Andrew Ohrt, PE

Andrew Ohrt specializes in water system resilience for public and private utility clients. Over the course of Andrew's career, he has assisted water, wastewater, and stormwater clients to build all-hazards resilience. These projects include all-hazards risk and resilience assessments, cybersecurity assessments, emergency response planning, and emergency preparedness training and exercising. He is currently supporting water clients to achieve compliance with the amendments to the Safe Drinking Water Act America's Water Infrastructure Act of 2018 (AWIA 2018). He has led or supported the execution of ten J100 standard-compliant risk and resilience assessments for water and wastewater systems. He holds the J100 certification to complete risk and resilience assessments for drinking water and wastewater systems and numerous FEMA certifications.

EXPERIENCE

SCADA Master Plan, City of Garden Grove, CA: Technical Specialist. West Yost is updating the City of Garden Grove's Water Master Plan to identify and prioritize improvements that will provide adequate flows and pressure to meet peak demands and fire flow requirements, meet regulatory requirements, provide redundancy for emergencies and address its aging infrastructure. West Yost's Operations Technology Cybersecurity and Resilience (OTCR) team also conducted an evaluation to provide a practical and implementable SCADA Implementation plan. Execution of the plan will provide the City with a modernized SCADA system that is flexible, user-friendly, and both physically and cyber resilient using industry leading design practices.

SCADA Master Plan, City of Tempe, AZ: Technical Specialist. West Yost is updating the City's SCADA Master Plan that was previously implemented in 2013. The scope of this project first includes assessing of the City's current cybersecurity posture and addressing continuity of operations during pandemics by providing a secure remote access. West Yost is working with City IT staff to evaluate current remote capabilities, including human machine interface (HMI) hardware, and developing an implementation plan for improvements. West Yost is also reviewing the output of a Risk and Resilience Assessment and Emergency Response Plan, including a significant review of cybersecurity. The outcomes of this assessment will be reviewed and planned for implementation. West Yost is addressing long term needs by providing the City with a modernized SCADA system that is flexible, user-friendly, and both physically and cyber-resilient using industry leading design practices.

SCADA Program Definition, City of Sacramento, CA: Technical Specialist. West Yost provided services to the City of Sacramento Department of Utilities (Department) to define the scope and level of effort for a SCADA Improvements Program. This work included conducting a baseline assessment and developing alternatives and recommendations for obsolete control system hardware, network design, and staffing roles and responsibilities. The evaluation considered the existing SCADA communications network, control system hardware/software, and on-going projects intended to modernize and improve the system staff roles and responsibilities to

STAFF TITLE: Principal Technical Specialist I

YEARS OF EXPERIENCE: 15

PROFESSIONAL REGISTRATIONS

- Professional Environmental Engineer, Alaska No. 14322, Minnesota No. 50531, Washington No. 47854

PROFESSIONAL CERTIFICATES

- AWWA J100-10 Risk Analysis and Management for Critical Asset Protection (RAMCAP) Standard for Risk and Resilience Management of Water and Wastewater System
- FEMA IS-100.b, IS-120.a, IS-130, IS-200.B, IS-700.A, IS-800.B, IS-860.B
- Institute of Asset Management Certificate
- AWWA Utility Risk and Resilience Certificate
- INL CCE ACCELERATE Certificate

EDUCATION

- MS, Civil Engineering, University of Minnesota, Twin Cities
- BA, Physics, Gustavus Adolphus College

PROFESSIONAL AFFILIATIONS

- American Water Works Association
- National Association of Clean Water Agencies
- Water Environment Federation

support and maintain the system. The deliverable included a technical baseline assessment, and key alternatives and assumptions used to drive recommendations for system improvement. Significant input from the Department was included through all stages of the document development.

Secure SCADA Network Implementation – Fridley Campus, Minneapolis, MN: Client Service Manager. The Fridley Filter Plant was constructed in the late 1920's and the Fridley Softening Plant was constructed in 1941. This project included implementation of network upgrades and improvements at the Fridley Filter Plant, based on a previous network and security assessment completed by the same technical team. The scope of work included detailed network design, PLC programming and system implementation to upgrade the treatment plant while the system continue to treat water.

Cybersecurity Guidance and Use-Case Tool Update, American Water Works Association (AWWA), Denver, CO: Project Manager. The objective of this project is to update the existing AWWA cybersecurity guidance, the use-case tool and associated outreach materials in a manner that facilitates compliance with the intent of the cybersecurity provisions in America's Water Infrastructure Act of 2018 §2013 Community Water System Risk and Resilience, which requires all community water systems serving populations of 3,300 or more to conduct and certify completion of an assessment of the risks to, and resilience of their systems, including an emergency response plan. The new provision places emphasis on cybersecurity risks, that could impact the following: 1) Electronic, computer, or other automated systems (including the security of such systems) which are utilized by the system; 2) The financial infrastructure of the system (meaning accounting and financial business systems operated by a utility, such as customer billing and payment systems).

Pump Station Instrumentation and Controls System (ICS) Upgrade for Honolulu Board of Water Supply (BWS), City and County of Honolulu, HI: QA/QC and Technical Support as related to resilience. West Yost, as a member of the Arcadis team, is providing services for Phase 1 of the Instrumentation and Controls System Upgrade project and will develop and provide two documents that form a complete Instrumentation and Controls System Master Plan. They include an Instrumentation and Controls System Strategic Plan and Instrumentation and Controls System Upgrades Program. The Instrumentation and Controls System Strategic Plan defines how the BWS Instrumentation and Controls System will support the overall BWS Vision, Mission, Values and Strategic Goals as documented in the BWS Strategic Plan 2014-2017. The Instrumentation and Controls System Upgrades Program will guide existing and develop new capital improvement projects to meet the goals of the Instrumentation and Controls System Strategic Plan. West Yost is working closely with BWS staff to create agreement with the assumptions and criteria used, and concurrence and understanding with the findings and recommendations in the preparation of draft chapters presented for comment.

SCADA Cybersecurity Assessment, City of Albany, OR: Technical Advisor. Assessed the current cybersecurity posture of the City's SCADA system and subsequent evaluation of the system using the AWWA Cybersecurity Guidance and Use-Case Tool. The scope of work included site visits, development of as-is documentation, and prioritization of recommendations for addressing vulnerabilities. Recommendations included projects to achieve compliance with AWIA 2018.

