TETRA TECH

Carol L. Hufnagel, PE

National Wet Weather Practice Leader

Ms. Hufnagel is a recognized national expert in the evaluation and control of sewer systems impacted by wet weather flow, including separate sanitary systems and combined sewer systems. This expertise includes evaluation through flow monitoring and modeling, evaluation and selection of alternatives, regulatory policy and impacts on receiving streams. She has led a variety of significant planning and implementation projects, and acted as a technical expert on other projects. Her work focuses on identification of solutions that provide multiple benefits and are implemented in the unique context of each client's specific issues.

Education:

MS, Civil Engineering, University of Michigan, 1991

BS, Civil Engineering, University of Michigan, 1984

Registrations/Certifications:

Professional Engineer:
Michigan, No. 34561, 1989
Ohio, No. 65862, 2003
Georgia, No. PE036917, 2012
Kentucky, No. 26639, 2009
Missouri, No. PE-2008019730, 2008
Nebraska, No. E-13028, 2009
New York, No. 097630-1, 2017
Pennsylvania, No. PE075749, 2008
Texas, No. 111988, 2012

Professional Affiliations:

Water Environment Federation

American Society of Civil Engineers

Office:

Ann Arbor, Michigan

Years of Experience:

(1984) 35

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(09/1984) 35

EXPERIENCE

Green Infrastructure

Green Stormwater Infrastructure (GSI) Program Management, Detroit Water and Sewerage Department (DWSD), Detroit, MI. 2013–2021**.** Program Manager (2013–2017). Technical Advisor (2017–2019). Activities include: program management and administration; planning, evaluation, and selection of projects; coordination with institutional partners and agencies for implementation of those projects; project design; public outreach and stakeholder coordination; and project implementation. Additional activities include code and ordinance development, interdepartmental coordination and support for DWSD's drainage charge program. Planning work included a specialized prioritization framework that ranked locations for GSI based on their stormwater gallon: CSO gallon ratio, per acre cost of "gray" CSO control, incidence of basement backup, and potential to provide social benefit to the area. GSI has included low impact development techniques, larger scale GSI practices (up to 100 acres of tributary area), and selective sewer separation with direct discharge to the receiving water and stormwater quality measures. Projects are evaluated based on impact (size), cost effectiveness ($/gallon managed) and social benefit. Program is a NPDES permit requirement and a component of the CSO Control Program. Contract value: $16M.

CSO Green Infrastructure Study, City of Omaha, NE. 2013–2018. Project Manager. Study and design phases of projects related to the City's CSO control program. Evaluation included identification of a broad range of opportunities, and the development and assessment of green infrastructure projects that will support the control of CSO discharges for equal or lower cost than traditional controls. Overall, five major neighborhood scale projects were selected. Projects are controlling stormwater internal to combined areas and resulting in significant end of pipe CSO reduction. Modeling addressed performance of the proposed projects as well as detailed considerations for diversions and drainage of practices to control hydraulic conditions and reduce flooding risk.

Green Infrastructure Implementation for CSO Control, City of Omaha, NE. 2015–2020. Project Manager. Implementation of green infrastructure projects to reduce CSO discharges. Projects were identified in the 2014 CSO Green Infrastructure Study for the City performed by Tetra Tech. Projects include the Field Club Trail corridor, which will include surface and subsurface stormwater management for up to 250 acres. This project could result in the elimination of a downstream CSO facility. The Hanscom Park project manages flows from approximately 100 acres of tributary area and develop recreational enhancements to Hanscom Park. Design criteria for the practices is control of the three-month storm event. The Hanscom Park Project was completed in 2019 and included large bioretention systems in Hanscom Park.

Green Infrastructure Plan for CSO Control, St. Louis MSD, MO. 2015. Technical Advisor to St. Louis MSD staff who internally prepared their consent decree required green infrastructure plan. Ms. Hufnagel assisted in

identification of strategies to implement green infrastructure for maximum CSO control benefit and regulatory compliance. St. Louis goal is overall 10% volume reduction for outfalls to the Mississippi River with an expenditure of $100 million.

Green Infrastructure Assessment for CSO Control Plan, City of Defiance, OH. 2015. Technical Advisor. Supplemental green infrastructure assessment for the CSO Long Term Control Plan.

National Demonstration of Advanced Drainage Concepts Using Green Infrastructure for CSO Control, Kansas City, MO. 2008–2012. Author and Researcher. Technical report assessing best practices and application of green infrastructure in CSO control programs in 12 major cities. Report was prepared as a special product of the overall study and evaluated the extent to which green infrastructure was blended with traditional controls to achieve regulatory compliance. Best practices for opportunity identification, program implementation, and technical evaluations (GIS, modeling) were reviewed. Issues of regulatory acceptance, embodiment of green infrastructure into consent decrees and strategies to inter-jurisdictional issues that may result in barriers to implementation were included in the assessment. Work in Kansas City involved the performance assessment and evaluation of a 100-acre distributed system of green infrastructure practices to control CSO discharges. Acted as the technical advisor to the base project. Cost: $1.2M.

City of Omaha Community Partners, United States Environmental Protection Agency, Omaha, NE. 2012–2013. Project Manager. Evaluated processes to reduce the barriers to green infrastructure implementation. Process approaches are being developed that more broadly assess the benefits of green infrastructure. Process development is balancing sensitivity to sources of funds, ease of application, and political and social acceptance. Developed processes to consistently and completely evaluate the costs and benefits of green infrastructure when applied to CSO areas. Cost $65k.

SUSTAIN Case Study Applications, Kansas City, MO, Louisville, KY, and Albuquerque, NM. 2012. Lead Technical Reviewer. Implemented case study applications. Kansas City and Louisville case studies evaluated the use of green infrastructure for CSO mitigation and involved calibration of SUSTAIN to existing models (InfoWorks, XP-SWMM) and modeling a variety of best management practices. Applications evaluate the cost-benefit relationships between green and grey infrastructure and identify the least-cost combinations of green and gray infrastructure to achieve the regional overflow exceedance frequency target. Published findings in EPA report (EPA/600/R-11/144, 2012). Cost: $300k.

Green Infrastructure Planning and Citizen Tool, 3 Rivers Wet Weather, Pittsburgh, PA. 2012. Concept Development/CSO Lead. Development of a web-based system to provide municipal officials, engineers, and property owners in the ALCOSAN service area with a means for integrating green infrastructure into the region's wet weather plan in a way that is appropriate, cost-effective, and sustainable. Project evaluated the optimal locations for green infrastructure placement to reduce combined sewer overflows and generated a computerized placement tool that assesses hydrologic and physical characteristics in selected areas. Product included best management practice (BMP) response curves for unique combination of BMP type, soil type and slope in SWMM and SUSTAIN for use in the back end of a web-based BMP placement and performance assessment tool. Cost: $200K.

WEFTEC Preconference Workshop. 2014. Chair. Implementation of Green Infrastructure Programs

WEFTEC Preconference Workshop. 2012. Chair. Piecing Together a Green Infrastructure Program: Components that Lead to Success.

WEFTEC Preconference Workshop. 2011. Chair. Green Infrastructure: Beyond the Hype to Real Results.

Combined and Sanitary Sewer Overflow

CSO Program Support, Department of Public Utilities, Seattle, WA. 2016–Ongoing. Technical Lead. Program Management Support efforts associated with the ongoing implementation of Seattle Public Utilities CSO Program. Activities included preparation of the CSO Reduction Program Update (2019) that identified future implementation to account for climate change and underperformance of previously implemented projects. The update incorporated concepts new to Seattle's program including flow reduction (multiple approaches not fully dependent on infiltration), and area wide planning versus outfall by outfall project definition. Other activities included in the effort involve strategy consultation to SPU's regulatory compliance team, risk evaluation and management, monitoring and assessment of the program's ability to achieve regulatory compliance, coordination with King County (regional wastewater agency) and compliance monitoring and modeling.

Consent Decree Capacity Evaluation Support, Houston, TX. 2020-ongoing. Project Manager. This work includes providing support to Houston Public Works for planning and execution of capacity evaluation and condition assessment work. These studies are intended to assess system improvements needed to remove overflows, extend useful life, reduce operations and maintenance, achieve consolidation of some facilities and improve resiliency. Tetra Tech is developing standardized processes and evaluation approaches for these studies and assisting the City in coordination of planning consultants.

Eddington Lift Station Capacity Rapid Assessment, Houston, TX. 2019–2020. Subject Matter Expert. Consent decree related analysis of the sanitary sewer system. Eddington Lift Station capacity rapid assessment was needed to assist the City in implementation of a completed lift station design. It included identification of potential long-term alternatives for capacity related SSO control, modeling of these alternatives in InfoWorks and Optimizer and short- and long-term recommendations for future analysis and system improvements. Questions addressed included methods to control capacity related overflows in Consent Decree identified problem areas 5 and 6. As subject matter expert, focused on the identification of potential alternatives in the solution set, interpretation of results and preparation of workshop materials/ summary memorandum.

Capacity Assessment Evaluation and Reporting, Houston, TX. 2019–2020. Subject Matter Expert. Consent decree related analysis of the sanitary sewer system. Capacity assessment included analysis of sewers that are being considered for rehabilitation. Work is being automated to accelerate the assessment process and provide information on capacity so that sewer rehabilitation can proceed. As a subject matter expert, considered hydrologic and hydraulic criteria, regulatory requirements, and processes for expeditious evaluation.

Chartiers Creek Facilities Planning, ALCOSAN (Allegheny County Sanitary Authority), PA. 2007–2012. Project Manager. Developed the Wet Weather Facility Plan for the Chartiers Creek, and various additional documents. Work included identification and selection of wet weather controls for the study area which includes 23 communities and 94 square miles. Planning work addressed both CSO and SSO discharges. The plan identified controls necessary to meet regulatory requirements of ALCOSAN's consent decree with EPA and PaDEP. Phases of work include data collection, municipal coordination, flow monitoring assessment, hydraulic modeling, alternatives identification and feasibility and plan development. Project also included coordination with the program manager for overall coordination and implementation of a community participation/ public outreach effort. Recommended projects included storage and improved transport capacity. Anticipated implementation value is $500M.

Long-Term CSO Control Plan, City of Toledo, OH. 2002–Ongoing. Project Manager (study phase), Technical and Regulatory Advisor (implementation phase). Part of a $515M CSO and wet weather flow management program. Lead author and developer of the Final Plan. Technical lead for meetings with USEPA on the plan and subsequent negotiation of plan. The plan includes a combination of storage, separation, source control and maximizing flow to treatment using the existing infrastructure. Work during the study phase include project management, technical direction, and evaluation for the flow characterization study, hydraulic modeling, water quality modeling, alternatives development and evaluation, regulatory interface, and public participation. Project is being performed under the terms of a consent decree. In 2019, launched efforts to implement the post construction monitoring effort to show compliance with performance expectations. Cost: $5.7M (fees). Study phase completed in 2007. Implementation Phase. Cost: $2.5M (fees).

CSO Control Program, City of Port Huron, MI. 1988–2021. Roles progressed from Project Manager to Project Director to Regulatory Advisor. Development and implementation of CSO program. Work involved initial system assessment (1988) and development of Long-Term CSO Control Plan (1992) and project plan for SRF funding. Plan evaluated separation and retention alternatives and included considerations for stormwater quality improvements. Plan included an implementation schedule which considered impact on receiving water quality, other infrastructure City needs, basement flooding problems, long-term maintenance needs of the sewer system, most cost-effective projects, availability of funding, and other City concerns and priorities. A hydraulic model using XP SWMM (later InfoSWMM) was developed for the interceptor system using temporary and permanent flow monitoring data collection. A series of sewer separation projects (estimated final project cost approximately $188M) that also addressed water and paving infrastructure needs were implemented beginning in 1997 and are scheduled for completion in 2021. Work included implementation of a Private Property I/I inspection program to limit the potential for high flow rates in the collection system following separation, post construction flow monitoring, and evaluation.

Hamilton County and Metropolitan Sewer District of Greater Cincinnati, OH. 2012. Project Director. Review of hydraulic/hydrologic models used in the regulatory and planning context for the “Project Groundwork” program. Models were reviewed specifically for the Lower Mill Creek application in the selection of the partial remedy. Work was performed as an independent technical review and confirmed the general suitability of the models, while making a series of recommendations intended to improve the overall confidence in and acceptance of the models.

Rouge River National Wet Weather Demonstration Project, Wayne County, MI. 1993–2002. Project Manager. Coordinated the evaluation of performance of nine retention-treatment basins constructed for CSO control in the Rouge Watershed. Work included setting overall direction for data collection plans, assisting communities in implementing plans and data interpretation, and evaluating results. Project helped to set direction for future CSO facilities in Michigan. Successfully worked with MDEQ to identify key "measures of success" which define the criteria by which CSO facilities will be evaluated. Items evaluated as part of the study included optimal design of CSO basins (hydrologic/hydraulic as well as treatment and support facilities), appropriate basin volume sizing, and watershed assessment including impact of CSO discharges relative to stormwater loads.

CSO Control Implementation, Omaha, NE. 2010–2016. Project Principal/Quality Control Director. Work included conceptual design services in the 26th and Corby Area–a 650-acre complex system of combined sewers that includes sewer separation and the application of green infrastructure for stormwater quality improvements. A project was implemented for a 110-acre area.

CSO Control Program Review, King County, WA. 2010–2012. Task Lead and Subject Matter Expert. Performed regulatory consultations and evaluation of wet weather treatment technologies. For regulatory assessment, provided comparative examples, lessons learned and strategies for planning and implementation based on other municipal consent decree actions. Technical lead for evaluation of various wet weather treatment technologies. Evaluated performance effectiveness of installed wet weather facilities and additional treatment elements to be considered in conjunction with wet weather treatment facilities remote from a WWTP. Presentations were made and input gathered from a group of stakeholders.

Milk River Intercounty Drainage Board, MI. 1990–2005, 2014–2015. Project Manager for various studies. These studies included evaluation of the collection system and receiving water quality. The collection system assessment to reduce excess inflow and redirect more concentrated sanitary flows directly to the interceptor, reducing the load to the CSO Basin. Hydraulic Engineer for the design of the 19 MG CSO basin (construction complete 2004 at cost of $32M). Post construction performance study of CSO basin following facility startup. Project assessed load removed by basin facility and effectiveness of collection and treatment. Project manager for additional study of water quality impacts on the receiving stream (Milk River), particularly dissolved oxygen impacts. Technical advisor for upgrades to the facility being implemented in 2015. Upgrades include improved flushing and replacement of a variety of components beyond their design life. Construction of improvements is ongoing through 2020.

Baby Creek CSO Facility, Detroit Water and Sewerage Department, MI. 2000–2002. Project Manager for Basis of Design Phase. Facility is a rapid screening and disinfection facility to treat flow rates up to 5000 cfs. Screens evaluated during concept phase were 4 mm opening bar screens (later modified to 6 mm perforated screens during design). Disinfection system was designed for variable feed of sodium hypochlorite under a wide range of design storms (volume and flow rate), requiring in excess of a 10:1 variable feed ratio from the disinfection system. Performance standard for the facility is fecal coliform bacteria to 400 cfu/100 ml (geometric mean). As lead hydraulic engineer, was responsible for hydraulic evaluation of facility and evaluation of hydraulics through the screens, evaluation of hydraulic controls (upstream and downstream), and assessment of maximum design volumes for disinfection, which impacted chemical storage requirements. Project siting was complicated by unclear property ownership, sewer right of ways through a cemetery (with encroachment of graves) proximity to a senior citizens complex, and placement in a City park. Existing downstream sewer enclosure (triple 14x17 foot box culvert) is used for disinfection contact. Project involved close coordination with multiple departments of DWSD, the Michigan Environment, Great Lakes & Energy, other consultants to DWSD, and subconsultants to Tetra Tech.

CSO Reduction Plan Amendment, Department of Public Utilities, Seattle, WA. 2008–2010. Project Technical Expert. Review of regulatory issues. Led survey of other major CSO municipalities relative to levels of control required, areas of dispute with regulatory agencies and costs both for the development of their plans and anticipated costs of implementation. Provided input regarding levels of control and assessment of the 1x/ year overflow standard in relation to other major CSO consent decree programs. Provided input on alternatives based on implementation experience in other municipalities.

CSO Retrofit Refinement, Department of Public Utilities, Seattle, WA. 2005. Project Technical Expert. Assisted the City in the program refinement to reduce frequency and volume of CSO discharges through low-cost retrofit improvements. A Programmatic PDP was prepared to assist SPU's Asset Management Committee in determining appropriate funding levels for the recurring program. Conducted interviews of SPU staff to assist in the development of recommendations for removing organizational impediments.

Flushing Bay/Creek Facilities Plan for CSO Control, Office of Management and Budget/Department of Environmental Protection, New York, NY. 2007. Value Engineering Workshop Participant. Technical and regulatory review of as part of value engineering workshop.

Water Environment Research Foundation. 2001–2007. Project Subcommittee Member. Study on technologies for the treatment of wet weather flows. Study evaluated the treatment effectiveness of swirl concentrators, ballasted flocculation process, retention/treatment basins among other methods. Processes were characterized in terms of their ability to reduce pollutant discharge, costs and operations and maintenance issues. Best Practices for Treatment of Wet Weather Wastewater Flows, 00-CTS-6 (Completed).

Water Environment Research Foundation. 2006–2009. