Regulatory Update
Monday, March 27, 2023: 10:00AM - 11:45AM
Room: TBD
Moderator: TBD

MWEA Regulatory Update
Lacey Hirschvogel & David Carani, MWEA Governmental Affairs Committee
Abstract: Consistent with tradition for the joint conference, the presenters will overview the latest developments in water and wastewater regulations and legislation. Topics that will be covered include:
• State and federal agency staffing update (aka, the great resignation)
• Federal and state grant and loan opportunities forinfrastructure
• Lead and copper rule
• Waters of the U.S. rule
• Numeric nutrient effluent limits for POTWs
• Ambient water quality standards
• PFAS
• Federal financial capability assessment guidance
• Coming Effluent Limit Guidelines (ELGs) forindustrial wastewater
• Environmental justice
• Climate change
• Integrated planning

AWWA Regulatory Update
Tim Ganz, Missouri American Water
Abstract: The EPA has maintained an active regulatory agenda for drinking water issues over the past year like PFAS, lead, and M/DBPs. As EPA has worked to continue to advance these regulatory efforts, several new priorities have emerged. These emerging priorities include strategic source protection, cybersecurity, and supply chain resiliency. This presentation will provide an update on these issues with an emphasis on their potential impact on water systems.

Diversity, Equity & Inclusion
Monday, March 27, 2023: 10:00AM - 11:45AM
Room: TBD
Moderator: TBD

Conference Introduction
MWEA & MO-AWWA Leadership
MWEA and AWWA jointly welcome new and nearly new Conference attendees to a Conference Orientation. This session will cover the conference schedule, introduce attendees to MWEA/AWWA leadership, and will include a short networking opportunity to meet other conference attendees and MWEA/AWWA leadership. Come get up to speed to maximize your conference experience!

DE&I Panel Discussion
Saki Urushidani, City of Springfield; Charles McAlister, GBA; & Lacey Hirschvogel & Michelle Carter, HDR
Abstract: This will be a panel discussion with water professionals from different parts of the state, different professions and who identify as part of minority identity groups. Panelists will be asked to share their stories and lived experiences as a minority in the water industry.

Smart Water
Monday, March 27, 2023: 10:00AM - 11:45AM
Room: TBD
Moderator: TBD

Maximizing Collection System Return on Investment Using Intelligent Algorithms in Springfield, MO

Zach Martin, City of Springfield & Andrew Faulkner, WCS Engineering

Zach Martin is the Principal Engineer for the Environmental Services - Water Quality Management and Protection division at the City of Springfield, MO. His role as principal engineer is to lead a team of science and engineering professional teams focused on sanitary sewer collection system planning and design, GIS and data analysis, MS4 program, green infrastructure, industrial pretreatment and environmental compliance. His previous technical experience involves project management of capital improvement projects, collection system master planning, hydraulic modeling and flow meter analysis. Zach is a licensed professional engineer in Indiana and Missouri and has a Bachelor's and Master's in Civil Engineering from Missouri University of Science and Technology.

Andrew Faulkner is a water and wastewater infrastructure planning engineer with over 14 years of experience in water distribution and collection systems modeling, strategic planning, and alternatives analysis. He has worked extensively with high-profile water utilities and engineering consultants. Andy is currently based in central Queensland and leads the hydraulic modeling, product development and QA/QC at WCS. He enjoys pushing the limits of water / wastewater planning through best-practice technologies in order to deliver innovative and cost-effective solutions to customers in an ever-evolving water industry.

Abstract: INTRODUCTION: The City of Springfield, MO (City) partnered with HDR and WCS Engineering (WCS) in 2020 to evaluate, optimize, and prioritize sanitary sewer overflow (SSO) remedial alternatives for the Springfield collection system. The City of Springfield's sanitary sewer collection system and treatment facilities serve citizens of the city, adjoining county, and four satellite communities. The City's sanitary sewer system has over 1250 miles of pipe, 16 lift stations, and 2 treatment plants. In addition, the City of Springfield has spearheaded an Integrated Planning initiative for the community in conjunction with an amended consent decree. This optimization and prioritization project supports the Integrated Planning framework to deliver best "bang for the-buck" when faced with budgetary constraints, enables communities to tackle manageable pieces of a long-term plan and establishes the foundation of a Triple Bottom Line analysis that can incorporate economic, environmental, and social factors.

This presentation will provide municipalities with an example framework to prioritize capital investments using a best in practice approach to apply intelligent algorithm optimization. The case study maximizes return on investment (ROI) with respect to scheduling capital improvements to reduce the frequency and severity of sanitary sewer overflows (SSOs) as early as possible.

METHODOLOGY: The Springfield Optimization Process evaluated conveyance, storage, flow control, I/I remediation, and treatment alternatives to abate SSOs for different levels of service. To enable an exhaustive and objective evaluation of all feasible improvement alternatives, the optimization analysis was undertaken using Optimizer (product of Optimatics). The raw output from Optimizer was linked to customized post-processing tools to automatically generate ArcGIS maps and detailed solution summaries. Optimization runs were completed for a wide range of scenarios to demonstrate key trends and differences between strategies for different levels of service and with different combinations of alternatives. Additionally, a broad range of sensitivity analyses were completed to provide confidence in the recommended strategy.

The variety of scenarios optimized provides valuable insights into potential treatment and collection system improvement strategies to mitigate system capacity deficiencies. The results from each scenario help to identify key trends and illustrate solution components that are consistent in each scenario and other solution components that are sensitive to key assumptions. The City can thereby make a more informed decision in determining a preferred

solution based on the robust set of scenarios, anticipated costs and levels of service presented in the optimized solutions. The Springfield Prioritization Process was to determine the sequence of project implementation that would maximize return on investment with respect to scheduling capital improvements to reduce the frequency and severity of sanitary sewer overflows (SSOs) as early as possible.
Multi-objective optimization analysis was applied using Optimizer WCSTM to evaluate thousands of implementation schedule alternatives to determine the Pareto front of capital projects that maximize overflow reduction.
The following prioritization scenarios were completed to better understand how the project implementation schedule is affected by different SSO reduction objectives:

1. Optimized solution prioritized based on modeled SSO volume
2. Optimized solution prioritized based on modeled SSO volume and count

Prioritization based on volume-only selects projects that provide the highest return on investment based on reducing overflow volume. In this scenario, projects that significantly reduce large overflows at a single location would be prioritized before projects that eliminate many small overflows. Eliminating many small overflows may provide a greater perceived benefit to the community and, therefore, an additional scenario was included that had a balanced objective to reduce both the volume and number of SSOs.
CONCLUSION: The Springfield optimization and subsequent prioritization analysis delivered the following outcomes for the City:

1. Illustrates that over 70% of network SSOs (both volume and count) can be eliminated within the first 46% of capital expenditure in the City of Springfield prioritization case study example.
2. Supports the City's Integrated Planning Efforts to deliver best "bang for the-buck" when faced with budgetary constraints.
3. Minimizes capital and life-cycle costs required to achieve compliance.
4. Prioritizes the investment schedule to maximize the reduction in overflows at each stage of capital investment.
5. Enables the City to tackle manageable pieces of the overall solution.
6. Establishes the foundation of a Triple Bottom Line analysis that can incorporate economic, environmental, and social factors.

If Amazon Ran a Treatment Facility: The Future of Water Treatment Automation
Rob Little, Woordard & Curran
Rob Little has over 28 years of experience with the evaluation, planning, design, and construction of water works facilities. He has worked on a wide variety of projects ranging from hydraulic modeling, distribution system analysis and infrastructure planning to water treatment facility, pumping station, storage tank and water main design. He is experienced in evaluating water treatment, pumping and storage facilities and has a thorough knowledge of current and known future drinking water regulations. Rob is the Leader of Woodard & Curran's water practice and is a senior technical expert in the area of hydraulics, pumping, treatment and storage.
ABSTRACT: The value of technology in treatment facility operations and management is undeniable. Business intelligence systems, on-line sensors, and artificial intelligence (AI) are on the rise. This presentation asks attendees to imagine a drinking water facility engineered by an industry disruptor like Amazon: what would Jeff Bezos implement to maximize efficiency, profitability, and customer experience? While Many of us still think of Amazon primarily as an online retailer, it's also a big tech company. Technology informs and optimizes every element of the business. The website alone is a case study in well-honed algorithms, but what other technology makes Amazon run? Automation and artificial intelligence are major drivers of the company's profitability. While treatment facilities already dabble in automation, Amazon takes it to a different level, employing robots to improve efficiencies and safety in distribution centers and artificial intelligence to

use predictive analytics to better sell products and services to customers. In addition to treatment control, we'll discuss what other aspects of facility operation could benefit from automation and AI.Clean drinking water is our most critical service and the budgetary constraints faced by public utilities call for creativity. While we likely won't see an annual Prime membership charge on our water bills anytime soon, it's not all that different from a subscription service model. The presenter will draw comparisons between the two and explore other hypotheticals related to business structure that could have something to offer our industry. The presentation will also explore some of the bigger picture elements that Amazon engages in, outside of day-to-day business. Amazon talks big about creating a circular economy. In many ways water treatment is already a more significant contributor to that model, but what resources do we not yet capture and utilize? Amazon is known in its communities for desirable tech jobs and unique campuses that play a community role. Are there lessons learned to attract people to the industry and improve public outreach? Big tech and water are very different industries. But as we adapt to new challenges, looking to some of the world's biggest businesses for inspiration is a valuable exercise.

Potpourri
Monday, March 27, 2023: 10:00AM - 11:45AM
Room: TBD
Moderator: TBD

A Happy Marriage: Leveraging SSES and IDDE for Sewer and Drain System Management

Zach Henderson & Samantha Weidenbenner, Woodward & Curran

Zach Henderson is Woodard & Curran's stormwater compliance Practice Leader with over 20 years of experience dedicated to management of municipal stormwater and water resource programs. He focuses on planning, compliance, and stormwater asset management and works closely with municipalities on building better stormwater programs. Zach is an advocate for the clean water industry and currently sits on the National Municipal Stormwater Alliance Board of Directors.

Samantha Weidenbenner is a wastewater and stormwater engineer with 10 years of experience in planning, modeling, and design. Her experience includes sizing storage tunnels and plan preparation for the separation of combined sewer systems into sanitary and stormwater systems. Her work has also focused on construction administration, feasibility designs for funding, and Municipal Separate Storm Sewer System compliance.

ABSTRACT: Wastewater AND stormwater infrastructure nationwide are experiencing the effects of age, population growth, funding constraints, and severe weather. Municipal Sewer and Water reports that, "According to an EPA survey, about 30 percent of [sanitary sewer] pipes are 40 to 80 years old, and roughly 10 percent of pipes are more than 80 years old." These old pipes are leaking, often undersized and they are prone to clogging.

Clean Water Act (CWA) obligations are increasingly requiring municipalities to develop and implement new compliance programs and are compelling changes to interdepartmental/interagency coordination and workflow. Entities involved in sewer and drainage system evaluation and management will find that leveraging seemingly disparate NPDES obligations will result in enhanced capital planning that address both wastewater and stormwater compliance obligations.

Siloed NPDES regulatory programs and municipal management entities can drive disparate investigation and investment to meet compliance obligations and asset management needs. NPDES obligations for wastewater entities rely on Sewer System Evaluation Surveys (SSES) to identify problem

infrastructure while stormwater entities rely on Illicit Discharge Detection and Elimination (IDDE) among others. Management entities often conduct these programs separately with minimal overlap in data integration and analysis, and they may never integrate their capital investments in renewal and rehabilitation into a cost-effective capital plan that address both exfiltration (IDDE) and infiltration (SSES).

There is a better path forward. This session will discuss overlapping Clean Water Act-driven compliance program needs that can improve both stormwater and sewer system master planning. By developing an integrated strategy that incorporates an inclusive understanding of both sewer and stormwater system investigation and maintenance needs, municipalities or management entities can maximize compliance and cost-savings and utilize a “one-water” approach to help obtain the political support necessary to move improvement programs forward.

The presentation will feature a discussion of comprehensive SSES and IDDE programs in detail and utilize several cases studies where integrated wastewater and stormwater program results are allowing a more comprehensive consequence of failure analysis, better prioritization of capital investments, and targeted implementation of rehabilitation dollars. The result is a more sustainable effort that meets multiple regulatory obligations and saves money.

Inspections of Private Waste Lagoons and Embankments: Best Practices from Federal Dam and Levee Safety Programs
Charles Krolikowski, AECOM

Charles Krolikowski is a geotechnical engineer with 9 years of experience in the design and rehabilitation of dams, levees, and earthen embankments; dam drilling and grouting; dam and levee assessments and inspections; planning and implementing geotechnical investigations; slope stability and seepage analyses; settlement analyses; and trenchless construction. Mr. Krolikowski is based out of AECOM’s Omaha, Nebraska office where he has been able to work on local projects in addition to larger national and international projects.

ABSTRACT: The incident at the Piney Point wastewater containment facility in April 2021 was a near geotechnical failure. Admittedly, a handful of faults were at play beyond geotechnical reasons as to why this geotechnical failure almost occurred. However, what can be drawn from this event is the realization that many similar embankments exist throughout the US in private wastewater treatment and industrial processes. These embankments are often earthen in nature, making them ideal for adopting practices from the robust programs for dam and levee safety in federal projects across the US. The application of these programs to private embankments can be a useful way to manage risks for the project life. The use of risk analysis, annual and periodic inspections, developing an operation and maintenance manual, emergency preparedness plan and other applications have been used in the federal realm for decades and are equally applicable to the privately owned waste lagoon embankments for managing risks in the project life. These best practices and industry knowledge are summarized in the following presentation.

Utility Management
Monday, March 27, 2023: 10:00AM - 11:45AM
Room: TBD
Moderator: TBD

SRF and Progressive DB – A Perfect Combination for the City of Perryville
Dave Bunch, HDR & Brent Buerck, City of Perryville

Dave Bunch is a Senior Project Manager with over 20 years’ experience in the water and wastewater industry specializing in treatment facility design with a specific appreciation for

nutrient removal and alternate delivery projects. His education includes a bachelor's degree in civil engineering from the University of Missouri Rolla (UMR) and master's degree in engineering management from the University of Kansas (KU). He is located in HDR's St. Louis office. Hobbies includes watching the gray hair fill in with two teenage drivers.

Brent Buerck is the City Administrator of Perryville, Missouri (population of about 8,500). He has been blessed to serve his hometown in this capacity for the past 12+ years. He has a Bachelor of Science in Criminal Justice from Southeast Missouri State University and a Master of Public Administration from the University of Missouri. Brent is also an alumni of the Delta Leadership Institute and completed the Harvard Kennedy School Program: Leadership for the 21st Century.

ABSTRACT: The City of Perryville is the one of the first municipalities to construct improvements to their wastewater treatment facility under the new design-build legislation with the support of Missouri's State Revolving Fund (SRF) program. The City initiated a plan to upgrade their existing plant 1.8 mgd trickling filter facility with the primary goals of increasing capacity to address anticipated growth and improve water quality through replacement of the existing liquid process train and improvement to their solids treatment operations.

Why the SRF program and why choose design-build delivery? The City spent several years planning the project and researching a variety of funding mechanisms as well as several delivery options including fixed price design-build, progressive design-build and construction manager at risk (CMAR). The City was set on implementing a project that provided the best value, best fit technology, and offered a collaborative process to achieving the capacity and treatment needs. The combined benefits and added protections provided by both SRF and design-build delivery method met or the City's expectations.

The design build process provided several benefits to the City including 1) the ability to select their team based on qualifications in lieu of lowest price, 2) the ability to clearly understand costs and make well informed decisions/selections and 3) control costs during a period of market volatility, uncertainty, and increased equipment and material delivery times. Similarly, the SRF program offered a structure and interest rate that allowed the City to undergo such an important project. This presentation will provide an overview of the project, the road the City traveled to chose the delivery method and funding mechanism, while also highlighting the benefits, and lessons learned relative to progressive design build delivery approach and funding through the SRF program.

West Plains Wastewater, Stormwater, and Drinking Water Integrated Management Plan

Sam Anselm, City of West Plains; David Carani & Lacey Hirschvogel, HDR

Sam Anselm is the City Adminsitrator for the City of West Plains.

David Carani is HDR's regional utility management practice lead and helps communities develop effective and affordable plans that prioritize capital and operational investments across dissimilar municipal utilities and functions. He specializes in developing Clean Water Act compliance strategies and understanding the environmental, financial, and socioeconomic impacts that new regulations have on municipal systems and ratepayers. David graduated from the University of Missouri where he earned Masters degrees in both public policy and natural resources science.

Lacey Hirschvogel is a utility planning specialist at HDR. In that role, Lacey works with municipal and industrial clients to develop strategies to navigate state and federal water quality and drinking water regulations, asset management drivers, and utility planning, operations, and financing needs. Prior to working for HDR, Lacey served as the Environmental and Public Policy Manager for a large public utility membership group in Missouri. She graduated with a Bachelor of Science degree in Chemistry from the University of Florida and a Master of Public Affairs degree at the University of Missouri.

ABSTRACT: The City of West Plains, Missouri (City) is currently facing significant infrastructure challenges that will impact planning decisions and drive investments over the next several decades. The need for these infrastructure investments is caused by a variety of issues including aging and failing infrastructure assets, regulatory compliance, and meeting capacity needs for economic development. In January 2021, the City discussed the impact of implementing these major projects with the West Plains City Council (Council) and found that combined drinking water and wastewater user rates would need to increase by 150% in the first six years, which would cause undue financial burdens for customers.

The City's situation is not unique, as aging infrastructure, increasingly complex water quality issues, and challenging economic conditions have strained municipal utility management and impacted community affordability across the country. In 2011, the US Environmental Protection Agency (EPA) recognized that when afforded the opportunity to use regulatory flexibilities to balance wastewater and stormwater improvements, municipalities can appropriately prioritize and schedule work that is affordable, aligns with community priorities, and meets regulatory obligations. The Missouri Department of Natural Resources (MDNR) also understands the value of integrated planning and supports municipality efforts to develop implementation schedules that align with community priorities and affordability.

In 2012, EPA released the Integrated Municipal Stormwater and Wastewater Planning Approach Framework (Framework), which outlined the guiding principles and elements that municipalities should follow if they wish to pursue this integrated planning approach. In January 2021, EPA acknowledged that the cost of drinking water system improvements also impacts ratepayers and should be considered in long-term infrastructure planning efforts.

In 2021, the City was awarded an MDNR technical assistance grant through the Missouri Public Utility Alliance (MPUA) Resource Services Corporation to develop an Integrated Management Plan (IMP) that aligns with EPA's 2012 Framework. This presentation will summarize results from the City's planning efforts. Specifically, it will outline how the City identified affordable wastewater, drinking water, and stormwater system improvements and implementation schedules that address the City's known infrastructure challenges, improve water quality, and provide regulatory certainty over the next 30 years.

Wet Weather
Monday, March 27, 2023: 10:00AM - 11:45AM
Room: TBD
Moderator: TBD

Gravois Trunk Sanitary Storage Facility – A Wet-Weather Storage Solution to Eliminate Constructed Sanitary Sewer Overflow (SSO) Outfalls

Curt Kimmell, Burns & McDonnell; Steven Roberts, St. Louis MSD; John Weiland, Wade Trim, Inc.

Curt Kimmel, P.E. is a Professional Engineer with 18+ years of experience in hydrology and hydraulics, stormwater and sanitary sewer planning and design, and site development. He currently serves as an Associate Civil Engineer and Project Manager for the Systems Group of Burns & McDonnell's Upper Midwest Water Global Practice. Curt has served as the Project Manager for multiple projects included in the Metropolitan St. Louis Sewer District's (MSD's) Lemay Sanitary System Improvements program, including multiple wet-weather sanitary storage facilities and numerous sanitary relief sewers. Curt holds a BS in Civil Engineering from the Missouri University of Science and Technology (formerly University of Missouri-Rolla) and is a registered Professional Engineer in Missouri.

Steven Roberts, P.E. is a project manager at the Metropolitan St Louis Sewer District (MSD).

Steve has been with MSD for 14 years and oversaw the implementation of sewer infrastructure projects in the Lemay Watershed as part of MSD's "Project Clear" initiative. Steve began his career in the consulting industry in the mid-Michigan area. He has a BS Degree in Engineering from Michigan State University and is a registered professional engineer in the State of Missouri and Michigan. Steve moved to St Louis in 2008 and resides in Eureka, Missouri. Steve is married and has 4 children. Steve enjoys spending time with his family, camping, Michigan State football/basketball, exercise, building household projects, and gardening. He is also active in his church and is a former United States Marine, serving in the infantry during the Desert Storm conflict.

John Weiland, P.E. is a Senior Project Manager and water resources engineer with Wade Trim, Inc. John has over 25 years of experience in designing collection system improvements to rehabilitate aging infrastructure, address capacity limitations, and manage wet-weather overflows. His work includes projects for major sewer districts throughout the Midwest. John is Past-President of the American Society of Civil Engineers – St. Louis Section, President-Elect of the Engineers' Club of St. Louis, Member Services Executive Committee representative for the Environmental and Water Resources Institute (EWRI) of ASCE, and is an active member of WEF and the Missouri and Nebraska Water Environment Associations. He has a BS and MS in Civil Engineering from the Missouri University of Science and Technology.

ABSTRACT: In August 2014, the Metropolitan St. Louis Sewer District (MSD) finalized a Sanitary Sewer Overflow (SSO) Control Master Plan as part of its Consent Decree with the United States Environmental Protection Agency (EPA) and the Missouri Coalition for the Environment. The original approach in the SSO Control Master Plan to eliminate two (2) of the eighteen (18) Constructed SSO Outfalls in the Gravois Creek Watershed – BP-588 and BP-599 – was construction of the Gravois Trunk Sanitary Relief Sewer in nine (9) phases totaling approximately 48,000 LF. Later in 2014, it was determined that construction of a majority of the phases was unfeasible because of several factors, including difficulty in obtaining easement rights for the proposed relief sewer. MSD and Burns & McDonnell then implemented a fast-paced re-evaluation of the original plan that resulted in a solution to eliminate the two (2) Constructed SSO Outfalls without a relief sewer: a wet-weather sanitary storage facility.

The overarching function of a wet-weather sanitary storage facility is to control the amount of wet-weather sanitary flow that is conveyed to the downstream sanitary system by implementing storage. Controlling the amount of wet-weather sanitary flow, in turn, allows the Constructed SSO Outfalls to be eliminated by alleviating surcharged conditions in the downstream sanitary system. Design of the Gravois Trunk Sanitary Storage Facility began in September 2015 and concluded in September 2018, and the design process included both a Pre-Design Phase and a Detailed Design Phase. Design of this wet-weather sanitary storage facility included the obvious technical aspects to ensure that it functions as intended (hydraulic modeling, structural design, pump/pipe sizing, site-civil layout, electrical, instrumentation/control, etc.). In addition to these technical design tasks, successful design of the facility also required considerations for available land, public engagement, floodplain impacts, permitting agencies, governmental jurisdictions, and funding sources.

As designed, the Gravois Trunk Sanitary Storage Facility includes two (2) 4.0-million gallon storage tanks, a wet-weather pump station, service water cistern, diversion structure, control building, odor control system, consolidation sewers, and related appurtenances. The completed design and construction of the facility have met the milestone dates for removal of BP-588 and BP-599 established in MSD's SSO Control Master Plan. Additionally, the cost of the facility and other related projects ended up being comparable to the budgetary numbers established in the SSO Control Master Plan. This project is a great representation of how alternative ideals and diligent design can lead to a successful project that accomplishes given

goals within a Client's schedule and budget constraints.

Trolley Trail Basin - Expect the Unexpected

Colleen Connor & Timothy Schneller, GBA

Colleen Connor is a graduate of Iowa State University and has 18 years of water and wastewater industry experience. She has worked on a variety of wastewater and water projects, including master plans, new sewer design, sewer separation, pump stations, treatment plant upgrades, and studies. Colleen has undertaken many roles at GBA ranging from staff engineer to project manager and has helped lead the team on GBA's innovative mapping efforts. Recently she has served as Project Manager for two of KCMO's CSO projects.

Tim Schneller is a Director of Engineering Services with over 36 years of experience. Throughout his career as an engineer and project manager, Tim has successfully directed numerous studies, master plans, design and construction period services for a wide variety of wastewater projects including major interceptor sewers, pumping stations and force mains, and industrial pretreatment and municipal wastewater treatment plants.

ABSTRACT: The Kansas City, Missouri Trolley Trail Storage Basin Project is a successful example of consultants working together with City departments to benefit the community. GBA developed a unique project that improves water quality and provides community enhancements to a neighborhood park for the City of Kansas City, Missouri. To relieve overflow and capacity issues in the Blue River Interceptor Sewer (BRIS), GBA designed a 3MG clay-lined earthen storage basin with accompanying gravity sewers, automated control and gate system, and radio signalization. The project is in Kansas City's South Oak Park. As part of the project, the GBA team worked with the City Water Department and Parks Department to develop a new trail system connecting the park to the Trolley Track Trail, along with trail improvements in the park. The project also benefited the community by removing and disposing of >51,000 tons of unregulated landfill material at the site.

As part of KCMO's Consent Decree, improvements were required at Diversion Structure 068/ Outfall 058 to reduce overflow volumes to no more than 0.32MG annually, and no more than seven overflow events in a year. The project was initially envisioned as a 9,400-linear foot relief sanitary sewer from the combined sewer structure at South Oak Park downstream to the BRIS. The originally-proposed alignment alternatives paralleled the existing sewer, but was fraught with constructability issues. Challenges encountered through the original alignments included a deteriorating parallel storm system, work adjacent to a stream including crossings and exposed manholes, traversing a major electrical transmission system, an abandoned mine, private property crossings, railroad right-of-way, and navigating a popular trail. Furthermore, hydraulic evaluations of the proposed relief sewer alternatives indicated continued surcharging of the system with improvements in place.

The design team evaluated nine different alternatives: parallel relief sewer, a replacement sewer, relocation of the diversion structure with sewer separation, as well as aboveground and underground storage upstream of the BRIS. Storage options considered included prestressed concrete tank, concrete basin, and earthen clay-lined basin. After evaluation of costs and challenges associated with the relief sewer alignment, it was determined that storage upstream of the BRIS would provide hydraulic benefits while being a more cost-effective and less disruptive solution.

During the design phase of the project, an unregulated landfill was discovered at the site of the proposed storage basin. The design team then further evaluated additional storage site locations, costs, and analysis of landfill materials. The team worked together with City officials from multiple departments, evaluating landfill costs and concerns, floodplain issues, park considerations, and trail considerations. The City was then able to make an informed decision to maintain the project in the

originally-proposed site and remove the landfill material simultaneously with the sewer project. Design of the storage basin and associated sewer system included several public meetings and coordination with stakeholders including the City's Office of Environmental Quality, Parks Department, Industrial Discharge Department, and the Missouri Department of Natural Resources. The design team worked closely with KC Water's Facilities Department to consider maintenance issues such as mowing and trash in the basin, as well as control of the gate system and signalization to the City's Blue River WWTP.

Design began in 2014; the project bid in 2019; construction was completed in 2021 and the basin has been operational since. Construction presented additional challenges due to the site constraints, requiring that the park remain open throughout construction and that a vegetated buffer remain adjacent to the stream and park. The design and construction team worked together to overcome challenges during construction including difficulty in finding appropriate soils, landfill disposal, rock, and concrete issues.

Construction of the storage basin upstream of the overloaded BRIS enables the storm peak to pass in the BRIS while holding the peak from the combined sewer basin upstream. The updated system, including the earthen storage basin, sensors, gates, and controls, allows the City to store combined sewer flows for up to 24 hours to reduce impacts on the BRIS. Additionally, the citizens nearby have been able to enjoy the parks improvements and new trail connecting to the Trolley Trail Basin.

This project exemplifies many City and private entities working together to solve a problem. The Trolley Trail Basin Project meets the City's consent decree requirements and has the added benefits of removing unregulated landfill waste and providing additional community benefits in South Oak Park.

GBA will discuss the ups and downs, ins and outs of the design and construction process bringing this unique project to fruition for the City of Kansas City, Missouri.

Fats, Oils & Grease
Monday, March 27, 2023: 10:00AM - 11:45AM
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Moderator: TBD

FOG Management Programs: A National Survey

Katie Bruegge, KimHEC

Katie Bruegge graduated from Bradley University in Peoria, IL with a BS in Environmental Science - Biology in 2012. After graduation, she worked in natural resource conservation and monitoring until she moved to Missouri. Katie joined the wastewater workforce in 2017 when she started working for the City of St. Joseph Water Protection Division. In her various roles with Water Protection, Katie was responsible for the Industrial Pretreatment Program, Water Protection Facility laboratory, MS4 compliance team, FOG program, and the City's developing biosolids fertilizer program. Currently, Katie is the Environmental Program Manager at KimHEC in St. Louis where she has the privilege of helping clients meet their pretreatment and other compliance requirements. She holds an A level Wastewater Operator Certification, D level Laboratory Analyst Certification, is a Core Emerging Leader Training (formerly Core Growth) alum, and is a proud recipient of the Crystal Crucible Award.

ABSTRACT: Fats, Oils, and Grease (FOG) can create headaches for collection systems when allowed to accumulate in the sanitary sewer. FOG Management Programs are a way to reduce the amount of FOG entering the sewer system by regulating the Food Service Establishments (FSEs) in a community. Almost 20 years ago (2004), the Environmental Protection Agency (EPA) submitted a report to Congress stating that 47% of Combined Sewer Overflows (CSOs) and Sanitary Sewer

Overflows (SSOs) are caused by “grease from restaurants, homes, and industrial sources.” Since then, many communities have implemented FOG Management Programs. However, there can be many differences between programs.

In 2022, KimHEC conducted a nationwide survey to gather information about how cities are implementing their Fats, Oils, and Grease (FOG) Management Programs. This presentation will summarize the results of the survey, highlighting what respondents identified as key aspects of their programs.

Example survey questions that will be discussed during this presentation include, but are not limited to:

- How does your FOG Management Program track compliance?
- How is the FOG Management Program funded?
- Have you been able to quantify cost savings from your FOG Management Program?
- What works about your FOG Management Program?
- What doesn’t work about your FOG Management Program?
- What were your biggest issues initiating a FOG Management Program?
- What type of facilities are regulated in your FOG Management Program?

Initiating a FOG Program: From Concept to Inspections

Jacob Schwoerer & Jeff Twehus, City of Jefferson

Jacob Schwoerer (Sh-where), a native to Northeast Wisconsin, is employed by the City of Jefferson City as the Laboratory and Pretreatment Supervisor. He received his Bachelor of Science degree from the University of Wisconsin-Stevens Point in Water Resources with minors in both Soil Science and Wetland Science. In addition, he received his Master of Science degree from Mizzou in Natural Resource Management. He holds a Class “A” Wastewater Operators license. In his free time, Jacob enjoys spending time with his wife and two daughters, hunting, fishing and rock climbing.

Jeff Twehus (Twe-house), is employed by the City of Jefferson City as the Wastewater Environmental Scientist. Jeff has been involved in the startup and implementation of the City’s Fats, Oils, and Grease program. He has been an employee of the City for 20 years and has worked at both Wastewater Collections and the Wastewater Plant which has allowed him to excel as the FOG inspector. He currently holds a Class “C” Wastewater Operators license. In his free time, Jeff enjoys spending time in the outdoors hunting, fishing, and farming.

ABSTRACT: Hardened fats, oils, and grease (FOG) deposits in sewer lines play a major role in role in creating line blockages and sanitary sewer overflows (SSO’s). Historically, these problems were fixed by simply cleaning out the sewer lines at regular intervals as to keep them clear of FOG. More recently, many municipalities have implemented FOG programs aimed at holding food service establishments (FSE’s) accountable for proper installation and cleanouts of their grease traps and interceptors (GT/GI). This presentation will be broken into two parts. The first half of presentation will aim to provide a case study for the City of Jefferson City’s FOG program startup, how collaborating with other departments within the City is vital to starting a successful program, why making City Code changes will likely be necessary and how we developed an in-house software using GIS in order to complete and track inspections. The second half of the presentation will be aimed at what a typical FOG inspection looks like, the necessary tools used to complete inspections, how and who we collaborate with inside and outside of the City now that the program has begun and lessons learned after the first year of implementation.

Data Management
Monday, March 27, 2023: 2:00PM - 5:05PM

Room: TBD
Moderator: TBD

The Goldilocks Question: Finding the Right Asset Management Software

Samantha Weidenbenner & Scott Medeiros, Woodard & Curran

Samantha Weidenbenner has 10 years of experience in wastewater and stormwater system planning, modeling, and design. She has extensive experience in modeling and analyzing wastewater collections systems. Samantha's experience includes sizing storage tunnels and plan preparation for the separation of combined sewer systems into sanitary and stormwater systems. Her work has also focused on construction administration, feasibility designs for funding, and Municipal Separate Storm Sewer System (MS4) compliance. Samantha has managed emergency response plan creation, mapped wastewater district customer complaints, sized air valves, developed pedestrian trail signage, and designed ADA compliant accessible ramps. She has managed projects primarily in the greater St. Louis region and Illinois.

Scott Medeiros is a Senior Vice President with Woodard & Curran and a registered Professional Engineer in multiple New England states with 29+ years in the A/E industry. In the role of Business Development Leader, he works with a team of Senior Client Managers, to support clients with capital needs by developing unique solutions to engineering challenges and strategically identifying funding opportunities and path to advance projects.

ABSTRACT: There is an array of asset management software used to record vital asset information, structural aspects of the maintenance process, and provide mission critical information to operators. This technology is an essential component for successful utility operations and maintenance, along with people, funding, and management structures. Utilities must carefully evaluate the myriad of options to choose the best fitting software that provides necessary functions to effectively maintain critical assets now and in the future.

Identifying needs, goals, and financial resources is the first step in defining the best approach to asset management technology. A standard off-the-shelf program might provide adequate functionality to implement a program for some organizations, but more complex entities will require a blended solution that can leverage the built-in capabilities of the standard package with customization and system integration. Other situations might call for a completely customized tool to best fit organizational goals or address certain needs.

By examining how utilities across the country found the right asset management software fit, this presentation will provide an overview of standard software package implementation to complex, multi-site customization with business intelligence tools to address specific requirements. Within each example, specific software solutions will be featured including ArcGIS, Cityworks, Utility Cloud, Power BI, and more, as well as the key criteria that each organization determined made it the right fit.

The examples provided will draw on a range of utility services and sizes from planning to implementation and ongoing support needed for a successful asset management program. These real-world examples will provide guidance for other utilities of all sizes in assessing needs clearly and balancing software capabilities against cost and complexity. Regardless of size and scope, an informed approach to selecting the right asset management software and providing the support needed through implementation and beyond will improve a utility's ability to manage assets, navigate maintenance procedures, and develop a substantiated fiscal plan for success.

SCADA Data – Organizing, Slicing, and Dicing

Neil Amiri & Claire Mclaughlin, Missouri American Water

Neil Amiri has designed water and wastewater SCADA systems for over 20 years, and has worked in the SCADA realm a total of 25 years covering many industries. He holds a professional engineer license, “A” drinking water operator license, and an electrical engineering degree from Missouri S&T. He has 5 children and is an active scout leader, loves camping and the outdoors.

Claire Mclaughlin has been working in the Asset Planning department of Missouri American Water for the past 2 years. She has been working on incorporating technologies to streamline the data analysis process for planning studies. She holds a bachelor’s degree in Civil Engineering and her Master’s degree in Engineering from Saint Louis University.

ABSTRACT: Five years ago Missouri American Water had many disparate SCADA data logging platforms at our treatment and distribution facilities across the state. The data was housed locally on each SCADA machine, and retrieving data for critical functions such as regulatory reporting and project planning was always a challenge. Also, when computers were changed out, retrieving the historical data and saving it for future use was complicated.

In this presentation we plan to cover the journey of developing an enterprise level historian – creating a standard asset library, importing years of past data, baking in fault tolerance, and bringing all districts under one centralized historian.

We also plan to present several use cases of how putting this data at the fingertips of operators, plant managers, engineers, and water quality personnel has brought about significant changes in the way we make decisions, operate our facilities, and plan future capital projects.

Data Driven Stormwater Infrastructure Programming for Des Moines

Chad Johnson & Erica Wellen, CDM Smith

Chad Johnson is a Senior Project Manager with CDM Smith, who is a licensed civil engineer, project management professional, and certified floodplain manager with over 24 years of experience. He is a highly skilled and respected project manager and engineer who has helped deliver more than 100 water infrastructure study, design and construction projects throughout the Midwest. He is a strong analytical thinker and can apply a wide range of skills and experiences to a variety of project and engineering challenges—regardless of project size or scope. He leads projects from initial planning and inception to final construction and ongoing maintenance, including stormwater planning, river or system modeling, report preparation, design and construction document preparation, and construction engineering. He graduated in 1997 with a BS in Civil Engineering from Brigham Young University and an MS in Civil Engineering from the University of Kansas in 200. He and his wife live in Kansas, with four children out of the house and starting to provide positive contributions to society. He enjoys camping, travelling, and mentoring others.

Erica Wellen is an environmental engineer at CDM Smith with seven years of experience supporting projects in stormwater and wastewater collection and conveyance design, infrastructure master planning, green infrastructure, and environmental regulation compliance. She has completed environmental compliance reports, feasibility studies and alternatives analyses, CERCLA projects representing federal and private sectors, remediation projects, and cost estimating. She has provided services for study, design, and construction engineering and administration for a variety of conveyance projects. She has a Bachelor of Science in Environmental Engineering from Missouri University of Science and Technology.

ABSTRACT: The City of Des Moines, Iowa, serves over 215,000 residents and encompasses 89 square miles of City infrastructure. The City has developed in recent years an updated Des Moines Strategic Plan (Guide DSM and Plan DSM), as well as a Public Works Strategic Plan, that included goals for upgraded infrastructure, a financially sound city, and a high performing governmental

organization. As part of meeting these goals, the City teamed with CDM Smith to develop a comprehensive Citywide Stormwater Master Plan (SMP). The City had completed several stormwater drainage plans to address chronic flooding at specific locations, and City staff wanted to move from reactive responses to developing sustainable, data driven systems to provide proactive asset operation and maintenance, geodatabase management, and capital project planning.

The City stormwater infrastructure includes pipes inlets, junction structures, outfalls, open channels, detention basins, levees, and pump stations. The City has already embarked on parallel efforts to address combined sewer areas and ugrades to existing levee systems and levee-associated infrastructure throughout the City. The current effort within the SMP is focused on existing grey infrastructure including 579 miles of pipe, 28,000 drainage structures, and over 30 detention basins. Some of the existing infrastructure dates back over 100 years, and records are fairly detailed in some areas and more experiential in older areas.

The City of Des Moines maintains a robust GIS database of existing pipes and drainage structures that was used as a baseline for the SMP. The initial efforts included discussions with all City office and field staff to identify existing standard operating procedures for maintaining condition data, flooding complaints, known problem areas, maintenance work orders, as well as methodology to identify and prioritize capital improvement projects. This effort included a robust public outreach effort to receive input from residents and City stakeholders in identifying problem areas as well as providing additional information to the public on identifying and reporting stormwater infrastructure related problems. A framework was developed to analyze existing pipe and manhole data, identify problem areas related to both renewal as well as capacity, and prioritize efforts around the City to efficiently address problem areas in a rational manner. This involved a city wide analysis as well as a more detailed and refined analysis of top priority sub-watersheds in the City.

Based on the analysis of the existing infrastructure, a proposed financial plan for future maintenance and capital improvements was prepared, including expenditures over time, additional staffing, maintenance and operation, and capital funding, along with a proposed rate structure to pay for the program.

The analysis methodology for city wide flood and condition risk ratings, detailed analysis, and future adaptation will be discussed. The results of the initial analysis will be presented, as well as the accuracy of the city-wide analysis relative to the more detailed investigation that was completed in certain areas and a strategy for identifying and prioritizing capital and maintenance operations. The proposed financial plan will be presented, including assumptions and areas for adaptation in the future.

Utility Management
Monday, March 27, 2023: 2:00PM - 5:05PM
Room: TBD
Moderator: TBD

What Do You Mean I Voided the Warranty on My New Equipment?

Ed Cope & Nora Estopare, St. Louis MSD

Ed Cope has served as Asset Management Manager in the Operations Department for the Metropolitan St. Louis Sewer District (MSD) in St. Louis, Missouri for 13 years. Working with other MSD departments, he is responsible for establishment of, adherence to, and ongoing improvement of work processes and systems supporting effective and sustainable management of MSD's storm and sewer collection system, treatment plant, pump station, and fleet assets. Mr. Cope received his MBA degree from Washington University in St. Louis, Missouri, and a BS degree in Chemical

Engineering from Princeton University. He also attended the Executive Leadership Institute of the National Forum for Black Public Administrators. He is a registered Professional Engineer in the state of Missouri. Mr. Cope was previously Operations Division Manager responsible for MSD's largest wastewater treatment plant at Bissell Point.
Nora Estopare is a Principal Engineer in the Asset Management group of MSD.
ABSTRACT: Where we have been…Construction of a multimillion-dollar capital project at the treatment plant is wrapping after years of contractors being onsite. Weekly project status meetings are ending and the substantially complete milestones of the project have been met. Responsibility for the project equipment is being transitioned from the project team to facility operations ownership. Unfortunately, asset specifications were not collected as equipment was installed, and the contractor has provided all O&M information as a single file on a thumb drive. Where do you start to establish a preventative maintenance schedule to meet all equipment warranty requirements?

This presentation will discuss changes the Metropolitan St. Louis Sewer District (MSD) has made to incorporate an Asset Management component into their project delivery process. Revisions to MSD's Engineers Joint Contract Documents Committee and Green Book contract procurement language incorporate new Asset Management requirements during the design and construction phases of the project to facilitate timely information transfer. Templated asset specification sheets have been developed to mirror the asset classifications in MSD's computerized maintenance management system, and procedural improvements implemented to streamline data integration.

Where we are headed… Construction of a $115 million capital project for the expansion of MSD's Lower Meramec Wastewater Treatment Plant is underway. This expansion will increase the facility's wastewater treatment capacity and allow for the elimination of MSD's Fenton Wastewater Treatment Plant. The capital project scope includes the addition of two primary clarifiers, odor control features, a blower building, four aeration basins, three secondary clarifiers, and two disinfection basins; in addition to improvements to existing primary clarifiers, secondary clarifiers, and disinfection basins for wet weather service. This is one of MSD's first construction contracts procured with new Asset Management requirements. Asset specifications for nearly 200 pieces of new equipment will be collected over the 2.5 year project duration as new equipment arrives on site, with the goal of having the break-in and preventative maintenance activities developed and scheduled when equipment is commissioned into operation.

Making Decisions When You Have Apples to Oranges

Clara Haenchen, City of Jefferson

Clara Haenchen began employment with the City of Jefferson WWTP as an operator in 1997. She has BS in Agriculture from Lincoln University with 2 additional years in Graduate School at MU in Soil Science. She worked in the Laboratory until she was promoted to the Plant Manager in 2016. Clara holds a Class A Wastewater Treatment license; and also, Class D and DS III Drinking Water Treatment licenses. Besides working as an operator, Clara's involved with MWEA, serving on the board and committees. Clara currently serves on the board as the Professional Wastewater Operations Division (PWOD) representative and coordinates MDNR Operator training approvals for MWEA.
ABSTRACT: How to compare Apples to Apples after Apples to Oranges. The need for Date Driven Decisions with Asset Management. Asset Management with your infrastructure needs should involve data driven decision making. This applies to a broad range of projects. Where do you start with the data you have and what do you need? Determine what data is needed, such as Lab Data, Manufacturer Data and Regulatory Data. What is driving why you need the data? Identify the needs and this will help you determine what information you need or don't need.

The City of Jefferson will be upgrading Biosolids dewatering equipment. The project will be used as an example of how to make data driven decisions. Replacement of aging equipment is needed, and the City would also like a dryer end product for land application while maintaining Class B biosolids. What needs to be considered? What are the options? How do you compare options? Where do you start? Begin evaluating operational needs and plant specific requirements of the equipment. Are you considering dryness of biosolids, safer work environment, ease of operation, footprint/space needed, chemicals required, hour of operation, cost, energy use, new construction or retrofit (what do you do in the meantime to meet regulatory), maintenance over time, removal of equipment for repairs, and where does the funding come from for the project. All these questions require information and the data sizes for the information varies and is specific to the question.

All data is relative to what your trying to determine. Some involve “Big Analytics” when your making decisions from very large data sets. How do you go about making decisions with all the data? There are standards to consider when reviewing the 5 V’s of “Big Data” analytics, these include Volume, Velocity, Variety, Veracity, and Value.

Now that you have all the data, it’s time to make decisions. What are we going to do to produce drier biosolids and take us to the next 20 years of operations? All the data that is collected confirms and supports your decisions. Doing your due diligence will make you more confident in your final decisions. This will help you explain to staff why you are choosing the options that you have and also others that may ask the same questions of “Why”? You’ll also be able to take it to higher ups with documentation that will help support them as they take it to Council and then onto the voters for any approvals needed.

Women in Leadership - Difficult Conversations

Melanie Jollett, KC Water; Julie Jenson, CMT; Theresa Calvert, ACE Pipe

Melanie Jollett has over 25 years of experience in water distribution system modeling and design in both the municipal and private industries. She is currently serving as the Water Distribution Engineering Division Head for KC Water. The division is responsible for the replacement of 28 miles of water mains every year within the distribution system. Prior to joining KC Water, she worked for Colorado Springs Utilities as their lead distribution system modeler.

Julie Jenson has 21+ years of experience in the water and wastewater industry in the Kansas City area. She is a licensed PE in the state of Missouri and has worked in the public and private sectors of the industry . She is currently the office manager and Water Resources Group Manager for Crawford, Murphy & Tilly (CMT) in the Kansas City Office where she enjoys developing and continuing the strong relationships she has made over the years, as well as managing projects and pursuing future work for the office. Mostly, she enjoys managing and mentoring her younger staff to prepare them for a lifelong career in the civil engineering field.

Theresa Calvert is currently the Vice President of Ace Pipe Cleaning, Inc. (APC) and has a BSBA Finance degree from the University of Missouri – Columbia.

Her 20-year tenure in the wastewater industry has mostly included managing APC teams who facilitate contracting, bidding, field data processing, and project controls.

Theresa is a member of WEF, AWWA-Missouri/Kansas and MWEA. She is also very active with the Missouri Chamber of Commerce.

ABSTRACT: Whether it's giving or receiving feedback, a personnel change, or other situation, difficult conversations can be immensely stressful for managers. As women, difficult conversations occur frequently and developing tools to help manage and conduct these conversations is vital. This presentation will discuss how to prepare for these interactions and how to manage the associated stress.

Water Distribution
Monday, March 27, 2023: 2:00PM - 5:05PM
Room: TBD
Moderator: TBD

Horizontal Collector Wells as a Raw Water Source

James MacAdam, Burns & McDonnell; Luca DeAngelis, Layne; Greg Camp, City of Festus

James is a Civil Engineer with 5.5 years of industry experience with the planning, design, and construction administration of municipal water and wastewater infrastructure. In three years of working with Burns & McDonnell, James has worked with communities throughout the Midwest on wastewater treatment, pumping systems, collection, and distribution projects. James has worked on a mix of planning, design, and construction projects and has worked on projects utilizing both design bid build delivery as well as design-build delivery.

Luca is a senior hydrogeologist with Ranney Collector Wells (Layne). Luca has 25 years of experience in hydrogeology focusing on water supply sources for municipal and industrial clients. Working with Layne, Luca now focuses his efforts on the design and construction of horizontal collector wells throughout the United States.

Greg serves as the City Administrator for the City of Festus, Missouri and serves on the finance and taxation advisory of the Missouri Municipal League. Greg also serves as the current President of the Jefferson County Water Authority, which provides finished water the Cities of Festus and Herculaneum Missouri.

ABSTRACT: A horizontal collector well (HCW), also known as a radial collector well, is an alternative raw water supply method to more well-known conventional methods such as surface water intakes or vertical wells. An HCW used as a raw water source offers several advantages over surface water intakes and vertical wells but is not always a suitable option based on the geological setting.

The concept of a horizontal collector well is similar to that of a vertical well, except that the well screens are projected horizontally through an aquifer rather than vertically. This is achieved by sinking a large diameter concrete caisson (approximately 13- to 16-feet in internal diameter) through an aquifer, excavating the inside of the caisson, and using horizontal directional drilling methods near the bottom of the caisson to project well screens horizontally that convey groundwater inside of the caisson. A pump house installed on top of the caisson at the ground surface pumps the raw water out and as the water level inside the caisson drops the differential head created by the groundwater promotes flow through the well laterals and into the caisson.

The horizontal orientation of multiple laterals all near the bottom of an aquifer promotes a higher rate of well yield than that of a vertical well. Because of the high potential yield of a horizontal collector well, they are optimally used where there is a highly transmissive aquifer that is hydraulically connected to a surface water body. For example, an alluvium along major rivers is a common location for horizontal collector wells. The surface water body promotes induced infiltration as the groundwater is pumped out of the caisson at a high rate. Because of the induced infiltration caused by a surface water body, horizontal collector well raw water is sometimes considered as “groundwater under the influence of surface water”. However, raw water quality of a surface water induced groundwater source is still filtered through sand and gravel layers and closer resembles the water quality of groundwater than that of surface water. Horizontal collector wells, when used in the right setting, can provide a much higher yield than that of vertical wells, therefore requiring less infrastructure and space of a vertical well field, and are not susceptible to varying surface water levels and water quality than that of a surface water intake water source.

The purpose of this presentation is to explain how a horizontal collector well works, how they are constructed, when they can serve as the most efficient raw water source for raw water applications, and discuss a case study of a HCW project along the Mississippi River. The three main players of the project (Engineer – James, Contractor – Luca, Owner – Greg) are the presenters. The project utilized a progressive design-build delivery to best meet the needs of the Owner and project.

Evansville's Proactive Approach to Maintaining Critical Water Mains

Wayne Lindsay, Pure Technologies

Wayne Lindsay has worked in the water and wastewater industry for over 30 years, beginning his career with Sverdrup Civil Engineering/Jacobs Engineering, which was head-quartered in St Louis MO. Over the past 30 years he has been an active member of AWWA and WEF throughout his career. Over his civil engineering consulting career with national engineering firms, he has been involved in projects in the areas of water treatment and distribution and wastewater collection systems and treatment. In addition to this, he has been active in the Clean Water Partnership and participated in NACWA while working on numerous consent decree programs across the county. He has a broad- based experience in working with municipalities and water agencies on all types of civil water infrastructure projects. Throughout his career, has championed an asset management approach for his clients to support their needs to effectively manage their critical assets and extend their useful life. This focus led him to become engaged with Pure Technologies, an industry leader in buried pressure pipeline asset management. He is responsible for a seven-state region in the Midwest including Missouri and Kansas as an area technology representative for Pure. He works closely with Pure's operations project delivery teams to develop inspection plans to support his clients' asset management challenges of buried critical pressure pipe assets.

ABSTRACT: Evansville Water and Sewer Utility (EWSU) owns and operates a 36-inch water PCCP transmission main and the condition was largely unknown. EWSU contracted a condition assessment of the main to mitigate risk. Electromagnetic technology used to identify broken wire wraps. This technology enabled inspections with the water main in service. The electromagnetic inspection indicated approximately 5% of pipes showed signs of broken wire wraps. Working with Pure, three pipes were identified for replacement. Once excavated, an external verification was performed confirming the proper pipes had been identified. EWSU ordered the appropriate fittings and new pipes for replacement. Within two months EWSU was ready to replace the damaged pipe segments. The city contracted to have pipes at three separate locations replaced in a planned outage. Pipe, couplers were ordered, shipped, and stored prior street closing and pipe replacement. In that a forensic analysis was planned, Pure met with the city to define the pipe section removal process to optimize the forensic analysis. On the day of replacement, EWSU's team de-energized the water supply to the impacted service area. The heavily traveled streets were closed, and three repair crews completed the repairs within the planned 25-hour timeframe. This proactive approach provided the city the ability to avoid a costly catastrophic failure and mitigate water service and traffic disruptions. This high-profile event resulted in a major through fare shut down in downtown. The Mayor of Evansville proactively in advised the timing of the road closures. He visited all three job sites to observing the work which was reported on the local TV news. The work was performed in one day and the line was back in service within 25-hour start to finish. Pure's PipeDiver technology was "spot on" in identifying the three exact 16-foot pipe sections in a pipe "yield" point of failure. Pure performed a forensic analysis of the most impacted pipe stick. Presentation will show the pipe sections removed that had the most significant level of degradation. Materials and samples were collected from the pipe for analysis. An in-depth analysis to determine the cause of the pipe

degradation was performed as 38 pipes had anomalies. A statistical rate of degradation of the pipeline allowed EWSU developed a management plan to extend the main's life. EWSU contracted with Pure to inspect a 48-inch 1970's PCCP main. The proactive approach will extend the remaining useful life of critical mains.

Social Impacts of the Prospect Ave 16-in Water Main Replacement

Danielle Sandman, HNTB & Terry Thomas, KC Water

Danielle Sandman is a water resource engineer at HNTB in Kansas City. Danielle has her bachelor's degree in Civil Engineer from University of Missouri Kansas City and has been a part of the water industry for 5 years. She is a registered professional engineering in the State of Missouri, and a member of the Society of Women Engineers.

ABSTRACT: In 2012, the City of Kansas City, MO started the Water Main Replacement Program to improve water infrastructure across the city. This program was designed to update the aging and failing water infrastructure, and with some existing water mains in Kansas City up to 100 years old, water main breaks in certain areas of the City are very common. Currently, there are about 2,800 miles of underground water mains serving Kansas City, and the Water Main Replacement Program sees to replace about 1% of water mains per year (28 miles of pipe per year). At this cadence, the City will replace and entire water distribution system over 100-years, therefore providing a continuous loop of water main replacement and improvements throughout the City.

The Prospect Avenue Water Main Replacement was a water main replacement project under the Kansas City's Water Service Department (KC Water) Water Main Replacement Program for fiscal year 2020. The project consisted of replacing about 19,000 feet of 16-inch water main along Prospect Avenue, between Linwood Boulevard and 63rd Street, in Kansas City, Missouri. This replaced accounted for 13% of replacements for fiscal year 2020 and included the replacement of all fittings and appurtenances within the project limits, as well as providing other distribution system improvements (service lines and side street connections).

This particular water main replacement lies in an area of Kansas City known as "East of Troost", which is a "Redlined" district. Kansas City became a "Redlined" City in 1939 through the federal organization Home Owners' Loan Corporation (HOLC) under Roosevelt's "New Deal", established in 1935. During this time, neighborhoods in major cities, including Kansas City, were assigned grades based on their "mortgage security". Neighborhoods that were minority based and consisted of low-income and/or poverty were graded as "D" neighborhoods and termed "hazardous" for mortgage security, and therefore made it difficult of these neighborhoods to access mortgage financing. Without the access to mortgage financing, price point of "hazardous" properties went down, causing appraisal values to decline, and thus reducing the amount of funding a neighborhood would see.

Today, these neighborhoods are still suffering from Roosevelt's "New Deal", almost 90 years later. According to the 2015-2019 American Community Survey Data from the Environmental Protection Agency (EPA), the "East of Troost" neighborhood still houses 90% of black communities, majority of which are considered to be "low income". These "low income" neighborhoods are witness to many aging and failing infrastructure as a result, including the existing Prospect 16-inch water main, which dates as far back as 1902.

Historically, KC water mains are designed to be placed within the right-of-way and outside the street, adjacent to the sidewalk. Due to the redlined neighborhood's high foot and bus traffic, normal design considerations needed to be re-evaluated and manipulated to best serve the community and provide the best quality of life in this area. By working 1-on-1 with the KC Water, HNTB was able to come up with an innovative and equitable design that avoided all sidewalks and bus stops, therefore avoiding a disruption to

the local community, providing a better quality of life, and avoiding an unfavorable public perception of the City.

The Prospect Ave 16-inch water main replacement has not been the first equitable replacement by KC Water. Since the program began in 2012, KC Water has been evaluating which water mains need to be replaced based on priority (age, breakage, material, and overall risk of failure) rather than location. Over 50% of water main replacements in Kansas City that have come out of the Water Main Replacement Program have been in “grade D/hazardous” areas. In 2020, the KC Water reported a 39% decreased in water main breaks thanks to this program. This strategy by KC Water has provided a substantial benefit to the redline communities and helps to improve the aging infrastructure of communities that suffer environmental injustices.

Wastewater Treatment
Monday, March 27, 2023: 2:00PM - 5:05PM
Room: TBD
Moderator: TBD

The DO Limbo - How Low Can You Go?
Rachel Sweezy & Eric Redmond, Black & Veatch
Rachel Swezy is a wastewater process engineer at Black & Veatch. She got her Bachelor's in Chemical Engineering from the University of Kansas and a Master's in Environmental Engineering from the University of Kansas.
Eric Redmond is a senior process engineer with Black and Veatch. He graduated from the University of Iowa with a masters of Environmental Engineering. His focus area is low energy nutrient removal, coupled with intensification approaches. These include low DO operation and nitrogen transformation with aerobic sludge granulation.
ABSTRACT: "Biological treatment processes have been around for more than a century with continually increasing understanding of the process as a whole. Throughout the evolution of activated sludge, dissolved oxygen (DO) has been a focus of operational control. The typical aeration process can account for 50-70% of a total facilities energy usage, reducing this demand and meeting nutrient limits with existing infrastructure will require innovative approaches. Implementation of advanced aeration control along with low DO operation offers the opportunity for facilities to reduce aeration energy costs by up to 20-30%.

WRF Project 5083 Advancing Low-Energy Nitrogen and Phosphorus Removal is currently under development to further explore recent advances and establish operational guidance. One of the key areas, low dissolved oxygen, offers the opportunity to significantly reduce operational costs while meeting stringent effluent nutrient criteria. The presentation will review current best practice basin and aeration system design for low DO operation as well as a few case studies. Review of nutrient performance, aeration controls, and overall operation will provide a demonstration of the ongoing efforts to improve our understanding as an industry of low DO operation.

Currently 3 Kansas wastewater plants are being designed for upgrades by Black & Veatch for new nutrient permit limits. All plants will meet 1 mg/L TP and 10 mg/L TN limits. These designs include simultaneous nitrification denitrification (SND). This Low DO operation saves energy by allowing an oxygen gradient to form in the BNR basin that creates zones for nitrification and denitrification. A review of design considerations, DO setpoints, and aeration control will be discussed for SND design. Increasing aeration flexibility requires specific attention to blower turndown and diffuser grid designs to ensure desired environmental

conditions are maintained throughout seasonal variations. The designs of these facilities have been informed by full-scale facilities and bench scale work from these operational low DO facilities.

The Trinity River Authority (TRA) Central Regional Wastewater System (CRWS) Treatment Plant currently operates a low DO secondary system with ammonium based airflow control (ABAC). TRA is a participating utility in the WRF Project 5083, and has worked with Black & Veatch to define the application, design, and operation of low dissolved oxygen (DO) facilities. As part of the project, a series of nitrification rate, phosphorus release, and phosphorus uptake tests were carried out. Samples from the following three TRA facilities were tested: Central Regional Wastewater System (CRWS), Ten Mile Creek Regional Wastewater System (TMCRWS), and Denton Creek Regional Wastewater System (DCRWS). These facilities range in capacity from 11.5 to 189 mgd AADF with varying degrees of nutrient removal. Both the CRWS And DCRWS facilities achieve phosphorus and nitrogen removals of <0.5 mg P/L and <10 mg N/L, respectively. However, the average DO of the two facilities is 0.75 and 3.0 mg/L for CRWS and DCRWS, respectively. The TMCRWS facility is a high DO facility that meets effluent ammonium limits. These three facilities were tested at a range of DO concentrations to document nutrient removal rates to provide recommendations on operational and design approaches.

Nitrification tests were conducted at low, medium, and high DO concentrations of 0.25, 0.75, and 1.50 mg/L. Concentrations of DO were monitored by probe and manually adjusted over a 2-hour period. Two trials of each DO level were carried out to determine replicability for each site. Ammonia removal specific rates for CRWS were between 87-92% higher than both DCRWS and TMCRWS under the low DO condition. CRWS also outperformed in the high DO condition with ammonia removal rates between 33-47% higher than the other two sites. The phosphorus release and uptake tests were conducted at relatively low and high DO conditions of 0.25 and 1.50 mg/L. The bench scale work performed at TRA high and low DO facilities will seek to inform design and operation of future facilities.

Many facilities have the opportunity to optimize secondary treatment performance, from both a performance and energy standpoint. Often, these transitions require low capital costs to realize significant annual savings."

Losing Stream, Sinking WWTF?

James McCleish & Sean Mickey, Horner & Shifrin; Brian Strickland, Strickland Engineering

Jim McCleish is an award-winning project manager who specializes in the areas of water treatment transmission and distribution, storage and pumping facilities and water supply feasibility studies. He is a registered Professional Engineer in the states of Missouri and Illinois. He also has extensive experience in the study and design of municipal wastewater treatment plants and collection systems and sludge management and is experienced in industrial wastewater, hazardous waste management, groundwater and soil remediation and stormwater permitting projects. He received his BS degree in Civil Engineering from the University of Illinois, Champaign-Urbana and MS degree in Environmental Engineering from Washington University.

Sean Mickey

Brian Strickland

ABSTRACT: "The Cape Girardeau County Reorganized Common Sewer District regionalization project decommissioned over 23 existing permitted treatment facilities and utilized over 27 miles of sewer to combine flows to a new centralized wastewater treatment facility. The ideal site for the new central WWTF was determined to be on a segment of land donated by Fruitland American Meat. The existing site had an old terraced multicell lagoon that was originally designed as an “evaporative” lagoon system that was to be decommissioned and regionalized with the project. Though the cost was optimal, and the location was beneficial for sewage conveyance to a central plant, the local

geology posed multiple challenges during design and construction.
Preliminary geotechnical borings on the site showed various rock elevations. The design team was suspicious of Karst features given experience in the region and proximity to fault lines. These issues can cause structural issues on any construction site resulting in property damage and loss of use, however, for a wastewater treatment facility utilizing an activated sludge process, loss/damage to key structures adds an environmental damage component to local waterways and could impact local groundwater supply wells. Additional challenges were introduced from geohydrologic evaluations performed by Missouri Geological Survey staff which gave the site sever rating and listed the preferred receiving stream as a losing stream with strict discharge limits.
To overcome karst issues and rock pinnacles, and even moderate size sinkholes if found during excavations, a structural design alternate was included to utilize grade beams to reinforce tank bottoms and bridge any karst features. The new treatment tanks, headworks, and effluent channels were designed on a common mat foundation to prevent differential settling and provide a single large foundation. The new SBR process was designed to provide a high quality effluent meeting losing stream requirements. The new UV disinfection designed with redundant capacity to allow year round disinfection, and the design included expansion capacity for nutrient removal and tertiary filtration. The plant has been online since Spring 2022, operated by Strickland Engineering, and producing the high quality effluent as required."

Macon Municipal Utilities Headworks – From Start to Finish

Jeff Barnard, Burns & McDonnell & Stephanie Wilson, City of Macon

Jeff Barnard has spent over 20 years partnering with communities in Missouri to address challenging water and wastewater utility issues. As the leader of Burns & McDonnell's Water group in St. Louis, Missouri Jeff has focused on building a multi-faceted team that has the ability to address client needs with expertise and efficiency. From planning through construction, our team focuses on "making our clients successful" by taking a holistic approach to development and implementation of capital project solutions. Our most recent work at the Macon Municipal Utilities Wastewater Treatment Facility exemplifies the strengths of our team as we planned, designed, and administered construction of their new headworks facility.
Stephanie Wilson has performed the General Manager functions with Macon Municipal Utilities since 2007. MMU invests in GIS mapping for maintenance planning, cured-in-place-pipe for rehabilitation, plus other opportunities to improve its wastewater collection system. MMU has recently invested in the design and construction of a new headworks facility to protect downstream equipment at the wastewater treatment plant.
ABSTRACT: The City of Macon is the smallest combined sewer community in Missouri. Macon Municipal Utilities provides the City with electric, water, wastewater and natural gas services. As a result of being a combined sewer community, the MMU experiences significant variations in peak flows at the wastewater treatment plant. In combined sewer systems, wet weather flow dictates the future capacity and capital costs of conveyance and treatment infrastructure. The headworks represents the interface point of the wastewater treatment plant and the collection system, whose relationship is contingent upon balancing hydraulic capacity with incoming flows. Back in 2018, Burns & McDonnell recommended a unique approach to evaluate MMU's collection system, focused on short- and long-term collection system goals, to better understand the incoming peak flows prior to the sizing and design of the new headworks facility. In addition to the intricate hydraulic considerations, combined sewer communities have an increased potential to convey large solids, such as gravel and rock, within the collection system to the wastewater treatment plant. There's nothing glamorous about influent screening and grit removal, but efficacy of these processes affects all downstream processes. For MMU, which was previously without a proper headworks facility at the WWTP, this meant

significant and continued damage to primary clarifier sludge pumps. The labor and pump repair costs associated with this damage, was an immediate pain point for MMU that required attention.

Together, MMU and Burns & McDonnell completed a flow monitoring program and developed a hydraulic model to help MMU make data driven decisions regarding the collection system and treatment plant improvements; the first of which is the sizing of the new headworks facility.

This presentation will cover the entire life of the new MMU headworks facility; from the preliminary flow metering and hydraulic modeling, through the design and construction process. This presentation will highlight the collaborative design process with MMU to optimize the final design, focused on operations and maintenance of the headworks facility. A focus throughout the design process was planning for the future. MMU will likely need to replace the trickling filter technology at the wastewater treatment plant before the useful life of the new headworks facility is up. Burns & McDonnell and MMU kept an eye toward the future needs at the wastewater treatment plant; including pump station configuration and site layout, throughout the design and construction process. Construction of the new headworks facility was completed in 2022 and includes fine screening, grit removal, and influent pumping, with provisions for future installation of coarse screening.

Water Treatment
Monday, March 27, 2023: 2:00PM - 5:05PM
Room: TBD
Moderator: TBD

Reimagining Softening with High-Rate Pellet Reactors

Erika Cooper & Thomas Crowley, Carollo Engineers

Ms. Cooper has over 20 years experience in the design of water systems. She is licensed in TX and OK and has managed over 500M in capital improvements projects.

Mr. Crowley has over 30 years in the water and wastewater field. He specializes in lime-softening and lime feed systems. He has worked on the conceptual and final design of several pellet softening facilities.

ABSTRACT: Traditional softening processes utilize a solids contact process that is often difficult to operate, maintain, and requires a large effective square feet of settling area to effectively remove solids. Pellet softening reactors involves the use of a high-rate fluidized bed of softened pellets that are up to 97% pure calcium carbonate that are “drained’ and then utilized in numerous commercial applications such as the manufacture of drywall or porcelain products. As a result, this has the potential provide a more sustainable approach than conventional lime softening.

This paper will present the reasons why communities should consider softening of their water, the various types of softening reactors including the pellet reactors, and several case studies in which pellet reactors were utilized in the treatment process.

Attendees will be provided with the following:

- An understanding of the reasons/drivers for selecting a softening process for water treatment.
- Instruction on the basics of softening, the chemical reactions involved, and the limiting factors in these reactions.
- A review of the various types of softening reactors and their advantages and disadvantages in uses for water treatment.
- An introduction to the softening pellet reactor, typical design criteria, and operation and maintenance requirement.
- Case studies for the application of pellet reactors in:
    - Conventional groundwater treatment

    - Reduction/concentration of brine waste stream from RO concentrate to increase water efficiencies of desalinization project.
    - Surface water treatment (split treatment)
- Cost opinions for typical pellet softening process as a comparison to traditional softening treatment approaches.

Conclusions:

- Pellet softening represents an attractive alternative for communities considering an expansion of or retirement of conventional softening facilities due to 30-40 higher loading rates (smaller footprint).
- Pellet softening provides a 97% pure “calcium carbonate pellet” that provides a potentially more sustainable product than conventional softening.
- Pellet softening can be utilized for economical treatment of brine waste streams
- Pellet softening has some drawbacks a) it requires a different operational approach b) magnesium removal is limited c) operation with lime as pH adjustment requires a higher level of capital investment.

Understanding Precipitative Softening: It’s not Hard!

David Green, MDNR

David Greene works at the Missouri Department of Natural Resources, where his primary role is providing operator training and technical assistance to drinking water systems in DNR’s Kansas City region. Prior to working for DNR, David was the Lab Director for the Kansas City Water Department, where he worked for 28 years. David attended the University of Kansas and presently holds a Master of Science degree in Environmental Policy & Management. His certifications include Missouri A-Level Drinking Water, DS-II, and Wastewater Level C, and he is a member of MO-AWWA and MWEA.

ABSTRACT: Well, it’s kind of hard. But Missouri Drinking Water Treatment Plant operators can solidify their knowledge of the lime-soda treatment process for hardness removal with this brief review of the principles of pH, alkalinity, hardness, and stability. Concepts presented include an overview of precipitative softening, the carbonate system as it relates to alkalinity and hardness, and a brief review of element symbols, chemical formulas and equations, as well as the pH scale. Information is presented at a level of detail and complexity consistent with most water industry operator certification training offerings. Solutions and solubility is explained. Carbonate equilibria and benefits from lime-soda softening in addition to softening are also discussed. The subjects are encapsulated in a 50 minute presentation consisting of approximately 55 slides.

Softening with Beneficial Residuals: Pellet Softening for Ground- and Surface Water Treatment

Ashley Pifer, Garver

Dr. Ashley Pifer has focused her career on developing innovative solutions to water quality challenges using established and advanced technologies. Her interest in water quality began during her PhD work at the University of Arkansas on disinfection byproduct formation and control, and it has continued throughout her time at Garver. Over the years, she has worked closely with water systems to solve water quality challenges through monitoring, water treatment, and distribution system management.

ABSTRACT: Many groundwater and surface water supplies in Missouri have high levels of hardness, which can negatively affect consumers’ perceptions of their drinking water as well as their hot water systems. When consumers implement softening in individual homes and businesses, ion exchange or reverse osmosis systems are common choices. Both technologies generate waste brine that passes through water reclamation facilities and contributes to salinization of receiving streams. Softening can be accomplished before water reaches consumers by implementing the same technologies at water treatment plants, as well as conventional (lime, lime-soda, or caustic soda) softening. Brine, as well as the large

volumes of sludge generated by conventional softening, then poses a challenge for water treatment plants.
Pellet softening has long been practiced in Europe for groundwater treatment, and it is beginning to be implemented in the United States. Pellet softening relies on the same chemistry as conventional softening, but occurs within upflow, fluidized bed reactors (UFBRs). Within the UFBRs, calcium carbonate precipitates onto seed particles, typically sand or calcite particles, to form pellets. The presence of the seed particles accelerates the softening process and the resulting pellets dewater by gravity to more than 95% solids. While these pellets could be landfilled, they can also be a beneficial product suitable for agricultural and industrial applications.
This presentation will provide an overview of common softening technologies, including conventional lime-soda softening, ion exchange, reverse osmosis, and nanofiltration. Pellet softening fundamentals and an overview of pellet softening equipment will be provided, along with a discussion of how the technology can be incorporated into groundwater and surface water treatment process trains. The authors recently completed a United States Bureau of Reclamation-funded pellet softening pilot study for a surface water with low organic content. Two UFBRs with different chemical addition and flow regimes operated in parallel over a 20-week period, and both achieved the project's softening goals. The UFBRs were operated upstream of recarbonation and ultrafiltration membranes, which operated successfully without significant irreversible fouling throughout the study. This presentation will summarize results from the study and discuss the operational considerations, challenges, and opportunities associated with the use of pellet softening in groundwater and surface water applications.

Inflow/Infiltration
Monday, March 27, 2023: 2:00PM - 5:05PM
Room: TBD
Moderator: TBD

Knocking on I/I's Door - Navigating Challenges for the Success of KC Water's Keep Out the Rain Private I/I Removal Program

Tina Hawes, KC Water; Irene Wilson, CDM Smith; Brooke Hudlemeyer, Olsson; Julie McNiff, Jacobs Engineering

Tina Hawes, KC Water Smart Sewer Division – Tina has worked for the City of Kansas City for the past 16 years in the Public Works, Parks and Water Departments where she is currently a Construction Manager in the Smart Sewer Program. She thrives on being a public servant in the water, wastewater and stormwater industry and takes pride in helping to deliver the best product possible to the public. Tina is a KC Water Partner in the Keep Out the Rain (KOTR) Program along with three Design Professionals (Jacobs, CDM, and Olsson) and thirteen Plumbing Contractors. As the Construction Manager, she collaborates and communicates with the Design Professionals and Contractors to keep everything running smoothly and make sure everyone gets paid on time. In her free time, she enjoys spending time at the lake boating and camping with her husband and two daughters.
Irene Wilson, PMP - She is a CDM Smith Project Manager and environmental engineer in water services. She has experience in the design of drinking water treatment technologies, pilot operations, and has supported municipal projects nationally. Prior to CDM Smith, Irene worked for an international non-profit where she designed small-scale UF and RO treatment kiosks –providing treated water in challenging contexts in Haiti, Guatemala, and East Africa. She is based in Denver, CO.
Brooke Hudlemeyer, PE - Brooke is a graduate of the Missouri University of Science and

Technology with a Bachelor of Science degree in Chemical Engineering. She is a licensed professional engineer in Missouri, Kansas, and Iowa. She has over 11 years of experience managing water and wastewater design and construction projects for a municipality and now for the Olsson team as a Project Manager.
Julie McNiff, PE, PMP is a graduate of the Missouri University of Science & Technology with Bachelor of Science degrees in Chemical Engineering and Biological Sciences. She is also a graduate of the University of Kansas with a Master of Science degree in Environmental Engineering. Julie is a licensed professional engineer in Missouri, Kansas, and Nebraska as well as a certified Project Management Professional. She has over 22 years of experience managing a variety of municipal projects from the pursuit stage through close out. Julie is currently a Project Manager, Client Service Leader, and Office Manager for Jacobs in Kansas City.
ABSTRACT: Infiltration and Inflow (I/I) sources on private property have been shown to be significant contributors to basement backups, sanitary sewer overflows, and bypasses. The private sector of the collection system is generally described as the building connections and service lateral from the building to the publicly owned connection at the sewer main. Allowing the flow of storm water and ground water into the City's public sewer system has a dramatic effect on the system from the point of entry to the effluent from the treatment plant. These effects include increased cost of constructing and operating sewer systems, increased cost of constructing and operating wastewater treatment plants, adverse impacts on the effective treatment of wastewater, reduction in the available capacity of the sanitary sewer system, creation of conditions that pollute area waterways, and direct threats to public health and safety by causing or contributing to sewer back-ups and sewer overflows.

Disconnection of private I/I sources has proven to be very effective in communities across the country in the reduction, and sometimes elimination, of backups, overflows, and bypasses. While negotiating their Consent Decree, the City of Kansas City, Missouri determined that a private I/I evaluation and reduction program, called Keep out the Rain (KOTR), would help them achieve their I/I reduction goals. As a result, the KOTR program was implemented as a voluntary, limited-time program to help Kansas City, Missouri residents locate, and fix prohibited private inflow connections to the sanitary sewer system at no cost to the property owner.

Building plumbing evaluations identify locations where rainwater and groundwater are entering the sanitary sewer service lateral of a building. Exterior evaluations are conducted to record any driveway, stairwell and patio drains, gutter downspouts, or cleanouts where rainwater or groundwater enters the sanitary sewer system. Interior plumbing evaluations are conducted to record any sump pumps or other sources entering into the sanitary system.

Access to the building interior is necessary to complete the evaluation so proper communication with property owners and occupants is extremely important. Residents' participation helps reduce wastewater treatment costs and the potential for sanitary sewer overflows and basement backups in Kansas City neighborhoods, protecting public health and our natural environment.

Three firms were selected to partner with KC Water on KOTR as the design team. The design team conducts building plumbing evaluations on private property and coordinates the disconnection of I/I sources determined to be cost-effective in areas located throughout Kansas City's separate sanitary sewer systems. Join the project team as they discuss the challenges and successes having navigated the program since its inception and through the pandemic.

Why Hasn't Your SSES Testing Worked? Important Components For Conducting SSES Programs On Both Public And Private Property

Scott Belz & Zach Matteo, AECOM

Mr. Belz has been actively engaged in field investigation and data reporting services since 1980. His career has been dedicated to sanitary and storm sewer investigation programs. Scott was a founding member of the AECOM Field Services Group which began conducting SSES projects during the sewer collection system investigation requirements under WWTP Facility Plans being enforced by the USEPA in the early 1980's. Mr. Belz is recognized as a national leader within the WEF organization as an expert in public and private property investigation. He has assisted local communities with developing strong investigation and I/I removal plans; especially in the area of private property.

Mr. Matteo is a civil engineer with 15 years of experience in the industry with a broad background in a variety of subdisciplines and specializing in hydrology and hydraulics. He has utilized HEC-HMS, HEC-RAS, SWMM, HY-8 and HydroCAD among other software programs on a variety of H&H projects. Mr. Matteo's work includes analysis of storm, sanitary, and combined sewer systems as well as floodplain/floodway delineations. He is experienced in preparing project specifications, cost estimates, and technical reports. Mr. Matteo also has extensive experience in field evaluations and construction observation on a multitude of projects throughout his career.

ABSTRACT: This presentation will look into the evaluation of existing drainage conditions to help align what type of sewer investigation techniques will best identify deficiencies in the storm and sanitary sewer system.

INTRODUCTION

AECOM have conducted Sanitary Sewer Evaluation Surveys (SSES) for many municipal clients. These studies require several components of the sewer system to be investigated to identify inflow or infiltration. AECOM has developed a comprehensive program that will identify these sources on both public and private property. One of the keys to any SSES program is Understanding the Study Area Drainage. The program also includes, but is not limited to: Flow Monitoring, Groundwater Monitoring, Public Education, Manhole Inspection, Mainline Dye Testing, Residential Dye Testing and Smoke Testing.

UNDERSTANDING THE STUDY AREA DRAINAGE

Understanding the drainage for both storm and sanitary sewers is a key factor in determining which type of testing will be the most effective for an I/I program. Many programs neglect to understand how both systems drain and identify the possible I/I sources prior to planning any kind of testing. For instance, areas with traditional sanitary sewers that cross over storm sewers can be investigated with both smoke and dye testing methods. However, in areas with houses that discharge to curb outlets, smoke testing is highly ineffective. Similarly to areas that have sanitary sewers located in the rear yards, most issues are on private property since there are limited storm sewers that cross or parallel the sanitary. For these areas, private property investigation must be used to identify I/I.

Mirror, Mirror, On the Wall…….Does I/I Reduction Help at All?

Andrew Kauffman & Brittnee Wilson, St. Louis MSD

Andrew has over 10 years of experience as a civil engineer with the focus in sanitary sewer evaluation studies, flow monitoring, asset management, and project planning. He has been with the District for 8 years. He is currently the watershed lead for Deer Creek and University City in the Lemay Service Area. Prior to working for the District, he worked at a utility company in St. Louis, as a project engineering, integrating their assets and work order management to Maximo. He has also work as a consultant mapping and evaluating the District's collection system.

Brittnee has been with the Metropolitan St. Louis Sewer District for 9 years. Throughout her time at the District she has worked as a Hydraulic Modeler for both the Lemay and Missouri River Service Areas. She also is the Project Manager for the District's Flow

Monitoring and Radar Rainfall Contracts and the past manager of the CCTV Vendor Contract.
ABSTRACT: "The Metropolitan St. Louis Sewer District (MSD) entered into a $4.7 billion, 23-year Consent Decree (CD) in 2012 with the United States Environmental Protection Agency (USEPA) and Missouri Department of Natural Resources (MDNR). To comply with the Consent Decree, the Sanitary Sewer Overflow Master Plan (SSOMP) was developed and approved in August 2014. The SSOMP includes over 400 projects to provide capacity in the sewer system and allow for the elimination of Constructed Sanitary Sewer Overflow (SSO) Outfalls, alleviate known SSOs, and building backups, as well as eliminate unpermitted bypassing at Wastewater Treatment Facilities. These projects are typically scheduled with Inflow and Infiltration (I/I) Reduction projects (e.g., public sewer rehabilitation, private downspout and area drain disconnects) followed up with sanitary relief projects.

As part of the SSOMP, Sewer System Evaluation Survey (SSES) Reports were prepared to identify public and private I/I. Through the use of smoke testing, manhole inspections, and dye water flooding the SSES reports identified the following:

Areas of excessive inflow/infiltration (I/I) contributing to Sanitary Sewer Overflows (SSOs) and Building Backups

Known SSOs within each Watershed

The physical and structural conditions of all structures within the Sanitary Sewer System

Unauthorized direct connections and stormwater direct connections

In addition, MSD utilized flow monitoring and modeling efforts along with customer complaint data to make engineering decisions that will benefit the MSD's rate payers and increase the overall effectiveness of MSD's Capital Improvement Program. In many areas both I/I Reduction and Relief projects will be needed, but in some instances the I/I Reduction project successfully reduced peak wet weather flows such that future sanitary relief projects are not needed or can be reduced in scope.

MSD's 23-year SSOMP is not yet completed. However, to date, the majority of the I/I Reduction Projects have been completed. Attacking I/I first, within the sanitary system, has allowed St. Louis MSD to reduce or eliminate multiple sanitary relief projects. This shows that I/I reduction projects can be effective components of a Sanitary Sewer Overflow Master Plan.
"

Industrial
Monday, March 27, 2023: 2:00PM - 5:05PM
Room: TBD
Moderator: TBD

Good Water Makes Good Ammunition
Doug Wachsnicht, Goodwin Brothers Construction
Doug has been with Goodwin Brothers since 1996 and has served as Vice President since 2010. In over 25 years at Goodwin Brothers Doug's primary focus has been in the water markets. Doug currently oversees water projects from concept to closeout in the role of Project Executive. Doug's successes have included both design-bid-build and design-build projects in the public and private sectors totaling hundreds of millions of dollars in construction value. This gives Doug a well-rounded knowledge of the different delivery methods in a wide variety of project types, sizes and scopes.
ABSTRACT: Construction of a new water treatment facility within highly secure Lake City

Army Ammunition Plant to provide both drinking and production water for the facility. This plant replaces WWII era water treatment facilities to maintain production at this 3,935-acre U.S. government-owned, contractor-operated facility that produces over a billion rounds of ammunition per year. Lake City is the largest small arms manufacturing plant in the world.

Antidegradation for Landfill Leachate: Not Your Everyday Wastewater

Connie Walden, Jacob Dean & Evan Bergmann, Great River Engineering

Connie Walden, PhD, PE is the Water Team Leader at Great River Engineering and manages a variety of water infrastructure projects. She is an Environmental Engineer with a PhD from the University of Arkansas specializing in modeling water and wastewater systems in both academia and private consulting. Her project experience includes the design and construction of potable water systems, wastewater treatment facility improvements, and leachate management.

Jacob Dean is a Project Engineer at Great River Engineering. Jacob graduated from the University of Missouri – Kansas City in December 2019, completing his Master of Science in Civil Engineering with a focus on water and environmental engineering. Jacob has gained experience in stormwater, drinking water, and wastewater engineering analysis and design. Along with his engineering experience, Mr. Dean has also gained experience with surveying, construction inspection, and geographic information systems (GIS).

Evan Bergmann graduated from the Missouri University of Science and Technology in May 2022, completing his Bachelor of Science in Civil Engineering with a focus on water and environmental engineering. Evan is on the Water Team at Great River Engineering (GRE) where he assists on wastewater, drinking water, and stormwater analysis and design. Mr. Bergmann has also gained experience in cost estimating, quantities, and permitting processes. He has been employed in both the municipal and private engineering sector making him a diverse engineer understanding goals, objectives, and challenges that each sector faces. Additional experience includes surveying, construction inspection, and geographic information systems. Outside of engineering Evan plays cornhole competitively participating in tournaments across the Midwest. Over New Year's (2022) Evan played in the National College Cornhole Championship in Myrtle Beach, South Carolina where he placed 5th in doubles play and made an appearance on ESPN2.

ABSTRACT:

Purpose: The Webster County Landfill is south of Marshfield in Webster County, Missouri and is currently owned by Webster County. The site consists of approximately 80 acres of which 14 acres were utilized for the sanitary landfill. This location is reported as the previous City of Marshfield Dump.

The landfill ceased accepting waste on June 30, 1987, and was officially closed on December 4, 2004, with a minimum post-closure care period of 20 years. Currently, the Webster County Landfill is in compliance with the Solid Waste Management Program requirements.

This presentation comprises documentation for the Antidegradation Review process to produce water quality-based effluent limits (WQBELs) for a new discharge in the James River Watershed. The Webster County Landfill was designed to collect and store leachate generated and prevent leachate from discharging off-site. Leachate is currently stored, pumped, and hauled to the Marshfield Wastewater Treatment Facility (WWTF). This management approach is burdensome on the County and time-consuming for County staff. Therefore, the Webster County Commission requested Great River Engineering to assist with an Antidegradation Review for on-site treatment options.

The Webster County Landfill is in the process of planning improvements to its leachate management plan. This project evaluated different potential leachate handling and treatment improvements that offer a range of treatment and disposal capabilities to evaluate non-degrading and less-degrading alternatives

as mandated by Missouri's Antidegradation Policy and Implementation Procedure.

Benefit and Relevance: This antidegradation study is the 4th ever antidegradation review request for landfill leachate in Missouri since the State implementation of Antidegradation Implementation in 2008. This review differs from previous antidegradation reviews in Missouri due to the radionuclides and PFAS present. According to the water quality standards for the James River watershed the pH should range from 6-9, fecal coliform levels should not exceed 126 colonies per milliliter per day, and nitrate levels of 10 mg/L or less are the standard criteria.

Within the draft James River Watershed Total Nitrogen Permitting Framework, point source facilities with permitted flows less than 100,000 gallons per day (gpd) and discharging to the James River Watershed are required to optimize their facility and control equipment to achieve Total Nitrogen (TN) effluent goals stated in the framework. The framework lists the final effluent goal of 15 mg/L expressed in an annual average goal.

Under Section 303(d), 305(b) and 314 of the Clean Water Act, each state is required to report the status of their state waters to EPA on April 1 every even-numbered year. The 303(d) status of the James River includes Whole Body Contact Category A and impaired for e. Coli. The proposed effluent limits are as follows:

Proposed Effluent Limits
Parameter - Effluent Parameter Max Daily Limit
BOD_5 (mg/L) < 10
TSS (mg/L) <10
Ammonia as N (mg/L) - <0.9
pH - 6.5-9.0
E. Coli (#/100 ml) - 126
Total Phosphorus - Monitoring
α-Terpineol (mg/L) - 0.042
Benzoic Acid (mg/L) - 0.119
P-Cresol (mg/L) - 0.024
Phenol (mg/L) - 0.048
Zinc (mg/L) - 0.535

Alternatives Evaluation: Leachate is formed when rainwater filters through wastes placed in a landfill. When this liquid meets buried wastes, it leaches (i.e., draws out) chemicals, organics, and pathogens from those wastes. This project analyzed alternative improvements to the current Webster County Landfill leachate management process.

A total of six alternatives were evaluated including the base control alternative, three non-degrading alternatives, and two additional less-degrading alternatives. The alternatives were evaluated based on their practicability, economic efficiency, affordability, and degradation on a pollutant basis.

Conclusion: All three of the non-degrading alternatives, land application, subsurface drip irrigation, and regional treatment, were determined to be non-practicable.

Of the three remaining alternatives, Alternative 6, a Membrane Bioreactor (MBR) with Ultrafiltration was determined to be the least degrading preferred alternative. The other less-degrading alternatives were not preferred due to financial concerns as well as concerns with ease of operation.

Project Status: This project is currently under review by the department. Additional limits may be required for PFAS and radionuclides.

Key Findings: When choosing a treatment process, available operators and their ability to run the proposed equipment should be considered carefully. In this instance, we contacted an operator early in the process and included them in the decision-making process. While cost is a primary driver, economic and social impacts play just as important roles when proposing a new outfall.

Unique Aspects: This presentation also includes an explanation of the fundamentals of the Clean Water Act and the antidegradation review process for those unfamiliar with this topic. An

overview of wastewater management at landfills sets the stage to convey the project and issues to a wide audience.

How corporate ESG goals are influencing capital improvement plans and projects
Bob Januska, GHD
Bob Januska is a professional engineer with broad experience in industrial wastewater project development and delivery. He is a graduate of the California Institue of Technology. He currently serves as an industrial water business group leader for GHD.
ABSTRACT: Capital Investment Programs (CIPs) in publicly traded companies are incorporating compliance with stated Environmental, Social and Governance (ESG) goals, encompassing such things as water and carbon neutrality. This presentation will discuss how various corporations' commitments to ESG initiatives are incorporated into their capital programs and modifying more traditional metrics including return on investments (ROI) and payback. Many manufacturing firms publicly commit to ESG goals that are a challenge to justify from a local plant level ROI perspective. The presentation will include - examples of water reuse strategies, constructed projects in various industries, impacts to typical ROI evaluations and messaging of progress on ESG goals to shareholders.

