 1768 EtherNet/IP communication bridge module | 10/100 Mbps | 128 EtherNet/IP connections | 64 |
| 1768-EWEB | 1768 Ethernet web server module | 10/100 Mbps | 128 EtherNet/IP connections | 64 |

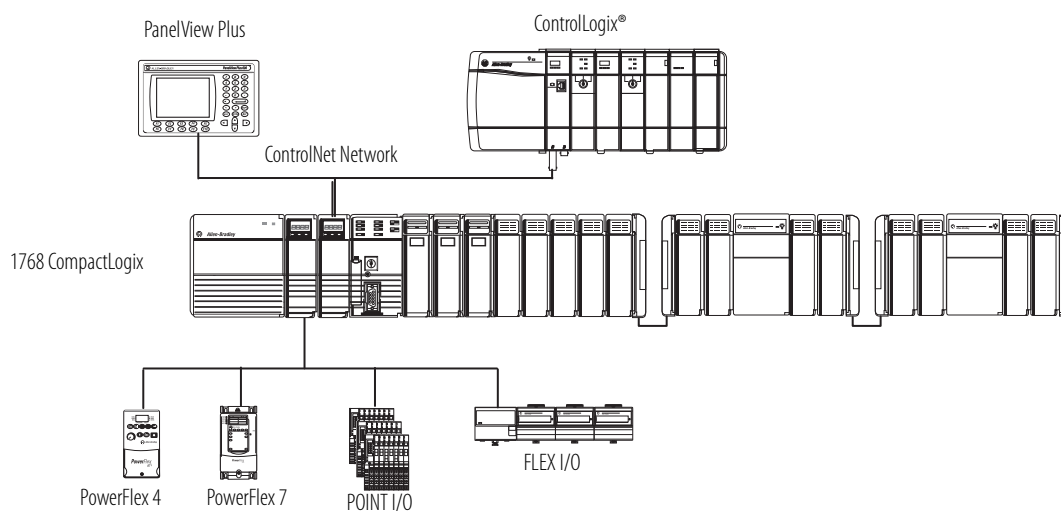
(1) The number of nodes listed for CompactLogix 5370 controllers represents the maximum number of EtherNet/IP nodes you can include in a Logix Designer application project for those controller. For example, in a Logix Designer application project that uses a 1769-L18ERM-BB1B controller, you can add as many as 8 EtherNet/IP nodes to the project.

ControlNet Communication Options for 1768 CompactLogix Controllers

The ControlNet network is an open, control network for real-time, high-throughput applications. The ControlNet network uses the Common Industrial Protocol (CIP) to combine the functionality of an I/O network and a peer-to-peer network providing high-speed performance for both functions. The ControlNet network gives you deterministic, repeatable transfers of all mission-critical control data in addition to supporting transfers of non-time-critical data. I/O updates and controller-to-controller interlocking always take precedence over program uploads and downloads and messaging.

| Cat. No. | Description | Communication Rate | Logix Connections |
|-----------|---|--------------------|-------------------|
| 1768-CNBR | 1768 CompactLogix controller, ControlNet communication bridge module, single media | 5 Mbps | 48 |
| 1768-CNBR | 1768 CompactLogix controller, ControlNet communication bridge module, redundant media | 10/100 Mbps | 48 |

1768 CompactLogix Controllers on a ControlNet Network



DeviceNet Communication Options

The DeviceNet network is an open, low-level network that provides connections between simple industrial devices (such as sensors and actuators) and higher-level devices (such as controllers and computers).

| Cat. No. | Description | Communication Rate | Number of Nodes |
|----------|--------------------------------------|--|-----------------|
| 1769-SDN | Compact I/O DeviceNet scanner module | 125 Kbps (500 m max) | 64 |
| 1769-ADN | Compact I/O DeviceNet adapter module | 250 Kbps (250 m max) 500 Kbps (100 m max) | |

Serial Communication Options

These CompactLogix controllers support serial communication.

| Cat. No. | Serial Options |
|--|--|
| 1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B | 1734-232ASC module for an RS-232 serial interface 1734-485 ASC module for an RS-422 and RS-485 serial device |
| 1769-L24ER-BB1B, 1769-L24ER-QBFC1B | 1769-ASCII module for an ASCII interface to RS-232, RS-422, and RS-485 devices 1769-SM2 module for a Modbus RTU interface |
| 1769-L27ERM-QBFC1B | |
| 1769-L30ER, 1769-L30ERM | |
| 1769-L33ER, 1769-L33ERM | |
| 1769-L36ERM | |
| 1768-L43, 1768-L43S, 1768-L45, 1768-L45S | Built-in serial port 1769-ASCII module for an ASCII interface to RS-232, RS-422, and RS-485 devices 1769-SM2 module for a Modbus RTU interface |

Modbus Support

To access a Modbus TCP network, connect through the embedded Ethernet port of the CompactLogix 5370 controllers and execute a specific ladder-logic routine. For more information, see Knowledgebase document 470365 at <http://www.rockwellautomation.com/knowledgebase/>.

To access a Modbus RTU network, connect through the serial port (if available) and execute a specific ladder-logic routine. For more information, see Using Logix5000 Controllers as Masters or Slaves on Modbus Application Solution, publication [CIG-AP129](#).

CompactLogix Integrated Motion

The Logix architecture supports motion control components that work in a wide variety of machine architectures.

- Integrated motion on EtherNet/IP supports a connection to Ethernet drives.
- The Kinetix integrated-motion solution uses a SERCOS interface module to perform multi-axis, synchronized motion.
- Logix integrated motion supports the analog family of servo modules for controlling drives/actuators.
- Networked motion provides the ability to connect via the DeviceNet network to a single axis drive to perform point-to-point indexing.

| Motion Feature | CompactLogix 5370 L3 | CompactLogix 5370 L2 | CompactLogix 5370 L1 | 1768-L43, 1768-L43S CompactLogix and Compact GuardLogix | 1768-L45, 1768-L45S CompactLogix and Compact GuardLogix |
|---|---|---|---|--|--|
| EtherNet/IP sequence of events for software registration | Yes | Yes | Yes | Yes | Yes |
| Kinematics | Yes | Yes | Yes | No | No |
| Integrated motion on an EtherNet/IP network | Yes ⁽¹⁾ | Yes ⁽²⁾ | Yes ⁽³⁾ | No | No |
| Indexing | Yes with AMCI 1769-3602 pulse-train output module | Yes with AMCI 1769-3602 pulse-train output module | Yes with one of these pulse-train output modules: <ul style="list-style-type: none"> • AMCI 1734-3401 • AMCI 1734-3401L | — | — |
| Load observer (with only Kinetix 6500 drives) | Yes | Yes | Yes | No | No |
| Total axis count | 100 | 100 | 100 | 12 <ul style="list-style-type: none"> • 4 position • 2 feedback • 6 virtual | 16 <ul style="list-style-type: none"> • 8 position • 2 feedback • 6 virtual |
| Virtual axis, max. | 100 | 100 | 100 | 6 | 6 |
| EtherNet/IP axis, max. | 16 | 4 | 2 | None | None |
| EtherNet/IP feedback, VHz, torque, or velocity axis, max. | 48 | 16 | 8 | None | None |

(1) In the CompactLogix 5370 L3 controller family, only the 1769-L30ERM, 1769-L33ERM, 1769-L36ERM controllers support Integrated Motion on an EtherNet/IP network.

(2) In the CompactLogix 5370 L2 controller family, only the 1769-L27ERM-QBFC1B controller supports Integrated Motion on an EtherNet/IP network.

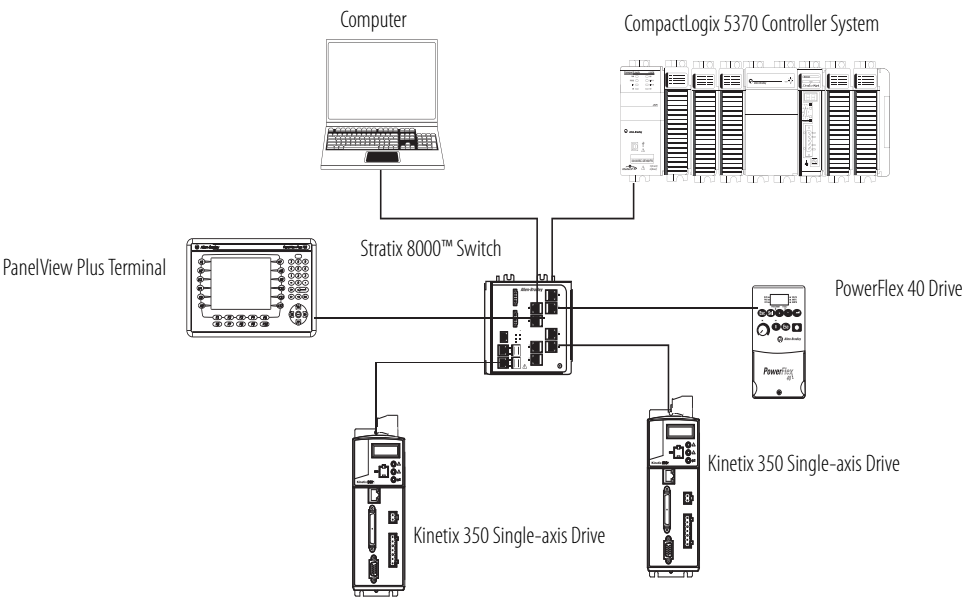
(3) In the CompactLogix 5370 L1 controller family, only the 1769-L18ERM-BB1B controller supports Integrated Motion on an EtherNet/IP network.

For more information, see the:

- Motion Analyzer CD to size your motion application and to make final component selection. Download the software from <http://www.ab.com/motion/software/analyzer.html>.
- Kinetix Motion Control Selection Guide, publication [GMC-SG001](#), to verify drive, motor, and accessory specifications.

Some CompactLogix 5370 controllers support integrated motion on an EtherNet/IP network. Select the controller with sufficient axis-support for your application.

Integrated Motion on an EtherNet/IP Network Example Configuration



SERCOS Interface Modules

The 1768 CompactLogix controller supports a SERCOS interface.

| Cat. No. | Description | Number of Axis |
|------------|--|----------------|
| 1768-M04SE | 1768 CompactLogix SERCOS interface modules | 4 |

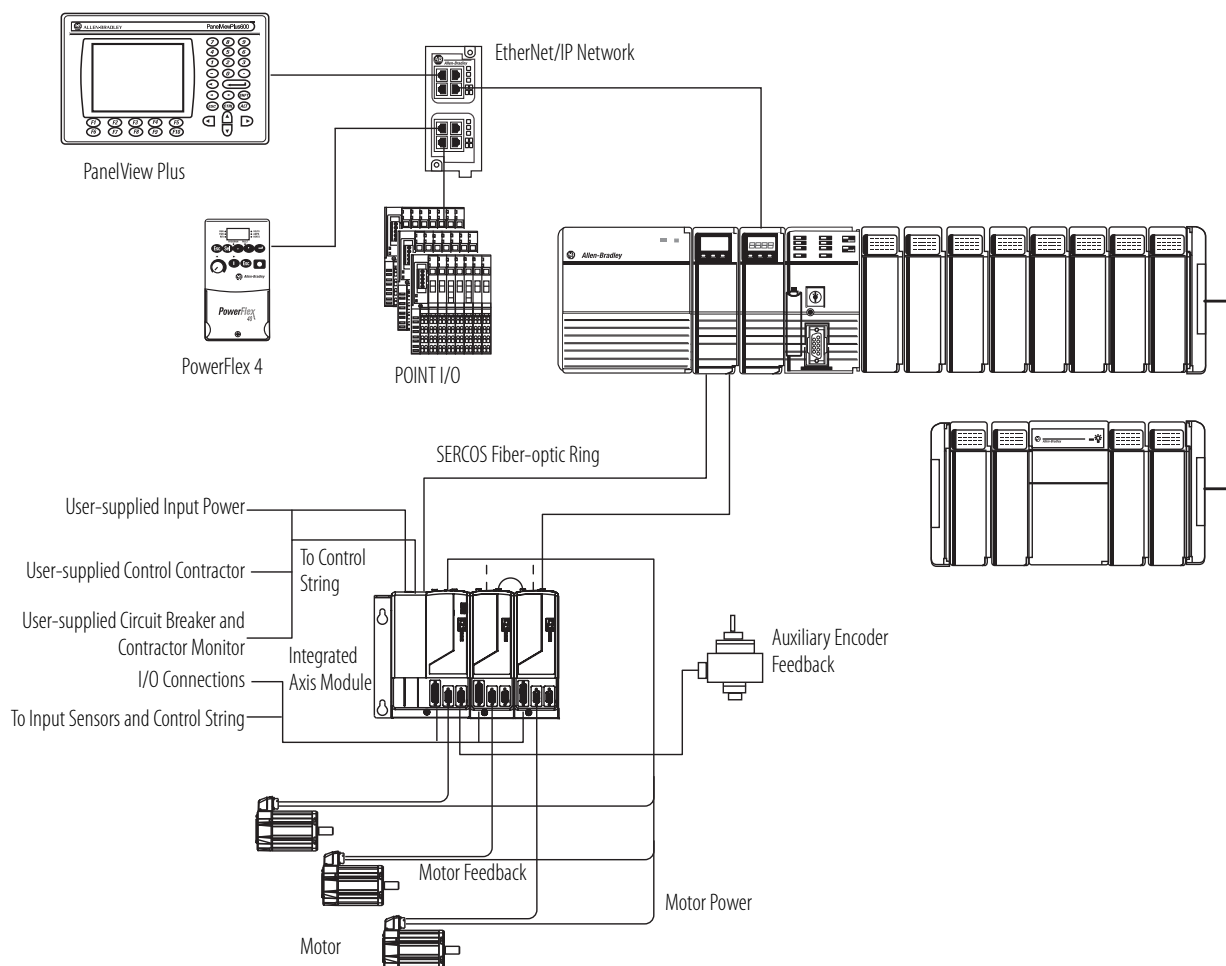
The SERCOS interface module can connect to these servo drives:

- 2093 Kinetix 2000 servo drive
- 2094 Kinetix 6000 servo drive
- 2094 Kinetix 6000M integrated drive-motor system
- 2099 Kinetix 7000 high-power servo drive
- 2098 Ultra™ 3000 SERCOS servo drive
- 1394C SERCOS drive
- 8720MC spindle

For detailed SERCOS specifications, see CompactLogix Integrated Motion Specifications Technical Data, publication [1768-TD001](#).

| With this controller | You can have |
|----------------------|--|
| 1768-L43 | <ul style="list-style-type: none">• Four axis• Two feedback axis• Six virtual axis |
| 1768-L45 | <ul style="list-style-type: none">• Eight axis• Four feedback axis• Six virtual axis |

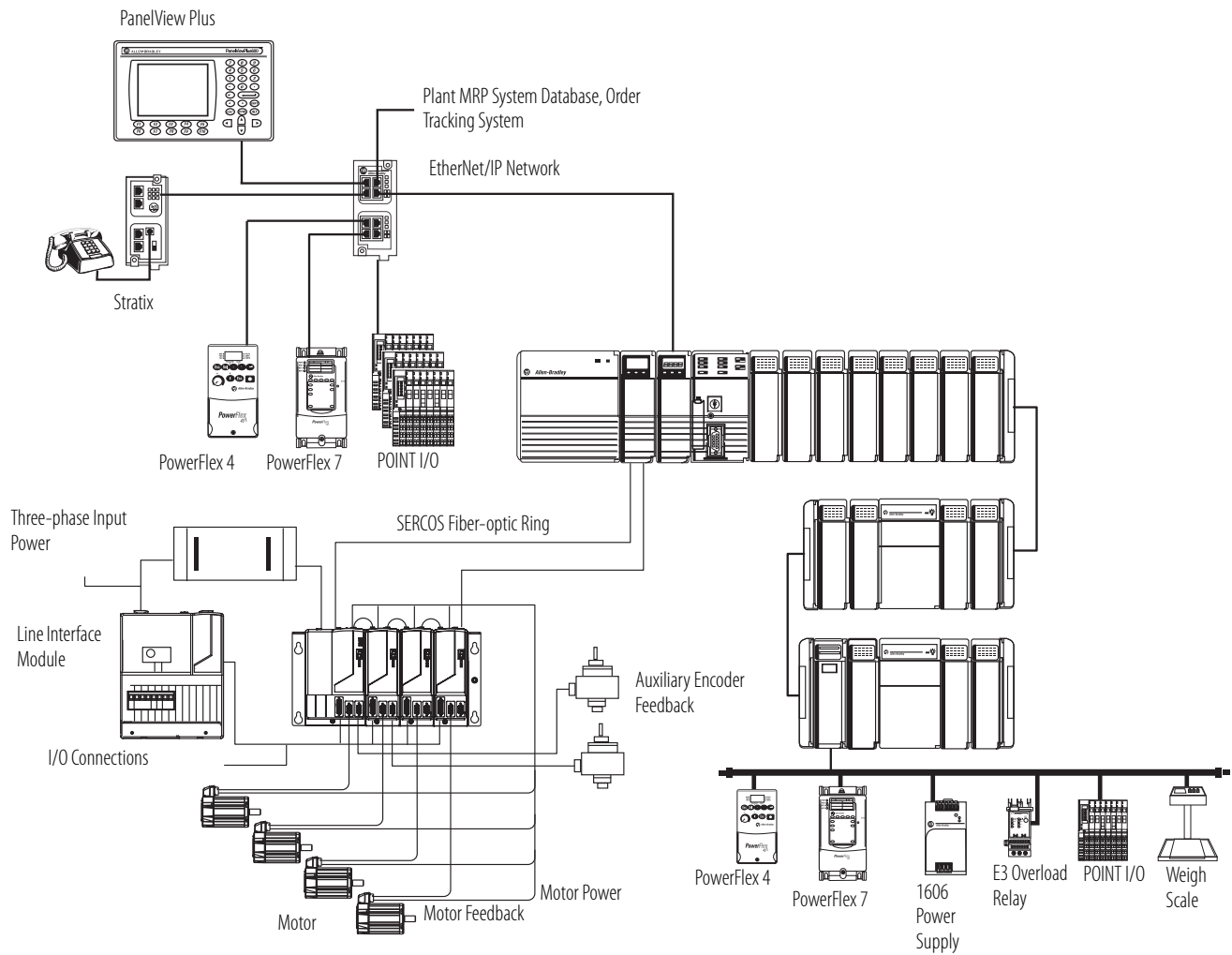
1768 CompactLogix Controller and Three-axis Integrated Motion with Kinetix Servo Drives



A three-axis system with Kinetix drives supports:

- execution of 4 axes per 1 ms.
- velocity bandwidth > 400 Hz and current loop bandwidth > 1000 Hz.
- high resolution, unlimited travel, and absolute feedback features.
- two feedback ports per Kinetix drive.

1768 CompactLogix Controller and Four-axis Integrated Motion with Kinetix Drives and LIM Interface



A four-axis system with Kinetix drives supports:

- execution of 4 axes per 1 ms.
- velocity bandwidth > 400 Hz and current loop bandwidth > 1000 Hz.
- high resolution, unlimited travel, and absolute feedback features.
- two feedback ports per Kinetix drive.
- optional 2094 Line Interface Module (LIM) as the incoming power source for an entire control panel.

Compact GuardLogix Integrated Safety

The Compact GuardLogix controller is a 1768-L4xS CompactLogix controller that provides safety control to achieve SIL 3/PLe according to ISO 13849. A major benefit of this system is that it's still a single project, safety and standard together.

| Application | Description |
|-------------|--|
| SIL 1, 2, 3 | The Compact GuardLogix controller system is type-approved and certified for use in safety applications up to and including SIL 3 according to IEC 61508, and applications up to and including PLe/Cat.4 according to ISO 13849-1. For more information, see: <ul style="list-style-type: none">GuardLogix Controllers Systems Safety Reference Manual, publication 1756-RM093.Compact GuardLogix Controllers User Manual, publication 1768-UM002.GuardLogix Safety Application Instruction Set Reference Manual, publication 1756-RM095. |

During development, safety and standard have the same rules, multiple programmers, online editing, and forcing are all possible. Once the project is tested and ready for final validation, you apply the safety application signature and safety-lock the application to set the safety task to a SIL 3 integrity level, which is then enforced by the GuardLogix® controller. When safety memory is locked and protected, the safety logic can't be modified and all safety functions operate with SIL 3 integrity. On the standard side of the GuardLogix controller, all functions operate like a regular Logix controller. Thus online editing, forcing, and other activities are all possible.

With this level of integration, safety memory can be read by standard logic and external devices, like HMIs or other controllers, eliminating the need to condition safety memory for use elsewhere. The result is easy system-wide integration and the ability to display safety status on displays or marquees. Use Guard I/O modules for field device connectivity. For safety interlocking between GuardLogix controllers use Ethernet or ControlNet networks. Multiple GuardLogix controllers can share safety data for zone to zone interlocking, or a single GuardLogix controller can use remote distributed safety I/O between different cells/areas.

In addition to the standard features of a CompactLogix controller, the Compact GuardLogix controller has these safety-related features.

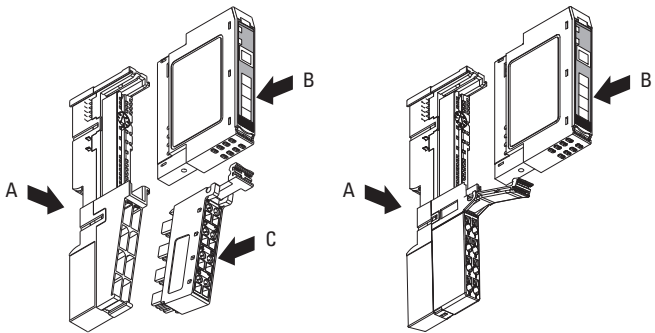
| Characteristic | 1768-L43S | 1768-L45S |
|-----------------------|---|---|
| Available user memory | 2 MB standard 0.5 MB safety | 3 MB standard 1 MB safety |
| Communication options | <ul style="list-style-type: none">EtherNet/IP (standard and safety)ControlNet (standard and safety)DeviceNet (standard) | <ul style="list-style-type: none">EtherNet/IP (standard and safety)ControlNet (standard and safety)DeviceNet (standard) |
| Programming languages | <ul style="list-style-type: none">Standard task: all languagesSafety task: relay ladder, safety application instructions | <ul style="list-style-type: none">Standard task: all languagesSafety task: relay ladder, safety application instructions |

Additional Local I/O Modules

1734 POINT I/O Modules

Additional 1734 POINT I/O modules can be installed on a CompactLogix 5370 L1 controller. The POINT I/O family is ideal for applications where flexibility and low-cost of ownership are key for successful control system design and operation.

The base (A) mounts onto the DIN rail and provides the backplane. The POINT I/O module (B) snaps into the base. The removable terminal block (C) also snaps into the base and provides the wiring and terminations for field-side connections, as well as system power for the backplane.



1734 AC Digital Modules

| Cat. No. | Inputs/Outputs | Voltage Category | Wiring Base | POINTBus™ Current @ 5V DC |
|----------|--------------------------------|------------------|--|---------------------------|
| 1734-IA2 | 2 inputs, nonisolated, sink | 120V AC | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS | 75 mA |
| 1734-IA4 | 4 inputs, nonisolated, sink | | | |
| 1734-IM2 | 2 inputs, nonisolated, sink | 220V AC | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS | 75 mA |
| 1734-IM4 | 4 inputs, nonisolated, sink | | | |
| 1734-OA2 | 2 outputs, nonisolated, source | 120/220V AC | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS | 75 mA |
| 1734-OA4 | 4 outputs, nonisolated, source | | | |

1734 DC Digital Modules

| Cat. No. | Inputs/Outputs | Voltage Category | Wiring Base | POINTBus Current @ 5V DC |
|-----------|--|------------------|--|--------------------------|
| 1734-IB2 | 2 inputs, sink | 24V DC | 1734-TB, 1734-TBS | 75 mA |
| 1734-IB4 | 4 inputs, sink | | | |
| 1734-IB4D | 4 inputs, sink, diagnostic | 24V DC | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS | 50 mA |
| 1734-IB8 | 8 inputs, sink | 24V DC | 1734-TB, 1734-TBS | 75 mA |
| 1734-IB8S | 8 inputs, sink, safety | 24V DC | 1734-TB, 1734-TOP | 175 mA |
| 1734-IV2 | 2 inputs, source | 24V DC | 1734-TB, 1734-TBS | 75 mA |
| 1734-IV4 | 4 inputs, source | | | |
| 1734-IV8 | 8 inputs, source | | | |
| 1734-OB2 | 2 outputs, nonisolated, source | 12/24V DC | 1734-TB, 1734-TBS | 75 mA |
| 1734-OB2E | 2 outputs, nonisolated protected, source | | | |
| 1734-OB4 | 4 outputs, nonisolated, source | | | |
| 1734-OB4E | 4 outputs, nonisolated protected, source | | | |
| 1734-OB8 | 8 outputs, nonisolated, source | | | |
| 1734-OB8E | 8 outputs, nonisolated protected, source | | | |
| 1734-OB8S | 8 outputs, safety | 24V DC | 1734-TB, 1734-TOP | 190 mA |
| 1734-OV2E | 2 outputs, nonisolated protected, sink | 12/24V DC | 1734-TB, 1734-TBS | 75 mA |
| 1734-OV4E | 4 outputs, nonisolated protected, sink | | | |
| 1734-OV8E | 8 outputs, nonisolated protected, sink | | | |

1734 Relay Contact Output Modules

| Cat. No. | Inputs/Outputs | Voltage Range | Wiring Base | POINTBus Current @ 5V DC |
|----------|---|--|-------------------|--------------------------|
| 1734-OW2 | 2 Form A (normally open) relays | 5...28.8V DC @ 2.0 A 48V DC @ 0.5 A 125V DC @ 0.25 A 125V DC @ 2.0 A 240V AC @ 2.0 A | 1734-TB, 1734-TBS | 80 mA |
| 1734-OW4 | 4 Form A (normally open) relays | | | |
| 1734-OX2 | 2 Form C isolated (normally open; normally closed) electromechanical relays | | | 100 mA |

1734 Analog and Temperature Modules

| Cat. No. | Inputs/Outputs | Range | Resolution | Wiring Base | POINTBus Current @ 5V DC |
|-----------|--------------------------------------|--|--|-------------------|--------------------------|
| 1734-IE2C | 2 single-ended, nonisolated, current | 4...20 mA 0...20 mA | 16 bits over 0...21 mA 0.32 μ A/cnt | 1734-TB, 1734-TBS | 75 mA |
| 1734-IE2V | 2 single-ended, nonisolated, voltage | 0...10V (-0.0V under, +0.5V over) \pm 10V (-0.5V under, +0.5V over) | 15 bits plus sign 320 μ V/cnt in unipolar or bipolar mode | | |
| 1734-IE4C | 4 single-ended, nonisolated, current | 4...20 mA 0...20 mA | 16 bits - over 0...21 mA 0.32 μ A/cnt | | |

| Cat. No. | Inputs/Outputs | Range | Resolution | Wiring Base | POINTBus Current @ 5V DC |
|-----------|--|---|---|---|--------------------------|
| 1734-IE4S | 4 inputs, single-ended, safety rated | 0...20 mA, 4...20 mA ±5V, 0...5V, ±10V, 0...10V | 12 bits | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS, 1734-TOP3, 1734-TOP3S | 110 mA |
| 1734-IE8C | 8 single-ended, nonisolated, current | 4...20 mA 0...20 mA | 16 bits - over 0...21 mA 0.32 μ A/cnt | 1734-TB, 1734-TBS | 75 mA |
| 1734-IR2 | 2 single-ended, nonisolated | 0...600 Ω | 16 bits 9.5 m Ω /cnt 0.03 °C/cnt (Pt385 @ 25 °C) [0.05 °F/cnt (Pt385 @ 77 °F)] | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS | 220 mA |
| 1734-IR2E | 2 single-ended, nonisolated, protected | 0...220 Ω | 16 bits 2.4 m Ω /cnt 0.006 °C/cnt (Pt385 @ 25 °C) [0.0114 °F/cnt (Pt385 @ 77 °F)] | | |
| 1734-IT2I | 2 differential, individually isolated | Sensors B, C, E, J, K, N, R, S, T | 15 bits plus sign 2.5 μ V/cnt | 1734-TBCJC | 175 mA |
| 1734-OE2C | 2 single-ended, nonisolated, current | 4...20 mA 0...20 mA | 13 bits over 0...21 mA 2.5 μ A/cnt (average) 3...2.7 μ A/cnt (typical range) | 1734-TB, 1734-TBS, 1734-TB3, 1734-TB3S | 75 mA |
| 1734-OE2V | 2 single-ended, nonisolated, voltage | 0...10V (-0.0V under, +0.5V over) ±10V (-0.5V under, +0.5V over) | 14 bits (13 plus sign) 1.28 mV/cnt in unipolar or bipolar mode | | |
| 1734-OE4C | 4 single-ended, nonisolated, current | 4...20 mA 0...20 mA | 16 bits over 0...21 mA 0.32 μ A/cnt | | |

1734 Counter Modules

| Cat. No. | Inputs/Outputs | Range | Frequency | Wiring Base | POINTBus Current @ 5V DC |
|-------------|---|-------------|--|---|--------------------------|
| 1734-IJ | 1 - 1 group of A/Areturn, B/Breturn and Z/Zreturn | 5V DC | 1.0 MHz counter and encoder X1 500 kHz encoder X2 (no filter) 250 kHz encoder X4 (no filter) | 1734-TB, 1734-TBS, 1734-TB3, 1734-TB3S | 160 mA |
| 1734-IK | 1 - 1 group of A/Areturn, B/Breturn and Z/Zreturn | 15...24V DC | | | 160 mA |
| 1734-VHSC24 | 1 - 1 group of A/Areturn, B/Breturn and Z/Zreturn | 15...24V DC | | | 180 mA |
| 1734-VHSC5 | 1 - 1 group of A/Areturn, B/Breturn and Z/Zreturn | 5V DC | | | 180 mA |

1734 Self-configurable Modules

| Cat. No. | Inputs/Outputs | Voltage Category | Wiring Base | POINTBus Current @ 5V DC |
|-----------|---------------------|------------------|--|--------------------------|
| 1734-8CFG | 8 self configurable | 24V DC | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS | 100 mA |

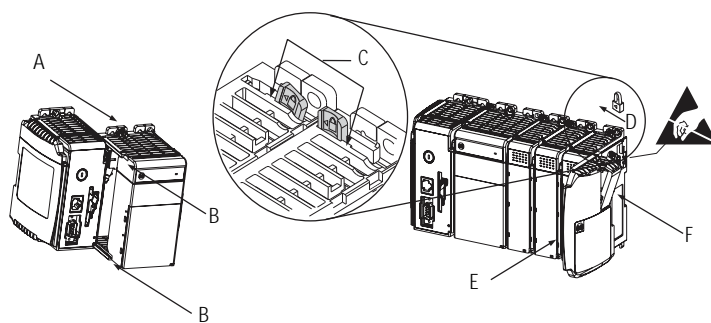
1734 Specialty I/O Modules

| Cat. No. | Description | Wiring Base | POINTBus Current |
|-------------|---|---|------------------|
| 1734-232ASC | The 1734-232ASC and 1734-485ASC serial interface modules offer a serial-link communication interface solution for peripheral products with RS-232 (only 1734-232ASC), RS-485, and RS-422 ports (only 1734-485ASC.) | 1734-TB, 1734-TBS | 75 mA |
| 1734-485ASC | | | |
| 1734-ARM | The 1734-ARM address reserve module reserves address and slot numbers to maintain a numbering scheme of an existing system. The 1734-ARM has no module configuration and does not communicate I/O data. | 1734-TB, 1734-TBS | 75 mA |
| 1734-CTM | The common terminal module (1734-CTM) and voltage terminal module (1734-VTM) expand the termination capabilities of POINT I/O modules. Install the modules to provide support for higher density (8 channel) POINT I/O modules. | 1734-TB, 1734-TBS, 1734-TOP, 1734-TOPS | 75 mA |
| 1734-VTM | | | |
| 1734-SSI | The 1734-SSI module collects serial data from absolute-position, encoding sensors that use standard Synchronous Serial Interface (SSI) protocol. | 1734-TB, 1734-TBS | 110 mA |

1769 Compact I/O Modules

The 1769 Compact I/O modules can be installed on the CompactLogix 5370 L2 and L3 controllers and 1768 CompactLogix controllers. The modules mechanically lock together by means of a tongue-and-groove design and have an integrated communication bus that is connected from module to module by a moveable bus connector.

Each I/O module includes a built-in removable terminal block with finger-safe cover for connections to I/O sensors and actuators. The terminal block is behind a door at the front of the module. I/O wiring can be routed from beneath the module to the I/O terminals.



For detailed specifications, see 1769 Compact I/O Modules Specifications Technical Data, publication [1769-TD006](#).

Power Supply Distance Ratings

Check each module's specification table for the power supply distance rating. This indicates how many slot positions the module can be from the power supply.

1769 AC Digital Modules

| Cat. No. | Inputs/Outputs | Voltage Category | Operating Voltage Range | Backplane Current | Power Supply Distance Rating |
|-----------|---------------------------------|------------------|------------------------------|-----------------------------|------------------------------|
| 1769-IA8I | 8 inputs, individually isolated | 100/120V AC | 79...132V AC, 47...63 Hz | 90 mA @ 5.1V ⁽¹⁾ | 8 |
| 1769-IA16 | 16 inputs | 100/120V AC | 79...132V AC, 47...63 Hz | 115 mA @ 5.1V | 8 |
| 1769-IM12 | 12 inputs | 200/240V AC | 159...265V AC, 47...63 Hz | 100 mA @ 5.1V | 8 |
| 1769-OA8 | 8 outputs | 100/240V AC | 85...265V AC 47...63 Hz | 145 mA @ 5.1V | 8 |
| 1769-OA16 | 16 outputs | 100/240V AC | 85...265V AC 47...63 Hz | 225 mA @ 5.1V | 8 |

(1) Maximum is 190 mA.

1769 DC Digital Modules

| Cat. No. | Inputs/Outputs | Voltage Category | Operating Voltage Range | Backplane Current | Power Supply Distance Rating |
|--------------|-----------------------|--|---|------------------------------|------------------------------|
| 1769-IG16 | 16 inputs | 5V DC TTL | 4.5...5.5V DC | 120 mA @ 5.1V | 8 |
| 1769-IQ16 | 16 inputs | 24V DC sink/source | 10...30V DC @ 30 °C (86 °F) 10...26.4V DC @ 60 °C (140 °F) | 115 mA @ 5.1V | 8 |
| 1769-IQ16F | 16 inputs, high-speed | 24V DC sink/source | 10...30V DC @ 30 °C (86 °F) 10...26.4V DC @ 60 °C (140 °F) | 100 mA @ 5.1V | 8 |
| 1769-IQ32 | 32 inputs | 24V DC sink/source | 10...30V DC @ 30 °C (86 °F) 10...26.4V DC @ 60 °C (140 °F) | 170 mA @ 5.1V | 8 |
| 1769-IQ32T | 32 inputs | 24V DC sink/source | 20.4...26.4V DC @ 60 °C (140 °F) | 170 mA @ 5.1V | 8 |
| 1769-IQ6XOW4 | 6 inputs 4 outputs | 24V DC sink/source input AC/DC normally open relay contact outputs | 10...30V DC @ 30 °C (86 °F) 10...26.4V DC @ 60 °C (140 °F) | 105 mA @ 5.1V 50 mA @ 24V | 8 |
| 1769-OB8 | 8 outputs | 24V DC source | 20.4...26.4V DC | 145 mA @ 5.1V | 8 |
| 1769-OB16 | 16 outputs | 24V DC source | 20.4...26.4V DC | 200 mA @ 5.1V | 8 |
| 1769-OB16P | 16 outputs, protected | 24V DC source | 20.4...26.4V DC | 160 mA @ 5.1V | 8 |
| 1769-OB32 | 32 outputs | 24V DC source | 20.4...26.4V DC | 300 mA @ 5.1V | 6 |
| 1769-OB32T | 32 outputs | 24V DC source | 10.2...26.4V DC | 220 mA @ 5.1V | 8 |
| 1769-OG16 | 16 outputs | 5V DC TTL | 4.5...5.5V DC | 200 mA @ 5.1V | 8 |
| 1769-OV16 | 16 outputs | 24V DC sink | 20.4...26.4V DC | 200 mA @ 5.1V | 8 |
| 1769-OV32T | 32 outputs | 24V DC sink | 10.2...26.4V DC | 300 mA @ 5.1V | 8 |

1769 Contact Output Modules

| Cat. No. | Inputs/Outputs | Operating Voltage Range | Backplane Current | Power Supply Distance Rating |
|-----------|----------------------------------|----------------------------|-------------------------------|------------------------------|
| 1769-OW8 | 8 outputs | 5...265V AC 5...125V DC | 125 mA @ 5.1V 100 mA @ 24V | 8 |
| 1769-OW8I | 8 outputs, individually isolated | 5...265V AC 5...125V DC | 125 mA @ 5.1V 100 mA @ 24V | 8 |
| 1769-OW16 | 16 outputs | 5...265V AC 5...125V DC | 205 mA @ 5.1V 180 mA @ 24V | 8 |

1769 Analog Modules

| Cat. No. | Inputs/Outputs | Range | Resolution | Backplane Current | Power Supply Distance Rating |
|----------------|---|---|---|-------------------------------|------------------------------|
| 1769-IF4 | 4 inputs, differential or single-ended | $\pm 10V$, 0...10V, 0...5V, 1...5V 0...20 mA, 4...20 mA | 14 bits (unipolar) 14 bits plus sign (bipolar) | 120 mA @ 5.1V 60 mA @ 24V | 8 |
| 1769-IF4I | 4 inputs, differential or single-ended, individually isolated | $\pm 10V$, 0...10V, 0...5V, 1...5V 0...20 mA, 4...20 mA | 16 bits (unipolar) 15 bits plus sign (bipolar) | 145 mA @ 5.1V 125 mA @ 24V | 8 |
| 1769-IF8 | 8 inputs, differential or single-ended | $\pm 10V$, 0...10V, 0...5V, 1...5V 0...20 mA, 4...20 mA | 16 bits (unipolar) 15 bits plus sign (bipolar) | 120 mA @ 5.1V 70 mA @ 24V | 8 |
| 1769-IF16C | 16 inputs, single-ended | 0...20 mA, 4...20 mA | 16 bits (unipolar) 15 bits plus sign (bipolar) | 190 mA @ 5.1V 70 mA @ 24V | 8 |
| 1769-IF16V | 16 inputs, differential | $\pm 10V$, 0...10V, 0...5V, 1...5V | 16 bits (unipolar) 15 bits plus sign (bipolar) | 190 mA @ 5.1V 70 mA @ 24V | 8 |
| 1769-IF4XOF2 | 4 differential or single-ended inputs 2 single-ended outputs | 0...10V 0...20 mA | Input: 8 bits plus sign Output: 8 bits plus sign | 120 mA @ 5.1V 160 mA @ 24V | 8 |
| 1769-IF4FXOF2F | 4 fast differential or single-ended inputs 2 fast single-ended outputs | $\pm 10V$, 0...10V, 0...5V, 1...5V 0...20 mA, 4...20 mA | Input: 14 bits (unipolar) 14 bits plus sign (bipolar) Output: 13 bits (unipolar) 13 bits plus sign (bipolar) | 220 mA @ 5.1V 120 mA @ 24V | 8 |
| 1769-OF2 | 2 outputs, single-ended | $\pm 10V$, 0...10V, 0...5V, 1...5V 0...20 mA, 4...20 mA | 14 bits (unipolar) 14 bits plus sign (bipolar) | 120 mA @ 5.1V 120 mA @ 24V | 8 |
| 1769-OF4 | 4 outputs, single-ended | $\pm 10V$, 0...10V, 0...5V, 1...5V 0...20 mA, 4...20 mA | 15 bits plus sign unipolar and bipolar | 120 mA @ 5.1V 170 mA @ 24V | 8 |
| 1769-OF4CI | 4 outputs, differential, individually isolated | 0...20 mA 4...20 mA | 16 bits (unipolar) | 140 mA @ 5.1V 145 mA @ 24V | 8 |
| 1769-OF4VI | 4 outputs, differential, individually isolated | $\pm 10V$ 0...10V 0...5V 1...5V | 15 bits plus sign (bipolar) | 145 mA @ 5.1V 75 mA @ 24V | 8 |
| 1769-OF8C | 8 outputs, single-ended | 0...20 mA 4...20 mA | 16 bits (unipolar) | 140 mA @ 5.1V 145 mA @ 24V | 8 |
| 1769-OF8V | 8 outputs, single-ended | $\pm 10V$ 0...10V 0...5V 1...5V | 16 bits plus sign (bipolar) | 145 mA @ 5.1V 125 mA @ 24V | 8 |

1769 Analog RTD and Thermocouple Modules

| Cat. No. | Inputs/Outputs | Sensors Supported | Backplane Current | Power Supply Distance Rating |
|----------|-----------------------|--|------------------------------|------------------------------|
| 1769-IR6 | 6 RTD inputs | 100, 200, 500, 1000 Ω Platinum 385 100, 200, 500, 1000 Ω Platinum 3916 120 Ω Nickel 618 120 Ω Nickel 672 10 Ω Nickel-iron 518 0...150 Ω , 0...500 Ω , 0...1000 Ω , 0...3000 Ω | 100 mA @ 5.1V 45 mA @ 24V | 8 |
| 1769-IT6 | 6 thermocouple inputs | Thermocouple types B, C, E, J, K, N, R, S, T $\pm 50V$, $\pm 100V$ | 100 mA @ 5.1V 45 mA @ 24V | 8 ⁽¹⁾ |

(1) To reduce the effects of electrical noise, install the 1769-IT6 module at least two slots away from the AC power supplies.

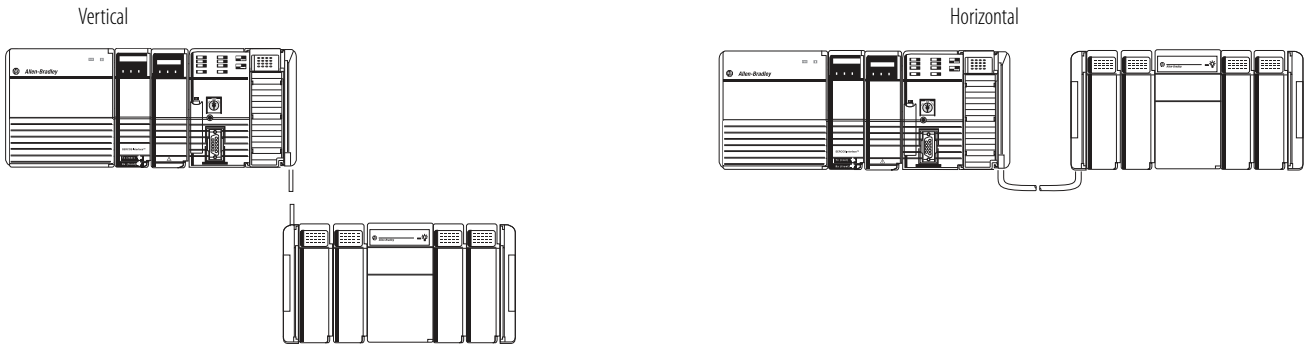
1769 Specialty I/O Modules

| Cat. No. | Description | Backplane Current | Power Supply Distance Rating |
|--------------|--|-------------------|------------------------------|
| 1769-ARM | Use a 1769-ARM address reserve module to reserve module slots. After creating an I/O configuration and user program, you can remove and replace any I/O module in the system with a 1769-ARM module once you inhibit the removed module in the Logix Designer application. | 60 mA @ 5.1V | 8 |
| 1769-ASCII | The 1769-ASCII module, a general purpose two-channel ASCII interface, provides a flexible network interface to a wide variety of RS-232, RS-485, and RS-422 ASCII devices. The module provides the communication connections to the ASCII device. | 425 mA @ 5.1V | 4 |
| 1769-BOOLEAN | Use the 1769-BOOLEAN module in applications that require repeatability, such as material handling and packaging, when there is a requirement to activate an output based on an input's transition. If the Boolean expression is true, the output is directed to the ON state. If the Boolean expression is false, the output channel is directed to the OFF state. There are four operators that you can configure as OR, AND, XOR, or none. | 220 mA @ 5.1V | 8 |
| 1769-HSC | Use the 1769-HSC when you need: <ul style="list-style-type: none"> a counter module that is capable of reacting to high-speed input signals. to generate rate and time-between-pulses (pulse interval) data. as many as two channels of quadrature or four channels of pulse/count inputs. | 245 mA @ 5.1V | 4 |
| 1769-SM1 | The Compact I/O to DPI/SCANport™ module connects to PowerFlex 7-class drives, other DPI-based host devices, and SCANport-based host devices such as 1305 and 1336 PLUS II drives. | 280 mA @ 5.1V | 6 |
| 1769-SM2 | The Compact I/O to DSI/Modbus module connects to PowerFlex 4-class drives and to other Modbus RTU slave devices, such as PowerFlex 7-class drives with 20-COMM-H RS485 HVAC adapters. | 350 mA @ 5.1V | 4 |

1769 Expansion Cables

If you divide 1769 modules into multiple banks, make sure:

- each bank needs its own power supply.
- use expansion cables to connect the banks.
- the last I/O bank requires an end cap.



How you orient I/O banks determines the expansion cables you need to connect the I/O banks.

| If you add a | And connect the chassis | Use this cable ⁽¹⁾ |
|--------------|-------------------------|-------------------------------|
| Second bank | Right to left | 1769-CRLx |
| | Right to right | 1769-CRRx |
| Third bank | Right to left | 1769-CRLx |
| | Right to right | 1769-CRRx |
| | Left to left | 1769-CLLx |

(1) Where x = 1 for 1 ft (305 mm) or 3 for 3.28 ft (1 m).

1769 End Caps

The final 1769 Compact I/O bank requires an end cap on the end without the expansion cable. The CompactLogix 5370 L2 controller comes with a right-end cap, so you do not need to order one separately.

- Right end cap, catalog number 1769-ECR
- Left end cap, catalog number 1769-ECL

1769 Wiring Systems

As an alternative to buying removable terminal blocks (RTBs) and connecting the wires yourself, you can buy a wiring system of:

- interface modules (IFMs) that provide the output terminal blocks for digital I/O modules. Use the pre-wired cables that match the I/O module to the IFM.
- analog interface modules (AIFMs) that provide the output terminal blocks for analog I/O modules. Use the pre-wired cables that match the I/O module to the AIFM.
- I/O module-ready cables. One end of the cable assembly is an RTB that plugs into the front of the I/O module. The other end has individually color-coded conductors that connect to a standard terminal block.

Removable Terminal Kits

You can order removable terminal kits with the CompactLogix 5370 L1 and L2 controllers separately. The kits are used to connect wiring to the controllers. describes the kits.

| Cat. Nos. | Controllers Supported | Description |
|---------------|--|---|
| 1769-RTB45 | CompactLogix 5370 L1 | <ul style="list-style-type: none">• Four 10-pin connectors used to connect wiring to the controllers' embedded digital I/O module.• One 5-pin connector used to connect an external 24V DC power source to the controller. |
| 1769-RTB40DIO | CompactLogix 5370 L2 | Four 10-pin connectors used to connect wiring to the controllers' embedded digital I/O module. |
| 1769-RTB40AIO | 1769-L24ER-QBFC1B and 1769-L27ERM-QBFC1B | Four 10-pin connectors used to connect wiring to the controllers' embedded analog I/O module. |

CompactLogix Power Supplies

Select power supplies based on the controller and the number of additional I/O banks.

| For a | Select |
|---------------------------------|---|
| CompactLogix 5370 L3 controller | <ul style="list-style-type: none"> One 1769 power supply for the controller and local I/O modules One 1769 power supply for each additional bank of I/O modules |
| CompactLogix 5370 L2 controller | No power supply as it is integral to the controller package |
| CompactLogix 5370 L1 controller | No power supply as it is integral to the controller package |
| 1768 CompactLogix controller | <ul style="list-style-type: none"> One 1768 power supply for the controller and 1768 modules One 1769 power supply for each additional bank of I/O modules |

Power Supplies

| Cat. No. | Description | Voltage Category | Operating Voltage Range |
|----------|---|------------------|---|
| 1769-PA2 | 1769 Compact I/O expansion power supply | 120V/220V AC | 85...265V AC |
| 1769-PB2 | | 24V DC | 19.2...31.2V DC |
| 1769-PA4 | | 120V/220V AC | 85...265V AC or 170...265V AC (switch selectable) 47...63 Hz |
| 1769-PB4 | | 24V DC | 19.2...31.2V DC |
| 1768-PA3 | 1768 CompactLogix power supply | 120V/220V AC | 85...265V AC or 108...132V DC |
| 1768-PB3 | | 24V DC | 16.8...31.2V DC |

For detailed specifications, see Compact Power Supplies Specifications Technical Data, publication [1769-TD008](#).

Programming Software

Your selection of modules and network configuration determines what software packages you need to configure and program your system.

Studio 5000 Environment

The Studio 5000™ Engineering and Design Environment combines engineering and design elements into a common environment. The first element in the Studio 5000 environment is the Logix Designer application. The Logix Designer application is the rebranding of RSLogix 5000 software and continues to be the product to program Logix5000™ controllers for discrete, process, batch, motion, safety, and drive-based solutions.



The Studio 5000 environment is the foundation for the future of Rockwell Automation® engineering design tools and capabilities. The Studio 5000 environment is the one place for design engineers to develop all of the elements of their control system.

The Studio 5000 environment does not support the following controllers.

- 1768 CompactLogix controllers
- 1769-L23x Packaged CompactLogix controllers
- 1769-L3x Modular CompactLogix controllers

You must use RSLogix 5000 software, version 20 or earlier, with the controllers listed above.

CompactLogix System Software

| If you have | You need | Order |
|--|--|--|
| CompactLogix controller | Studio 5000 Logix Designer™ application | 9324 series ⁽¹⁾ |
| 1768-M04SE SERCOS motion module | | |
| 1768-CNBR, 1768-CNBR ControlNet communication module | RSNetWorx™ for ControlNet software | 9324 series ⁽²⁾ or 9357-CNETL3 (RSNetWorx for ControlNet) |
| 1769-SDN DeviceNet communication module | RSNetWorx for DeviceNet software | 9324 series ⁽²⁾ or 9357-DNETL3 (RSNetWorx for DeviceNet) |
| 1768-ENBT, 1768-EWEB EtherNet/IP communication module EtherNet/IP ports (CompactLogix 5370 controllers) | RSLinx® software or BOOTP/DHCP server utility to set IP addresses Optional RSNetWorx for EtherNet/IP software | 9324 series ⁽²⁾ or Optional 9357-ENETL3 (RSNetWorx for EtherNet/IP) |
| Communication card in a workstation | RSLinx software | 9324 series ⁽¹⁾ |

(1) All 9324 packages include RSLinx Classic Light software.

(2) Comes with some editions of Studio 5000 environment.

Studio 5000 Logix Designer Application

To use the Logix Designer application effectively, your personal computer must meet the following hardware and software requirements.

Hardware Requirements

The personal computer must meet these minimum requirements. By using a computer meeting or exceeding the recommended characteristics, you improve performance.

| Characteristic | Minimum | Recommended |
|-----------------|----------------------|---|
| Processor | Pentium 4 | Intel Core i5 |
| Speed | 2.8 GHz | 2.4 GHz |
| RAM memory | 1 GB | 8 GB |
| Hard disk space | 16 GB free | 20 GB free |
| Graphics device | 1024x768, true color | DirectX 9, with WDDM 1.0 or higher driver |

Software Requirements

Operating system and service pack compatibility is as follows:

- This version of Logix Designer has been tested on the following operating systems:
 - Microsoft Windows 7 Professional (64-bit) with Service Pack 1
 - Microsoft Windows 7 Home Premium (64-bit) with Service Pack 1
 - Microsoft Windows 7 Home Premium (32-bit) with Service Pack 1
 - Microsoft Windows Server 2008 R2 Standard Edition with Service Pack 1
- This version of the Logix Designer application has not been tested but is expected to operate correctly on all other editions and service packs of the following operating systems:
 - Microsoft Windows 7
 - Microsoft Windows Server 2008 R2
- For operating systems that support User Account Control (UAC), this version of the Logix Designer application was tested with UAC set to the most restrictive level ("Always notify" for Windows 7). This version of the Logix Designer application is also expected to operate correctly when UAC is configured for any less restrictive setting.
- Running the Logix Designer application in conjunction with Fast-User Switching, in Safe mode, or via Remote Desktop is not supported.

Additional Software Product Considerations

Additional software compatibility is as follows:

- FactoryTalk Services Platform, version 2.51 or later, is not required to run the Logix Designer application; however, it is required to perform some security functions in the Logix Designer application.
- RSLinx Classic software communication software is not required to install the Logix Designer application; however, it is required to perform online communication with controllers.
- RSLinx Classic, version 3.51.00, is a component aligned to Logix Designer, version 21.00.00. RSLinx Classic software, version 3.51.00, (CPR9 Service Release 5.1) has been tested, and is compatible, with the following products.
 - FactoryTalk Services Platform, version 2.51.00
 - RSLinx Enterprise software, version 5.51.00
 - RSNetWorx software, version 21.00.00
 - FactoryTalk Activation Manager, version 3.51.00
- RSLinx Classic software, version 3.51.00, Logix Designer application, version 21.00.00, and device profiles that ship with the Logix Designer application, version 21.00.00, are not compatible with these products.
 - RSNetWorx software, version 11.00.00 or earlier
 - DeviceNet Tag Generator, version 11.00.20

RSNetWorx software and the DeviceNet Tag Generator must be upgraded prior to installing these products.

- FactoryTalk View SE (CPR 9) software and RSLinx Enterprise communication software are not required to install the Logix Designer application; however, these products are required to fully use the alarm capabilities introduced with version 16.03.00.
- Be sure to check the software requirements for other Rockwell Software® products that you intend to install to be sure that these products are also compatible with the system.

L3000e® Programmable Logic Controller

Developed for the Needs of the Water / Wastewater Industry

FEATURES / OPTIONS

- 1 Ghz Speed
- 512 Mbytes RAM
- 16 Gbytes Flash
- Secure Digital MMC
- 10/100Mbps Ethernet Port
- 4 USB 2.0 Ports
- 3 Serial Ports
- HDMI Video Port
- Industrial Strength
- Open Architecture
Hundreds of I/O Points
- 5/12/16/24 Card Rack Models
- Warranty
5 Years Standard
- Easily Replaceable Battery
- Temperature Rated to
185° F
- BriteLite LED Display
- Built on the QNX Real-Time Operating System (RTOS) used by NASA as well as many manufacturers in the communication and automotive industries.
- I/O rack configurations available and they are backwards compatible with our L2000 family line of controllers.
- 11,000 Lines of code per second processed (L2000 processes approximately 200 per second)
- Integrated web server for customized visualization of process data (easily disabled if not desired)
- Modbus TCP / Modbus Serial protocol support with future support for DNP3, DF1, Fieldbus, etc.
- Easily transport Program and Configuration between PLCs
- Secure - Encryption/Decryption
- Communicate reliably with serial and ethernet ports
- Conformal Coating resists humidity/ corrosion



Exhibit C

FCC Radio Station Authorization (License)



Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: RIALTO, CITY OF

RIALTO, CITY OF
150 SOUTH PALM AVENUE
RIALTO, CA 92376

| | |
|---|-----------------------------|
| Call Sign WNEY348 | |
| File Number 0004036836 | |
| Radio Service MG - Microwave Industrial/Business Pool | |
| SMSA | Station Class FXO |

FCC Registration Number (FRN): 0001527555

| | | | |
|---------------------------------|-------------------------------------|--------------------------------------|---------------------------------|
| Grant Date 11-19-2009 | Effective Date 11-19-2009 | Expiration Date 02-16-2020 | Print Date 11-19-2009 |
|---------------------------------|-------------------------------------|--------------------------------------|---------------------------------|

LOCATION

Fixed Location Address or Area of Operation:

335 S RIALTO AVE

City: RIALTO

County: SAN BERNARDINO

State: CA

| Loc No. | Location Name | Latitude | Longitude | Elevation | Antenna Structure Registration No. |
|---------|---------------|--------------|---------------|-----------|---------------------------------------|
| 001 | STATION | 35-05-54.9 N | 117-22-31.1 W | 371.9 | |

FREQUENCY PATHS

| Frequency (MHz) | Tot (%) | Emission Desig | EIRP (dBm) | Constr Date | Path No | Seg | Emit Loc No | Ant Hgt (m) | Gain (dBi) Reflector Ht(m)xWd(m) | Beam (deg) | POL | AZIM (deg) | Rec Loc No | Rec Call Sign |
|--|------------|-------------------|---------------|----------------|------------|-----|-------------------|----------------|---|---------------|------|---------------|------------------|---------------------|
| 952.48125 | 0.00015 | 12K0F2D | 41.200 | | 001 | 1 | 001 | 15.2 | 8.2 OMNI | V | OMNI | 001 | 001 | REMOTE |
| This is a multiple address system master-to-remote path. | | | | | | | | | | | | | | |
| 928.48125 | 0.00015 | 12K0F2D | 42.200 | | 002 | 1 | 001 | 6.1 | 10.0 50.0 | V | VARY | 001 | 001 | MASTER |
| This is a multiple address system remote-to-master path. | | | | | | | | | | | | | | |

Waivers/Conditions:

MULTIPLE ADDRESS SYSTEM AUTHORIZED WITH MASTER STATION ON 952.48125 AT STATED COORDINATES AND REMOTE STATIONS ON 928.48125 OPERATING WITHIN A 5 MILE RADIUS OF THE MASTER STATION

Conditions:

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

Exhibit D

Radio Survey Report



Linkture

City of Rialto

**Radio Site Survey
Report**

March 7, 2014



March 7, 2014

A site survey was conducted at the City of Rialto January 29th and March 5th & 6th, 2014. The original scope of the survey was to check signal levels to some of their licensed sites, which seem to be having communications problems, using the new SD9 licensed transceiver. We were then going to survey the sites down in Lytle Creek using the unlicensed spread spectrum radios as a tail end link back to the Highland Reservoir. However, this option proved unnecessary as we were able to get acceptable signal to these sites with the SD9 link. We surveyed a total of 16 sites; all with the SD9 licensed transceiver. This survey was necessary for the following reasons:

- The survey conducted in 2005 was done with 9790/9710 legacy radios, which have been replaced by the SD9 and are no longer available.
- Since the 2005 survey, the tree canopy has increased in height and volume because of 9 years of growth and new construction may have placed buildings in the radios paths that were not there before. These things can completely change the RF environment.
- The new SD9 radios have greater sensitivity and better RF characteristics than the radios used in the 2005 survey rendering the results of that survey virtually useless for planning purposes.

The following is an explanation of some terms used in the report:

RSSI means Received Signal Strength Indicator; the **LOWER** the number the stronger the signal, i.e. -80 is a stronger, more desirable signal than -90. This is simply how “loud” the signal is. Radios have an RSSI level at which they begin to experience data bit errors (receiver sensitivity) and thus corrupted data transmissions. This number varies depending on the manufacturer of the radio. It should be noted that these numbers are usually arrived at in a controlled “bench test” environment and are not real world. In actuality, the radio may fail at a much higher (better) signal strength instead of failing at the published number (i.e., a radio rated at -113dB, it may fail at -105dB). When evaluating RSSI levels for a radio system, we usually try to keep a 20dB “**fade margin**” between the RSSI recorded and the manufacturers advertised RSSI at which the radio begins to fail. This fade margin gives the radio some operating room if it encounters a degradation of signal while operating. This may be a result of interference, maturing vegetation or new structures being built in the path.

SNR means Signal to Noise Ratio; the **HIGHER** the number the better. This is the radio frequency “environment”, in other words, how “noisy” or how much interference is out there and how hard will it be for the radio to hear any other radio it may need to communicate with. The higher the number, the quieter the frequency band the radio is utilizing. This is very important because if the radio has such a quiet operating environment, i.e. 29, it will tolerate a lesser signal strength (-90 versus -80). We have found that typically most locations will have a SNR of 20 to 25 or higher. These numbers are critical to an Ethernet communication system but are much less critical to a serial system, especially in 5 watt licensed radios.

Polling: For this survey, we used an RTU simulator program that polls the master radio and then receives a reply back. We typically run 500 to 1,000 polls to ensure that the signal level is strong enough and no breaks in communication occur. The program records the number of polls sent, the number received, the number missed, and a percentage of good polls. The percentage of good polls should be 90 percent or better for an optimum system. We also used the SD9s built in Link Test program to verify the results obtained with the LinkWatcher program mentioned above.

1. **Main Office (Master Radio):** The existing SCADA system was shut down for the duration of the survey. An SD9 master radio was connected to their existing omni antenna.
2. **Rialto Well 1 & Cedar Res / RTU 1:** I raised the survey antenna to the existing 17' height. The RSSI was -68, SNR was 23, and polling was 100%. No additional height is required and a 10dB yagi will work fine.
3. **Rialto Well 3 / RTU 3:** I raised the survey antenna to the existing 24' height. The RSSI was -62, SNR was 23, and polling was 100%. No additional height is required and a 10dB yagi will work here as well.
4. **Rialto 7 / RTU 4:** I raised the survey antenna to the existing 15' height. RSSI was -61 and SNR was 23. Polling was 100%. Recommend a 6db yagi for this site mounted at the existing height as, with the 10db yagi, the signal is almost too strong for stable operation of the radio.
5. **Cactus Res & Rialto Well 4 / RTU 6:** I raised the survey antenna to the existing 15' height. RSSI was -63, SNR was 23, and polling was 100%. No additional height is necessary at this site. Recommend using a 10dB yagi.
6. **City 1 & 2 / RTU 7:** This is the northern most site in the Lytle Creek Wash. We decided to check this site for acceptable signal with the SD9 radio and, if successful, we would continue to test the other sites in the Creek bed with this radio. The 12db survey antenna was used at this, and all other sites in the wash. I raised the antenna to the maximum height of 47 feet and oriented the antenna for the best signal strength. The RSSI was -75 and the SNR was 24. Polling was 100%. We noticed that the current antenna was not oriented in the same direction and that could have been the problem with bad communications to this site. Technicians on site at the time reoriented the antenna to match that of our test antenna. I was asked to lower the antenna to the same height as the existing antenna. The RSSI was -88 and the SNR was 20 at 25 feet. While operable, this height does not allow for much fade margin. Recommend that the antenna height at this, and other creek bed sites, be at least 60 feet. This will give you more fade margin and increase stability of your communications. Recommend a 12dB yagi antenna for this site. It should be noted that all of the WWD sites also located in the wash have 60' towers, for a reason.

7. **Well 3 / RTU 8:** I raised the 12db antenna to the maximum height of 47 feet. The RSSI was -74 and SNR was 23. Polling was 100%. I lowered the antenna to 25' and the RSSI degraded to -93 and SNR was 19. This also affected data transfer as polling was only 65%. Because of this site's close proximity to the western edge of the wash, maximum height is going to be required, along with the higher gain antenna. We discussed the possibility of mounting the antenna atop one of the support structures for the netting used at the end of the ball field. These appear to be about 50' tall. If at all possible, I would recommend attaching a 10 foot pole to one of these polls to get as high as possible. The optimum solution would be to place a 60' tower at this site as well. Recommend using the 12dB yagi antenna at this location.
8. **City Well 4A / RTU 9:** I raised the 12dB survey antenna to a height of 47' and oriented for best signal strength. The RSSI was -78 and SNR was 22. Polling was 100%. I did notice a higher than normal fluctuation of the RSSI/SNR however. This is due to the need for additional height at this location to stabilize the signal. As I lowered the antenna, the fluctuation became much worse. Recommend a 60' tower and 12dB yagi be used at this site.
9. **Zone 4 / RTU 12:** I raised the antenna to the existing height of 26'. The RSSI was -62, SNR was 23, and polling was 100%. No additional height is required. Recommend a 10dB yagi at this location.
10. **Highland Res / RTU 15:** I raised the survey antenna to a height of 37'. The RSSI was -74, the SNR was 21, and polling was 100%. The current antenna height at this location is approximately 40' and is adequate. Recommend a 10dB yagi at the current antenna height.
11. **Easton Res / RTU 16:** I raised the survey antenna to the existing height of 25'. The RSSI was -71, SNR was 24, and polling was 100%. No additional height is required. Recommend a 10dB yagi at this location.
12. **Booster 3 / RTU 17:** This site is located adjacent to Riverside Avenue in an underground vault. Currently, the antenna is located on top of the grate covering the vault at approximately 3' AGL. I first used a low profile omni antenna to simulate current location and readings. The RSSI was -84 but would fluctuate drastically at times. This is because, at this level, the path to the master is affected by personnel walking by on the sidewalk and vehicles on the street. This is an unacceptable antenna solution for this site. I then took the 10dB yagi on a 6' pole and took readings at various points around the structure. The best location for the antenna is on the northwest corner of the structure. The RSSI was -72, SNR was 23 and polling was 100%. However, at this height, the signal is still affected by personnel and vehicles traversing the path. Recommend a 10dB yagi be mounted at a minimum of 15' at this location. Also recommend the City trim the low hanging branches of the large tree just south of the vault.

13. **Booster 1 & 2 / RTU 20:** This site was also surveyed with the 12dB yagi because of its location in the wash. The mast was raised to a height of 47 feet and oriented for best signal strength. The RSSI was -78 and SNR was 22. Polling was 100%. I was asked to take readings at the current antenna height of approximately 25 feet. The RSSI was -97, SNR was 18, and polling was unsuccessful. We were not able to pass data at this height. It appears that another agency is in the process of installing a tower at this site. A tower base was found on the street side of the wall. City personnel should explore the possibility of determining who the tower belongs to and seeing if an agreement can be reached to share tower space. Recommend a 12dB antenna at this location mounted no lower than 60 feet.
14. **Booster 6-10 / RTU 23:** When we arrived at this station, I noticed that there were 2 antennas on the short tenon on top of the pole. They were both 900MHz yagis and were oriented approximately 90 degrees from each other. However, they were right on top of one another which is unacceptable for good signal propagation. Antennas of the same frequency on the same pole, either yagi or omni, must have a 6-10 foot separation to avoid interfering with one another. Recommend finding out who the other yagi belongs to and installing an additional length of pipe to the top of the pole to achieve the required separation. We raised our test antenna to the height of the existing one (approximately 25 feet). The RSSI was -72, SNR was 23, and polling was 100. I raised the antenna to 30' to see if additional height would improve the signal. RSSI improved to -67 and SNR remained at 23. We also discussed the heavy tree canopy at this site. Recommend that the pine tree right next to the antenna pole have some of the branches trimmed that have grown right in front of the antennas path. Also recommend trimming the large deciduous tree that is approximately 75 feet away and in the antennas path. As the leaves fill out in the spring and summer the signal will start to degrade. This site will do well with the MDS 10dB yagi antenna.
15. **Chino Well 2, Booster 11 / RTU 24:** This is the closest site to the main office and has very strong signal strength. I raised the survey antenna to the existing height of 22'. With the antenna pointed in the direction of the main office, the RSSI was >-60. I had to turn the antenna 90 degrees to the path to get an acceptable reading of -67. The SNR was 23 and polling was 100%. Recommend a 6dB yagi for this location and, if necessary, an attenuator if the signal is still >-60.
16. **Well 5 / RTU 27:** This site had exceptionally strong signal. At the existing height with the antenna pointed in the proper direction, the RSSI was >-60 and the SNR was 23. I turned our test antenna 90 degrees to the correct path and still had a very good signal, -62 RSSI. Polling was 100%. Recommend a 6dB yagi antenna at this site.
17. **City Well 3A / New Site:** This is a new site that will be developed in the future. I parked the van next to the well and raised the mast to 47 feet. RSSI was -77 and SNR was 22 using the 12dB antenna. Polling was 100 percent. Recommend a 60' tower along with the 12dB antenna at this site.

Recommendations: We recommend that the current SCADA radio communication system be replaced with the GE MDS SD9-ES radio. This, along with the other recommendations of antennas and increased height at the various locations, will provide you with a highly reliable SCADA communications system that will last you well into the future. It is also highly recommended that all existing infrastructure (i.e., cables, antennas, lightning protectors, etc.) also be replaced.

Please let me know if you have any questions or concerns regarding this report.

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Exhibit E

Remote Terminal Unit I/O List

Rialto Water System SCADA Remote I/O's

| RTU # | Remote Transmission Site | Instrument | Signal Type | Purpose |
|-------|---|--|--|--|
| 1 | Rialto Well 1 and Cedar Reservoirs 1 & 2 Reservoirs Cedar Reservoir #1 Level Cedar Reservoir #2 Level Flow meter (yard) West Vally Control Building Intrusion Switch Building door RTU door Power Power Usage Rialto Well 1 Pump Pump Pump on Auto Mode Pump on Hand Mode Pump Call Pump Running Pump Failed System Waste Discharge Valve Open System Discharge Valve Open System Discharge Flow Rate Power Phase Failure Power Fail Power Usage | Pressure Xmtr Pressure Xmtr Meter Head 4-20 Magnetic Switch Magnetic Switch Relay Contact SCE Pulse Generator Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Limit Switch on arm Water Specialties Flow Meter Relay Contact Relay Contact SCE Pulse Generator | 4-20 mA Input 4-20 mA Input 4-20 mA Input* Discrete Input Discrete Input Discrete Input Pulse Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Pulse Discrete Input Discrete Input Pulse | Status Status Flow rate and Total Alarm Alarm Status/Alarm Power Usage Status Status Control Status Alarm Status Status Flow rate and Total Alarm Alarm Power Usage |
| 3 | Rialto Well #3 Well Pump Well pump in Hand Well pump in Auto Pump Call Pump Running Waste Valve Open System Valve Open Motor High Temperature Pump Failed VFD Fault Discharge Flow meter Chlorination Chlorine Pump Fail Chlorine Vallve Open Low Chlorine Tablet Chlorination Flow Intrusion Building Intrusion Switch Panel Intrusion Switch Power Phase Failure Power Fail Power Usage | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Limit Switch on piston Limit Switch on arm Temperature Switch Relay Contact Relay Contact Water Specialties Flow Meter Relay Contact Relay Contact Relay Contact Flow Switch Magnetic Switch Magnetic Switch Relay Contact Relay Contact SCE Pulse Generator | Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input | Status Status Control Status Status Status Alarm Alarm Alarm Flow rate and Total Alarm Status Alarm No flow alarm Alarm Alarm Alarm Alarm Power Usage |
| 4 | Bypass 2 (Rialto Well #7) Foothill and Cedar Monitor Zone x pressure Monitor Zone x pressure Valve Position Clay Valve control RTU door | Rialto Well 7 is no longer active. Gage Pressure Xmtr/Tap Gage Pressure Xmtr/Tap Limit Switch Relay output Magnetic | 4-20 mA 4-20 mA Discrete Input Discrete Output Discrete Input | Status Status Status Control Alarm |

Rialto Water System SCADA Remote I/O's

| RTU # | Remote Transmission Site | Instrument | Signal Type | Purpose |
|-------|---|------------------------------|-----------------|---------------------|
| 6 | Cactus Reservoir and Boosters #4 and #5 and Bypass | | | |
| | Cactus Reservoir | Pressure Xmtr | | Tank level |
| | Booster #4 | | | |
| | Well pump in Hand | Selector Switch Contact | Discrete Input | Status |
| | Well pump in Auto | Selector Switch Contact | Discrete Input | Status |
| | Pump Running | Relay Contact | Discrete Input | Status |
| | Pump Fail | Relay Contact | Discrete Input | Alarm |
| | Pump Call | Relay Contact | Discrete Output | Control |
| | Check Valve Open | Roller Arm Limit Switch | Discrete Input | Check Valve Status |
| | Flow meter | Water Specialties Prop Meter | 4-20 mA Input | Flowrate |
| | Pump System Discharge | Gage Pressure Xmtr/Tap | 4-20 mA Input | Pressure |
| | Booster #5 | | | |
| | Well pump in Hand | Selector Switch Contact | Discrete Input | Status |
| | Well pump in Auto | Selector Switch Contact | Discrete Input | Status |
| | Pump Running | Relay Contact | Discrete Input | Status |
| | Pump Fail | Relay Contact | Discrete Input | Alarm |
| | Pump Call | Relay Contact | Discrete Output | Control |
| | Check Valve Open | Roller Arm Limit Switch | Discrete Input | Check Valve Status |
| | Flow meter | Water Specialties Prop Meter | 4-20 mA Input | Flowrate |
| | Pump System Discharge | Gage Pressure Xmtr/Tap | 4-20 mA Input | Pressure |
| | Bypass Flow Meter | Differential Pressure Xmtr | 4-20 mA Input | Flowrate |
| | Power Fail | Relay Contact | Discrete Input | Alarm |
| | Power Usage | SCE Pulse Generator | Pulse Input | Power Usage |
| 7 | City Wells #1 and #2 | | | |
| | City Well Pump #1 | | | |
| | Well pump in Hand | Selector Switch Contact | Discrete Input | Status |
| | Well pump in Auto | Selector Switch Contact | Discrete Input | Status |
| | Pump Call | Relay Contact | Discrete Output | Control |
| | Pump Running | Relay Contact | Discrete Input | Status |
| | Motor High Temperature | Temperature Switch | Discrete Input | Alarm |
| | Pump Failed | Relay Contact | Discrete Input | Alarm |
| | System | | | |
| | Waste Valve Open | Limit Switch on piston | Discrete Input | Status |
| | Waste Valve Closed | Limit Switch on piston | Discrete Input | Status |
| | System Valve Open | Limit Switch on arm | Discrete Input | Status |
| | System Valve Closed | Limit Switch on arm | Discrete Input | Status |
| | Discharge Flow meter | Water Specialties Flow Meter | Pulse Input | Flow rate and Total |
| | Pump Discharge Pressure | Pressure Gage Xmtr/Tap | 4-20 mA Input | Status |
| | WellLevel | Pressure Transmitter | 4-20 mA Input | Status |
| | Chlorination | | | |
| | Chlorine Pump Fail | Relay Contact | Discrete Input | Alarm |
| | Chlorine Valve Open | Relay Contact | Discrete Input | Status |
| | Low Chlorine Tablet | Relay Contact | Discrete Input | Alarm |
| | Chlorination Flow | Flow Switch | Discrete Input | No flow alarm |
| | Intrusion | | | |
| | Building Intrusion Switch | Magnetic Switch | Discrete Input | Alarm |
| | Panel Intrusion Switch | Magnetic Switch | Discrete Input | Alarm |
| | Phase Failure | Relay Contact | Discrete Input | Alarm |
| | Power | | | |
| | Power Fail | Relay Contact | Discrete Input | Alarm |
| | Power Usage | SCE Pulse Generator | Pulse Input | Power Usage |
| | 24VDC Power Fail | Relay Contact | Discrete Input | Alarm |
| | Low Battery Alarm | Relay Contact | Discrete Input | Alarm |

Rialto Water System SCADA Remote I/O's

| RTU # | Remote Transmission Site | Instrument | Signal Type | Purpose |
|-------|---|--|---|--|
| | City Well Pump #2 Well pump in Hand Well pump in Auto Pump Call Pump Running Motor High Temperature Pump Failed System Waste Valve Open Waste Valve Closed System Valve Open System Valve Closed Discharge Flow meter Pump Discharge Pressure WellLevel Chlorination Chlorine Pump Fail Chlorine Vallve Open Low Chlorine Tablet Chlorination Flow Intrusion Building Intrusion Switch Panel Intrusion Switch Phase Failure Power Power Fail Power Usage 24VDC Power Fail Low Battery Alarm | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Temperature Switch Relay Contact Limit Switch on piston Limit Switch on piston Limit Switch on arm Limit Switch on arm Water Specialties Flow Meter Pressure Gage Xmtr/Tap Pressure Transmitter Relay Contact Relay Contact Relay Contact Flow Switch Magnetic Switch Magnetic Switch Relay Contact Relay Contact SCE Pulse Generator Relay Contact Relay Contact | Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input 4-20 mA Input 4-20 mA Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input Discrete Input Discrete Input | Status Status Control Status Alarm Alarm Status Status Status Status Status Flow rate and Total Status Status Alarm Status Alarm No flow alarm Alarm Alarm Alarm Alarm Power Usage Alarm Alarm |
| 8 | City Well #3 Pump Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Pump Waste Discharge Valve Open System Discharge Check Valve Flow meter Well Chlorination System Pump Fail Valve Fail Low Tablet Chlorination Flow Switchgear Intrusion Doors RTU door Power Power Fail Power Usage | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Limit Switch on arm Water Specialties Flow Meter Depth/Level Sensor Relay Contact Relay Contact Relay Contact Flow Switch Magnetic Door Switch Magnetic Door Switch Relay Contact SCE Pulse Generator | Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Pulse Input 4-20 mA Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input | Status Status Status Alarm Control Status Check Valve Status Flowrate Depth/level Alarm Alarm Alarm No flow alarm Intrusion Intrusion Alarm Power Usage |
| 9 | City Well #4A Pump Well pump in Hand Well pump in Auto Pump Running | Selector Switch Contact Selector Switch Contact Relay Contact | Discrete Input Discrete Input Discrete Input | Status Status Status |

Rialto Water System SCADA Remote I/O's

| RTU # | Remote Transmission Site | Instrument | Signal Type | Purpose |
|-------|--|---|---|---|
| | Pump Fail Pump Call System Pump Waste Discharge Valve Open System Discharge Check Valve Flow meter Well Depth Pump System Discharge Chlorination System Pump Fail Valve Fail Low Tablet Chlorination Flow Switchgear Intrusion Doors RTU door Power Power Fail Power Usage | Relay Contact Relay Contact Limit Switch on piston Limit Switch on arm Water Specialties Flow Meter Depth/Level Sensor Gage Pressure Xmtr/Tap Relay Contact Relay Contact Relay Contact Flow Switch Magnetic Door Switch Magnetic Door Switch Relay Contact SCE Pulse Generator | Discrete Input Discrete Output Discrete Input Discrete Input 4-20 mA Input 4-20 mA Input 4-20 mA Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input | Alarm Control Status Check Valve Status Flowrate Depth/level Pressure Alarm Alarm Alarm No flow alarm Intrusion Intrusion Alarm Power Usage |
| 15 | Highland Reservoir Reservoir Level Chlorination System Pump Fail Valve Fail Low Tablet Chlorination Flow Intrusion Building door RTU door Power Power Failure Power Usage | Milltronics Ultrasonic Sensor Relay Contact Relay Contact Relay Contact Flow Switch Magnetic Door Switch Magnetic Door Switch Relay Contact SCE Pulse Generator | 4-20 mA Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input | Power failure Alarm Alarm Alarm No flow alarm Intrusion Intrusion Alarm Power Usage |
| 16 | Easton Reservoir Reservoir Level RTU door Intrusion Power Power Usage | Pressure Xmtr Magnetic Door Switch Relay Contact SCE Pulse Generator | 4-20 mA Input Discrete Discrete Pulse | Status Intrusion Power failure Power Usage |
| 17 | Booster #3 Pump Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System System Valve Open Check Valve Open Main (Zone pressure monitoring) Flow meter Pump System Discharge Vault Flood Switchgear Intrusion Doors RTU door Power Power Fail | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Roller Arm Limit Switch Pressure Transmitter Differential Pressure Xmtr Gage Pressure Xmtr/Tap Float Switch Magnetic Door Switch Magnetic Door Switch Relay Contact | Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input 4-20 mA Input 4-20 mA Input 4-20 mA Input 4-20 mA Input Discrete Input Discrete Input Discrete Input Discrete Input | Status Status Status Alarm Control Status Check Valve Status Pressure Flowrate Pressure Alarm Intrusion Intrusion Alarm |

Rialto Water System SCADA Remote I/O's

| RTU # | Remote Transmission Site | Instrument | Signal Type | Purpose |
|-------|--|--|--|--|
| | Power Usage | SCE Pulse Generator | Pulse Input | Power Usage |
| 20 | Booster 1 & 2 Booster Pump 1 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Valve Open Check Valve Open Booster Pump 2 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Valve Open Check Valve Open Switchgear Intrusion Doors RTU door Power Fail Power Usage Pump System Discharge | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Roller Arm Limit Switch Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Roller Arm Limit Switch Magnetic Door Switch Magnetic Door Switch Relay Contact SCE Pulse Generator Gage Pressure Xmtr/Tap | Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input | Status Status Status Alarm Control Status Check Valve Status Status Status Status Alarm Control Status Check Valve Status Intrusion Intrusion Alarm Power Usage Pressure |
| 23 | Boosters #6-10 Booster Pump 6 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Valve Open Booster Pump 7 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Valve Open Booster Pump 8 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Valve Open Booster Pump 9 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Valve Open Boosters 6-9 Discharge Pressure | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Gage Pressure Xmtr/Tap | Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input | Status Status Status Alarm Control Status Status Status Status Alarm Control Status Status Status Status Alarm Control Status Pressure Status |

Rialto Water System SCADA Remote I/O's

| RTU # | Remote Transmission Site | Instrument | Signal Type | Purpose |
|-------|--|--|---|--|
| | Booster Pump 10 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Valve Open Flow Meter Discharge Pressure Intrusion Building Door RTU door Power Fail Power Usage Flow meter-shared WV | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Water Specialties Flow Meter Gage Pressure Xmtr/Tap Magnetic Door Switch Magnetic Door Switch Relay Contact SCE Pulse Generator tap exist signal @WV RTU | Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input 4-20 mA Input 4-20 mA Input Discrete Input Discrete Input Discrete Input Pulse Input 4-20 mA Input | Status Status Status Alarm Control Status Flowrate Pressure Status Alarm Alarm Alarm Power Usage Flowrate |
| 24 | Chino Well #2 and Booster #11 Chino Well #2 Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call Pump Waste Discharge Valve Open System Discharge Check Valve Flow meter Well Depth Pump System Discharge Switchgear Intrusion Doors RTU door Chlorination System Pump Fail Valve Fail Low Tablet Chlorination Flow Power Fail Power Usage | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Limit Switch on arm Water Specialties Flow Meter Pressure Transmitter Gage Pressure Xmtr/Tap Magnetic Door Switch Magnetic Door Switch Relay Contact Relay Contact Relay Contact Flow Switch Relay Contact SCE Pulse Generator | Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input 4-20 mA Input 4-20 mA Input 4-20 mA Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input Pulse Input | Status Status Status Alarm Control Status Check Valve Status Flowrate Well Water Level Pressure Intrusion Intrusion Alarm Alarm Alarm No flow alarm Alarm Power Usage |
| 27 | Rialto Well #5 Pump Well pump in Hand Well pump in Auto Pump Running Pump Fail Pump Call System Pump Waste Discharge Valve Open System Discharge Check Valve Flow meter Well Depth Pump System Discharge Intrusion Building Doors and Roof Hatch Switch gear doors RTU door Chlorination System Pump Fail Valve Fail | Selector Switch Contact Selector Switch Contact Relay Contact Relay Contact Relay Contact Limit Switch on piston Limit Switch on arm Water Specialties Flow Meter Pressure Transmitter Gage Pressure Xmtr/Tap Magnetic Door Switch Magnetic Door Switch Magnetic Door Switch Relay Contact Relay Contact | Discrete Input Discrete Input Discrete Input Discrete Input Discrete Output Discrete Input Discrete Input 4-20 mA Input 4-20 mA Input 4-20 mA Input Discrete Input Discrete Input Discrete Input Discrete Input Discrete Input | Status Status Status Alarm Control Status Check Valve Status Flowrate Well Water Level Pressure Intrusion Alarm Intrusion Alarm Intrusion Alarm Alarm Alarm |

Rialto Water System SCADA Remote I/O's

| RTU # | Remote Transmission Site | Instrument | Signal Type | Purpose |
|-------|--|--|--|---|
| | Low Tablet Chlorination Flow Power Power Fail Power Usage By-pass valve zone 2 to zone 3 clay valve Valve control Zone x side of clay valve | Relay Contact Flow Switch Relay Contact SCE Pulse Generator Solenoid Gage Pressure Xmtr/Tap | Discrete Input Discrete Input Discrete Input Pulse Input Relay Output 4-20 mA Input | Alarm No flow alarm Alarm Power Usage Control Pressure |
| ?? | Rialto Park Pressure Reducing Station Monitor Zone 2 pressure Monitor Zone 3 pressure RTU door | Gage Pressure Xmtr/Tap Gage Pressure Xmtr/Tap Magnetic | | Pressure Pressure Intrusion |
| BS | Base Station Weather Monitor Rainfall Temperature Wind | | | |

Exhibit F

Cost Opinion

Exhibit "A"

Rialto SCADA Project

Probable Cost Opinion
September 2014

| NO. | DESCRIPTION | QUANTITY | UNIT | UNIT COST | ITEM COST |
|-----|---|----------|------|-----------|-------------|
| 1 | MOBILIZATION & DEMOBILIZATION | 1 | LS | \$15,000 | \$15,000 * |
| 2 | DEMOLITION | 1 | LS | \$12,000 | \$12,000 |
| 3 | REMOTE TERMINAL UNITS | 17 | LS | \$30,000 | \$510,000 |
| 4 | MASTER STATION HARDWARE & INSTALLATION | 1 | LS | \$115,000 | \$115,000 |
| 5 | MASTER STATION SOFTWARE | 1 | LS | \$35,000 | \$35,000 |
| 6 | SCADA PROGRAMMING | 1 | LS | \$85,000 | \$85,000 |
| 7 | INSTRUMENTS | 1 | LS | \$128,000 | \$128,000 |
| 8 | MCC MODIFICATIONS | 1 | LS | \$64,000 | \$64,000 |
| 9 | CONDUITS & WIRES | 1 | LS | \$240,000 | \$240,000 |
| 10 | LABOR AND MISCELLANEOUS MATERIALS | 1 | LS | \$40,000 | \$40,000 |
| 11 | START-UP & TESTING, MANUALS, and TRAINING | 1 | LS | \$40,000 | \$40,000 |
| | | | | TOTAL | \$1,284,000 |