Schofield SCADA Upgrade P1, Aqua Engineers, Wahiawa, HI: QA/QC. The project provides an assessment of the existing control system infrastructure and recommends a network detailed design, and computer hardware and software architecture to improve user functionality and system support. The project recommends controller hardware that needs upgrading based on the manufacturer's product support lifecycle. A bill of materials was developed for all recommended hardware. West Yost coordinates with the providers of existing Plant vendor systems that are not currently available on the SCADA system regarding quotes to add these packages to the SCADA system. West Yost works with Aqua Engineers to document control strategies for Plant processes (current and future conditions) for programming improvements, including a reuse water pump station. The project also evaluated and made recommendations for adding several Variable Frequency Drives (VFD) to the SCADA system. With Aqua Engineer's feedback, the project provides design and an opinion of probable cost to move forward with the improved Plant SCADA system to simplify operations and maintenance.

ADDITIONAL EXPERIENCE

Secure SCADA Network Implementation – Columbia Heights, Minneapolis Water Work, Minneapolis, MN: Client Services Manager. The Columbia Heights Membrane Plant, which opened in 2005, has a capacity of 38 MGD, with ultrafiltration membranes and equipment. This project includes design (Phase 1) and implementation (Phase 2) of network upgrades and improvements at the Columbia Heights Membrane Plant, based on a previous network and security assessment completed by the same technical team. The scope of work included detailed network design, PLC programming and system implementation to upgrade the treatment plant while the system continued to treat water. This project includes extensive design and implementation of a complete replacement of the ControlNet network currently implemented in the plant and conversion to ethernet communications.

Embedded Security and Emergency Manager, Prince William County Service Authority, VA: From August 2017 to April 2018, served as the embedded security and emergency preparedness manager for the Prince William County Service Authority (PWCSA) in the Washington, D.C. National Capitol Region. Significant components of this include: training staff in the principles of the Incident Command System, development of communications plans and guidance documents, conducting workshops, drills, and a table-top exercise to enhance PWCSA's organizational resilience to service disruption emergency events.

He was responsible for building capacity around the use of Incident Command System and the National Incident Management System. He provided training to staff at all levels of the organization on implementing Incident Command System for all types of incidents.

Andrew worked closely with the communications staff to develop an Emergency Communications Plan to supplement the Emergency Response Plan. This plan was developed to improve internal and external communications. It includes pre-scripted messages and guidance on developing meaningful and consumable messaging for initial and ongoing communications with customers, staff, and stakeholders. He worked with staff to understand current capabilities and develop additional capabilities to quickly contact customers via multiple media methods.

Additional responsibilities included:

- Evaluating technology to further improve customer communication and emergency management.
- Documenting incidents and developed lessons learned from incidents that occurred during his tenure. He led incident review meetings to evaluate root causes.
- Developed an emergency escalation plan. Integrated with the County Office of Emergency Management and work order management software.
- Revised the multiyear training and exercise plan to account for new conditions and new focus as directed by utility management.
- Reviewing capital improvement projects with a consideration for increasing resilience and maintaining the required asset levels of service during upgrades.
- Evaluated response capabilities to keep key critical infrastructure customers in operation during a water service disruption. Developed a guidance manual for key customers.

Black Sky Event Capabilities Scoping, Prince William County Service Authority, DC: Conducted black sky event scoping for PWCSA. Through this effort, applied the concepts of black sky planning including how water and wastewater services fit within the context of maintaining social order within the service area and the region. He investigated the utility's dependence on other critical infrastructure sectors. He explored the qualitative pros and cons of procuring and maintain long-term standby power generation capabilities and other relevant response and recovery capabilities. He also evaluated the industry best practice risk and resilience assessment method (J100) for applicability in the evaluation of black sky events mitigation measures. This effort coincided with Andrew participating in AWWA's Building Water Sector Resilience for Black Sky Hazards training event.

Emergency Preparedness Training and Exercising, Multiple Utilities – Washington, DC Capital Region: Coordinated emergency preparedness exercise planning and staffing for multiple water/wastewater utilities in the Washington, DC Capital Region. Exercises were conducted according to ICS, NIMS, and HSEEP. Scenarios included implementing ICS to respond to drinking water contamination, power loss during a hurricane, and loss of SCADA system operation. He also acted as a controller and evaluator during the exercises and supported after action reporting for each exercise.

Asset Management – Resilience Integration Support, Miami-Dade Water and Sewer Department, FL: Beginning in late 2017, Andrew supported the development of a holistic risk management program. His contribution focused on integrating the AWWA J100 standard risk and resilience assessment methodology and sea level rise considerations into an asset management framework. The outcome of this project was a holistic risk management framework to better inform capital and O&M investment.

Asset Management Plan Development Support, Multiple Utilities – NJ: Provided asset management plan (AMP) support to multiple water/wastewater utilities in the state of New Jersey. He was responsible for evaluating the resilience of each utilities' critical assets relative to the resilience assessment criteria presented in the New Jersey Department of Environmental Protection's Asset Management Technical Guidance (2016). This includes evaluating physical security, cybersecurity, backup power, communications and asset system resilience.

Utility System Vulnerability Assessments, Columbus Department of Public Utilities, MD: Beginning in mid-2016 Andrew began coordination and delivery of risk and resilience assessments for the Divisions of Water, Sewerage and Drainage, and Power. The risk and resilience assessments included an evaluation of source water risk, malicious adversary threats, cyber threats, natural hazard threats, dependency hazards and proximity hazards.

Utility System Vulnerability Assessments, Prince William County Services Authority Water, VA: Andrew was responsible for coordination and delivery of a risk and resilience assessment for PWCSA water/wastewater systems. The risk and resilience assessment included an evaluation of malicious adversary threats, cyber threats, natural hazard threats, dependency hazards and proximity hazards. The assessment was conducted according to the AWWA J100 standard.

Utility System Vulnerability Assessments, City of Minneapolis – Water Treatment and Distribution Services Division: Andrew led coordination and delivery of a risk and resilience assessment for the City of Minneapolis Water. The risk and resilience assessment included an evaluation of malicious adversary threats, cyber threats, natural hazard threats, dependency hazards and proximity hazards. Extensive analysis of drought and source water contamination was conducted as part of this evaluation. This was done to understand the probability of an event occurring, the vulnerability of the water supply, and the associated consequences of an event impacting the water utility and community. The assessment was conducted per the J100 standard. Additional issues under evaluation include climate change, cybersecurity, contamination threat, emergency preparedness posture and potential grant funding for mitigation and emergency preparedness projects.

Utility System Vulnerability Assessments, Charlottesville, Virginia Area Water/Wastewater Utilities: Beginning in late 2016 Andrew joined a project team as a subcontractor to conduct risk and resilience assessments for four water/wastewater utilities in the Charlottesville, Virginia area. He has leveraged his extensive knowledge of the J100 standard in support of the team to: evaluate consequences of asset loss, characterize threats, design risk mitigation measures, and to conduct risk mitigation measure benefit-cost analyses.

Water Utility Emergency Response Planning, Prince William County Services Authority Water, VA: Andrew was responsible for coordination and delivery of an emergency response plan (ERP), functional annexes and support annexes for Prince William County Services Authority water/wastewater systems. The ERP is compliant with standards including the National Incident Management System (NIMS), the National Response Framework (NRF) and the Federal Emergency Management Agency's Comprehensive Preparedness Guide 101 (CPG-101).

Water Treatment and Distribution Services Division, City of Minneapolis, MN: Andrew was the project manager for development of an emergency response plan (ERP), functional annexes and support annexes for City of Minneapolis – Water Treatment and Distribution Services Division. The ERP is compliant with standards including the National Incident Management System (NIMS), the National Response Framework (NRF) and the Federal Emergency Management Agency's Comprehensive Preparedness Guide 101 (CPG-101).

Public Utilities, City of Toledo, OH: Andrew revised the emergency response plan for a large drinking water utility in the Midwest. He developed emergency response provisions for raw water supply mains running below a hazardous waste disposal facility.

Global Security Policy Development, Confidential Industrial Client: Andrew led development of a global security policy and plan for an industrial client with over 10,000 employees globally. The plan included physical security standards for integration in the client's ISO 14001 Environmental, Health, and Safety Management System.

Multi-Hazard Mitigation Planning, City of Indianapolis/Marion County, IN: Andrew was the project manager for development of the 2018 Revised Multi-Hazard Mitigation Plan for the City of Indianapolis/Marion County, Indiana. Fifteen hazards were evaluated with a focus on flooding within the County. In addition, "cross-cutting themes" of climate change and social equity were evaluated for each hazard. A climate vulnerability assessment, focusing on several hazards including flooding were completed in 2018.

2018 AMERICA'S WATER INFRASTRUCTURE ACT RESPONSE

America's Water Infrastructure Act Risk and Resilience Assessment, Santa Clara Valley Water District (Valley Water), San Jose, CA: Technical Lead. West Yost is assisting Valley Water with their America's Water Infrastructure Act (AWIA) 2018 (S.3021) risk and resilience assessment (RRA) and emergency response plan (ERP)-compliance certification. West Yost reviewed and documented Valley Water's previously completed RRAs and ERPs to provide a thorough gap analysis. Staff interviews will be conducted to gather data for sensitive and high-security information. West Yost will make project recommendations to address compliance gaps. West Yost will complete summary reports for Valley Water to document compliance and will prepare certification letters for submittal to the Environmental Protection Agency. We will develop a compliance dashboard to provide a high-level summary for executives and critical customers.

Cyber Risk and Resilience Assessment, Fairfax Water, Fairfax, VA: Project Manager. West Yost is supporting Fairfax Water obtain America's Water Infrastructure Act (AWIA) compliance. West Yost is conducting a cyber-risk and resilience assessment (cyber-RRA) of industrial control and enterprise systems. The cyber-RRA is being conducted

according to American Water Works Association's (AWWA's) J100 methodology and AWWA's Water Sector Cybersecurity Risk Management Guidance and Tool. West Yost is also integrating the principles of Idaho National Laboratory's Cyber-Informed Engineering (CIE) and Cyber-Informed/ Consequence-Driven Engineering (CCE) into the cyber-RRA. CIE/CCE is a new methodology developed to identify engineering controls to reduce the consequences of a cyberattack. West Yost is developing cyber-risk mitigation measures that will be integrated into the physical RRA to create a seamless, comprehensive all-hazards RRA.

2018 America's Water Infrastructure Act Risk and Resilience Assessment and Emergency Response Plan Compliance Projects: Technical Lead. West Yost has assisted approximately 15 clients with their all-hazards America's Water Infrastructure Act (AWIA) 2018-compliant Risk and Resilience Assessments (RRAs) and Emergency Response Plans (ERPs). For each project, West Yost completes a thorough gap analysis after reviewing and organizing previously completed RRA- and ERP-related resources. We conduct both RRAs and ERPs according to the American Water Works Association (AWWA) standards, which represent cross-sector best practices. Each RRA considers natural, built, cyber, and personnel assets and any relevant threats and hazards. Risk and resilience management strategies are developed to address the highest risks and reduce vulnerabilities. Next, an ERP is developed. This is built on existing emergency preparedness plans and refined to align with AWIA and state requirements and industry best practices. Finally, we prepare self-certification documentation for submittal to the Environmental Protection Agency. We performed or are performing these services for the following clients.

Large Utilities (serving more than 100,000 people):

- City of Fairfield, CA
- Fontana Water Company – San Gabriel Valley Water Company, Fontana, CA
- Los Angeles County – San Gabriel Valley Water Company, El Monte, CA
- Joint Water Commission and Barney Reservoir Joint Operating Commission, OR
- Lake Oswego-Tigard Water Partnership, OR

2018 America's Water Infrastructure Act Risk and Resilience Assessment/Emergency Response Plan Compliance Gap Assessment, City of Petaluma, CA: Technical Lead. West Yost conducted a gap analysis of the City's current risk and resilience assessment and emergency response plan-related documents. West Yost provided a summary table to the City.

2018 America's Water Infrastructure Act Cyber-Risk and Resilience Assessment, Municipal Water District of Orange County, CA: Project Manager. As a subcontractor to Herndon Solutions Group, West Yost conducted cyber-risk and resilience (cyber-RRAs) for member agencies using the American Water Works Association's Cybersecurity Risk Management Tool and Guidance and elements of the Idaho National Laboratory's Cyber-Informed Engineering methodology. West Yost conducted site visits and workshops to understand how each member agency uses technology and the associated cybersecurity controls they have in place. We developed cyber-risk and resilience management strategies to support America's Water Infrastructure Act emergency response plan compliance.

CYBERSECURITY ASSESSMENTS (PRE-AMERICA'S WATER INFRASTRUCTURE ACT)

SCADA Cybersecurity Assessment, City of Galt, CA: Conducted an assessment of the current cybersecurity posture of the City's SCADA system and subsequent evaluation of the system using the AWWA Cybersecurity Guidance and Use Case Tool. The scope of work included site visits and development of as-is documentation, and prioritized recommendations for addressing vulnerabilities.

SELECTED PRESENTATIONS AND PUBLICATIONS

- Ohrt, Andrew and Dan Groves. Cybersecurity Guidance and Tool. 2019 CA-NV AWWA Section Spring Conference. March 2019.
- Ohrt, Andrew. "Warren, Et al. Learn About New Infrastructure Act Requirements, Evaluate Your Utility's Existing Emergency Plan or Outline a New One. Facilitator. Utility Management Conference. 2019."
- Gruenspecht, Zvi and Ohrt, Andrew. "Cultural Evolution in the Wake of a Water Loss Incident." Water Infrastructure Conference. 2018.
- Ohrt, Andrew and Allison Wheeler. "Using Geographic Information Systems (GIS) at Chicago's Department of Water Management to Track Hydrant Flushing and Water Quality Programs." Annual Conference of the Minnesota Section of AWWA. 2018.
- Spence, Shannon and Andrew Ohrt. "It's Not as Easy as 1-2-3 - One Utility's Pursuit of Resilience While Maintaining Exceptional Service." AWWA ACE18. 2018.
- Ohrt, Andrew. "Finding the Silver Lining of a Service Interruption Incident." Central States Water Environment Association. 2018
- Moore, Sarah and Andrew Ohrt. "Risk & Resilience Management: The Columbus DPU Way." Water Infrastructure Conference. 2017.

- Contributing Author. “Manual M68: Water Quality in Distribution Systems, Chapter 11: Security Issues.” 2016.
- Gerads, Glen and Andrew Ohrt. “Perspectives on a J100 Vulnerability Assessment - Outcomes and Lessons Learned by Minneapolis Water.” American Public Works Association. Public Works Expo. 2016.
- Ohrt, Andrew and Kevin Slaven. “Integrating Asset Management Principals to Emergency Preparedness - A Risk and Resilience-Based Management Approach to Infrastructure Assets.” AWWA ACE15. 2015.
- Ohrt, Andrew and George Kraynick. “Protecting Minneapolis’ Drinking Water – Assessing and Mitigating Upper Mississippi River Source Water Risk.” AWWA ACE15. 2015.
- Rezania, S., A. Bankston, S. Spence and A. Ohrt. “Eating the Risk Assessment Process One Bite at a Time.“ AWWA ACE14. 2015.
- Ervin, R., S. Spence and A. Ohrt. “Fostering Risk and Resilience Management Using the J100 Standard.” AWWA WIC14. 2014.

Michael Gruenbaum

Michael Gruenbaum is a control systems engineer and project manager responsible for providing project management and control systems engineering services. He has extensive experience with project management, SCADA master planning, and implementation of SCADA master plans. His expertise includes PLC programming, HMI configuration, and development of control strategies, control panels, P&IDs, and specifications for the water and wastewater sectors.

STAFF TITLE: Technical Specialist III

YEARS OF EXPERIENCE: 9

CERTIFICATIONS

- Occupational Certificate, CAD Technician, Pasadena City College, Pasadena
- Occupational Certificate, CAD Designer, Pasadena City College, Pasadena
- Occupational Certificate, Computer Aided Technical Modeler and Animator (CATMA), Pasadena City College, Pasadena

EDUCATION

- Electrical and Electronic Technology, Pasadena City College, Pasadena

EXPERIENCE

SCADA Master Plan, City of Garden Grove, CA: I&C Engineer. West Yost is updating the City of Garden Grove's Water Master Plan to identify and prioritize improvements that will provide adequate flows and pressure to meet peak demands and fire flow requirements, meet regulatory requirements, provide redundancy for emergencies and address its aging infrastructure. West Yost's Operations Technology Cybersecurity and Resilience (OTCR) team also conducted an evaluation to provide a practical and implementable SCADA Implementation plan. Execution of the plan will provide the City with a modernized SCADA system that is flexible, user-friendly, and both physically and cyber resilient using industry leading design practices. Michael led the development of the SCADA Master Plan as well as many of the client engagements. In addition, Michael led the development of the as-is control strategies by reverse-engineering the existing PLC code.

SCADA Master Plan, City of Davis, CA: I&C Engineer. The City of Davis' SCADA Master Plan's scope of work included: documenting the City's SCADA vision, goals, and objectives; conducting a baseline assessment and gap analysis; developing a detailed project portfolio and SCADA systems standards; and finally preparing a compiled SCADA Master Plan. The project portfolio included development of conceptual level cost estimates for upgrades to key facilities for input into the City's CIP plan and budget. Also included in the Master Plan was development of SCADA system support roles and responsibilities in coordination with the City IT department, standards for control system equipment, and a high-level system architecture and network design for a complete SCADA system monitoring and controlling 36 sites, including water pump stations and reservoirs, groundwater wells, stormwater pump stations, sanitary sewer lift stations, and a wastewater treatment plant. In addition to being heavily involved in Construction Management, Michael is involved in reverse-engineering as-is control strategies based on existing PLC code. Based on client input with regards to operational improvements, Michael is developing to-be control strategies. Michael is also actively involved in PLC programming using Rockwell Studio 5000 and HMI configuration using Ignition by Inductive Automation.

SCADA Master Plan, City of Tempe, AZ: Technical Specialist. West Yost is updating the City's SCADA Master Plan that was previously implemented in 2013. The scope of this project first includes assessing of the City's current cybersecurity posture and addressing continuity of operations during pandemics by providing a secure remote access. West Yost is working with City IT staff to evaluate current remote capabilities,

including human machine interface (HMI) hardware, and developing an implementation plan for improvements. West Yost is also reviewing the output of a Risk and Resilience Assessment and Emergency Response Plan, including a significant review of cybersecurity. The outcomes of this assessment will be reviewed and planned for implementation. West Yost is addressing long term needs by providing the City with a modernized SCADA system that is flexible, user-friendly, and both physically and cyber-resilient using industry leading design practices.

SCADA Program Definition, City of Sacramento, CA: Technical Specialist. West Yost provided services to the City of Sacramento Department of Utilities (Department) to define the scope and level of effort for a SCADA Improvements Program. This work included conducting a baseline assessment and developing alternatives and recommendations for obsolete control system hardware, network design, and staffing roles and responsibilities. The evaluation considered the existing SCADA communications network, control system hardware/software, and on-going projects intended to modernize and improve the system staff roles and responsibilities to support and maintain the system. The deliverable included a technical baseline assessment, and key alternatives and assumptions used to drive recommendations for system improvement. Significant input from the Department was included through all stages of the document development.

RP-5 Expansion and Solids Treatment Facility Design, IEUA, Chino Hills, CA: I&C Engineer. The detailed design phase of the $150M solids handling facilities at RP-5. Detailed design is being complemented with 3D design tools and Navisworks viewer for interactive design review workshops and presentations. The design will also integrate new IEUA design and I&C standards, tagging conventions, and SCADA standards. Michael led the I&C design on this project including development of P&IDs, control strategies, specifications, I/O list, and instrument data sheets. Michael also assisted the electrical team with marking up all electrical location plans with locations of instruments as well as with developing motor control schematics.

Blower Rehabilitation Design, City of San Jose, CA: I&C Engineer. The project involves designing three separate blower systems to feed aeration basins at the plant. Four existing engine driven blowers will be demolished. The team will replace the existing 4160V motors and gas engines with new motors (1750-4000 hp) on 10 blowers and adding medium voltage variable frequency drives to feed the motors. The design also includes specifying new 4160V switchgear and modifying existing medium voltage switchgear. New controls are included for each blower. The project also includes new electrical rooms in three buildings for the new equipment. Michael designed 10 new/retrofitted blower control panels, assisted with the development of the P&IDs, and assisted with the development of DIV 40 specifications.

J-124 Digester Gas Facilities Upgrades, Orange County Sanitation District, CA: I&C Engineer. Brown and Caldwell is modifying, rehabilitating and repairing the digester gas handling facilities at J-124 Plant 1 and Plant 2. The scope includes: replacing low pressure gas vents on all digesters; new gas compressors and dryers, and a low-pressure gas flare system to replace the existing high-pressure system with a low-pressure system; sections of the gas piping need modification to manage condensation and corrosion; building a new compressor building at Plant 2 and then rehabilitating the existing gas compressor building at Plant 1. Michael set up the P&ID project in Plant 3D 2018, developed panel and network drawings, and is the lead for the SCADA Administration Tool (SAT).

SO2 Switchgear Replacement, City of San Jose, CA: I&C Engineer. This project requires modifications to existing 4160V switchgear S40, G3 and G3A to reduce incident arc flash energy levels based on power system analysis done by the City. The modifications to this switchgear include replacement of existing protection relays with solid state type protection relays, the complete replacement of main switchgear M4 and the associated bus duct. The 2000A power breakers in this switchgear require replacement with 3000A breakers to provide added capacity for future loads. Additionally, the protection relays will be updated to the solid-state type and the entire switchgear M4 is being replaced for added reliability and to reduce incident energy arc flash levels. In addition, this switchgear is housed in a metal walk-in enclosure that will also be replaced. Michael was responsible for the entire I&C portion of the project – including ABB S800 DCS Panel design, network panel design, Modbus design, network components selection, and developing all I&C specifications.

P-079 CPEN Water Distribution Improvements, US Navy NAVFAC Atlantic, San Diego, CA: I&C Engineer. The project required Brown and Caldwell to prepare a complete set of construction documents consisting of full plans and specifications, required studies, investigations and detailed cost estimate for the project located in Camp Pendleton. The services provided includes the replacement of an existing 18-inch potable water transmission pipeline with a 24-inch pipeline, upgrade and retrofit the replacement of inadequate booster pump stations, demolish existing potable water elevated steel tank storage facility, replace adequately sized surface or subterranean potable water storage reservoir system, construct underground surface or subterranean water storage, install new and updated Supervisory Control and Data Acquisition systems, and prepare hydraulic and surge

analysis to verify the pipeline and appurtenances size and BPS pump size retrofit. Michael was responsible for designing Allen Bradley Control Logix PLC panels, designing a new 5GHZ radio system, developing specifications, as well as for drafting all P&IDs in AutoCAD P&ID 2016.

Ocean Outfall System Rehabilitation, Project No. J-117, Orange County Sanitation District, Fountain Valley and Huntington Beach, CA: I&C Engineer. To address operational issues and support future water recycling measures, this project includes inspecting and rehabilitating two reinforced concrete pipelines (84- and 120-inch diameter), evaluating the performance of two large pump stations (480 mgd and 240 mgd), and designing a new 200+mgd pump station and associated works. Upon completion, the rehabilitated ocean outfall system will be able to handle existing and future daily flows to maintain safe, reliable operations. Michael designed several Modicon M580 PLC and RIO panels, developed the SCADA Administration Tool (SAT) and drafted piping and instrumentation diagrams (P&IDs) in AutoCad P&ID 2016.

Various LOPA Projects, Phillips 66 Los Angeles Refinery, Carson/Wilmington, CA: I&C Designer/Field Tech. As part of the LOPA (Layers of Protection Analysis) program, Phillips 66 simulates several different scenarios with critical equipment failing (level transmitter failure, control valve failure, etc.) and assigns a risk criticality to the scenario. The critical scenarios are executed as projects where safeguards and redundancy are installed to mitigate the potentially catastrophic event. Michael was responsible for field verification of all instrumentation, field control panels, and junction boxes as well as design of new P&IDs, instrument installation details, and modification of DCS panels/control panels.

Boilers 4, 6, 7, 8 Upgrade, Phillips 66 Los Angeles Refinery, Wilmington, CA: I&C Designer/Field Tech. Four large boilers were in need of major retrofitting. Due to flame scanner failures, the Boilers were frequently being run in manual mode without protection from the DCS. The project was aimed at replacing all flame scanners, adding redundancy to pilot gas and fuel gas control valves, adding redundancy to field instrumentation, and installing new control panels. Michael was responsible for all predesign including initial meetings with the client, field verifications of all instrumentation, field control panels, and junction boxes as well as initial markups of new P&IDs, control panel modifications, scope development and providing the client with a Total Installed Cost (TIC) for the project.

DCS Upgrade Phase VI, Phillips 66 Los Angeles Refinery, Carson, CA: I&C Designer/Field Tech. Phillips 66 was undertaking a plantwide DCS upgrade in separate phases. Under Phase VI, the DHT-3 unit, Hydrogen unit, HDT unit, and Crude unit would all be upgraded from an old DCS system to the new Honeywell Experion DCS. The project included replacing all field instrumentation, valves/valve actuators, compressor control panels, DCS panels and all wiring to field devices, network panels, and all DCS operator workstations. Michael was responsible for field verifications of all instrumentation, field control panels, and junction boxes as well as design of new P&IDs, compressor control panels, relay panels, instrument installation details, and DCS panels.

Joel A. Cox, GICSP, CCNA, GPEN

Joel Cox is a tech specialist who provides a broad range of design and delivery of communications systems and data center infrastructure with a focus on network communications and cybersecurity.

He has served as Project Manager, Subject Matter Expert for the design and implementation of Information Technology (IT) enterprise systems and Operational Technology (OT) to support manufacturing, services and municipal water and wastewater treatment systems.

His experience includes project management, disaster recovery planning and information system security; communications network design and implementation; database design and implementation; storage design and implementation; and virtualization design and implementation.

In previous engagements, Joel led the IT team from startup to initial public offering (IPO) for a leading identity theft protection organization, which involved rigorous information security design and testing to protect personally identifiable information (PII). He worked closely with the audit and security teams to maintain International Organization for Standardization (ISO) 27001 and payment card industry (PCI) certifications. Joel has been featured in IBM SAP implementation marketing materials highlighting successful project implementations.

EXPERIENCE

SCADA AND CYBERSECURITY PROJECT EXPERIENCE

SCADA Master Plan, City of Garden Grove, CA: Technical Specialist. West Yost is updating the City of Garden Grove's Water Master Plan to identify and prioritize improvements that will provide adequate flows and pressure to meet peak demands and fire flow requirements, meet regulatory requirements, provide redundancy for emergencies and address its aging infrastructure. West Yost's Operations Technology Cybersecurity and Resilience (OTCR) team also conducted an evaluation to provide a practical and implementable SCADA Implementation plan. Execution of the plan will provide the City with a modernized SCADA system that is flexible, user-friendly, and both physically and cyber resilient using industry leading design practices.

SCADA Improvement Program, City of Buckeye, AZ: This project included an assessment of the City's current SCADA system and development of a 3-year, $3.2 million program to upgrade the system. The scope of work included a system assessment, review of previous consultants work and close coordination with City IT.

Water Integration – Critical Phase 1, City of Buckeye, AZ: Serving as Program Manager for implementation of the first critical project identified in the SCADA Improvements Program. This project involves upgrade and integration of four water wells, a reservoir, booster pump station and arsenic treatment facility. Additional as part of this project, development of key deliverables for the entire program are included, specifically a general Request for Qualifications (RFQ) for systems integrators and panel builders.

STAFF TITLE: Engineering Technical Manager I

YEARS OF EXPERIENCE: 27

EDUCATION/TRAINING/ CERTIFICATIONS

- Cisco Certified Network Associate (CCNA), Routing and Switching, Security, Cisco ID No. CSCO12375337
- GIAC GPEN (Penetration Testing)
- GIAC GICSP (Industrial Security Professional)
- SANS SEC560, Network Penetration Testing and Ethical Hacking
- SANS ICS410, ICS/SCADA Security Essentials
- Red Tiger Security, Securing ICS/ SCADA Systems
- Department of Homeland Security, 210W – Cybersecurity for Industrial Control Systems

PROFESSIONAL QUALIFICATIONS

- Virtualization: VMWare
- Storage Systems: NetApp, IBM
- Network: Cisco, F5
- Power/UPS Systems: APC Symmetra
- Operating Systems: Linux, Windows, Mac
- Open Source Tools: Nagios, Metasploit, Wireshark, etc.
- Databases: MySQL, DB2, Oracle, SQL Server
- Web servers: Apache, Tomcat, IIS, Weblogic
- Scripting: Various scripting languages

Aqua Engineers Cybersecurity Assessment, Aqua Engineers, Honolulu, HI: Project Manager and Technical Lead. Conducted an assessment of the current cybersecurity posture of the Aqua's SCADA system and subsequent evaluation of the system using the AWWA Cybersecurity Guidance Tool. The scope of work includes site visits and development of as-is documentation, and prioritized recommendations for addressing vulnerabilities.

Pump Station Instrumentation and Controls System (ICS) Upgrade for Honolulu Board of Water Supply (BWS), City and County of Honolulu, HI: Project Manager and Technical Lead for the network design and implementation elements of the project. West Yost, as a member of the Arcadis team, is providing services for Phase 1 of the instrumentation and Controls Upgrade project and will develop and provide two documents that form a complete Instrumentation and Controls System (ICS) Master Plan. They include an ICS Strategic Plan and ICS Upgrades Program. The ICS Strategic Plan defines how the BWS ICS will support the overall BWS Vision, Mission, Values and Strategic Goals as documented in the BWS Strategic Plan 2014-2017. The ICS Upgrades Program will guide existing and develop new capital improvement projects to meet the goals of the ICS Strategic Plan. West Yost is working closely with BWS staff to ensure agreement with the assumptions and criteria used and concurrence and understanding with the findings and recommendations in the preparation of draft chapters presented for comment.

SCADA Master Plan, Water Replenishment District of Southern California, Lakewood, CA: Subject Matter Expert for Communications and Cybersecurity, responsibilities included reviewing communications for existing facilities, conducting workshops with City IT to understand their vision and technology standards, identifying gaps between current environment and WRD's vision, and providing input to the Master Plan project portfolio.

Wastewater Treatment Plant Upgrade Procurement Phase, City of Davis, CA: Subject Matter Expert for Communications and Cybersecurity, responsibilities included working with client IT and SCADA staff to review integrators design and submittals. Reviewed City IT technology standards and incorporated these into the final design. Established roles and responsibilities for operational support of network and server infrastructure.

SCADA Master Plan, City of Davis, CA: Technical Lead for the network design and implementation elements of the project. The City of Davis SCADA Master Plan scope of work included documenting the SCADA Vision, Goals and Objectives, conducting a Baseline Assessment and Gap Analysis, development of a detailed Project Portfolio, SCADA Systems Standards and final development of a compiled SCADA Master Plan. The Project portfolio included development of conceptual level cost estimates for upgrades to key facilities for input into the City's Capital Improvements Plan and budget. Also included in the Master Plan was development of SCADA System Support Roles and Responsibilities, in coordination with the City IT department, standards for control system equipment as well as a high level system architecture and network design.

SCADA Network Analysis and Detailed Design, City of Davis, CA: Technical Lead for the network design and implementation elements of the project. Identified in the City's SCADA Master Plan, this project included detailed network analysis and documentation; detailed network design; development of a detailed implementation plan and penetration testing. This project addresses the Detailed Network Analysis and Documentation portion of the SCADA Master Plan Project.

SCADA Master Plan, Town of Marana, AZ: Subject Matter Expert for Communications and Cybersecurity. Responsibilities included conducting network and security assessment and documenting as-is communications design; providing recommendations for secure network convergence; and providing input to Master Plan deliverables.

SCADA Phase II Implementation, City of Goodyear, AZ: Subject Matter Expert for Communications and Cybersecurity. Responsibilities included conducting network and security assessment, leading quick-win initiatives, and providing recommendations for improved network design. Worked with local telecommunications provider to contract services and installation of infrastructure to deliver services. Coordinated and managed installation of communication services and verification of overall communications design. Leading server built leveraging virtualization (VMWare) for HMI servers.

IT-SCADA Secure Integration, City of Minneapolis, MN: Subject Matter Expert for Communications and Cybersecurity. Responsibilities included conducting network and security assessment, providing recommendations for secure network convergence, and assisting with data classification activities.

Secure SCADA Network Implementation – Fridley Campus, Minneapolis Water Works, MN: Technical Lead for the network design and implementation elements. The Fridley Filter Plant was constructed in the late 1920's and the Fridley Softening Plant on the same campus was constructed in 1941. This project included implementation of network upgrades and improvements at Fridley Filter Plant, based on a previous network and security assessment completed by the same technical team. The scope of work included detailed network design, PLC programming, and system implementation to upgrade the treatment plant while the system continue to treat water.

Secure SCADA Network Implementation – Columbia Heights, Minneapolis Water Works, MN: Technical Lead for the network design and implementation elements of the project. The Columbia Heights Membrane Plant, which opened in 2005, has a capacity of 78 MGD, with ultrafiltration membranes and equipment. This project includes design (Phase 1) and implementation (Phase 2) of network upgrades and improvements at Columbia Heights Membrane Plant, based on a previous network and security assessment completed by the same technical team. The scope of work includes detailed network design, PLC programming and system implementation to upgrade the treatment plant while the system continue to treat water. This project includes extensive design and implementation of a complete replacement of the ControlNet network currently implemented in the plant and conversion to ethernet communications.

Secure Network Design, City of Minneapolis, MN: Project Manager and Subject Matter Expert for Communications and Cybersecurity. Responsibilities included documenting the as-is network; mapping all fiber and identifying dark fiber; conducting fiber testing; documenting to-be design and getting final approval; and preparing bill of materials, configuration, implementation, and migration of SCADA devices to new network.

SCADA Master Plan, City of Tempe, AZ: Technical Specialist. West Yost is updating the City's SCADA Master Plan that was previously implemented in 2013. The scope of this project first includes assessing of the City's current cybersecurity posture and addressing continuity of operations during pandemics by providing a secure remote access. West Yost is working with City IT staff to evaluate current remote capabilities, including human machine interface (HMI) hardware, and developing an implementation plan for improvements. West Yost is also reviewing the output of a Risk and Resilience Assessment and Emergency Response Plan, including a significant review of cybersecurity. The outcomes of this assessment will be reviewed and planned for implementation. West Yost is addressing long term needs by providing the City with a modernized SCADA system that is flexible, user-friendly, and both physically and cyber-resilient using industry leading design practices. Responsibilities include conducting network and security assessment, providing recommendations for secure network convergence, and providing design and implementation services. Designed communications integration for all field sites leveraging existing City network infrastructure.

Cyber Security Assessment and Implementation Projects, Bernards Township Sewerage Authority, Liberty Corner, NJ: Project Manager. Multiple projects included conducting network and security assessment, providing recommendations for secure network convergence, network design, and providing implementation services. Vendor management for telecommunications services, including contract review, service selection, and installation.

2018 AMERICA'S WATER INFRASTRUCTURE ACT RESPONSE

Cyber Risk and Resilience Assessment, Fairfax Water, Fairfax, CA: Technical Lead. West Yost is currently supporting Fairfax Water build AWIA compliance. West Yost is conducting a cyber-risk and resilience assessment (cyber-RRA) of industrial control and enterprise systems. The cyber-RRA is being conducted according to AWWA's J100 methodology and AWWA's Water Sector Cybersecurity Risk Management Guidance and Tool. The cyber-RRA will conclude with the development of cyber-risk mitigation measures. This will allow direct integration into the physical RRA to seamlessly create an comprehensive all-hazards RRA. West Yost is also integrating the principles of Idaho National Laboratory's Cyber-Informed Engineering (CIE) and Cyber-Informed/ Consequence-Driven Engineer (CCE) into the cyber-RRA. CIE/CCE is a new methodology aimed at the identification of engineering controls to reduce the consequences of a cyberattack.

2018 America's Water Infrastructure Act Risk and Resilience Assessment/Emergency Response Plan Compliance Gap Assessment, Santa Clara Valley Water District, San Jose, CA: Technical Lead. West Yost assisted Santa Clara Valley Water District (Valley Water) with their America's Water Infrastructure Act 2018 risk and resilience assessment (RRA) and emergency response plan (ERP) compliance certification. Valley Water serves approximately 1.8 million people and includes Silicon Valley in their service area. We reviewed previously completed RRAs and ERPs to provide a thorough gap analysis. We completed staff interviews, made project recommendations, and wrote summary reports and certification letters. We evaluated Valley Water's critical chemical suppliers in a detailed chemical supply chain resilience evaluation using an abbreviated set of questionnaires based on the Supply Chain Resilience Assessment & Management program at the Ohio State University.

2018 America's Water Infrastructure Act Risk and Resilience Assessment and Emergency Response Plan Compliance Projects: Technical Lead. West Yost has assisted approximately 15 clients with their all-hazards America's Water Infrastructure Act (AWIA) 2018-compliant Risk and Resilience Assessments (RRAs) and Emergency Response Plans (ERPs). For each project, West Yost completes a thorough gap analysis after reviewing and organizing previously completed RRA- and ERP-related resources. We

conduct both RRAs and ERPs according to the American Water Works Association (AWWA) standards, which represent cross-sector best practices. Each RRA considers natural, built, cyber, and personnel assets and any relevant threats and hazards. Risk and resilience management strategies are developed to address the highest risks and reduce vulnerabilities. Next, an ERP is developed. This is built on existing emergency preparedness plans and refined to align with AWIA and state requirements and industry best practices. Finally, we prepare self-certification documentation for submittal to the Environmental Protection Agency. We performed or are performing these services for the following clients.

Large Utilities (serving more than 100,000 people):

- Fontana Water Company – San Gabriel Valley Water Company, Fontana, CA
- Lake Oswego-Tigard Water Partnership, OR
- Los Angeles County – San Gabriel Valley Water Company, El Monte, CA

Medium Utilities (serving between 50,000 and 99,999 people):

- City of Pleasanton, CA

2018 America's Water Infrastructure Act Cyber-Risk and Resilience Assessment, Municipal Water District of Orange County, CA: Project Manager. As a subcontractor to Herndon Solutions Group, West Yost conducted cyber-risk and resilience (cyber-RRAs) for member agencies using the American Water Works Association's Cybersecurity Risk Management Tool and Guidance and elements of the Idaho National Laboratory's Cyber-Informed Engineering methodology. West Yost conducted site visits and workshops to understand how each member agency uses technology and the associated cybersecurity controls they have in place. We developed cyber-risk and resilience management strategies to support America's Water Infrastructure Act emergency response plan compliance.

CYBERSECURITY ASSESSMENTS (PRE-AMERICA'S WATER INFRASTRUCTURE ACT)

SCADA Cybersecurity Assessment, City of Galt, CA: Project Manager and Technical Lead. Conducted an assessment of the current cybersecurity posture of the City's SCADA system and subsequent evaluation of the system using the AWWA Cybersecurity Guidance and Use Case Tool. The scope of work included site visits and development of as-is documentation, and prioritized recommendations for addressing vulnerabilities.

IT and SCADA Infrastructure Cybersecurity Risk and Vulnerability Assessment, Eastern Municipal Water District, Perris, CA: Project Manager responsible for providing overall project management, data collection, baseline gap analysis, penetration testing, assessment using NIST-CSF framework, and development of project portfolio based on recommendations.

WATER SECTOR LEADERSHIP, AMERICAN WATER WORKS ASSOCIATION

American Water Works Association Workshops for Cybersecurity, Denver, CO: Technical Specialist. West Yost's team is participating in the development and delivery of training workshops designed to equip water sector managers and operators with the skills needed to effectively apply the American Water Works Association's (AWWA's) cybersecurity resources. Workshop participant outcomes include identifying gaps in cybersecurity coverage as well as creating detailed, actionable steps to address those gaps to ultimately increase water systems' security and preparedness. Each workshop features interactive discussions and activities that demonstrate how to specifically apply the content of AWWA's Guidance and Use Case Tool to address utilities' needs.

AWWA Cybersecurity in the Water Sector, American Water Works Association, Denver, CO: This project designed, developed, and delivered face-to-face training workshops to equip water sector managers and operators with the skills needed to effectively apply AWWA's cybersecurity resources. Workshop participant outcomes included identifying gaps in cybersecurity coverage as well as creating detailed, actionable steps to address those gaps to ultimately increase water systems' security and preparedness. For this project, we organized existing materials (Guidance and Use Case Tool) for use in workshops. Each workshop featured interactive discussions and activities that demonstrated how to specifically apply the content to address the needs of the participants attending the workshop. The workshops included tailored content for operators and managers at small to medium-sized water utilities (serving < 10,000 population) with limited internal capacity.

Cybersecurity Guidance and Use-Case Tool Update, American Water Works Association (AWWA), Denver, CO: Technical Expert related to cybersecurity elements of the project. The objective of this project is to update the existing AWWA cybersecurity guidance, the use-case tool and associated outreach materials in a manner that facilitates compliance with the intent of the cybersecurity provisions in America's Water Infrastructure Act of 2018 §2013 Community Water System Risk and Resilience, which requires all community water systems serving populations of 3,300 or more to conduct and certify completion of an assessment

of the risks to, and resilience of their systems, including an emergency response plan. The new provision places emphasis on cybersecurity risks, that could impact the following: 1) Electronic, computer, or other automated systems (including the security of such systems) which are utilized by the system; 2) The financial infrastructure of the system (meaning accounting and financial business systems operated by a utility, such as customer billing and payment systems).

ADDITIONAL EXPERIENCE

Infrastructure Development, LifeLock, Inc., Tempe, Arizona: Held various IT technical and leadership positions over a 5+ year period. Led all infrastructure design, implementation, and operational support beginning with a couple of servers through the buildout of two data centers. Provided project management, engineering, security, and support services. Active participation in ISO 27001 and PCI audits to ensure storage and management of member PII and credit card information met industry standards. Key accomplishments included design and implementation of infrastructure for a hyper-growth environment, management of multiple projects, disaster recovery planning and initial implementation, and migration to a virtualized environment.

Infrastructure Development, Merchants' Credit Guide Company, Phoenix, AZ: Led all infrastructure design, implementation and operational support. Provided project management, engineering and support services. Key accomplishments include management of the implementation of a new call center and all associated technology, as well as stabilization of existing infrastructure.

Infrastructure Development, Hollister Incorporated, Chicago, IL: Led all infrastructure design, implementation and operational support. Provided project management, engineering and support services. Led development and BASIS teams during SAP implementation and managed SAP upgrades. Led design and implementation of a global network and shared services model. Led SAP European implementation.

PUBLICATIONS

- *Our SCADA System is Secure, Right? Top 10 Mistakes Utilities Make On Cybersecurity* – AZ Water 2016, AWWA Water Infrastructure Conference 2016, ACE 2016