Alternative Delivery
Tuesday, March 28, 2023: 8:00AM - 12:00PM
Room: TBD
Moderator: TBD

How to Collaborate Final Design While Keeping a Design-Build Project On Schedule
Suzie Carpenter & Hannah Fodor, Black & Veatch, Blake Anderson, KC Water, Doug Wachsnicht, Goodwin Brothers
Suzie has 22 years of experience in water and wastewater and is a senior project manager for Black & Veatch. She has managed multi-discipline teams on projects ranging from study through detailed design at small and large facilities
Blake Anderson is Facilities Engineering Division Head and directs, coordinates, and exercises functional authority over graduate engineers, registered engineers, and assigned major engineering projects involving planning, design, development, construction, renovation, maintenance, or operation of water and wastewater projects.
Doug has been with Goodwin Brothers since 1996 and has served as Vice President since 2010. In over 25 years at Goodwin Brothers Doug's primary focus has been in the water markets overseeing water projects from concept to closeout in the role of Project Executive. Projects have included both design-bid-build, design-build and CMAR projects in the public and private sectors. Doug serves as Design-Build Principle-In-Charge for the Blue River Biosolids project.
ABSTRACT: This presentation will present successes and challenges experienced during the design phase of the Kansas City, Missouri Water Services Blue River Wastewater Treatment Plant Biosolids Improvements Project (Biosolids Improvements Project) which is being delivered as fixed-price design build. This project replaces the incineration process that had been part of the biosolids handling for Kansas City since the 1980's with a thermal hydrolysis process (THP) which creates a Class A biosolids. The Design-Build team began work on the project in January 2021 and startup and commissioning is scheduled to begin in April of 2024.
As the industry continues to utilize design-build for project delivery, teams will need to understand the steps needed to deliver a project that allows for Owner's review and input while also keeping the contracting team on schedule and budget. For the Biosolids Improvements Project, the team established a plan to utilize

collaborative workshops which included operations and maintenance staff, design package deliverables, and small group sessions to gather feedback and decisions for design finalization. All team members including the Owner, Owner's Advisor (OA) , engineers, and construction partners were actively engaged and trusted each other as the project progressed. Representatives from the Owner, OA, Engineer, and Contractor will participate in the presentation.

Since this is a design-build project, the OA, comprised of a team of Carollo Engineers and Jacobs, established a baseline design for pricing the project. During development of the proposal, the Design-Build team, comprised of Goodwin Brothers and Black & Veatch, offered alternative technical concepts that were approved prior to pricing the project. As the design progressed from 15% concept to final documents, details needed to be worked through and confirmed. The OA team needed to confirm that the changes met the intent of the baseline documents. The Design-Build team needed to make sure the final design met the contract requirements within the established budget.

The presentation will focus on three areas that required collaboration the most as the design progressed. These included snail shell removal, sidestream treatment, and operational controls. For each of these areas, the final design required close collaboration of all parties. The Design-Build team developed options, pros and cons for the options, and cost and schedule impacts for the group to evaluate. Decisions were needed in a timely manner to allow for materials to be ordered and delivered within the timeline established in the project schedule. For each of these areas, the presentation will cover why there were details to discuss and how consensus was received.

Hybrid Project Delivery Method-It's Sort of Design-Build

Sean Mickey, Brian Williams & Jim McCleish, Horner & Shifrin

Sean Mickey is a project engineer who specializes in the areas of water and wastewater treatment system design. He has designed systems for brackish groundwater and seawater desalination, multiple activated sludge based processes including nutrient removal technologies, and class A and B biosolids processes, industrial high purity process water, environmentally friendly discharge, and zero liquid discharge systems from a multitude of various water qualities. Sean was awarded a BS Chemical Engineering from the University of Kansas and a PhD in Chemical Engineering from Missouri S&T with a dissertation focused on gaseous adsorption on carbon-based materials.

Brian Williams

Jim McCleish is an award-winning project manager who specializes in the areas of water treatment transmission and distribution, storage and pumping facilities and water supply feasibility studies. He is a registered Professional Engineer in the states of Missouri and Illinois. He also has extensive experience in the study and design of municipal wastewater treatment plants and collection systems and sludge management and is experienced in industrial wastewater, hazardous waste management, groundwater and soil remediation and stormwater permitting projects. He received his BS degree in Civil Engineering from the University of Illinois, Champaign-Urbana and MS degree in Environmental Engineering from Washington University.

ABSTRACT: The existing Butler County PWSD #3 WTP was constructed over 50 years ago, and aging equipment and plant infrastructure led to the required replacement of the full facility. Raw water quality requires iron and manganese removal, with minimal additional treatment necessary for potable use. Due to the costs of complete facility replacement and condition of all existing facilities, alternate project delivery methods were evaluated to meet the District's budgetary needs.

Previous alternative evaluations showed that the preferred alternative was to construct a new pressure filtration system with chlorine feed and greensand media for the iron and magnesium removal plant, although the expected cost was well beyond expectations of the District. To save

construction costs, it was shown that a factory-built treatment system pre-installed in prefabricated building segments would provide significant cost savings vs. being fully built on site in a new process treatment building.
With a pre-procurement purchase order agreement and an engineer already on contract, the District was able to move forward with a hybrid project delivery method in which the process equipment manufacturer, factory assembler, and engineer were able to work together during the design phase to develop general construction plans and specifications for the new factory built water treatment plant to be installed on site. This project delivery method has allowed the project to be executed within the District's budget and is currently in fabrication with expected facility startup by March 2023.
: The existing Butler County PWSD #3 WTP was constructed over 50 years ago, and aging equipment and plant infrastructure led to the required replacement of the full facility. Raw water quality requires iron and manganese removal, with minimal additional treatment necessary for potable use. Due to the costs of complete facility replacement and condition of all existing facilities, alternate project delivery methods were evaluated to meet the District's budgetary needs.
Previous alternative evaluations showed that the preferred alternative was to construct a new pressure filtration system with chlorine feed and greensand media for the iron and magnesium removal plant, although the expected cost was well beyond expectations of the District. To save construction costs, it was shown that a factory-built treatment system pre-installed in prefabricated building segments would provide significant cost savings vs. being fully built on site in a new process treatment building.
With a pre-procurement purchase order agreement and an engineer already on contract, the District was able to move forward with a hybrid project delivery method in which the process equipment manufacturer, factory assembler, and engineer were able to work together during the design phase to develop general construction plans and specifications for the new factory built water treatment plant to be installed on site. This project delivery method has allowed the project to be executed within the District's budget and is currently in fabrication with expected facility startup by March 2023.

Collaborating to Deliver Innovative Wet Weather Resiliency

Nathan White & Jim Fitzpatrick, Black & Veatch

Nathan has been with Black & Veatch for 16 years and currently leads wastewater treatment facility studies, design, construction administration and startup on projects across the Midwest. An alumni of the University of Missouri-Rolla, he is a licensed professional engineer in Missouri and Kansas.
Jim has over 29 years of experience and currently leads Black & Veatch's Wastewater and Biosolids Technology and Process Engineering Section. His specialties include wet-weather flow treatment, and he has over 50 publications and presentations on this topic, including the High-Rate Treatment chapter of WEF's guidance manual Wet Weather Design and Operation in Water Resource Recovery Facilities.
ABSTRACT: In 2021 Johnson County Wastewater (JCW) began operating major improvements at its Tomahawk Creek Wastewater Treatment Facility located in the southern suburbs of the Kansas City metropolitan area. These improvements significantly increase peak wet weather capacity and meet new nutrient limits. They mark a major milestone in JCW's Integrated Plan to identify, assess, and prioritize infrastructure initiatives and investments. This milestone was successfully achieved through collaboration at many stages of the project, including:

1. Collaborative Permitting – JCW and its consultants (Black & Veatch and HDR) met with the Kansas Department of Health and Environment (KDHE) early during the preliminary engineering phase to explain the team's selected alternatives and demonstrate how they would successfully meet regulatory requirements for discharge during both dry weather and wet weather conditions. KDHE authorized the improvements through major

modifications to its National Pollutant Discharge Elimination System (NPDES) permit with no objections from the United States Environmental Protection Agency (USEPA). Additional meetings were held as the project progressed and design alternatives developed.

2. Collaborative Design and Construction – JCW selected McCarthy as construction manager at risk (CMAR) when design was approximately 60% complete. This allowed the project team to gain more accurate constructability reviews, move forward with better cost certainty, and conduct timely value engineering evaluations that identified alternatives to save the project $40 million in construction costs and deliver the project on budget and on schedule.

The improvements expand average design capacity to 19 mgd (from 10 mgd) and peak design flow capacity to 172 mgd. The new facilities include pile cloth disk filters for tertiary treatment of flows up to 57 mgd and auxiliary treatment of wet-weather flows up to 115 mgd, making it the world's largest capacity dual-purpose pile cloth disk filter installation to date. New biological treatment facilities include an activated sludge process configured for side-stream enhanced biological phosphorus removal and 4-stage Bardenpho for nitrogen removal. These are designed to achieve annual average effluent limits of 79.2 lb/day total phosphorus and 8.0 mg/L nitrate + nitrite nitrogen, along with annual average effluent goals of 0.5 mg/L total phosphorus and 10 mg/L total nitrogen.

Many Missouri utilities battling wet-weather flows are looking for solutions that also provide cost-effective benefits during normal flows as opposed to investing in treatment infrastructure that is only used a few times each year during wet weather. With the right technologies, design and operation, a dual-purpose auxiliary treatment strategy like the one used by JCW can be more cost-effective and resilient than additional storage and equalization infrastructure.

Collaborative Delivery Roundtable
Scott Phillips, Garney Construction
Scott Phillips, Assoc. DBIA™, has been involved in water/wastewater, utility infrastructure, and industrial construction for 25 years. He oversees the Business Development activities for Garney Construction in the Central US where he helps educate and assist Owners in the use and benefits of collaborative delivery. His industry involvement includes: AWWA's national MAC Council (Communication Committee Chair, Journal Advisory Board Liaison), AWWA's Missouri Section Board of Directors (MAC and Awards Chair, Membership Co-Chair), WEF's Industrial Wastewater Committee (Food & Beverage subcommittee Vice Chair), DBIA's National Water/Wastewater committee and Conference Planning Committee, and is the President of the Engineer's Club of Kansas City.
ABSTRACT: Join us as a panel of subject-matter-expert owners, designers, contractors, and suppliers discuss Design-Build, CMAR, and P3 project delivery methods. Among the topics discussed are benefits, drivers, schedule impact, constructability reviews, procurement (RFQ/P) tips, best practices for first-time owners, etc. These sessions are very popular and have high audience participation and Q&A.

Water 101
Tuesday, March 28, 2023: 8:00AM - 12:00PM
Room: TBD
Moderator: TBD

Pressure Surge and How to Control It in Constant Speed and VFD Pumping
William Nichol, VAG USA, LLC

Bill is a mechanical engineer with over 45 years' experience in the design, application and sales of valves and related equipment. He started his

career designing hydraulic actuation systems for applications ranging from steelmaking to the NASA Apollo program. After serving in the US Air Force Bill spent nine years as Engineering Manager for a manufacturer of marine valves and underway replenishment systems for the US Navy and worked closely with the DoD and naval architects. He then joined GA Industries and for the past 37 years has focused on the application of valves in municipal water and sewage systems, principally to control water hammer and pressure surges in pumping stations.

ABSTRACT: Personnel involved with pumping systems are familiar with the words “water hammer,” “hydraulic transient” and “pressure surge.” The prevention of these phenomena should be a primary consideration when designing or operating a pumping system or a flow control facility.

Due to the laws of energy conservation, an unavoidable pressure surge is produced anytime a fluid’s velocity is changed by valve or pump operation. An understanding of how surges are produced and propagate is essential to designing systems, as well as operating equipment, in a manner that prevents excessive pressure surge and the consequential potential for catastrophic damage, personal injury…or worse.

While conceding that the comprehensive analysis of pressure transients can be very complex and knowing many fine technical publications have been written and transient analysis computer software is commercially available, this presentation will discuss fluid elasticity, surge wave speed, critical period, Joukowsky’s equation and how time and flow cutoff characteristic affect surge in simple systems using layman’s terms and basic mathematics to arrive at an estimation of its surge potential.

Armed with a basic understanding of how surges are produced and propagate, the presentation goes on to discuss how automatic valves can be utilized to control pressure surge in both constant speed and variable frequency driven water and sewage pumping systems.

The presentation also explains the difference between pressure surge (“waterhammer”) and the “bang” that sometimes accompanies a pump shutdown when a free-closing mechanical check valve is used.

Finally, employing a VFD or automatic valves can prevent excessive pressure surge during normal pump operation, but unacceptable surges may result from a power or drive failure or other unintentional pump stoppages. This presentation will discuss how surge relief valves and surge anticipating valves operate to protect systems from excessive, damaging surges.

Ozone 101

Karen Dietze & Bob Hulsey, Black & Veatch

Karen Marie Dietze is a drinking water process engineer at Black & Veatch with over 10 years of experience in drinking water treatment optimization studies and treatment system design for municipal and industrial facilities. Karen Marie received a Bachelor’s in Civil Engineering from the University of Texas and a Master’s in Environmental Engineering from the University of Kansas.

Bob Hulsey is an Associate Vice President and serves as the Global Practice and Technology Leader, Water at Black & Veatch. Bob received a B.S. in Chemical Engineering from the University of Colorado and a M.S. in Environmental Engineering from the University of Kansas. He has served as both the President of the International Ultraviolet Association and as the Chairman of the International Ozone Association – Pan American Group as well as the chair of the Missouri AWWA section Research Committee.

ABSTRACT: Ozone is the most powerful oxidant available for primary disinfection credits in drinking water treatment. In addition to its use for primary disinfection, it also has a wide range of water quality benefits such as oxidation of DBP precursors, reduction of chlorine demand, cyanotoxin removal, taste and odor control, and removal of color. Due to emerging regulations and the impacts of climate change on source water quality, utilities across the country are turning to ozone to address various treatment needs that cannot be met through conventional

treatment processes. This paper will provide an overview of ozonation, typical applications and treatment objectives, ozone dosing assessments, and basic design considerations, highlighting case studies from utilities where water quality, treatment goals, and existing structures dictated different approaches to implementation.

Given the specific treatment objective (e.g., primary disinfection, taste and odor control, cyanotoxin control, DBP control), ozone demand testing is often performed on the bench-scale to assess the effectiveness of varying dosages on contaminant removal, establish ozone decay curves, determine disinfection performance, and evaluate the expected level of bromate formation. The merits of ozonation are often evaluated at different locations within a treatment process. This presentation will explore the tradeoffs of feeding ozone at various locations within a conventional or lime-softening drinking water treatment process and the impact of varying water quality conditions, such as TOC and pH, on ozone demand/dose and residual. Case studies will demonstrate the differing decisions on how to best apply ozone given multiple objectives, water quality, and existing facilities. These systems are applicable to waters found in the Midwest; river/reservoir sources, existing/new structures affecting hydraulics, conventional/lime-softening treatment, with multiple water quality and treatment goals. By providing a wide range of ozone case studies with background information on why decisions were made, utilities can better decisions on how to implement and operate ozone systems successfully.

Drinking Water Chemicals 101

Roopa Matole, HDR

Roopa Matole is a licensed, professional engineer with HDR Engineering. She has 7 years as a process engineer on drinking water and wastewater design and construction projects. Roopa completed a master's degree in Environmental Engineering at the University of Kansas. She is currently the chair for Kansas AWWA Diversity and Inclusion committee.

ABSTRACT: Chemicals play an important role in operation of water and wastewater treatment plants. Typical chemicals used at public water treatment plants are lime, alum, ammonia, fluoride, carbon dioxide, chlorine etc. Have you ever wondered why these chemicals are used? If yes, then you are at the right place. Regardless of you being a designer or an operator, the importance of understanding the use of chemicals cannot be understated. The proper use of chemicals can result in effective operation of a plant, which can in turn provide some savings on the operation and maintenance cost.

Typical raw water source include ground water and surface water, and these have different constituents. The typical ground water primary constituents include but not limited to iron/manganese, carbon dioxide, H2S, calcium and magnesium hardness, TOC, pH, alkalinity and other secondary constituents. And the typical surface water constituents include but not limited to suspended solids/turbidity, TOC, pH, alkalinity and calcium/magnesium hardness. Along with these, the surface water are suspectable for algae growth and zebra mussels.

To address these constituents, the public WTPs use different treatment process combined with different chemicals. The typical treatment process includes pre-treatment, filtration, advanced treatment, disinfection, clearwell and high service pumping. Chemicals are fed at different level of treatment. The level of chemical reaction with raw water constituents depends on the treatment process. For example, lime is used during pre-treatment process and fed into a softening basin to reduce calcium and magnesium hardness. During this process, the pH of the water increases and in order to reduce the pH, carbon dioxide is dosed downstream of softening basin. This presentation "Drinking Water Chemicals 101" will provide a high-level understanding of the different raw water constituents, treatment process and different chemicals used, its purpose and dosage locations. Lastly, this presentation will provide high level understanding on finished water

disinfection byproduct and its relationship with disinfection chemical used.

The Role of Carbon Dioxide in Lead Corrosion Control Including Treatment Methods and Equipment

Michael Dirth, TOMCO2 Systems Company

Mr. Dirth earned his Bachelor's of Science degree in Chemical and Petroleum Refining Engineering from the Colorado School of Mines – Golden, Colorado in 1983. Mr. Dirth has held positions as Sales Engineer for Liquid Air Corporation; Process Engineer for the Clorox Company; and CO2 Applications Engineer and Technical Services Manager for Airgas Carbonic. In 2002 he joined TOMCO2 Systems in his current role as Product Manager for the Water Technologies Division. Mr. Dirth has over 30 years of Applications Engineering experience in the CO2 Industry and utilizes this experience assisting Consulting Engineering firms with the design of CO2 pH control systems for Municipal Water Treatment Plants throughout the United States and Canada. Mr. Dirth has been involved with the design of over 500 CO2 pH control systems in his career and is a current member of the AWWA B510 standards committee for Carbon Dioxide.

ABSTRACT: The participant will learn about the effect of CO2 in carbonate chemistry, lead corrosion, dissolved inorganic carbon, the physical properties of CO2, carbon dioxide pH control systems, the equipment required, and the differences between CO2 injection methods. The presentation will be based on EPA Publication 816-B-16-003 (March 2016): Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primary Agencies and Public Water Systems. The focus will be on pH, Alkalinity and dissolved inorganic carbon (DIC) from Sections 2.3.1, 3.1.1 and Exhibit 3.1; as they relate to carbon dioxide (CO2) to minimize lead corrosion in water distribution systems.

The physical properties of carbon dioxide are unique. These properties dictate how carbon dioxide is manufactured, transported, stored and applied into the process. The reaction of carbon dioxide in water is what is utilized for municipal water treatment pH control applications including lead corrosion control.

The typical equipment required is a bulk liquid carbon dioxide storage receiver, vaporizer, vapor heater, pressure regulators, feed panel and diffuser. Detailed discussion of the selection of the appropriate equipment for the site conditions and process application will be discussed. A comparison of different carbon dioxide feed methods will be provided.

Nutrients
Tuesday, March 28, 2023: 8:00AM - 12:00PM
Room: TBD
Moderator: TBD

Concept through Commissioning Collaborative Delivery: Nutrient Removal

Amanda Caldwell-Jacques, Burns & McDonnel; Jeff Bergstrom & Nolan Townsend, Marshal Municipal Utilities

Amanda Caldwell-Jacques is an environmental engineer at Burns & McDonnell. She received her formal education at the University of Illinois. Amanda has experience with municipal wastewater and water treatment plant design, specializing in the areas of facility planning, process optimization, commissioning, and collaborative delivery.

Jeff Bergstrom is the General Manager of Marshall Municipal Utilities. Jeff has more than 30 years experience in the utility industry. As General Manager of MMU, he manages water treatment/distribution, wastewater collection/treatment, electric production/distribution, and broadband services.

Nolan Townsend is the Marshall Wastewater Plant Superintendent.

ABSTRACT: Marshall Municipal Utilities (MMU) has been working hard to keep equipment well beyond its useful life in service at their Wastewater Treatment Plant (WWTP). In 2020 they began the process of looking for a design team to help replace aged equipment, some of which had already failed. Due to the equipment condition, the need was urgent. Burns & McDonnell (BMcD) and MMU elected to utilize a collaborative project delivery method, allowing the project to move forward with additional flexibility, early and consistent cost and schedule understanding, and increased owner control.
BMcD worked with MMU to identify a number of areas of within their facility that were in need of improvement including headworks, secondary treatment including aeration basins, clarifiers, and return pumping station. Several secondary treatment alternatives were reviewed, with consideration to potential future nutrient limits and biological phosphorus removal while balancing current flows/loadings and future development. Equipment and processes that can be easily maintained and operated were given heavy consideration.
At this early study phase, the DB team was able to deliver an accurate cost estimate which allowed the Utility to understand the scope of work and identify some portions of the work that could be performed by MMU labor to further reduce cost and schedule. In addition, an aeration system that can be fully maintained without taking the system out of service ultimately allowed scope and cost to be further reduced by eliminating improvements in a second aeration basin.
The existing two cell (each at 145-ft diameter) aeration basins and three 112-ft diameter clarifier basins are being retrofit with new equipment. After years of labor and cost intensive maintenance dedicated to older blowers and rotating bridge aeration system, the new systems provide greater access and allow equipment to be removed from the basin for maintenance. Biological treatment includes a cyclic aeration system to biologically remove BOD, ammonia, and total nitrogen (TN). Return activated sludge (RAS) is transferred from the clarifiers to the center of the first aeration cell via the existing RAS pump station with only some minor electrical upgrades. Nitrogen removal will be accomplished by cycling the air on and off in the basin, resulting in alternating aerobic and anoxic conditions. During the aerated cycle, ammonia is reduced to nitrate, which is then converted to nitrogen gas in the anoxic cycle. Denitrification, in the anoxic cycle, allows for lower oxygen demands in the process as well as the return of alkalinity to the wastewater.
Aeration will be provided through higher efficiency displacement blowers screw blowers, which will be controlled by dissolved oxygen (DO) concentration and oxidation-reduction potential (ORP) or timer settings. Operators will have the flexibility to adjust cycle times according to influent loading conditions.
The final scope was set to include a new diffused air system including retrievable high-efficiency strip diffusers, submersible mixers, screw blowers, and a supporting electrical building in addition to new clarifier mechanisms. The team then set out to complete a more detailed design and begin procurement of key equipment and improve schedule.
Regular communication between MMU, BMcD, and selected suppliers and subcontractors resulted in quick decisions and amicable solutions to potential problems early in the process, proving that a truly integrated team can make a difference. Collaboration created viable solutions with cost visibility to keep the original budget intact during a time of unprecedented inflationary and supply chain issues.
Construction of improvements is underway with anticipated completion in fourth quarter 2022 .
Discussions on this topic will largely focus on the nutrient removal design, collaborative delivery method, and new process performance.
Audience involvement and contribution will be a component of this presentation so that the audience can get the greatest benefit from this engagement.

Water Research Foundation's Holistic Approach to Improved Nutrient Management – Water Research Foundation Project No. 4974

Dave Clark & Trent Stober, HDR

David Clark is the National Director of Wastewater. He leads the strategic efforts in understanding wastewater market issues as they affect HDR clients. Dave works alongside the regional directors to integrate the national wastewater strategic plan with the regional and local office strategic plans. In addition, Dave works with the business class technical leads to outline technical skills that we need to develop in order to assist our clients. Dave leads the effort to promote HDR's wastewater image, leveraging our technical skills, engaging in research activities and increasing participation in professional organization activities. Dave has over 25 years of experience in the wastewater industry. He has an extensive knowledge of the Clean Water Act and specifically total maximum daily loads (TMDLs) and its impact on HDR clients. Dave has a bachelors and a masters degree in civil engineering from the University of Washington. In addition, he was recently named a Fellow of the Water Environment Federation (WEF).

Trent Stober is HDR's National Director of Water and Wastewater Utility Management Services (UMS) with over 27 years of experience in water, wastewater, and stormwater utility planning and support. His UMS team provides utility planning, risk and resiliency assessments, asset management, financial, and regulatory support for municipal water utilities. Mr. Stober provides a strong technical resource for utility planning and decision-making having guided multi-billion-dollar municipal capital investment programs. He served as MWEA President from 2004-2005 and as WEF Delegate from 2010-2013.

ABSTRACT: Clean water agencies, regulatory agencies, and watershed stakeholders are searching for innovative approaches and best practices to address water quality challenges due to nutrient enrichment and a changing climate. Through a series of interactive workshops in three different geographic regions, this Water Research Foundation project developed a framework to advance nutrient management that fosters innovation and new opportunities. The project goal is to focus on approaches that may be applied nationally and tailored to address unique water quality improvement needs and varying watershed contributions from point and nonpoint sources. Three key webinars were conducted to capture experiences in the western (San Francisco Bay area), eastern (Philadelphia), and central regions (Iowa) of the United States. These sessions were conducted on March 19, 2020, hosted by the Bay Area Clean Water Agencies (BACWA); June 4, 2020, hosted by Philadelphia Water Department; and September 17, 2020, hosted by Iowa Soybean Association and City of Cedar Rapids, Iowa. Overall, these experiences inform holistic approaches to both urban and agricultural nutrient management issues, with an overarching goal to develop innovative approaches and best practices for holistic nutrient management on a national scale.

The culmination of the 2020 webinar sessions and literature review resulted in a new framework to improve holistic watershed nutrient management in the following three key elements. Impacts of climate change and environmental justice challenges were overarching themes that are addressed through this framework and addressed within each element.

- Practices: Technical solutions to understanding and solving water quality challenges. Practices range from watershed and receiving water diagnostic tools to nutrient reduction strategies. Diagnostic tools include continued advancement of watershed and receiving water models, water quality monitoring techniques, and data analytics. Nutrient reduction practices include point source controls through enhanced wastewater treatment and nonpoint source controls implemented through urban stormwater and agricultural runoff best management practices.
- Policies: Innovative approaches to enable nutrient reductions through regulatory and institutional programs. Policy strategies include using regulatory flexibilities through permitting processes, water quality endpoint development, and long-range planning that enable adaptive and incentive-based implementation approaches. Recent

amendments of the Federal Clean Water Act provide defined flexibilities to align municipal utility programs with community priorities, affordability challenges, and water quality needs.

- Partnerships: Collaborative efforts between watershed stakeholders through strong leadership and mutual trust. Effective partnerships rely on principled stakeholder engagement, shared team motivation, and strong organizational capacity. These partnerships involve sharing information, resources, and expertise to develop trust between stakeholders and implement strategies that achieve water quality outcomes.

This nutrient management framework provides a structured process with key success factors that can be tailored to develop holistic watershed-based nutrient reduction plans. Balanced nutrient reduction plans that integrate practices, policies, and partnerships should yield more effective and efficient implementation focused on consensus-based outcomes that provide greater net environmental benefits. The framework also provides a diagnostic lens to identify missing elements of existing nutrient reduction efforts that have not achieved planned outcomes. Water sector engagement and literature reviews demonstrated an overemphasis on implementing point source reductions or restrictive regulatory policies that did not yield meaningful water quality improvements or net environmental benefits. Rather, some nutrient reduction efforts may have resulted in negative environmental externalities while pursuing diminishing water quality returns and missed opportunities to provide more holistic environmental benefits, such as investments into nature-based solutions. Particularly in cases where substantial point source reductions have occurred, opportunities to adaptively manage future efforts with enhanced policies and partnerships may further advance watershed and receiving water restoration.

This session presents a unique new way to advance holistic nutrient management in watersheds with a focus on Practices, Policies and Partnerships. Panelists will address how watershed managers can use the Practices, Policies and Partnerships framework to better plan nutrient management efforts and diagnose barriers to further progress. The influence of climate change and considerations about environmental justice will be discussed. The session will focus on achieving following outcomes:

- Investigate key water quality and regulatory drivers for nutrient reduction efforts and how climate change and environmental justice are overarching influences on future reduction programs.
- Provide an overview of the Water Research Foundation framework for holistic nutrient management and application to existing and developing nutrient reduction programs.
- Identify environmental benefits that may be realized through implementing a program that integrates the practices, policies, and partnerships success factors.

Expanding your BNR Toolkit: Understanding the Application of RAS Fermentation

Leon Dowling, Black & Veatch

Dr. Leon Downing is the Global Practice and Technology Leader for Nutrient Removal and Recovery for Black & Veatch from Madison, Wisconsin. A graduate of the University of Wisconsin – Platteville, Leon received his post-graduate degrees at the University of Notre Dame. Downing provides technology leadership in support of Black & Veatch process engineering and applied research projects globally.

ABSTRACT: Management of the global phosphorus cycle is crucial for long-term sustainability. Water resource recovery facilities (WRRFs) play a critical role in in the phosphorus control and balance in many watersheds throughout North America, and the discharge of soluble and other bioavailable forms of phosphorus from WRRFs has a global impact on soluble-nutrient balances in the water cycle. Enhanced biological phosphorus removal (EBPR) is one key process applied to remove phosphorus from the liquid discharges at WRRFs. Through EBPR, phosphorus is concentrated from the wastewater into the biosolids stream, where it can be recovered in

biosolids or extracted as a fertilizer product. Recycling phosphorus in this way helps close the phosphorus cycle without discharging phosphorus into waterbodies. Over the past 50 years, EBPR has evolved from an unexplained phenomenon to a widely adopted process that is simultaneously praised for its efficiency and environmental soundness and, cursed for its instability. Understanding of the process has never been complete, but recent advances in the research and interests in alternative processes at the facility mean the time has come to enhance water-sector understanding with the latest knowledge of EBPR ecology, functionality, and design.

One of the key innovations for phosphorus removal has been the adoption of sidestream EBPR (S2EBPR) concepts into the design of EBPR facilities. These concepts focus on fermentative activity of phosphate accumulation organisms (PAOs) to drive EBPR, often in sidestream reactors. These sidestream reactors focus on hydrolysis of a portion of return activated sludge (RAS) or mixed liquor (ML) to select for PAOs and drive phosphorus removal. Conventional design EBPR focused on providing volatile fatty acids (VFAs) to PAOs in an influent anaerobic zone. As an alternative, RAS fermentation diverts a portion of RAS flow to a longer hydraulic retention time (HRT) sidestream reactor. In this sidestream reactor, biomass and particulate COD is fermented to generate the VFA required for PAO metabolism. In a strict RAS fermentation reactor, this results is selection of PAO metabolism without direct use of influent readily biodegradable COD (rbCOD) or VFA. In a carbon focused wastewater paradigm, this provides increased flexibility for COD diversion and capture; use of influent rbCOD for nitrogen removal; and potentially more stable phosphorus removal due to a lack of sensitivity to influent COD characteristics.

This presentation will present the most recent results from Water Research Foundation project 4975, which is focused on developing practical guidelines for fermentative phosphorus removal processes. An overview of the project and concepts will be presented, with a focus on carbon balance and carbon sources for EBPR. Multiple case studies will then be presented, each with a different focus:

- Startup of RAS fermentation in Johnson County
- RAS fermentation with carbon addition and the approach to developing an EBPR carbon balance
- Mixed liquor fermentation and impacts of low DO operation

Attendees will be exposed to operational experience, as well as take home messages about designing for fermentation processes in EBPR systems.

Trading TP: Sell It or Keep It?

Jay Hoskins, St. Louis MSD; David Carani & Lacey Hirschvogel, HDR

Jay Hoskins oversees MSD's environmental compliance programs, environmental laboratory operations, and water quality monitoring program. Jay is also WEF Government Affairs Institute Member Association Engagement Director. Jay has a BS in Civil Engineering from the Missouri University of Science & Technology, and a MS in Environmental Engineering & Science from Clemson University.

David Carani is HDR's regional utility management practice lead and helps communities develop effective and affordable plans that prioritize capital and operational investments across dissimilar municipal utilities and functions. He specializes in developing Clean Water Act compliance strategies and understanding the environmental, financial, and socioeconomic impacts that new regulations have on municipal systems and ratepayers. David graduated from the University of Missouri where he earned Masters degrees in both public policy and natural resources science.

Lacey Hirschvogel is a utility planning specialist at HDR. In that role, Lacey works with municipal and industrial clients to develop strategies to navigate state and federal water quality and drinking water regulations, asset management drivers, and utility planning, operations, and financing needs. Prior to working for HDR, Lacey served as the Environmental and Public Policy Manager for a large public utility membership group in

Missouri. She graduated with a Bachelor of Science degree in Chemistry from the University of Florida and a Master of Public Affairs degree at the University of Missouri.

ABSTRACT: Missouri DNR has proposed a Total Phosphorous (TP) effluent reduction target rule for point sources that requires large POTWs to start removing TP in 2029, and all other major POTWs to remove TP by 2033. The rule allows "credits" to be generated and then traded to comply with the reduction targets. This presentation will discuss how these credits are generated, used, banked, or sold for compliance purposes. It will also show the value of trading to managing the cost and timing of building nutrient controls within a utility's capital improvement program.

Pump Stations
Tuesday, March 28, 2023: 8:00AM - 12:00PM
Room: TBD
Moderator: TBD

Increasing Centrifugal Pump's Mean Time Between Maintenance

Ed Dunn, Trillium Flow Technologies

Ed Dunn graduated in 1990 from Purdue University as a BSME. He was immediately employed by Yeomans Chicago Corporation, a manufacturer of wastewater pumps as an Application Engineer. After 4 years, Ed was promoted to the position of Regional Sales Manager. Ed left Yeomans in 2001 to become the Division Manager of Precision Systems a packaged pump station manufacturer. After 12 years in this role, Ed went back to pump sales working for two different companies that manufacture both water and wastewater centrifugal pumps: Crane Pumps and Systems and Trillium Flow Technologies (Current employer). This career has provided Ed with over 30+ years of direct interaction with operators and engineers in the water and wastewater industry.

ABSTRACT: Centrifugal pumps are one of the most commonly manufactured products in the world. For the Water and Wastewater Industry they are used for a multitude of applications from the beginning of the water cycle with Well Pumps pumping water to a water treatment plant to the end of the cycle with Return Activated Sludge Pumps at the wastewater treatment plant. With hundreds of different types of pumps between those two ends, communicating which is the best for each application is too much information to cover in a single session. What we can and will cover however are the items that are universal for all centrifugal pumps. We will start with performance curves and proceed to how a pump reacts to everything it discharges to. We will watch how water flows through a pump and discuss how that water can harm the pump. The goal of this session will be to provide everyone with the tools they need to keep centrifugal pumps operating and maximize the Mean Time Between Maintenance (MTBM) of those pumps.

To begin our discussion, we will present basic hydraulics of a centrifugal pump and its performance curve. We will go through the industry terms associated with centrifugal pumps, like BEP, NPSH-R, AOR & POR, and many more such that everyone understands the terms that pump people take for granted.

We will then discuss the system that the pump discharges into. Can that system affect the pump's MTBM? Yes, it can. We'll see how not all points on a pump performance curve are not created equal. Using Computerized Fluid Dynamics modelling, we will look inside a pump as it operates and see how water can damage pumps.

No centrifugal pump discussion is complete however without a discussion of the other half of

the system, the pump's intake. We will finish up our session with an overview of cavitation, air entrainment, and vortices. How are these items related yet different and how they can all damage centrifugal pumps. Anyone that has heard a pump 'pumping rocks' has heard the damage these things can cause a pump and should want to learn how they can eliminate these issues.

While this session is focused on the Owner/Operators of centrifugal pumps and their need to maximize MTBM of their pumps, our discussion would also assist anyone involved in the design of centrifugal pump applications. A good station and system design are critical to a long lasting low maintenance pump. Trillium has been manufacturing water and wastewater centrifugal pumps since 1933. We have learned a great deal about manufacturing and applying pumps and maximizing a pump's MTBM and look forward to sharing that information with anyone that attends this session.

East Bottoms Pump Station – Rehabilitation in Motion

Jessica Borries, Burns & McDonnell & Steve Harris, Garney

Jessica Borries is senior process engineer and project manager with Burns & McDonnell. Ms. Borries holds a B.S. in Mechanical Engineering from the United States Military Academy at West Point and completed five years of active duty service in the Army with overseas experience. She joined Burns and McDonnell in 2014, and her experience has spanned multiple water treatment plants in the region including evaluation, rehabilitation, and new design of all aspects of water treatment from raw water intake to high service pumping.

Stephen Harris has worked through the ranks from a laborer to a lead man, Foreman, Field Engineer, Superintendent, and Project manager. Stephen's expertise is in the construction of water and wastewater treatment plants, working on both new plants and within existing facilities. His work history has focused on mechanical equipment installation, yard piping, interior piping, instrumentation, gas and chemical systems, and concrete work as well. Stephen has experience leading projects and teams efficiently and working closely with Owners, Engineers, suppliers, and subcontractors to produce successful partnerships and outcomes. He has a strong commitment to safety, quality, meeting deadlines, and keeping projects on track. Stephen has worked on many project delivery methods including Design-Build, CMAR, Hard Bid, and Emergency Outages

ABSTRACT: The East Bottoms Pump Station (EBPS) is the second largest Kansas City metropolitan water supply pump station and is critical infrastructure serving the east side of the City's South Direct Distribution System. Originally built in 1924 and expanded in the years thereafter, the EBPS exhibits deterioration yet continues to function and remains a vital component of the City's water supply system. The EBPS consists of four existing two-stage, bottom suction horizontal split case pumps with a capacity of 24 MGD per pump for a firm pumping capacity of 72 MGD and a below grade 17 MG concrete storage reservoir. The purpose of this presentation is to discuss the development and implementation of a three-phase plan for a complete rehabilitation plan for the EBPS, including unique aspects related to the construction sequencing of the project. The plan began in 2010 with a study to develop the three phases of implementation. The three phases are described below:
Phase 1 of the EBPS improvements was completed in 2015. The improvements included shop refurbishment of pumps 2 and 4, replacement of 13,200-volt switchgear, new controls and communication systems, new battery back-up system, ventilation improvements within the switchgear room, replacement of the pump priming system and replacement of electrical cables, wiring and conduits.

Phase 2 improvements addressed structural and architectural issues with the pump station, including roofing replacement, masonry tuckpointing, cleaning structures on the site, replacement of discharge ball valves and flow

meters for all pumps and replacement of the site perimeter fence.

Phase 3 improvements included two studies to evaluate improved redundancy of total pumping. Alternatives evaluated included a satellite pump station on the site, a different style of pump directly on top of the reservoir, and internal expansion of the facility with a similar pump. Ultimately, an expansion with similar pump was selected and additional analysis was completed to evaluate compatible pump selections and potential reconfigurations of the high-pressure pump discharge piping. Concurrently, a study to evaluate baffling or bifurcation and baffling of the reservoir was conducted. Baffling was selected for final implementation.

Once a final configuration was selected, construction documents and specifications were assembled to implement the improvements. Other improvements that were incorporated to the final construction documents included replacement of the reservoir inlet and outlet slide gates, rehabilitation of the ventilation system, driveway and parking area replacement and installation of baffle walls in the reservoir to improve water turnover in the reservoir. A unique feature of this project is that a set of construction phasing documents were assembled to keep a minimum of two pumps available for operation at all times with the exception of a limited number of pre-approved, single-day duration shutdowns.

Following bidding of the project, Garney was selected as the General Contractor. Prior to breaking ground in the construction phase, the City, Burns & McDonnell, and Garney worked together in a series of meetings to refine and hone the construction phasing documents that were originally provided with the bidding documents. Unique ideas that were identified by the team included salvaging, modifying and temporarily re-installing an existing tee for a temporary bypass pumping pipe, and temporarily using butterfly valves that were released early in procurement to provide flexibility to select which pumps were in service. Additionally, instead of using temporary tees, Garney suggested gutting existing non-functional gate valves and using a custom blind flange plates to allow space for drilling of piles, which helped save schedule and reduced the need for temporary fittings. The reservoir inlet and outlet work was prioritized early in the sequence, thereby allowing the reservoir to be operated in “bypass mode” while the storage area was taken completely offline for approximately 100 days to allow for the construction of new CMU baffle walls. Construction of Phase 3 is currently approaching substantial completion.

Pump Station Flow Meters – Helping bring better Operations and Maintenance of Pumping Systems

Jay Kniker & Jeremy McCoy, St. Louis MSD

Jay Kniker, PE, is currently the Division Manger of Pump Stations at the Metropolitan St. Louis Sewer District. Prior to is current position, he was in the roles of Plant Engineer and Operations Manager. Jay has also work for Private Engineering firms on site development, water systems and pumping station design. Jay graduated from the Missouri University of Science and Technology in 1994 and is a registered Professional Engineer in the States of Missouri and Illinois.

Jeremy McCoy Jr, P.E. is the pump station engineer for Metropolitan Saint Louis Sewer District where he has spent his entire professional career since graduating in 2016 from University of Missouri-Columbia with a Bachelor of Science in Mechanical Engineer. Jeremy has provided support on various operational and capital improvement project throughout MSD Pump Station group, including installation of new equipment and rehabilitation of pump stations.

ABSTRACT: In 2019 MSD Operations decided to start installation of flow meters at their pump stations to address several issues. One to help our Engineering Department in the upgrades and modifications of our pump stations with actual data from the pump station. The second was to use the flow meters in the operation and maintenance of the pump station to monitor failures and to properly choose replacement

pumps. While installing the flow meters, we ran into construction issues on some older pump stations and determining the parameters to use the data in maintaining the pump station.
As part of the Capitol Improvement Program at MSD, modifications and upgrades of existing pump stations are needed. Likewise, new development will often add flow to existing pump stations. A common question from the Engineering Department was “what was the capacity of the pump station”, and “what flows do you see at the Pump Station”. Operations only answer at the time was giving the nameplate data from the pump installed, and going out to perform a drawdown test, or installation of a portable flow meter at the station. Since Operations knew that more pump station upgrade projects were forthcoming as part of the Asset Management Program, it was decided to install flow meters at pump stations to get a historical idea of the flows and performance of the pump station.
Once the decision to install flow meters was made, selecting the first pump stations to receive flow meters was based on critically rating of the pump station, known issues at sites and status of any upgrade projects. Flow meters were researched, knowing that some pump stations would require piping modifications, or installation of flow meters in non-ideal locations. Some pump stations required the installation of multiple flow meters due to current piping configurations.
Upon completion of installation of flow meters, collection of the data in the SCADA Historian became the priority. MSD SCADA was using licensed radio for communications that would not allow the data thru put need for Engineering requirements. MSD started using cellular services to acquire the data.
MSD has been collecting data for approximately 1 year now and are able to provide the Engineering Department a wide variety of flow profiles to include dry weather and wet weather flows. We have also been using these flow meter for new construction to confirm pumping rates for new sites.
MSD Operations are now looking at possible ways to utilize the data in maintenance of the pumps, by using alarm points in the data for possible wear items in the pumps, or even the possibility that the pumps maybe clogged, reducing the possibility of overflows.

Designing a Pump Station the Size of a Football Field

Tim Malcolm, Black & Veatch
Tim Malcolm, P.E. has been with Black & Veatch for 9 years and is currently an Engineering Manager supporting the Government & Environment sector. His work experience includes study, design, and construction phase services for water supply, treatment, and distribution projects. He is a registered civil engineer in the States of Nebraska and Kansas with a Bachelor’s degree from Kansas State University.
ABSTRACT: Beaver Water District (BWD) is a wholesale water supplier in northwest Arkansas. BWD pumps water from Beaver Lake, treats surface water through one of their three plants, and pumps finished water to Springdale, Fayetteville, Rogers, and Bentonville. Total capacity of the BWD plants is 140 MGD. As the population in northwest Arkansas continues to grow and expand to the west, additional capacity to deliver water to the western corridor is needed. In 2020, Black & Veatch began preliminary design of the Western Corridor Pump Station (WCPS) and then began detailed design in 2021. As detailed design progressed, BV and BWD determined bringing on a construction manager at risk (CMAR) was the best course of action to ensure fair pricing and cost control in a volatile construction market. Construction is anticipated to begin in early 2023.
Initial construction of the pump station will provide approximately 20 MGD of firm capacity for the City of Springdale by 2025. Initial buildout capacity by 2040 is designed for 65 MGD firm. The presentation elaborates on technical considerations for designing a large pumping station with space for 16 pumping units delivering water to four separate City distribution systems. A major aspect to the design of a pump station of this size and phased implementation approach was designing each

supporting system to meet the needs of the initial construction and operation as well as future expansions. Project challenges include hydraulic modeling, distribution system integration, facility layout for bridge crane access, pump sizing and phasing, piping layout to provide redundancy, surge considerations, reliability of the electrical system, onsite power generation, remote operation, and architectural design of a large facility in a rural setting. Additional challenges included coordinating timing of construction, testing, and commissioning with two separate pipeline projects connecting to the suction and discharge sides of the pump station.

Asset Management
Tuesday, March 28, 2023: 8:00AM - 12:00PM
Room: TBD
Moderator: TBD

Building an Effective Asset Management Program: City of Springfield's Journey
*Allen Busick, City of Springfie*ld
Allen Busick the is supervisor for capital projects at the Springfield, MO Southwest Wastewater Treatment Plant and Northwest Wastewater Treatment Plant. He has work at his current position at the treatment plants for 6 years. He worked in the chemical industry prior to working at the City. Allen graduated from the University of Arkansas in 2011 with a degree in chemical engineering and is a registered professional engineer in Missouri. He is passionate about helping to keep the Ozarks waterways clean and safe now and for future generations.
ABSTRACT: Asset management is a critical component of efficient operations. Equipment reliability ensures that equipment is available when needed and at the required capacity. Equipment available is critical to ensuring permit compliance. Proper asset management also helps to reduce overall lifecycle costs and therefore customer rates. It is critical in all phases of an asset's lifecycle: design, commissioning, operation, and disposal. Successful asset management should involve all personnel, including maintenance, operations, engineering, and administration. Preventative maintenance is a key component of a successful asset management program. This helps to ensure that downtime is planned and that equipment remains at its peak performance. This reduces the required reactive maintenance labor and costs. Top maintenance programs target 85% of labor hours as preventative maintenance. Preventative maintenance practices at Springfield includes fluid analysis, infrared thermal imaging, motor alignment, and lubrication. However, preventative maintenance is only a portion of asset management. Asset management begins with design for reliability. Proper design and commissioning can significantly reduce the lifecycle costs of an asset. Performing regular condition assessments helps to identify failures before they become an issue. Understanding failure modes can also help to correct maintenance and operational procedures to increase the time between failures.
The City of Springfield recently upgraded their computerized maintenance management system (CMMS). To make the most of the software, the City has focused on training and implementing best practices for asset management. The CMMS system allows the City to create a strategic asset management policy and track that strategy through the use of key performance indicators. Development of a strategic asset management program requires the development of a mission, goals, and strategy. Strategy should contain measurable goals specific to the program and reviewed on a regular schedule. Once the strategy is developed it can be tracked using KPIs. The City has also undergone changes to improve asset reliability by also adopting best practices during design and commissioning. Ensuring that systems are

designed and constructed for reliability can require simple changes but may have a big impact on the asset lifecycle. Correcting and preventing errors in this phase can reduce the total lifecycle cost. Springfield has many lessons learned with how issues with design can affect equipment reliability. During commissioning, training is also an important part of asset management. This helps to ensure that staff understand how to reliably operate and maintain the asset. However, training should be optimized to ensure proper use of staff time and investments. Proper management during design and commissioning can set the tone for the entire asset lifecycle.

Leveraging Energy Management Principles to Enhance Asset Management Programs…with a touch of Pump System Optimization Solutions (SOS)

Eric Dole, Garver

Eric Dole is a senior project manager at Garver where he serves as the Water and Energy Practice Leader. He specializes in delivering sustainable infrastructure solutions through optimized hydraulic systems and the unit processes they drive. Eric is the co-author of Chapter 3 of the AWWA M83 - Energy Management of Pumping and Treatment Processes MOP. He is a certified Pump Systems Assessment Professional (PSAP) through the Hydraulics Institute, and also an instructor in the HI PSAP course. One of his pump optimization projects was featured as the cover story for the WE&T Magazine in the November 2020 issue, titled “Pump Analysis – Training and Certification Drives Savings”.

ABSTRACT: For years, traditional asset management utilizes ASHRAE Level 1 audits where a visual assessment of a critical process components, such as pumps, blowers, filters, clarifiers, tanks, pipes etc. are performed. The engineer develops an inventory list and a risk register by coupling the field assessment data with the historical maintenance logs. This risk register is used to systematically evaluate risks, define their priority and potential impact, and document mitigation strategies with their respective costs. But does this tell the entire story? For electro-mechanical equipment the answer is “NO”. This presentation will reveal how energy intensity mapping and wire to water efficiency testing can significantly enhance the LOF accuracy.

Often a weathered, 12-year-old pump that was, and still is, properly designed for the application has a much higher wire-to-water efficiency than a 2-year-old pump that was improperly designed or operated. As such, the remaining life of the 12-year-old pump could be significantly greater than the improperly designed 2-year-old pump. This does not consider the fact that the electrical costs associated with operating an inefficient pump often overshadows the maintenance costs.

A better way to evaluate the “true” remaining useful life, or likelihood of failure (LOF), of critical electro-mechanical equipment and related processes is to integrate energy management strategies into the asset management protocol. Aspects of an energy management master plan, such as energy intensity ranking of facilities, can help prioritize the sites with higher kWh/MG or kW/MGD as locations that should be evaluated first, because these are the sites that poorly utilize electricity comparatively. An asset that does not utilize electricity efficiently to pump, treat or distribute water is an asset that will likely experience excessive maintenance and near-term failure, while also consuming excessive amounts of electricity resulting in high operating costs. Determining the baseline efficiency of internal pumping/aeration loads for high energy intensity sites, developing suggestions to help improve efficiencies and quantifying the operational savings into the replacement cost of the asset brings a new light to the business case. Often the improvement recommendations, or energy efficiency measures (EEMs), can be non-invasive like addition of an air release valve or changing the billing tariff structure of the site, to more invasive EEMs like pump/blower replacement.

This presentation will cover:

- The basics integrating energy management (EM) into asset management (AM)
- How to deploy wire-to-water and wire-to-air testing
- Interpreting the results
- Example EEMs
- Determining energy and operational cost savings

Gearing up your Asset Management Strategy for Wastewater Capital Planning

Dustin Hill & Claire Samojedny, Burns & McDonnell

Dustin Hill manages Burns & McDonnell Water & Wastewater Planning Group and is an Associate Civil Engineer. He has a bachelor's degree in Civil Engineering and a Master's Degree in Water Resources & Environmental Engineering. He has 17 years of industry experience in the water and wastewater planning space with technical experience focused on collection and distribution systems including hydraulic modeling, risk assessment, asset management, master planning, and program management for large scale private and public source I/I reduction programs.

Claire Samojedny is an Assistant Civil Engineer in Burns & McDonnell's Water Planning Department with almost two years of experience. She focuses on water distribution and wastewater collection system hydraulic modeling and asset management services.

ABSTRACT: The City of West Plains, MO has initiated a large scale, multi-year Wastewater Collection System Assessment & Capital Planning Program. This program includes condition assessment of major wastewater system components including gravity sewers, manholes and lift stations. Additional wastewater planning initiatives will include hydraulic modeling to complete a capacity assessment of the existing wastewater collection system, as well as evaluation of population growth within the community and the wastewater conveyance requirements to facilitate the growth. Collectively, these planning initiatives will support development of a long-term Capital Improvement Plan (CIP); focused on Inflow/Infiltration (I/I) Mitigation Planning, Capacity Improvement Project Planning and Sewer Rehabilitation Program Planning.

To aid the City in executing a program of this type, an effective asset management strategy was necessary to support data-driven decision-making capabilities, including risk-based prioritization to support long term wastewater capital planning.
Successful implementation of these strategies requires effective asset data management techniques that are transparent to all project stakeholders and allow all team members to collaborate against a common goal. Being able to efficiently gain access to tools which deliver up-to-date information regarding collection system asset data, inspection results and future planning impacts is critical.

The City of West Plains Wastewater Asset Data Management Plan focuses on the following strategic goals:

1. A strategy for updating the City's Wastewater System Geographic Information Systems (GIS) as part of the Wastewater Condition Assessment Program.
2. Establish effective tools to track progress and provide efficient access to asset data and inspections when and where it is needed.
3. Implement dynamic decision-making tools to enhance capabilities for developing cost-efficient strategies for wastewater capital planning.

In order to meet these goals, the following Strategic Initiatives provide a list of action items necessary to meet the goals and vision of the Asset Management Plan:

Strategic Initiative #1 - Communications: Set-up and support a sustainable and participatory governance structure to effectively prioritize, coordinate, and share information about wastewater asset data management.

Strategic Initiative #2 – Wastewater GIS: Update and maintain an accurate digital representation of the wastewater collection system
Strategic Initiative #3 – Wastewater Assessment Data: Collect and store asset and condition assessment data to support the wastewater collection system planning program. Develop solutions which allows easy access to collection system inspection data.
Strategic Initiative #4 – Wastewater Planning & Reporting Tools: Develop effective tools for City stakeholders to access and identify project scope, schedules and budgets for sewer rehabilitation renewal, I/I mitigation strategies and capacity improvement projects.

This presentation will highlight the overall asset management strategy that has been developed for the City of West Plains, Missouri in advance of a multi-year wastewater master planning effort. The asset management strategy will discuss the immediate needs and timing of the digital tools necessary to deliver wastewater capital planning initiatives while considering how the tools can be incorporated into more longer-term strategies for supporting delivery of the master plan as well as integration of wastewater operations and maintenance initiatives.

Riding the Asset Management Wave from Awareness to the Kiddie Pool
Michelle Carter, HDR
Michelle Carter has 17 years of experience with HDR in various municipal water and wastewater projects including facility planning, pipeline design, pump stations, flow metering, rehabilitation, condition assessment, project management, construction administration, and construction inspection. She received a Bachelor of Science in Civil and Environmental Engineering from South Dakota State University, is a registered Professional Engineer, and in her free time, she enjoys walking whichever direction her combined total of 180 lbs of dogs decides to walk.
ABSTRACT: In 2019, the Missouri Public Utility Alliance Resource Service Corporation (MPUA) recognized that addressing aging wastewater collection system infrastructure is consistently one of the most important challenges currently facing small and medium-sized communities (less than 20,000 population) in Missouri. After a Steering Committee, HDR and MPUA rolled out an MPUA Asset Management Toolkit; on the Missouri Department of Natural Resources website, focused on wastewater collection systems in 2020, the project planning landscape has changed so much that implementation of Asset Management is critical to keep up with the fast pace of tracking improvements needed. This presentation will remind communities of the tools available to them but also walk through the strategy of implementing different Phases (varying levels of complexity) to your asset management program depending on your needs and current data set(s). This presentation will also introduce the differences in data needed to apply a similar Asset Management strategy to water infrastructure given the focus that will soon be placed on LSL inventories and documentation of water distribution system infrastructure. Condition data has been less comprehensive for smaller communities on water infrastructure as opposed to wastewater collection systems leading to less utilization of Asset Management tools on water pipelines. Key take-aways will be:
- understanding importance of data collection
- selecting level of detail in condition assessment inputs for desired outcome
- considering mutual benefits of AM efforts for ties to work orders, preventive maintenance, etc
- how to set a goal for rate of asset replacement
- and; forecasting (spreading out) replacement costs

Depending on a municipalities available data sets, recommendations covered will show how Asset Management programs can support documentation of current utility inspection, maintenance, standard operating procedures, and renewal practices. A reminder of the calculation tools within the MPUA toolkit will also be reinforced so users understand how to

communicate with their governing stakeholders and public groups that their budgeting strategy for the utility is sustainable and data driven rather than reactive.

Collection Systems
Tuesday, March 28, 2023: 8:00AM - 12:00PM
Room: TBD
Moderator: TBD

Wipes Out the Wipes Crisis
Chris Downey, JWC Environmental
Chris Downey is the Midwest Regional Sales Manager for the Municipal business at JWC Environmental. He has direct responsibility for the growth of JWC's sales in the Midwest region and management of JWC's strategic partners in the area. He has over 15 years of industry experience with previous positions at Franklin Electric, Hydroflo Pumps USA Inc., and American Marsh Pumps. Chris has a B.S. in Industrial Distribution and an MBA, both from the University of Nebraska.
ABSTRACT: Headlines blaming wipes for sewage clogs and overflows seem to be an everyday occurrence. The composition of modern sewage is vastly different than influent from just a few decades ago and many collection systems are not designed to handle the challenging combination of wipes, fats, oils and grease. This evolution is leading to unplanned maintenance, increased worker exposure to safety risks, and expensive equipment damage. With the increased use of flushable wipes and other disposable, non-dispersible fabrics that end up in the waste stream, the challenges facing collection systems will continue to grow. Combined with the vast deterioration and disrepair of the North American wastewater system, municipalities require cost-effective, reliable solutions to deal with tough debris and to protect downstream equipment — without the luxury of a total system retrofit.

A reduction in the use of disposable wipes is not likely to happen soon. Wipes manufacturers are experiencing resounding success in the sale of household, industrial and healthcare cleaning wipes because they offer a convenient, hygienic and inexpensive cleaning option. There are no signs of the demand slowing. The global market for disposable wipes is forecasted to grow another 30% from under $20 billion in 2020 to over $26 billion over the next 5 years.

The crisis for wastewater professionals caused by the wipes has led to a variety of approaches including increased public education by utilities as well as legal actions at the municipal, state and federal levels. These efforts have had some localized success but have not resolved the problem.

In 2014 JWC embarked on a testing program to understand the different technologies available to combat wipes and how they deal with different types of flushed items. Their focus was on pre-conditioning non-dispersibles through grinding before they reach the pumps. The research also evaluated the mechanisms of "reweaving" where wipes form into long ropes or balls when combined with hair and FOG in the collections systems.

There are other technical options to address non-dispersibles. Numerous pump designs exist that can handle solids but there are design considerations on how they handle wipes. Just because a pump can pass the wipes does not necessarily prevent the wipes from causing a clog downstream in the collection system. There are also compact screening solutions to remove the wipes at pump stations.

JWC's presentation will first investigate the state of the wipes market today and current developments in the industry. We will then look at the effectiveness of public service announcements and legal efforts to combat the

wipes menace. Finally, we will look at technical options in pumps, grinders, and screens to handle wipes in collections. The overall goal is to provide information on the various options available to provide effective solutions to prevent equipment damage, eliminate worker safety risks, and reduce the time and energy costs associated with clogs in the collection system.

Getting it Right: Effective Sewage Overflow Response and Reporting

Jeff Pierce & Amir Kenner, KC Water

Jeffrey D. Pierce, Utility Superintendent, KC Water, supervises the investigations and Inspections section with a focus on CCTV, inspections, supplemental repair contracts, private line locate and investigations. He will share specialized information gleaned from 22 years at KC Water, including nine years as superintendent and five years dealing with leak survey practices and pipeline investigations and repair.

Amir Kenner, Senior Engineering Technician, KC Water, supervises the CCTV Investigations section and has experience in the investigations and inspections of wastewater and storm water sewer mains, laterals, and supplemental repair contracts. Mr. Kenner is the sole drone pilot with KC Water and has logged over 53 hours of 279 flights covering 321.5 miles. Utilizing the drone, Mr. Kenner has assisted in locating manholes, identifying sewer overflows, sewer asset inspections and other special projects assigned by the City Manager and KC Water Director. Mr. Kenner has over 17 years' experience, knowledge, and professionalism with KC Water

ABSTRACT: With any sewer collection system, events occur that sometimes release sewage into the environment. These sanitary sewer overflows -- both undesirable and inevitable -- ultimately require effective and efficient correction. Responsible utility management, environmental protection, public accountability, and regulatory requirements demand that these events be quickly and accurately identified, correctly and thoroughly controlled, and consistently and completely reported in order to achieve an objective of mitigating the adverse effects of similar events in the future.

With a geographic area of more than 319 square miles and serving a community of more than half a million regional residents in the Kansas City area, KC Water has developed and practices rigorous procedures to respond to the overflow of sewage into the environment. In particular, as one of 45 communities nationwide subject to a federal judicial consent decrees addressing combined sewer systems (CSOs), KC Water has developed unique expertise in policies, protocols and procedures related to managing sewage overflows.

This presentation will discuss the response protocols, functional procedures, technological tools, and reporting mechanisms that KC Water utilizes to resolve the environmental concerns of sanitary sewer overflows, including but not limited to:

1. An overview of KC Water's Sewer Overflow Response Plan.
2. Investigation, cleaning and repair processes specified in the plan.
3. Procedures to report sewage overflows to City and state officials and the public.
4. Special considerations learned from Kansas City's federal CSO consent decree requirements.
5. Regulatory and public notification practices and details, including media releases and public health considerations.

Attendees will gain understanding and insight into successful best practices associated with responsible utility response to sanitary sewer overflows. Information will be comprehensive and detailed and include information about functional steps developed and perfected from more than a decade of experience by one of Missouri's leading water utilities.

Taming St. Louis' "Fox River"; Sewer Design Challenges Within the Urban Core

Bob Welsch & Emily Sweeney, Stantec; Jared Barr, St. Louis MSD

Bob Welsch, P.E., is a Senior Principal in Stantec's St. Louis office with over 24 years of

design and management of large water resources infrastructure projects throughout the Midwest. He has a bachelor's and master's degree in Civil Engineering from the University of Missouri-Rolla. His projects range in scope from storm improvements, streambank stabilizations, inflow/infiltration analysis, H&H modeling, sanitary and combined sewer design including CSO/SSO assessment and developing construction documents and cost estimates.

Jared W. Barr, P.E., CFM is a practicing Civil Engineer and project manager in MSD's capital project program management group. He has a master's degree from the University of Iowa in Hydraulic Engineering. He has over ten years of experience working at MSD with considerable experience in delivering complex sanitary and combined sewer projects.

Emily Sweeney, P.E., is a Senior Project Engineer in Stantec's St. Louis office with over 15 years of experience with water and wastewater projects throughout the Midwest. She graduated from the University of Missouri St. Louis – Washington University Joint Undergraduate Engineering program with a Bachelor of Science in Civil Engineering. Her experience includes storm and sanitary sewer design, SSES, pump station and force main design, combined sewer overflow (CSO) control planning and design, and levee accreditation projects. She currently lives in St. Louis with her husband three daughters.

ABSTRACT: Surface flooding and building backups were occurring at the Fox Theater and several other notable businesses within the Grand Center area of the City of St. Louis. The alley next to the Fox Theater was known as the "Fox River" by businesses along the alley due to the amount of flooding that occurred during rain events. The area is served by a combined sewer that discharges into an 8-foot diameter brick trunk sewer. The project identified to mitigate the flooding issues, Olive/Washington – Grand to Vandeventer Combined Sewer Relief, is part of the Metropolitan St. Louis Sewer District's Cityshed Mitigation Program included in the Consent Decree.

The preliminary solution to alleviate the flooding and surcharging in the combined sewer was to construct a new storm sewer through the alley, parallel to the existing combined sewer. Based on a review of historical plans, it appeared that most of the buildings had separate laterals for the storm water and sanitary discharges, so separating the sewer seemed to be straight forward. In addition, the preliminary investigation into utility locations did not reveal any conflicts through the alley.

As with most design and construction projects within a tight urban corridor, it was anything but straight forward. The existing combined sewer was installed in the early 1900's in a primarily residential area. The Fox Theater, built in 1929, is the oldest building that is still connected to the system. With so much development and change along the alignment, several lateral connections were abandoned without being properly capped or disconnected from the sewer. Along with the developments adjacent to the alley came a slew of communication and electric utilities. In addition to the issues discovered through the alley, the new parallel sewer had to connect to an existing 8-foot diameter brick sewer, approximately 20 feet below grade, in the middle of a busy intersection.

For a parallel storm sewer to solve the issues occurring for the businesses along the alley, the majority of the storm water needed to be directed to the new sewer. To identify the storm vs. sanitary connections, every bathroom, kitchen, sink, drain, etc. at each of the buildings along the alley was dye tested. Two of the businesses had combined laterals that could not be separated. Utilizing the XPSWMM hydraulic model, it was determined that one of the businesses could remain connected to the existing sewer and the other business would have to be connected to the new sewer, changing the new sewer design from a storm sewer to a combined sewer. The alignment, elevations, connection locations, and inlet placements were carefully laid out to avoid as many utility conflicts as possible. The design

was complete, everything seemed to fit together perfectly, and then construction started.

Several issues arose during construction of the new sewer. Between a large electric utility vault that spanned the entire alley to an array of fiber optic cables covering depths between 2 feet and 14 feet with shoring left in place, at times it seemed like we would have to settle for the project to provide a lower level of service. While it didn't turn out exactly as planned, construction of the project was successfully completed in 2021.

This presentation will discuss the numerous challenges and obstacles that arose during the design and construction of the new sewer and strategies that were used to avoid or work around obstacles to keep the project moving forward, while still providing the businesses along the "Fox River" with the desired level of service. Working in a congested urban corridor with a spider web of utilities seemed impossible at times, but with some unique solutions and adaptability the end goal was still achieved.

A microbial source tracking study to identify fecal contamination in a karst water system

Saki Urushidani, City of Springfield & Dr. Babur Mirza, Missouri State

Saki Urushidani graduated from Missouri University of Science and Technology with her degree in Environmental Engineering in 2016. She is a licensed professional engineer who works for the City of Springfield's Environmental Services Department where she assists with MS4 permit compliance through project design and management. She also works with various aspects of the Springfield-Greene County integrated plan for the environment. She is the outgoing Chair for the Missouri Water Environment Association's Diversity, Equity and Inclusion Committee.

Babur Mirza is an Assistant Professor of Microbiology at Missouri State University. He received his doctorate in Microbial Ecology from Texas State University San Marcos. From 2010 to 2017, he worked as a postdoc and research scientist at the University of Texas at Arlington and Utah State University. His research expertise includes Microbial Source Tracking and genetic identification of bacteria in various environments.

ABSTRACT: Rivers and streams provide valuable services, such as drinking water, fisheries, and recreational opportunities. According to Environmental Protection Agency, more than 50% of the total tested rivers and streams within the USA have been identified as bacterially impaired based on the presence of fecal indicator bacteria (FIB). Waterborne pathogens originating from human fecal material of infected individuals are one of the major areas of health concern in karst environments where water can easily flow from old leaky septic tanks and broken sanitary sewer lines into rivers and streams. The current study was focused on temporal monitoring of FIB in Sequiota Spring. Based on an initial Microbial Source Tracking (MST) study, we observed a high abundance of human fecal indicator bacteria (HFIB) (up to 110,000 cells/L water) in July 2020.
The City of Springfield initiated a detailed assessment and repair plan for the upstream sanitary sewer lines as an initial remediation solution. Through this remediation effort, the HFIB significantly decreased (up to 55 times) in June 2022. We also assessed the waterfowl fecal indicator bacteria which were low ~300 cells/L and remained unchanged from the year 2020 to 2022. This suggests that the sewer repairs completed in the recharge area of Sequiota Spring were a primary cause of the reduction in HFIB. This study demonstrated a successful remediation effort in reducing human fecal contamination to reduce potential health risks at this site.

Wastewater Treatment
Tuesday, March 28, 2023: 8:00AM - 12:00PM
Room: TBD

Moderator: TBD

The Elusive Granule: How to Grow Flocs in a Continuous Flow System

Teresa Copper & Eric Redmond, Black & Veatch

Theresa is process engineer with Black and Veatch. She graduated from the University of Kansas with a Bachelors in Civil Engineering and a Masters of Environmental Engineering. Her focus area includes designing around granulation and densification processes.

Eric is a senior process engineer with Black and Veatch. He graduated from the University of Iowa with a masters of Environmental Engineering. His focus area is low energy nutrient removal, coupled with intensification approaches. These include low DO operation and nitrogen transformation with aerobic sludge granulation.

ABSTRACT: Aerobic granules and densified activated sludge can increase plant capacity, improve resiliency to toxicity, and lower energy demands compared to conventional activated sludge. Aerobic granules are large, dense microbial aggregates with typical diameters of 100- 5000 microns and sludge volumetric indices (SVIs) below 50 mL/g. In contrast, activated sludge flocs with good settling properties are typically 10 - 150 microns in size and exhibit SVIs of 100 – 150 mL/g. Densified activated sludge is defined as a combination of granules and flocs or excellent settling sludge bordering on granules. One of the main benefits of granules or densified sludge is improved settling characteristics, which can provide existing plants with increased capacity by allowing higher loading to secondary clarifiers.

Commercial aerobic granular sludge applications, such as the AquaNereda® process, utilize sequencing batch reactors (SBRs) to select and retain aerobic granules. While SBRs may be convenient for supporting aerobic granulation, similar selective pressures can be implemented in continuous-flow systems, leading to small granules or large flocs with enhanced settling properties and opportunities for nutrient removal; due to the unique biofilm structure of granules with allow for simultaneous nitrification and denitrification (SND). Multiple continuous flow plants across the US have reported instances of low SVIs (i.e., 40-60 mL/g) and dense flocs as observed via the microscope.

This presentation will use local case studies where continuous-flow granulation is achieved via metabolic and physical selectors to explain how these concepts can be applied for process intensification and biological nutrient removal (BNR). One focus area will be a full-scale experiment comparing a high food to microorganism (F/M) ratio vs. one at 50% in a side-by-side comparison.

The key concepts that will be discussed include:

1. Selector zone Food-to-Microorganism ratio (F/M): the F/M loading rate in selector zones, as well as the ability to achieve consistent feast and famine conditions in the aeration basin, are key to granulation. Data from full scale operations for two Kansas Plants, and other nearby facilities in design, will be used to demonstrate the importance of F/M values to achieve low SVIs. A large focus will be placed on design and operation to achieve F/Ms of 0.2 to 0.4 g COD/gTSS-d for stable granule formation.

2. Aeration control and DO setpoints: the criticality of selector zone effluent rbCOD on granulation and the ability to operate at low DO setpoints will be discussed in detail.

3. Selective wasting approaches: selective wasting by surface wasting (i.e., telescoping valve or rotating weir) and hydrocyclone separation will be discussed with design concepts from local facilities.

Audience members will gain an understanding of granule formation in a continuous-flow system and will be able to identify the performance and capacity benefits for their individual facilities.

Designing for Growth - KCMO's Todd Creek Granular Sludge WWTP

Jeff Keller & Paul Ward, Burns & McDonnell & Shawn Cross, KC Water

Jeff is the Technical Services Manager for Burns & McDonnell's Water Practice Area. He has been involved in water projects for 25 years with a focus on collaborative delivery, biological nutrient removal, and asset management. Jeff is a member of the DBIA National Water/Wastewater Markets Committee.

Paul is a Senior Engineer in Burns & McDonnell's Kansas City office. He is a registered Professional Engineer and has 10 years of professional experience. His focus is on biological treatment systems, process modeling, and treatment plant operations.

Shawn is a Project Manager with KC Water in the Facilities and Plants Engineering Division. He graduated from Missouri University of Science and Technology with a Bachelor of Science in Mechanical Engineering. His background is in bulk solids handling where he designed and installed systems in Chemical and Food plants all over the United States. He decided to join the Water and Wastewater industry on the owner side 4 years ago, and works at the Blue River WWTP

ABSTRACT: This presentation is the second in a planned series of 4 or 5 to track the challenges encountered in the life cycle of project development from study through design, construction, and startup of this new WWTP. It follows up on the first presentation given during the 2021 Joint Conference.

This first AGS facility in the State of Missouri has faced several challenges through the design development. This presentation will help to describe the challenges that the design team and owner addressed and help provide potential solutions to other communities that face similar challenges to growth, project budgets and permitting.

The planned new Todd Creek WWTP will serve a rapidly developing watershed, where projections of wastewater flow rates were increased significantly after the Facility Plan was developed. Because of these changes to projected growth, an antidegradation study was triggered during preliminary design, which resulted in significant coordination efforts with MDNR and technology providers to assure process performance. This population growth impacted the size of the facility from 3.4MGD to 4.6MGD, driving an increase in overall projected project cost, which was already escalating at each design milestone due to worldwide logistics and supply chain issues. The team worked with the City to manage costs through an extensive value engineering (VE) study, where a number of design alternatives were considered in terms of capital benefits vs. long-term performance for the City. Beyond pure design alternatives, the VE study identified the potential to have a 2-step permit that would allow downsizing of the biological process in the near-term with a lower initial project cost. This helps to protect rate payers from paying for capacity not needed in the watershed for many years. Due to the more modular nature of the AGS system, this reduced capacity was relatively easy to design as a 3-basin system versus the originally planned 4 basins. The modular nature of AGS system means future expansion of the design will be simpler and more integrated compared to a more conventional process with splitter structures, clarifiers, and return sludge pumping facilities. Finally, the AGS process is considered an innovative technology, which required extra coordination with MDNR to determine if the process could be permitted without a formal demonstration period after startup. Since many existing AGS facilities are located in Europe, providing adequate operating data to forego this requirement was challenging. The end of presentation will include a tour of the existing project model, showing process choices and interior of designed facilities.

The audience will gain insight into AGS technology as well as understand how value engineering can help improve project capital costs and value-based decisions for facility Owners. The presentation will also help the audience understand how watershed growth can

impact facility planning and permitting for treatment facilities.

The Answer to Sustainable, Effective Wastewater Treatment Is Under Our Feet

Suzan Chin-Taylor, Creative Raven & J. Rodney Dickerson, EnBiorganic

Suzan Chin-Taylor, MSc is an international entrepreneur, published author, course creator and keynote speaker. Her firms, The TUIT Group and Creative Raven, take the mystery out of digital marketing and PR to help businesses in the wastewater infrastructure, treatment and related civil infrastructure sectors thrive. She also hosts a weekly show, the DooDoo Diva's Smells Like Money podcast, dedicated to the wastewater industry, with a mission to deliver industry know-how from industry pros who know how.

J. Rodney Dickerson, PE, is a graduate of LTU, with a BS in Chemical Engineering. Rod has an extensive background in the fields of advanced microbial technologies for the treatment of municipal and industrial wastewater.chemical engineering, project engineering and corporate development. He holds 7 environmentally related process patents with several more pending. These process patents relate to the treatment of both water and air for contaminants and odors, and application of microbes to wastewater collection systems for elimination of odors, reduction of sludge and improvement of wastewater treatment process operations and capacity using microbiology.

ABSTRACT: The wastewater industry as a whole has now been given an opportunity to take another look at bioaugmentation from a different perspective and mindset. The term is not new but due to its inconsistent results, it has lost favor, however it isn't bioaugmentation's fault, we simply weren't using the best way.

This presentation will reveal how bioaugmentation is still one of the best and most viable solutions to some of wastewater's biggest pain points when the right microbiology and methods of application are utilized. We will be discussing how microbiology in wastewater treatment really works and the types of microbes that are best suited to deliver the desired results and why. The answer is truly under our feet – soil microbes.

Together we will explore soil biology or genus bacillus, and how mother nature has provided us with the optimum wastewater super-hero bacteria, why it works so well and how it can be applied effectively into collection systems, septic tertiary treatment facilities and municipal treatment plants to create a natural, sustainable method of treatment that lowers the carbon footprint and operational overhead.

Learning Objectives:
1. Discuss bioaugmentation, why forms of it have failed and how it is still the future of wastewater treatment
2. Explain the differences in microbiology that can be used for wastewater treatment and their pros and cons
3. Discover why soil bacteria is so effective at breaking down effluent material than anything we've ever tried before
4. Contrast and compare things that have been used in the past, long-term effects and how adopting a natural approach is more effective and sustainable
5. Discuss how using bioaugmentation with soil microbes benefits collection systems, mechanical treatment plants, lagoon facilities, onsite and industrial facilities

First North American Installation of an Adaptive Clarifier Inlet

Mario Benesch, HDR

Mario graduated from University of Stuttgart, Germany with MS in Environmental Engineering in 1998. Mario has 24 years with HDR in Portland OR as a senior wastewater process engineer.

ABSTRACT: The first US adaptive clarifier inlet installation has been commissioned in Norfolk, VA (Nansemond WRF, Hampton Roads Sanitation District). This technology has the potential to resurrect old shallow clarifiers to perform equal or better than a modern deep clarifier. This can lower compliance cost for many utilities that may otherwise require

replacements, additions, or filters. Upgraded clarifiers (in Europe) have demonstrated a 60% to 95% reduction of clarifier effluent solids and proven capacity gains up to 50%.
Conventional clarifiers are generally limited in their performance by the settling characteristics of the biological sludge and hydraulic conditions in the clarifier. The Hydrograv Adapt variable inlet structure (HA) changes that. Unlike traditional inlet structures, mixed liquor is introduced near the bottom of the clarifier below the sludge blanket. In addition, the inlet elevation and opening height adapts to the load thus always operating under ideal hydraulic conditions. Embedded in the functioning principal is also blanket filtration. With MLSS introduced into the sludge blanket, flow filters through the blanket comparable to a contact clarifier

This adaptive inlet has already been in operation for more than two years but was limited to manual operation due to pandemic related delays until August 2022. Yet still the average effluent turbidity was below 2 ntu and lower than the control clarifier. Throughout several stress tests the upgraded clarifier has shown to perform better than the control and the results of the high load tests suggest that the adapt clarifier now has 30% more capacity. Final commissioning and testing were conducted in August of 2022. Further capacity testing will determine if of the planned two new 160 ft clarifiers can be eliminated based on the archived capacity gains, which would save over $10 million after accounting for upgrading two existing clarifiers and equipping one new clarifier with adaptive inlets.

Lead & Copper / PFAS
Tuesday, March 28, 2023: 1:15PM - 5:00PM
Room: TBD
Moderator: TBD

Five Liter LCR Study by the City of St. Louis Water Division
Jim Kopp, City of St. Louis Water Division
Jim Kopp graduated from William Jewell College in Liberty MO with a BAs in Biology and Chemistry. Jim has been employed with the City of St. Louis Water Division since 198 and have held the positions of Chemist I, Chemist II, Chemistry Manage and now am the Laboratory Director. Jim supervises two laboratories at two different locations. The laboratories are responsible for assisting with the water treatment process and conducting microbial and chemical compliance analysis on the finished produced by our two water treatment plants.
ABSTRACT: In preparation for the Revised Lead and Copper and when asked by the MODNR to repeat full LCR monitoring, the City of St. Louis Water Division decided to collect our LCR samples using the sampling requirements specified by the Revised Lead and Copper and analyze all five liters collected at each location for lead and copper. Due to the average size our residential lots, the close proximity of the homes to the street, and the average size of our lead service line (1/2" or 3/4"), it is anticipated that a number of our sample locations will be drawing water from the main by the fifth liter sample.
The Water Division practices corrosion control through lime softening and elevated finished water pH above 9.3. Our water is slightly scale forming and our 90th percentile for Lead has been < 5.0µg/L since the first LCR study conducted in 1992
The study is still in process as of 10/31/2022. We are currently analyzing the second round of samples. The results from the first round of samples indicated that approximately 21% maximums for lead were found in samples 2 – 4 and 25% of the maximums for copper were found in samples 2 – 4 and therefore would be missed by the Revised LCR and the Improved LCR

The presentation will include the history of our treatment process and the challenges of trying to obtain 100 participants with lead service lines.

MO DNR Lead Service Line Inventory Spreadsheet

Austen Dudenhoeffer, DNR

Austen Dudenhoeffer has a Bachelor of Science Degree in Environmental Science, Minor in Geospatial Information Science. Served as Area Educator, GIS Technician, and currently work for MO Department of Natural Resources as an Environmental Program Analyst

ABSTRACT: Requirements for Completing the Missouri DNR Lead Service Line Inventory Spreadsheet - Following the 2014 Flint, Michigan case, there is heightened awareness that an estimated 6-10 million unidentified Lead Service Lines may be present in the United States. The Missouri Lead Ban has been in effect since 1989, but old Lead infrastructure may still pose potential risks. Therefore, US EPA federal regulation specifies that all states need to create a “Lead Service Line Inventory” (LSLI) to identify each service line as Lead, Non-Lead, Galvanized Requiring Replacement, or “Unknown: Possibly Lead.” All Community Water Systems and Non-Transient Non-Community Water systems must submit an initial Lead Service Line Inventory Spreadsheet to DNR by October 16, 2024. The spreadsheet should list all service lines in the system—based on records of customers and total service connections. While the initial inventory does not need to be 100% finished as far as identifications—systems should include the total number of service lines, all confirmed service line materials identified thus far, the number of full LSL replacements, and list any remaining unidentified service lines as “Unknown: Possibly Lead.” Systems will provide updated LSLI spreadsheet submissions on a 1 year or 3 year basis--depending on their monitoring schedules. Systems need to show progress in identifying new materials using existing records, approved ID methods, etc. If a system has completed their LSLI—they are encouraged to submit it to DNR within 30 days of completion (there is no reason to wait until the October 16, 2024 deadline—if the system has already finished their inventory). For larger systems, it may take years of time to completely identify all service line materials. This is a massive nation-wide endeavor, which is why $15 billion dollars has been allocated by the Bipartisan Infrastructure Law and even more funding is available through the Drinking Water State Revolving Fund, WIIN Act, etc. This funding may help understaffed systems and underserved communities to contract services for pot-holing, pay for pitcher filters, etc. While this presentation will focus on what is required to complete the Lead Service Line Inventory, more information regarding possible funding options can be obtained by contacting DNR’s Financial Assistance Center at (573) 751-1192.

How the Water Industry Can Prepare to Comply with Drinking-water Regulations on Per- and Polyfluoroalkyl Substances (PFAS)

Feng Xioa, University of Missouri

Dr. Feng “Frank” Xiao is a tenured Associate Professor in Civil and Environmental Engineering at the University of Missouri. His research focuses on water and soil quality engineering, including disinfection byproducts and biochar. Currently he is leading an interdisciplinary team with diverse expertise to address open questions in the following research areas: (i) the fate and transport of per- and polyfluoroalkyl substances (PFAS) in aquatic and soil environments; (ii) new and cost-effective technologies for removing PFAS from contaminated water and soil; and (iii) new analytical tools and nontarget identification by high resolution mass spectrometry. Dr. Xiao received the USEPA STAR Early Career Award in 2019 and United States National Science Foundation CAREER Award in 2021.

ABSTRACT: Given the pronounced threats of per- and polyfluoroalkyl substances (PFAS) to human health, many countries and regions around the world plan to finalize regulations on primary PFAS, including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), in drinking water. However, most water treatment facilities are not equipped to address these anticipated compliance challenges because current conventional drinking-water

treatment systems do not effectively remove persistent organic pollutants such as PFOA and PFOS from water. PFOA and PFOS, because of the high stability of the C–F bond, are refractory to hydroxyl radical-based advanced oxidation processes. Furthermore, accumulating evidence has shown that PFOA and PFOS can be generated from polyfluorinated precursor compounds in drinking-water disinfection processes. Effective strategies are, therefore, urgently needed for removing PFOA, PFOS, and precursor compounds in full-scale water treatment plants. In this presentation, Dr. Feng Xiao will assess key treatment challenges and present process treatment trains aimed at enhancing conventional water treatment processes to remove PFAS practically and effectively from water. The proposed treatment approaches to meet the drinking-water regulations for PFOA and PFOS may also help address problems of compliance with other regulated chemicals, such as disinfection byproducts. Regulatory agencies are encouraged to develop new, enforceable Treatment Techniques additional to conventional treatment/separation techniques to remove PFAS from water effectively. Drinking water utilities are encouraged to leverage federal, state, and local resources to upgrade water facilities to positively impact public health by improving the water quality.

A Dual PFAS Perspective - Landfill Leachate and Biosolids

Gary Hunter & Scott Carr, Black & Veatch

Gary Hunter is a specialist assigned to Black & Veatch's Water Technology Group and is responsible for process evaluation for both domestic and industrial wastewater treatment facilities. In this role, he is responsible for industrial pretreatment programs, industrial treatment, industrial reuse, and sustainability measures at treatment facilities. In this work, he has gained expertise in the design, operation and troubleshooting of wastewater treatment processes. Mr. Hunter serves as a Reuse Technology specialist in the East Region of Black & Veatch. He is serving as BV internal subject matter expert for PFAS in wastewater.
Scott has 36 years of experience in consulting and industry, focusing on biosolids processing and management. He is the Global Practice and Technology Leader for Biosolids for Black & Veatch and is experienced in planning and design for biosolids processing and management. Scott has an MS in Environmental Systems Engineering - Clemson University, BS in Agricultural Engineering - Auburn University, Professional Engineer, Board Certified Environmental Engineer.
ABSTRACT:

Wastewater 101
Tuesday, March 28, 2023: 1:15PM - 5:00PM
Room: TBD
Moderator: TBD

Hydraulic Modeling of Sanitary Sewer 101

Jeremy English, HDR

Jeremy has a bachelor's degree in Civil Engineering from Kansas State University and more than 30 years of experience performing utility planning, hydraulic modeling, project design, and project management. Jeremy's past work experience at the municipal utilities of Austin Texas Water and KC Water gives him a perspective from the owner’s point of view.

ABSTRACT: Whether focusing on I&I problems in one specific sewer basin or putting together a comprehensive city-wide wastewater master plan, hydraulic modeling has become an extremely important tool in the planning-phase assessment of sanitary sewer. Determining the leakiest parts of the sewer system, assessing pump station performance, and planning for the next big industry to come to town are just a few of the benefits a well-executed model can

provide. Hydraulic modelers who frequently work on these types of projects have become very familiar with the overall arc of tasks that bring a hydraulic model into its most accurate, useful, and presentable form:

- Review City GIS and identify data gaps
- Build initial model infrastructure or update the existing model with better quality data
- Develop flow metering plan and deploy flow meters
- Analyze and deconstruct dry and wet weather flow from flow monitoring period
- Calibrate the model to accurately reflect dry and wet weather flow seen out in the field
- Choose an appropriate design storm or set of design storms to run through the existing model
- Identify bottlenecks and problem areas
- Take into consideration future developments and calculate their projected flows
- Model gravity main, force main, pump station or other types of improvements to provide appropriate level of service for both current flows and future flows
- Present the potential future projects in a capital improvement plan

The upsides of a modeler being so familiar with these tasks are efficiency, repeatability, and the satisfaction of becoming excellent at one's craft. However, a potential downside of this kind of familiarity can be an inability or unwillingness to go back to the basics and explain the process and it's benefits more fully. Furthermore, modelers are notorious for using overly technical and confusing language when trying to explain certain aspects of a model build.
The goal in this presentation is to work against those downsides and give a clear, comprehensive, easy-to-understand, step-by-step walkthrough on how a hydraulic model is best built and best used.

Understanding Wastewater Ammonia Removal
E.C. West, Missouri DNR

Mr. E.C. West is a Water Specialist with the Missouri Department of Natural Resources, Southwest Regional Office, with over 40 years' experience in the operation and maintenance of wastewater treatment systems. Mr. West's primary role within the Department is to provide operator training for all levels of certification as well as providing on-site technical assistance to entities on the operation and maintenance of their plants. A key focus of recent years has been the efficient and effective treatment for ammonia removal. Many small plants were originally not designed to manage ammonia levels. Mr. West has taken special interest in helping these facilities to improve their effluent quality by employing simple yet effective means with an emphasis on low cost and simple operation. Mr. West is a graduate of the Crowder College Water and Wastewater Program and has served in various roles both in private industry and local government.
ABSTRACT: Will review basics of ammonia removal in wastewater including NH3, NH4 and Ammonia as N. Sources of ammonia. Ammonia/Nitrogen Cycle. Ammonia microbiology. Effects on Removal (Oxygen, pH, Temp, Alkalinity, Retention Time). And types of treatment - activated sludge, fixed film, MBBR.

Coagulant/Polymer 101 – Fundamentals of Sedimentation and Dewatering
Yong Kim, USGI
Dr. Yong Kim's technical interest includes fluid mixing and turbulence, surface chemistry, solids-liquid separation, and water disinfection. Previously employed by USFilter and Siemens Water Technologies, he is an active member of the Solids Separation Subcommittee of WEF/RBC. As a PhD Chemical Engineer, he has authored a book entitled "Coagulants and Flocculants: Theory and Practice." During his 35 year's professional career, he published over 40 technical papers with seven (7) US Patents issued to his credit.
ABSTRACT: Various topics regarding coagulation and flocculation are illustrated from perspectives of engineers and operators. That includes a summary of chemicals used in water industry, preparation before application, injection

methods, and typical dosages in applications. Polymer characteristics are discussed - physical form, molecular weight, charge density, and size distribution. Proper way of handling and storage of dry or emulsion polymer is reviewed as well as the shelf-life of neat polymer and diluted polymer solution. Use of solution viscosity will be shown as a reliable measure of the efficiency of polymer solution.

Quality of dilution water has serious impact on the efficiency of polymer solution. Hardness representing a major portion of the ionic strength of dilution water plays an important role in polymer activation. Considering the increasing trend of utilizing reclaimed water for polymer makeup at many WWTPs, chlorine level of dilution water must be checked and maintained below 4 mg/L. When reclaimed water is used, aging of polymer solution must be carefully evaluated. Chlorine, suspended solids, and TDS are reacting with polymer and degrading polymer solution seriously during aging.

Preparing efficient polymer solution is one of key components for successful solid-liquid separation. Due to its unique property of polymer, polymer make-down requires in-depth scientific understanding. The benefit of two-stage mixing and sufficient residence time in emulsion polymer system was found to improve the performance of dewatering process at Neshaminy WTP near Philadelphia. The plant operates at the capacity of 15 MGD to serve about 40,000 population. Two mixing chambers were evaluated side-by-side in dewatering alum-carbon sludge with two belt filter presses running simultaneously. It was observed that an upgraded mixing chamber could reduce polymer usage by 30% and process 11% more sludge without any sacrifice of cake solids.

Not only two-stage mixing but uniform mixing energy distribution in polymer mixing tank is critical in designing dry polymer system. Numerous long-chain polymer molecules contained in polymer solution can be easily chopped and broken down under non-uniform mixing environment. According to turbulent theory, an impeller with longer diameter is known to generate more uniform mixing intensity within the tank, which is ideal for polymer mixing. Dry polymer system developed based on this principle was installed at the Fairfield-Suisun Sewer District in California. The plant realized 42% polymer savings and 18% increase of sludge throughput to screw press after one year operation of new dry polymer system.

Don’t Forget the Microscope! Microscopy for the Wastewater Operator

Randy Eeasley, GBMc & Associates

Randy is an Environmental Scientist with GBMc & Associates, Inc. He also serves numerous positions with the American Water Works Association (AWWA) one of which is serving as the Chair of the G300 Standard Committee where his team recently completed updating the G300 Standard which is the water industry management standard for the protection of source water utilized worldwide. He has a diverse background in natural resource management, aquatic biology, limnology, reservoir management, pretreatment, water, and wastewater management. His over 40 years of experience includes: surface water quality modeling to determine the fate and transport of pollutants in the aquatic environment; conducting ecological surveys to characterize fish and benthic macroinvertebrate communities; comprehensive watershed management and protection studies; wetlands science; reservoir limnology studies; endangered species management and mitigation; management of certified laboratories, industrial pretreatment program, water quality program, watershed management programs; water and wastewater management, and environmental sampling of various media.

Randy graduated with a Bachelor of Science in Fisheries and Wildlife Management; a Master’s degree in Environmental Science, and a Graduate Certificate in GIS/Remote Sensing. He is certified as both a water and wastewater operator in the state of Arkansas.

ABSTRACT: A wastewater treatment plant is a biological ""bug” factory. You need to grow bacteria to successfully meet final effluent permit

limits. There are no replacements for the biological activity. You can build more wastewater equipment, you can use all the chemicals you want, but basically, it comes down to how well you can grow bacteria! So, if you are running a "bug" factory, it would be a pretty good idea to check the status on your product - the bugs. Using the Microscope is one of your most important tools in wastewater treatment.

If you have a biological wastewater treatment facility, you are running a ""Bug Factory". But do you know if you have good bugs or bad bugs? Based on the condition of the plant, certain types of conditions will promote different microbiology. Change the environmental conditions and you change the quality of the bacteria in your system. Regular microscopic examination can give operators valuable information to help prevent or correct process upsets. Learning how to interpret what type of bacteria you have in your system, and how to correlate that to lab testing and plant operations is key to running a smooth system.

Many utilities use a microscope for process control observation and record results in an electronic database, like Excel spreadsheets and other information management software. However, there seems to be an increasing disconnect between actual plant operation and what the microscopic exam results are telling us. Many operators have become reliant on SCADA systems, yet there are times when that information comes too late and the plant is already upset, but we missed the clues along the way.

This presentation will focus on the basics of Microscopy (types of microscopes, preparing samples, and discuss staining techniques); discussion and identification of common organisms such as: Protozoans (ciliates, flagellates, and amoebas) and Metazoans (rotifers, water bears, Annelids, and Nematodes); identification of Norcadioforms, Microthrix Parvicella, and other filamentous organisms as well as their impact on wastewater operations and control measures for their mitigation; floc structure and its overall effects on solids separation problems and foaming. How to develop your own customized examination program.

You don't have to be an academic microbiologist to make the observations discussed here. There are many reference manuals available on activated sludge microbiology, and quality training can be found almost everywhere. The topics explored in this presentation are only a few of the lessons I've learned during courses I have attended and observations I have made over the years.

In summary, using other process control information with timely, hands-on microscopic examination of the MLSS a few times per week can greatly enhance any process control program and help operators prevent or recover from plant upsets.

Stormwater
Tuesday, March 28, 2023: 1:15PM - 5:00PM
Room: TBD
Moderator: TBD

A Holistic Look at Flooding Improvements in St. Charles
Rebecca Howley & A.J. Girondo, GBA
Rebecca has over 25 years of experience, all at GBA, in the evaluation and design of storm and sanitary sewer systems for both small and large organizations and in developing solutions to meet clients' goals. Her responsibilities have included hydraulic modeling of gravity and pressure systems, design of sanitary and storm infrastructure, and recommending cost-effective methods to improve collection system and

treatment performance. She lives in University City with her husband, seven children, and a dog.

A.J. is GBA's Chesterfield regional office lead of the Water Environment Group. His 22 years of experience helped him develop project management and design skills for all aspects of infrastructure projects but gained the most experience with stormwater and hydraulics, transportation, site development, water and wastewater. At GBA, he leads teams for projects involving stormwater & transportation drainage, municipal engineering, site design and development review services. A.J. has specialized in stormwater management and design, site development, including storm sewer design, stream banks, streets and transportation drainage, sanitary sewers, water mains, and pump stations.

ABSTRACT: In August 2016, the residents of the City of St. Charles approved a 1/2 cent sales tax that would be split 2/3's of the funding going to Storm Water and 1/3 going to the Parks & Recreation Department. Since then, the City has prioritized flood reduction, new storm sewers, regional detention basins, creek bank stabilization and stormwater quality projects from their stormwater master plan, with 32 projects and a budget of about $38 million.

Several projects are located along Boschert Creek, a major urbanized stream in the Dardenne Creek watershed. This presentation will examine two of these projects, at Concordia Lane and at Duchesne Rd. and Hawthorn Ave., which included culvert replacements to increase capacity and associated streambank improvements.

At Concordia Lane, property and structure flooding occurred on Boschert Creek upstream of the culvert. A HEC-RAS model was developed and the alternatives analysis pointed to replacing the 14' x 11.5' existing box culvert with a new double 11' x 13' concrete box culvert. The new culvert design incorporated two new retaining walls, streambank grading and native restoration. A geomorphological evaluation was performed which resulted in recommendations for streambank stabilization improvements in the vicinity of the new culvert. The culvert replacement resulted in a 4-ft reduction in base flood elevation.

Duchesne Dr. and Hawthorn Ave. also experience inadequate stormwater capacity and creek bank failures, and were combined into one design and construction project. A geomorphological evaluation was performed for the entire length of the stream corridor. Bank failures include existing gabion walls that are undermined and threatened sanitary sewer utilities. The existing deteriorating and under capacity double RCPs at Hawthorn will be replaced with double 11' x 14' RCBs and tied into existing retaining walls. At Duchesne, the culvert will be replaced with double 12' x 14' RCBs and realigned, along with gravity retaining walls.

The projects also required design of new sanitary and storm sewers, relocation of water mains and a fire hydrant crossing the culvert, and new roadway section above the culverts, as well as project public meetings.

As part of the City's stormwater master plan, looking at Boschert Creek with a holistic view will allow the City to apply for LOMR due to the resulting reduction in the base flood elevation.

Science Based MS4 Program Implementation for the City of Kansas City

Cody Luebbering, Geosyntec Consultants

Cody Luebbering is a Water Quality Scientist with Geosyntec Consultant with 15 years of water quality and NPDES permitting experience. Mr. Luebbering has coupled water quality monitoring and sampling, aquatic biological sampling, WET testing, and natural resource management to provide support for water quality modeling/decision making, NPDES permitting requirements, environmental and remedial investigations, and research in biology and natural resource management.

ABSTRACT: Committed to protecting surface waters and reducing point and non-point source pollution, the City of Kansas City monitors local

streams' ecosystem condition as part of a multi-line approach to evaluating their MS4 program's effectiveness. Monitoring ecosystem condition establishes a scientific basis for the City in managing watershed development and stream buffers, while identifying ecosystem trends, and understanding variables (chemical and physical) contributing to stream conditions. The Missouri Department of Natural Resources (MDNR) have prescribed procedures for investigators and scientist to collect and monitor perennial stream habitat and macroinvertebrate communities. A suite of macroinvertebrate metrics (species richness, pollution tolerance, and percent composition) are calculated and compared to best condition (reference or nearby control) streams. The comparison to best condition serves as a benchmark to compare MS4 receiving streams and their health. Since 2007, the City has implemented monitoring of 19 local stream sites following MDNR macroinvertebrate assessment procedures as part of their MS4 program. Alongside macroinvertebrate assessments, the City monitors water quality and habitat conditions to identify variables related to macroinvertebrate community improvement or degradation. This presentation will outline the science-based approach the City has undertaken, describe the bioassessment procedure requirements, and summarize how these data may inform future watershed management and MS4 program implementation.

Urban Flooding: Risk, Vulnerability and Resilience in a Changing Climate

Elise Ibendahl & Megan Richardson, Jacobs

Elise Ibendahl is the Global Technology Lead for Flood Modeling and Planning for Jacobs Engineering Group, Inc. She is a licensed engineer in the State of Missouri, a Certified Floodplain Manager (CFM) and an Envision Sustainability Professional (ENV SP). She has over 25 years of experience in the water resources industry. She is a leader in the engineering community, respected for her past service as an ASCE Region VII Governor and her current service as a Trustee for the ASFPM Foundation Board. Ms. Ibendahl often serves as a senior technical resource for the hydrologic and hydraulic (H&H) components of Jacobs project work, specializing in urban flood analysis and mitigation design, and has served as a regional leader within Jacobs for FEMA Public Assistance Technical Assistance Contractor teams. She is experienced in hydrologic and hydraulic modeling of both sewer and open channels in a variety of platforms. She also has expertise in both 1D and 2D modeling and has performed in the role of project manager and/or subject matter expert for over 90 projects related to flood risk management for Federal, State, and Local entities throughout her career. She has provided design and analysis services for both local and nation-wide projects that contain aspects of drainage and stormwater management studies, including stream restoration, flood control study and design, urban stormwater master planning, green infrastructure solutions, sediment transport, and floodplain permitting.

Megan Richardson is a Water Resources EIT for Jacobs Engineering Group, Inc. She is a Certified Floodplain Manager (CFM) and has 1D and 2D modeling experience across several platforms. She has worked on a variety of stormwater-related projects, including projects that use optimization techniques to evaluate flood mitigation alternatives at the conceptual level.

ABSTRACT: Communities around the world, including those in Missouri, are experiencing an increasing frequency of extreme storm events that result in severe flooding, often in urban areas where a body of water is nowhere in sight. These areas impacted by urban flooding are frequently located outside of mapped flood area; consequently, urban flooding often impacts individuals and businesses who do not understand their risk, may not expect flooding, and have not invested in flood insurance.

A lack of flood insurance or economic means of recovery hinders resilience from damaging flood events, furthering the cycle of economic disparity in urban areas including historically redlined neighborhoods.

Many urban areas have a single pipe (sewer) system that conveys a mix of sanitary and storm water (combined sewer systems), rather than separate pipes for each (separate sewer systems). Urban flooding can occur from these combined sewer systems, presenting amplified public health hazards. Flooding in these areas can bring bacterial contamination into homes, businesses, and vehicles for a period of time, sometimes surpassing the basement level and impacting the first level of a structure. Yet the additional health hazard in these situations is sometimes not accounted for in benefit and consequence analyses, and social vulnerability is often neglected when characterizing the damages incurred from urban flooding.

Innovations in flood modeling and planning have better equipped us to understand and mitigate urban flooding, and to communicate the risks posed by storm events that grow increasingly larger due to climate change. In particular, integrated 1D/2D modeling allows for increasingly accurate pictures of the dynamic between surface flooding and subsurface sewer capacity. Furthermore, this modeling allows for the creation of data that lends itself to impactful visualization through a variety of tools from the tools built into the modeling software itself to GIS- and dashboard-based tools.

Once flood risk has been assessed, it may be combined with vulnerability data to inform cost/benefit analyses not only fiscally, but also in overall impact to human life. The cross-section of this data is key to understanding how to enable our communities to bounce back from urban flood events and aid in disrupting the cycle of economic disparity in urban areas. This presentation will explore this challenge by examining the following:

1. How did we get here?
2. Innovations in flood modeling and mitigation planning including informed modeling extents, integrated 1D/2D modeling, validation, master planning, and equitable cost-benefit analysis
3. Urban Flood Mitigation Toolkit components
4. What does a resilient community look like?
5. Where are we heading?
6. A list of additional resources for urban flooding

Solving Urban Flooding in CSO Basins Requires Bigger Thinking

Andy Sauer & Lauren Moore, Burns & McDonnell

Andy Sauer is the Green Infrastructure & Stormwater Manager for Burns & McDonnell Water Global Practice. Mr. Sauer has over 24 years of experience in water resources, stormwater management, watershed planning, and green infrastructure. He currently serves as the co-chair of the WEF Stormwater Policy, Governance and Regulation Subcommittee, and the lead chapter author for the upcoming WEF O&M of Stormwater Controls Manual. He has formerly served on the ISI Envision™ Review Board, been an adjunct professor, an invited speaker at professional training courses, and held several other leadership roles in technical organizations. He is a registered professional engineer and an Envision™ Sustainability Professional.

Lauren Moore is a professional engineer in the water resources field for Burns & McDonnell with 10 years of stormwater analysis and design experience. Her focus has been in green infrastructure design, including the appropriate stormwater and civil infrastructure policy and design tools for a properly functioning installation. Lauren's focus on all projects is to provide solutions in a forward-thinking and usable manner that best fit her client's needs, into the future.

ABSTRACT: The historical Westport area in Kansas City, Missouri has experienced frequent and severe flooding. Previous evaluations have all evaluated the flooding using a traditional stormwater management approach of meeting the regional stormwater standards. However, this approach resulted in solutions that were not cost effective, increased combined sewer overflows, and significantly impact this commercial and entertainment district. The Westport Regional Business League (WRBL)

wanted to look at the problem differently and instead of meeting a stormwater standard the goal was to provide meaningful flood reduction for the recent historical flooding events. The City and KC Water wanted the solution to improve streets, address public safety issues, increase pedestrian connectivity, and reduce combined sewer overflows. To address these multiple improvement objectives, WRBL selected the Burns & McDonnell team to develop innovative and adaptive stormwater solutions that will reduce flooding while improving the area to maintain and grow the economic conditions of the Westport District.

The Burns & McDonnell team applied a 2-D stormwater modeling approach to be able to evaluate the enclosed pipe system and the surface routing and flooding. The InfoWorks ICM with 2-D was utilized to simulate the hydrologic and hydraulic conditions for both historical events and for a range of design events. An integrated team of engineers, landscape architects, urban planners, and scientists then used the modeling tool to develop and evaluate a range of stormwater improvement alternatives. The improvement alternatives ranged from distributed storage to conveyance improvements to large underground storage. Ultimately the best alternative will be a combination of these different alternatives to achieve the most cost-effective and highest benefit solution. The design team worked with a stakeholder group to evaluate the alternatives that best provided additional benefits such as street and parking lot improvements as well as connectivity to the new streetcar. Using this innovative and adaptive design approach has resulted in stormwater solutions that will reduce the flooding, reduce downstream combined sewer overflows, and improve the overall area.

This presentation will summarize the overall adaptive stormwater evaluation approach, the 2-D model development, new stormwater evaluation criteria, sustainable surface restoration, and urban stormwater storage alternatives. The outcomes of this project can be applied to other older historical urban areas that may lack typical stormwater management but have frequent and severe flooding that needs to be addressed with adaptive and resilient stormwater solutions.

Innovation & Tech
Tuesday, March 28, 2023: 1:15PM - 5:00PM
Room: TBD
Moderator: TBD

Application of Machine Learning in Stormwater Risk Assessment
Elango Thevar, NEER
Elango is the Founder and CEO of NEER.ai and has spent more than 18 years in the water sector. He founded NEER to bring an affordable digital water management platform for 8 billion people. He graduated from the University of Madras in Chemical Engineering and holds a MS in Environmental Engineering from Oklahoma State University. He finished his MBA at the University of Missouri-Kansas City.
ABSTRACT:"The Stormwater Management Program (SMP) is a Johnson County, Kansas program which partners with the 20 cities in the County to manage stormwater and is funded by a 1/10th of one percent, county-wide sales tax. It administers these funds on behalf of the Cities, historically by providing matching funds to Cities for eligible projects, including study, design, and construction projects.

In 2016, SMP as part of new strategic asset management program implemented watershed-based approach to fund projects that incorporate flooding, water quality, and system management. Under “System Management” program, SMP started funding inspection, rehabilitation, and replacement of stormwater asset projects.

As part of this program, SMP developed a risk-based tool to prioritize stormwater assets. This tool is used to assign a prioritization score to all eligible assets contained in County-wide asset database. This prioritization score is calculated using Likelihood of Failure (LoF), Consequence of Failure (CoF), and total risk (Business Risk Score, BRE).

The two fundamental building blocks for defining total risk (BRE) are LoF and CoF. LoF describes the chance of an asset failure occurring and CoF measures the severity of the impacts if an asset were to fail.

Total Risk or BRE = LoF * CoF

Currently, SMP employs a linear age-based degradation model and incorporates an adjustment factor for increased salt load in estimating LoF. to prioritize inspection of stormwater assets (hard assets). For rehab/replacement projects, field verified condition score is used.

However, existing field verified condition rating systems like the National Association of Sewer Service Companies' (NASSCO) Pipeline Assessment and Certification Program (PACP) and Water Resource Commission (WRC) were initially developed for wastewater systems. These standard ratings do not capture the environment factors and other variables specific to stormwater pipes. Currently, no standardized methods exist for assessing the condition of stormwater pipes and structures in the U.S.

Given these challenges, SMP engaged with NEER to utilize its cloud-based Machine Learning (ML) solution to identify the risk condition of the stormwater assets and implement a proactive data driven asset management program.

As a part of this project, NEER developed a Machine Learning (ML) Model that is specific to Johnson County SMP to calculate LoF for all the hard assets such as inlets, junction boxes, bridges, culverts, enclosed gravity. All of these assets are represented either as Links or Nodes.

During the ML model creation, all the data obtained from AIMS and local municipalities (physical, functional/operational) were standardized. The NEER team developed micro-ML models to populate several missing parameters for few nodes and links. In addition, several environmental parameters were also superimposed to the existing datasets.

After the normalization of the datasets, the original datasets (113,124 links and 122,957 nodes) that had field verified conditions were selected for model training and validation. There were 39,814 links (35% of total links) and 44,600 nodes (36% of total nodes) that had field verified conditions. NEER was able to develop a best performing ML model using 80% of the data (field verified conditions data) for model training and the rest of the 20% of the data (field verified conditions data) for model validation. This ML model is able to predict LoF with an accuracy of 90% & 91% respectively for the existing nodes and links. This SMP specific LoF prediction ML model was configured to continuously train and optimize itself to improve accuracy over time. NEER also adopted the same methodology that is currently being used by SMP to calculate the CoF and Business Risk Exposure (BRE)/Total Risk score. This CoF and BRE/Total Risk score calculation was implemented in the NEER Platform, so that SMP can calculate CoF and BRE/Total Risk for each asset in Watershed Organization 1.
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Intelligent Water Systems: Machine learning, deep learning, and case studies
Yanran Xu & Zhen Jason He, Washington University
Yanran Xu is a Ph.D. student from Prof. Jason He's lab at Washington University in St. Louis. She obtained her master's degree at the University of Michigan - Ann Arbor and her bachelor's degree at Tongji University in China. Her research is mainly focused on resource

recovery with wastewater treatment. Her current projects include anaerobic digestion, membrane process, machine learning, and deep learning. **Jason He**'s research centers on environmental biotechnology, bioenergy production, biological wastewater treatment, resource recovery, bioelectrochemical systems, sustainable desalination technology, anaerobic digestion, forward osmosis and membrane bioreactors. He has received numerous awards for his scholarship, including being recognized as a highly cited researcher by Clarivate Analytics in 2018 and the Walter L. Huber Civil Engineering Research Prize in 2018. He is editor-in-chief for both Journal of Hazardous Materials and Water Environmental Research.

ABSTRACT: Due to the rapid advance in environmental analytical tools and monitoring technologies, data generation expands explosively in both quantity and complexity, which demands more advanced and powerful computational approaches, such as artificial intelligence (AI). AI technology has become the focus in many research areas, such as driverless cars, natural language processing, and disease diagnosis. Similarly, AI technology has been widely used in both drinking water treatment (DWT) and wastewater treatment (WWT), considering its powerful ability to handle complex nonlinear relationships and precise understanding of the overall dynamics of water treatment. AI technology has a long history which can be dated back to the 1950s, but its application is further developed as machine learning (ML) and deep learning (DL) models in recent years. Compared to the traditional dynamic-mechanistic models that require a thorough understanding of underlying reactions and system-specific calibration, ML and DL models are easier to apply by identifying the input-output data relationship without reflecting the physical, biological, or chemical process. Both the ML and DL models are black-box models, which work by estimating the relationship between the input and output parameters first and then predicting the new output based on the estimated nonlinear relationship.

In both drinking-water/wastewater treatment plants (DWTPs/WWTPs), the key applications of ML/DL models for advanced control include predictions, extracting feature importance, detecting anomalies, and advanced automated control. For example, ML/DL models have been applied to predict the water characteristic variables such as total phosphorus, total nitrogen, ammonium nitrogen, dissolved oxygen, chemical oxygen demand (COD), biological oxygen demand (BOD), methane, hydrogen, and total suspended solids (TSS) in WWTPs. Additionally, using ML/DL can conduct comprehensive analyses in various DWT processes, such as identification and analysis of source water contaminants, coagulation/flocculation, disinfection, and membrane filtration processes.

The whole ML/DL procedure includes data collection, data preprocessing, model training, validation and testing, and model interpretation. During the model construction, both ML and DL consist of various algorithms, such as decision tree (DT), random forest (RF), support vector machine (SVM), artificial neural network (ANN), recurrent neural network (RNN), long short-term memory (LSTM), and convolutional neural network (CNN), which are used to handle nonlinear classification and regression analysis. Besides, the model accuracy and validation can be further improved with statistical tools, such as correlation analysis, cross-validation, and grid search. Although, both ML and DL are black-box models, the inner input-output correlation can be explained based on the sensitivity analysis, showing the driving force behind the output results. However, there are still many challenges before getting satisfying results in ML/DL prediction, for example, the overfitting issue and how to select input features, which will be solved by introducing several case studies in detail.

Artificial Intelligence defect coding - Not for the faint of heart! Challenges & Lessons Learned

Mike Halde & Ayobamidele (Ayo) Bello, HR Green

Mike Halde is HR Green's Wastewater Public Practice Leader. His background is in water and wastewater design with specific focus on WW process/treatment and pumping systems. Mike has gained a reputation to lead clients to solutions for technically complex multi-discipline projects, from a hands-on approach. Mike is currently a Licensed Professional Engineer in Iowa, Missouri, and Texas. He holds a BS and MS in Civil Engineering from the South Dakota School of Mines & Technology (SDSM&T). Mike has served on their Environmental Engineering Professional Advisory Board and the Engineering Department.

Ayobamidele Bello is a Senior Project Manager in HR Green's Houston office. Ayo has more than 17 years of experience in water and wastewater treatment, and conveyance for municipal and industrial clients. His experience includes municipal and industrial wastewater collection, pumping and treatment, water supply design, solid waste permit applications, solid waste collection, transportation, disposal and treatment, as well as environmental assessments.

ABSTRACT: With continued development in AI technology, the use of AI in automated defect recognition and coding of sewer lines and manholes could potentially change the way sewer collection systems are managed and maintained in the future.

The City of Houston, TX is currently under a consent decree to televise and inspect all the sewer lines in the City over a ten (10) year period, develop a plan to address any major defects found during the inspection and execute the plan. The volume of the lines involved require innovative ways to expedite the inspection and defect coding, and subsequently speed up the process of evaluating cost effective and appropriate rehabilitation/repair methods to address the identified major defects. To help achieve this goal, the City of Houston has deployed the use of AI in detecting and coding defects in sewer lines following an evaluation of multiple AI platforms to determine accuracy and consistency of results as well as efficiency (turnaround time).

Following the evaluation, one platform was selected for implementation. This presentation presents the challenges and lessons learned from the implementation and use of the selected AI platform over a period of a year and half, and the integration of the results into the City's sewer rehabilitation and management as well as Consent Decree reporting.

Leveraging Technology for the Real Time Monitoring, Modeling and Flood Forecasting for the Johnson County Stormwater Management Program

Elango Thevar, NEER & Sarah Smith, Johnson County

Elango is the Founder and CEO of NEER.ai and has spent more than 18 years in the water sector. He founded NEER to bring an affordable digital water management platform for 8 billion people. He graduated from the University of Madras in Chemical Engineering and holds a MS in Environmental Engineering from Oklahoma State University. He finished his MBA at the University of Missouri-Kansas City.

Sarah Smith, PE, ENV SP, is a Project Manager for the Johnson County Stormwater Management Program (SMP). She has been with Johnson County since 2013. She earned her BS and MCE from the University of Kansas

ABSTRACT: The Stormwater Management Program (SMP) is a Johnson County, Kansas program which partners with the 20 cities in the County to manage stormwater and is funded by a 1/10th of one percent, county-wide sales tax. It administers these funds on behalf of the Cities, historically by providing matching funds to Cities for eligible projects, including study, design, and construction projects.

SMP has invested significantly on StormWatch Alert 2 systems (www.stormwatch.com) over the past 30 years to implement real-time early flood warning systems.

SMP has funded the installation and maintenance of many of the sites throughout the region and has utilized the data generated from the system for SMP-sponsored studies and projects. SMP also funds a portion of the cost to

maintain and improve the website. Johnson County owns 68 of the 108 sites in the system. In addition, City of Overland Park, Kansas Department of Transportation, and City of Kansas City, MO owns several sensors.

Currently, SMP with the help of City of Overland Park uses manual process of forecasting flooding conditions and implements emergency management procedures within the county based on existing stream level and National Weather Service's forecasted weather information. However, this process is very tedious, time consuming and not reliable to accurately forecast future flood conditions.

Given these challenges, SMP engaged with NEER for the pilot study to utilize its cloud-based Machine Learning (ML) solution to automatically forecast early flood warning system (upto 24 hours) for the Watershed Organization 1 using existing hydraulic models and StormWatch real time datasets.

NEER obtained existing HEC-1 and HEC-RAS models from FEMA for Watershed Organization 1. After verifying the integrity of the models, NEER converted existing HEC-1 and HEC-RAS models into EPA-SWMM model. During the conversion process, NEER followed the standard engineering practices to update the existing hydrology (subbasin and storage data) and hydraulic (open channel geometry, culverts, and bridge data) characteristics. After updating all the parameters, the hydraulic model was calibrated using StormWatch gage data collected during 2016 to 2020. There are a variety of statistical measures used to measure the goodness-of-fit between a long term continuous measured and a modeled hydrograph. For this study, statistical measures Integral Square Error (ISE) and Nash–Sutcliffe efficiency (NSE) were used as a single, non-subjective, statistical measure of model calibration (https://www.chijournal.org/C414). Generally, calibration results showed very good to excellent NSE and ISE range for all the gage locations.

After the calibration, NEER set up a continuous real time and forecasting stormwater simulation model. In this step, StormWatch gage data (rainfall and stage collected every 5 minute) was obtained and stored in a Time Series Database. In addition, the 24-hour forecasted rainfall data obtained from the National Weather Service was also used in forecasting the stage and water surface elevation along the Brush and Turkey Creek. This real time and forecasting model that is scheduled to run every 6 hours, provides a predicted and forecasted floodplain boundary, depth grid, water surface elevation grid, velocity grid, and flood severity grid. that can be used for operational decisions. The total number of buildings and roads flooded, and operational recommendations (such as closing of roads, and evacuation of buildings) for every 6 hours is stored and displayed in the dashboard.

Community Outreach
Tuesday, March 28, 2023: 1:15PM - 5:00PM
Room: TBD
Moderator: TBD

Vacant Lots to Parks, Connecting Hodiamont Tracks Greenway
Chad Olney, Emily Forthaus & Jonathan Sherman, Jacobs
Chad Olney, PE works for the US Army Corps of Engineers where he does design for stream stabilization and river engineering projects. Chad has been heavily involved with Engineers Without Borders for eight years. During his time at Kansas State University, he served as student chapter president and in 2017 traveled to Guatemala for a project assessment trip. After moving to Saint Louis, Chad continued his involvement with the organization by joining the Gateway Professional Chapter. In 2022, Chad founded the chapter's Community Engineering

Corps (CECorps) Program for which he currently serves as Program Coordinator.
Emily Forthaus is a geo-environmental engineer at Jacob's Engineering in St. Louis. She has been involved with the Saint Louis Community Engineering Corps Program since the summer of 2022 and serves as the environmental lead for the Vacant Lots to Parks project.
Jonathan Sherman is a professional Urban Planner at Jacob's Engineering in St. Louis. He serves as the Project Manager for the Vacant Lots Project.
ABSTRACT: Community Engineering Corps (CECorps) is a partnership between American Water Works Association (AWWA), American Society of Civil Engineers (ASCE), and Engineers Without Borders (EWB) that brings technical professionals together to serve communities across the United States. These individuals volunteer their time and expertise to assist communities that do not have the resources to access engineering services.

The EWB Gateway Professional Chapter has formed a CECorps partnership with two Saint Louis community organizations: St. Louis Association of Community Organizations (SLACO) and St. Louis Arts Chamber of Commerce to transform clusters of vacant lots along Great Rivers Greenway's planned Hodiamont Tracks Greenway that will run through North Saint Louis.

One of the primary sources of funding for the project comes from the St. Louis Metropolitan Sewer District (MSD) Rainscaping Large Grant Program that is part of the $120 million in rainscaping investments that MSD is spending as part of their consent decree with the Environmental Protection Agency (EPA) to reduce Combined Sewer Overflows (CSOs). This funding will be combined with other grants such as the National Endowment for The Arts, Operation Brightside, Missouri Department of Conservation. Charitable contributions, in-kind donations, and volunteers will also be leveraged to deliver the final product.

The CECorps design team consists of a variety of professional disciplines from civil, hydraulic, and geo-environmental engineers, a landscape architect and an urban planner representing both the private and public sectors. The team is working with their community partners at SLACO and STL Arts Chamber, as well as other stakeholders and residents to develop a holistic site design that connects the historically underserved neighborhoods to the greenway. Each park will be different, but key features that are likely to be included in the design include:
1) Stormwater Best Management Practices (BMPs) such as rain gardens, amended soils, rainwater harvesting, and trees
2) Community gathering and recreation, to include shade structures, meditation gardens and picnic areas
3) Art and education features such as sculptures, murals and signage, as well as demonstration gardens.
4) Traffic calming and infrastructure supporting pedestrians and bicycles
5) Site utilities include potable water, site lighting, and CCTV

As of October 28th when this abstract was submitted, the design is at 30% complete. Coordination and input from clients, stakeholders, and community members will guide future design iterations. The construction contractor will be involved from an early stage as well to provide cost estimates and constructability reviews. Construction is expected to start in Summer of 2023.

Maline Tunnel: You want me to go where?
John Lawson & Jay Kniker, St. Louis MSD
John Lawson, has worked at MSD - Operations for 19 years. Currently I am the Operation Supervisor for Bissell Pump Station. This is a position I have held for the past 2 years. Prior to that I spent over a year as an Assistant Operation Supervisor at various treatment plants. Before I moved into supervision I had over 10 years of field experience as a Pump Station Maintenance Technician and 6 years as a Collection System Technician.

My formal education consists of a 2-year certificate in Electrical Automation Technology, 2-year certificate in Industrial Technology, and a 1-year certificate in Fabrication and Welding all from Ranken Technical College. I have also completed 3 different internal training programs with a combined total of just over 7 years.

Jay Kniker, PE, is currently the Division Manger of Pump Stations at the Metropolitan St. Louis Sewer District. Prior to is current position, he was in the roles of Plant Engineer and Operations Manager. Jay has also work for Private Engineering firms on site development, water systems and pumping station design. Jay graduated from the Missouri University of Science and Technology in 1994 and is a registered Professional Engineer in the States of Missouri and Illinois

ABSTRACT: "Shortly after the completion of the Maline Tunnel, a twelve and a half million gallon CSO storage tunnel 28-foot in diameter located in North St. Louis City, MSD Operations Staff where asked to enter the tunnel to help in the 3-D modeling of the tunnel and for video production for a public education film. Entering a tunnel that is 185-feet deep and 3/4 of a mile long brought safety issues, and concerns for those that would be entering the tunnel.

A safety plan was developed that included bringing the safety coordinator and plant engineer to help with the confined space entry plan. How to get people in and out of the tunnel. Determining the exact location while moving in the tunnel thru communication, and emergency evacuation, depending on their location within the tunnel was developed in the plan. Once the plan was developed, discussions with other stake holders, and the fire department were brought in to discuss the plan and how they would be informed when entry was occurring. Once the safety plan was approved by all stakeholders, first responders and contractors, procuring the proper equipment began, to include fans, generators, crane equipment, man baskets, and radios. Some modifications of equipment were made to fit on the existing infrastructure, such as making a baseplate for the forced ventilation plan. The weather was checked, and dates selected for entry into the tunnel.

Once entry begin, several issues arose that need to be addressed on the fly such as modifications of the diversion structure entry plan as the man basket would not fit, making the removal of the entire the slab a requirement. Communication issues once in the tunnel, and the transfer of equipment, contractor camera batteries, once in the tunnel without compromising the evacuation plan. Once those issues were resolved, the mapping and film were completed over three days.

The end product was delivered that allows you to tour the underground world of the tunnel at the safety of your desk, and the public education film documented the reason for construction, construction of the tunnel, safety plan, and actual entry of the tunnel.

The discussion will also discuss possible design modifications for future tunnel design that could help in the manned entry of tunnels, and the development of safety plans during design of tunnels to incorporate in the design the ability of manned entry into deep tunnels.

Response Excellence: What is it and why does it matter?

Kevin Bartram & Andrea Savage, Daupler

Andrea Savage and Kevin Bartram have worked with dozens of utilities across the US and Canada to create efficiencies in real-time response efforts.

ABSTRACT: Performance under pressure tests the effectiveness of response protocols during a service disruption. ‘Response excellence’ is used to describe a response characterized by high performance across major components of the process. This presentation will define response excellence and introduce the following four performance measures: 1.) customer communications; 2.) the ability to quickly identify and resolve problems; 3.) efficient escalation and dispatch of response resources; and 4.) event documentation and analysis. Utilization of a response management system will be showcased as a vehicle for achieving excellence across these four performance categories. Examples from utility users of a web-based

response management system will demonstrate the value of achieving response excellence through mini case studies.

1.) Proactive communication with customers generates valuable information about events, reduces community risks, and minimizes call volumes. With the use of artificial intelligence (AI), software-based response management tools can integrate communication protocols and automated notifications to ensure critical information is collected and distributed. When call takers have an easy-to-follow template for capturing accurate event information, the value of the information increases exponentially. By highlighting several user experiences, this presentation will demonstrate how a response management system increases customer confidence and satisfaction through improved communication.

2.) AI can also maximize the value of incoming information to help organizations quickly identify and resolve problems. Customers don't always know how to describe an issue in industry terms, which can make it difficult to characterize severity. By leveraging a modern response management system with machine learning capabilities, customer representatives can more consistently and accurately characterize events and determine appropriate actions. Mini customer case studies will show how this translates to improved event detection, resolution and workforce optimization, especially against the backdrop of staffing shortages.

3.) Traditional dispatch and notification procedures, such as manual calling trees, are prone to error and delays. Automated callout and map integration are key features of web-based response management which improve dispatch efficiency and reduce overtime costs. Integration between information systems, including work order management platforms and scheduling software, offers near real-time visibility into response operations across an entire organization. Resource managers can make smarter deployment decisions based on current event conditions, crew availability and proximity of assets. Consequently, response time improvements drive labor cost savings and reduce costs related to damages or prolonged outages. Instances where these types of financial benefits resulted from quicker response times and optimal dispatch will be correlated with specific response management system use cases.

4.) Event documentation is critical for compliance and liability reduction. It also provides useful information for performance improvements. Automating data collection and analyzing incident trends over time can help service providers prioritize system investments and identify opportunities to enhance response capabilities. Examples of data-driven performance improvements will be used to underscore the value of robust documentation and analysis. Water utility user experiences will be shared to illustrate the benefits of event documentation and analysis provided by an advanced response management system.

Through the lens of these case studies, the audience will learn how a diverse subset of US water service providers are modernizing their response capabilities. Response performance will be characterized by four qualitative categories, and response excellence will be presented as an achievable target with the use of a response management system.

How AMI & MDM Has Improved Reliability for Our Utility & Our Community

Marty Ivy, Mayfield Electric and Water Systems

Marty Ivy, General Superintendent at Mayfield Electric and Water Systems in Mayfield, KY, brings 29 years of experience in the utility industry to the table. A graduate of Murray State University, he has spoken at events for the Kentucky Water Association, Alabama Water Association, Colorado Association, the Smart Water Summit and Smart Utility Summit.

ABSTRACT: This presentation will walk attendees through two natural disasters that hit the community of Mayfield, Kentucky.

The first part of the presentation will discuss how Mayfield Electric and Water was managed prior to having an AMI & MDM, and the reasons for why we didn't already have one in place.

On January 27th, 2009, MEWS suffered a direct hit from a 100-year ice storm. We are a municipality serving Electricity, Water, Wastewater and Broadband Services to our community. I will discuss how we coped without an AMI & MDM, and why immediately after the recovery was completed, I pushed for our utility to pursue bringing its system into the technology age.

The three main topics of this discussion will be:
Financial Impact & Benefits
Reliability of Services
Public Engagement – Public Information – What are our customers' expectations.

During the second part of my presentation, we will cover our progress through the next 10+ years of technology having AMI & MDM Systems in place.

Then came the unthinkable:

December 10, 2021 it was business as normal for Mayfield Electric Systems and the rest of the City of Mayfield, Kentucky. However, a couple of days before the storm, forecasters did a fantastic job keeping the public updated as they were collecting weather data for the potential of a strong storm that would blow through our area. Despite the potential for a higher-end severe threat to materialize, forecasters expressed uncertainty regarding the extent of instability. As the days went on so did the seriousness of a tornado.

This late-season tornado outbreak produced catastrophic damage and numerous fatalities across portions of the Southern United States and Ohio Valley from the evening of December 10th to the early morning of December 11, 2021. Fast forward to Friday, December 10, 2021 the National Weather Service issued a tornado emergency for our hometown of Mayfield, Kentucky. This tornado entered the Southwestern portion of the city at 9:25 pm CST as it reached EF4 intensity. One minute later, at 9:26 pm CST the National Weather Service office in Paducah issued a tornado emergency for Mayfield, Kentucky. Radar analysis indicated that debris had been lofted up to 30,000 feet into the tornado as it struck our town.

The fire station, City Hall, and police station in our city were destroyed, and one of Mayfield Electric and Water Systems elevated water tanks was blown over and smashed to pieces. Hundreds of large trees were snapped and debarked throughout Mayfield, numerous powerlines we downed, and the towns emergency operations center lost the ability to transmit radio communications.

The next day following the tornado we knew our town would never be the same again. In three plus minutes it had taken more than 400 homes and 137 businesses from our community. The magnitude of devastation this tornado caused did NOT break our community. In fact, our community came together in ways we had never been seen before with volunteers coming from far and wide to assist with the recovery efforts, and it was simply amazing.

Mayfield Electric and Water Systems' Substation, Internet, Water, and Wastewater facilities were all destroyed. We all worked around the clock for several months to regain some sort of normalcy for the citizens of Mayfield. With every day that passed progress was being made and there was light and the end of this nightmare. Although there is much left to do, we have come a long way since that night and we will forever be scared, but we will not let this tragedy define us and we will come back stronger and better.

In the final part of my presentation, I will talk about the advantages of having AMI & MDM systems installed helped us recover from such a disaster.

Water Treatment
Tuesday, March 28, 2023: 1:15PM - 5:00PM

Room: TBD
Moderator: TBD

Potable Reuse: Not Just for the Arid Southwest?

Mark Donovan & Ray Gosen, GHD

Mark Donovan is GHD's Water Treatment Practice Leader, specializing in advanced water treatment, desalination and reuse via membrane technology for over 25 years. Mark is a licensed Professional Engineer in California, Hawaii, and Oregon, and holds a BS in Chemical Engineering from the University of New Hampshire and a Masters in Chemical Engineering from California State University, Long Beach

Ray is a Water/Wastewater Graduate Engineer with GHD. Ray holds a BS in Environmental Engineering from Missouri University of Science and Technology.

ABSTRACT: Potable reuse, or treating municipal wastewater to high purity fit for drinking water purposes, has been around for decades in California and the arid southwest. With ongoing drought and climate change impacting water supplies across the US, communities in various parts of the country are now evaluating Potable Reuse to make up a portion of a well-balanced water supply portfolio. To assist communities in evaluating reuse, the EPA has developed a suite of tools to aid in the implementation of potable reuse.

This presentation will provide an overview of EPA tools available to water agencies, examine the various regulatory treatment requirements being developed in certain states, and provide examples of Potable Reuse projects being considered across the United States.

A “Success Story” from southern California will be shared, highlighting a recently implemented innovative project in California with widespread community benefits.

Crypto! Moving from Bin 1 to Bin 2 with a Multibarrier Approach

Emily Tummons, Black & Veatch

Dr. Emily Tummons joined Black & Veatch as a process engineer in the Water Technology Group in 2016 after completing her PhD in Environmental Engineering from Michigan State University. She is the National Lead & Copper Practice Leader for Black & Veatch and has designed and conducted water quality and corrosion studies for potable water treatment systems involving desktop, bench-scale, and pipe-loop evaluations to optimize corrosion control in the distribution system. Additionally, she has been involved in process optimization studies and regulatory reviews for municipal drinking water treatment facilities.

ABSTRACT: "This presentation will discuss the Round 2 Cryptosporidium monitoring of raw source water for the United States Environmental Protection Agency’s (USEPA’s) Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) and the implications for a utility (City of Topeka, Kansas) that used to be classified as Bin 1 but now falls into Bin 2. A change in classification from Bin 1 to Bin 2 will require the City of Topeka to have provisions for an additional 1-log removal/inactivation of Cryptosporidium oocysts. The USEPA’s LT2ESWTR requires water systems to comply with additional treatment requirements by using one or more management or treatment techniques from the microbial toolbox of options.

The City of Topeka is preparing to use a multiple toolbox approach to earning the additional 1-log of credit for Cryptosporidium removal/inactivation. The four toolbox options that the City will to monitor for use in the multiple toolbox approach include the following: presedimentation basin with coagulation, two-stage lime softening, combined filter effluent (CFE), and individual filter effluent (IFE). This presentation will discuss the alternative management and treatment techniques, some challenges associated with earning the additional Cryptosporidium removal/inactivation

credit, and the process of integrating treatment changes at the City of Topeka's water treatment plant.
Some of the City's water treatment plant upgrades included changing out all the turbidimeters at the effluent of each individual granular media filter, replacing filter underdrains, replacing filter media and optimizing the media depth. A study was completed to understand the impact on turbidity of recycling the decant from the solids thickeners to the head of the plant as it changes the influent turbidity used in the presedimentation basin calculation. Additional turbidimeters are being installed to better monitor the removal efficiency of turbidity through the presedimentation basins to earn credit for Cryptosporidium removal.
The Kansas Department of Health and Environment (KDHE) had previously developed forms for the following toolbox options: presedimentation basin with coagulation, CFE and IFE, but no utility in the state of Kansas was requesting credit for two-stage lime softening. The City worked with KDHE and first completed a 3-month trial to make modifications to the water treatment process to ensure that hardness precipitation was occurring in the second stage of lime softening. Then KDHE requested that the City perform a year-long monitoring program to verify the hardness removal in all seasonal conditions. This study was completed in August of 2022 and recently the City submitted their first quarterly LT2ESWTR compliance report for KDHE including the development of a two-stage lime softening form. All these tasks, plant modifications, and the outcomes will be discussed in the presentation.

Delivering One Water Solutions to Address Taste & Odor Issues for Maryville, MO

Aaron Robison & David Carani, HDR & Greg McDanel, Maryville University

Aaron was drawn to environmental engineering by the desire to provide safe drinking water for people and to protect the precious environment that we are entrusted with. He utilizes a combination of technical expertise, financial acumen, and strong interpersonal skills to help find solutions for community's pressing water needs. Aaron holds a bachelor's degree in civil engineering and a master's degree from the University of Missouri- Rolla and an MBA from the University of Missouri-Kansas City. In his free time, he enjoys spending time outdoors with his family and trying to brew the perfect IPA.
As a water quality and regulatory specialist at HDR, David assists clients with understanding and complying with complicated and contentious regulatory and water quality issues in Missouri and EPA Region 7. Much of his work focuses on understanding the environmental, financial, and socioeconomic impacts that new permit requirements and regulations could have on municipal systems and ratepayers. David graduated from the University of Missouri where he earned Masters degrees in both public policy and natural resources science.
Greg McDanel

ABSTRACT: Nutrient pollution, or cultural eutrophication, is a pervasive and challenging issue that continues to significantly impact rivers, lakes, and oceans across the country. According to data from the U.S. Environmental Protection Agency (EPA), approximately 20 percent of water quality impairments nationally are attributed to the impacts of nutrient pollution. Nutrient pollution fuels algal growth. These harmful algal blooms (HAB) lead to reduced dissolved oxygen, water clarity, and aesthetic quality that causes detrimental impacts to fisheries, recreation, and human health. In some cases, HABs are also associated with the production of toxins or taste and odor (T&O) compounds that create unique public health and treatment concerns for municipal utilities.
Over the past five years, the City of Maryville, MO (City), has experienced a significant increase in the magnitude and frequency of HABs in Mozingo Lake, which serves as their surface water supply and is a popular recreational destination. These HAB events have been associated with T&O events within the City's distribution system and have led to an increased concern for potential human health impacts resulting from cyanotoxins. In 2020, the City initiated a project to study the watershed, lake, and treatment process to identify holistic solutions that will address nutrient pollution in

the watershed and mitigate T&O effects through the treatment process.
The project identified a comprehensive improvement strategy that includes near-term and long-term actions to address treatment and source water quality concerns. In the near-term, the City is controlling HABs through periodic algaecide treatments in the lake while making critical water treatment plant (WTP) improvements needed to reduce T&O compounds and extend the plant's useful life. For treatment of T&O at the exiting treatment plant in the near-term, granular activated carbon (GAC) was chosen as the most cost-effective process for removal of T&O compounds. A GAC adsorber was placed into service on December 10, 2021. Immediate results saw reduction of influent geosmin level of 170 ng/l to less than 5 ng/l, well below the odor threshold of 10ng/l. The City is now focused on planning for a new WTP utilizing the best available technology (BAT) selected process of ozone addition followed by biofiltration, starting with pilot testing. The City is also pursuing long-term watershed restoration efforts that includes implementation of a water quality monitoring program and nutrient reduction practices to control nutrients from agricultural sources within the watershed.
This presentation will provide an overview of the alternative's analysis process, an update on the effectiveness of both the algaecide application program and the GAC Adsorber, initial results from the pilot scale testing, and an overview of the monitoring, watershed plan and will provide participants with proof for a holistic one water solution to T&O issues.

Innovative Chlorine Contactors for a Large Water Treatment Plant

Thomas Crowley, Carollo Engineers & Dustin Segraves, Oklahoma City

Mr. Crowley is a project manager with Carollo Engineers with over 30 years of experience in the planning, design, and construction of water treatment, supply, pumping and distribution projects. This project provided Oklahoma CIty with a key resiliency and redundancy at the states largest water plant as well as an opportunity to improve water quality and reduce disinfection by products.
Mr. Segraves is a project engineer for the City of Oklahoma City for the past 10 years. He was city of Oklahoma City's water quality director when this project was under design and construction. He will be presenting on the background and need for this project.
ABSTRACT: The purpose of this paper is to provide a case study on how the City of Oklahoma City provided redundancy and resiliency for disinfection at the states largest WTP and introduce an innovative contactor design that provided high disinfection efficiencies confirmed with CFD modeling and fluoride testing.
Description: The existing City of Oklahoma City 150 mgd Draper Water Treatment Plant has 15 MG of clearwell storage capacity designed and constructed in the 1960-1970's. With the clearwells approaching the end of their useful life, the City of Oklahoma City undertook a project to supplement and eventually replace this storage over time. In addition, the City was looking for a means to expand and improve the disinfection contact time to minimize disinfection by product formation and allow for subsequent expansion of the treatment process beyond 150 mgd. This presentation will provide:
- A review of the methodology utilized to determine the required storage capacity of a water treatment plant clearwell system. A more detailed methodology than "rules of thumb" will be presented.
- A review of bench scale analysis conducted utilizing Simulated Distribution System testing to determine the relationship between time, concentration of chlorine, pH, temperature on disinfection by product formation at the Draper WTP.
- A review of storage and disinfection alternatives considered and the reasons for selecting a 120-inch pipeline contactor for conveyance and disinfection.
- A summary of the computational fluid dynamics (CFD) modeling conducted on the pipeline contactor to determine disinfection contact time and minimize the volume required for disinfection.

• A review of the state and national standards for clearwell design and how these were interpreted as part of this project.
• Presentation of fluoride tracer studies confirming CFD modeling results and discussion of lessons learned.

Conclusions:

1) A thorough analysis of all variables are necessary for efficient and effective designs of resiliency/redundancy components within a treatment facility.
2) CFD modeling can be a very effective design tool to utilize in the sizing and arrangement of disinfection contactors.
3) Innovative design features such as a flash mix diffuser can provide a cost effective approach to pipeline contactor designs

Wastewater Treatment
Tuesday, March 28, 2023: 1:15PM - 5:00PM
Room: TBD
Moderator: TBD

Operating Firsts in the Region: Renewal of the Tomahawk Creek WWTF

Anjana Kadava, Johnson County Wastewater; Rachel Swezy & Jim Fitzpatrick, Black & Veatch

Anjana has over 17 years of wastewater treatment experience. She earned a master's degree from Missouri University of Science and Technology before becoming a process engineer with Black & Veatch where she helped model, evaluate, design and commission wastewater and biosolids treatment facilities across the country. As an operations engineer for Johnson County Wastewater she helped commission their renewed Tomahawk Creek WWTF and provides operational and optimization support for JCW's six treatment facilities.

Rachel is a Young Professional with approximately six years of experience as a wastewater treatment process engineer. Recently licensed as a Professional Engineer, she has modeled, evaluated and helped design and commission nutrient removal upgrades at municipal treatment facilities in the Midwest and Florida. Rachel has a master's degree in Environmental Engineering from the University of Kansas.

Jim has over 29 years of experience in the treatment field and is the leader of Black & Veatch's wastewater and biosolids process engineers. His specialties include wet-weather flow regulatory strategies and technologies as well as nutrient removal and recovery. He is a licensed Professional Engineer in Missouri with a master's degree in chemical engineering from the University of Louisville. He is proud to call Missouri his second home-state, and even more proud that his wife and two children were born and raised in the Show-Me State.

ABSTRACT: In 2021 Johnson County Wastewater (JCW) began operating major improvements at its Tomahawk Creek Wastewater Treatment Facility located in the southern suburbs of the Kansas City metropolitan area. Design capacity was expanded for annual average flows of 19 mgd and peak wet-weather flows up to 172 mgd. The old 10-mgd rock trickling filter process was upgraded to a state-of-the-art activated sludge biological nutrient removal (BNR) process to achieve 12-month rolling average effluent limits of 79.2 lb/day total phosphorus (TP) and 8.0 mg/L nitrate + nitrite nitrogen, along with 12-month rolling average effluent goals of 0.5 mg/L TP and 10 mg/L total nitrogen (TN). Two-stage mesophilic anaerobic digestion and dewatering centrifuges are operated for beneficial reuse of biosolids and biogas. Many of these improvements are among the first of their kind in the region, such as:

(1) Sidestream Deammonification – This system is the first of its kind operating in USEPA Region 7 and uses anammox bacteria with moving bed biofilm reactor (MBBR) technology to cost-effectively treat the ammonia-rich centrate generated from anaerobic digestion and

biosolids dewatering. This minimizes chemical and energy needs for nitrogen removal in the mainstream activated sludge process.

(2) RAS Fermentation – The new activated sludge treatment system includes return activated sludge (RAS) fermenters and a 4-stage Bardenpho process for side-stream enhanced biological phosphorus removal (S2EBPR), nitrification, denitrification, and BOD removal. Other nearby facilities operate mixed liquor fermenters for S2EBPR, but design and operational criteria are somewhat different for RAS fermenters.

(3) Static PS Fermenter - A static fermenter converts volatile solids in primary sludge (PS) to volatile fatty acids (VFA) to improve TP and TN removal performance and minimize purchased carbon dosing.

(4) Selective Surface Wasting – Poor settling biomass from the surface of the aeration basin is routinely wasted to improve mixed liquor settling characteristics. This significantly improves stability, capacity, and performance of secondary clarification. A sludge volume index (SVI) of 60 to 100 ml/g is typically achieved.

(5) Dual-Purpose Filtration - Pile cloth disk filters polish BNR effluent up to 57 mgd and provide auxiliary treatment of wet-weather flows up to 115 mgd. This is the region's first wet-weather high-rate filter and the world's largest capacity dual-purpose pile cloth disk filter installation to date.

This presentation will share data and lessons learned during the design, construction, and operation of these technologies. These lessons will be valuable to Missouri utilities and water professionals faced with new nutrient limits and ongoing struggles with wet-weather flows.: "In 2021 Johnson County Wastewater (JCW) began operating major improvements at its Tomahawk Creek Wastewater Treatment Facility located in the southern suburbs of the Kansas City metropolitan area. Design capacity was expanded for annual average flows of 19 mgd and peak wet-weather flows up to 172 mgd. The old 10-mgd rock trickling filter process was upgraded to a state-of-the-art activated sludge biological nutrient removal (BNR) process to achieve 12-month rolling average effluent limits of 79.2 lb/day total phosphorus (TP) and 8.0 mg/L nitrate + nitrite nitrogen, along with 12-month rolling average effluent goals of 0.5 mg/L TP and 10 mg/L total nitrogen (TN). Two-stage mesophilic anaerobic digestion and dewatering centrifuges are operated for beneficial reuse of biosolids and biogas. Many of these improvements are among the first of their kind in the region, such as:

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New Growth, New-Trients, New Plant

Christy Wilson, Horner & Shifrin; Tom Quirk, City of Mascoutah; Zach Osborn & Shawn Mickey

Christy Willson is a registered professional civil engineer with 23 years of experience in the water resources industry with a background in both the public and private sectors. Her knowledge includes hydraulic and hydrologic modeling, sanitary sewer design, storm sewer design, master plan development, and consent decree experience in wastewater, combined, and storm sewer collection systems.

ABSTRACT: The Mascoutah STP had approached it's life cycle expectations and was determined to need additional capacity to meet the City's updated growth projections. Due to the additional capacity required, the new plant Design Average Flow (DAF) was expected to increase from 0.90 MGD to 1.75 MGD, which triggered additional effluent limits, including a TP limit of 0.5. The Facility Plan showed that the preferred alternative to expand capacity and meet new limits was to construct a new SBR plant next to the existing plant and use the existing facility for solids handling and wet weather flows.

The new SBR plant was designed to meet tight BOD and TSS limits along with utilizing enhanced biological phosphorus removal to minimize chemical costs. The aeration process was also designed to utilize nitrification/denitrification cycles to optimize energy use, even though no TN limits were introduced on the effluent. An alum dosing system and tertiary filter were also designed to polish and meet the TP limit below 1 mg/L. To allow sludge thickening without returning nutrient slugs back to the head of the plant, an automated decant system was utilized to allow the digester to decant without turning anaerobic. Additional systems included with the new plant expansion included a perforated plate automatic influent screen, online influent and effluent phosphate analyzers, and various transfer pump stations. The new Mascoutah STP system is nearing the end of construction with startup scheduled for November 2022.

Technological advancement of biogas upgrading to renewable natural gas- from fundamentalists to case studies

Yue Roa, Washington University

I'm a third-year Ph.D. student at Washington University in St. Louis. I come from China and got bachelor's and master's degrees there. Currently, I work with Dr. Jason He in Environmental Biotechnology and Bioenergy Laboratory. My research area is biogas upgrading.

ABSTRACT: Biogas generated from organic wastes by anaerobic digesters is acknowledged as one of the foremost renewable energies and can help address the current energy challenges. However, many places that operate anaerobic digesters do not actually use biogas. Converting biogas to renewable natural gas (RNG) will enhance the utilization of this bioenergy. This presentation will thoroughly summarize state-of-the-art biogas upgrading approaches including CO2 removal and CO2 conversion to methane. Practical examples of biogas upgrading will be introduced. Research progress on new technologies for biogas upgrading will be discussed. It aims to provide the audience with knowledge about biogas upgrading and identify the associated challenges that must be addressed for a broader implementation of the biogas upgrading technologies.

There are mainly five different CO2 removal technologies including water scrubbing, organic solvent scrubbing, chemical adsorption, membrane separation, and photosynthetic

biogas upgrading. CO2 is removed from the raw biogas through either physical, chemical, or biological processes. On the other hand, there are two different CO2 conversion technologies including chemoautotrophic biogas upgrading and chemical hydrogenation process. CO2 will be converted into CH4 with exogenous H2 during these two technologies. The cost of each technology varies depending on the operation and required equipment. Details of all these technologies will be introduced in the presentation along with industrial implementation.

Hydrogenotrophic methanogens utilize H2 and CO2 to convert into CH4 in the process of anaerobic digestion (AD). But insufficient H2 generated through AD results in a high amount of CO2 in the raw biogas. Extra H2 is needed in the reactor to convert raw biogas into biomethane in which the amount of CH4 is close to natural gas. However, the key challenge is the gas-liquid transfer efficiency of H2. To solve this problem, previous researchers investigated the effects of gas retention time, mixing rate, and the ratio of H2 and CO2. In addition, various diffusion devices were also installed to enhance the gas-liquid transfer rate. This study investigated the feasibility of a novel lab-scale in-situ biogas upgrading system and the development of the bacterial community. Synthetic wastewater was used to mimic brewery wastewater as a substrate. The reactor was designed vertically with three different function zones: anaerobic digestion (AD) zone, bioconversion zone, and gas-liquid separation zone. Inner circulation was applied to the AD zone to enhance mixing, and extra H2 was only injected into the bioconversion zone continuously for biofilm consumption. An optimal upgrading situation was achieved when methane content was increased to 90%. Batch experiments were also conducted to investigate the biofilm formed on the membrane. The bacteria community showed that methanogen was the dominant species in the AD zone and hydrogenotrophic methanogens played an essential role in the formed biofilm.

Keywords: Anaerobic digestion; biogas upgrading; biogas utilization; hydrogenotrophic methanogenesis.

WWTF Upgrades Support Resiliency, Treatment Consolidation, and Growth in Troy, MO

Brent Rood, Woodard & Curran

Brent Rood has five years of consulting experience, including three years of municipal water and wastewater infrastructure planning, design, and construction administration experience at Woodard & Curran. Brent graduated from the University of Missouri – Columbia with a B.S. and M.S. in Civil & Environmental Engineering and a research thesis involving water resource recovery through emerging forward osmosis membrane technologies.

ABSTRACT: The City of Troy, MO recently completed upgrades to their Southeast Wastewater Treatment Facility (SE WWTF) which converted the existing Membrane Bioreactor (MBR) facility to a 1.87 MGD (Average Daily Flow) Conventional Activated Sludge facility. Troy experienced 56% population growth between 2000 and 2010 and 20% population growth between 2010 and 2020. Significant improvements to the City's treatment facilities were needed to support continued population growth and economic development. The existing MBR facility was constructed in 2005 and presented significant operational challenges, including capacity shortfalls leading to permit violations and an EPA Final Administrative Consent Order in 2017. This project allowed the City to comply with the EPA Consent Order, consolidated the City's treatment systems by converting the Highway 47 WWTF to a new lift station and offline equalization storage facility, and supports future growth and economic development.

Several biological treatment alternatives were considered including Membrane Bioreactor, Conventional Activated Sludge, Oxidation Ditch, Sequencing Batch Reactor, Integrated Fixed Film Activated Sludge, and Moving Bed Biofilm Reactor, with the preferred alternative being a

Conventional Activated Sludge System based on an evaluation of up-front capital costs, O&M costs, life cycle costs, operational flexibility, facility layout, future expansion, wet weather management, and constructability. The primary driver for biological treatment sizing was winter nitrification, with design sizing being based on anticipated future limits driven by the new 2013 EPA water quality criteria for ammonia. Upgrades to the SE WWTF included influent lift station pumping and electrical building, headworks building with fine screening, aeration tanks splitter box, aeration tanks with anoxic selector zones, secondary clarifiers splitter box, secondary clarifiers, RAS & WAS pumping system, tertiary filtration, UV disinfection, outfall rehabilitation, electrical, HVAC, plumbing, and fire protection improvements, and new SCADA control system.

Additionally, a new interceptor sewer and force main, sized for future growth, was constructed to convey flow from the converted Highway 47 Lift Station to the upgraded SE WWTF. Design and construction of the SE WWTF and Highway 47 Lift Station upgrades were primarily funded with a $18.8M low-interest loan through the Missouri State Revolving Fund, and construction was completed on-schedule and on-budget through the peaks of the COVID-19 pandemic. As an additional project, construction is underway for aerobic sludge holding improvements at the SE WWTF. Potential future improvements at the SE WWTF include grit removal and biosolids dewatering and handling.

The upgraded SE WWTF provides permit compliance confidence and supports future economic growth in the Troy, MO area while also being configured for efficient phased upgrades based on future capacity, loading, and discharge permit limit drivers. This presentation of Troy's wastewater treatment upgrades in support of significant system growth will offer planning, design, construction, and operational knowledge and lessons that attendees can apply to their own projects.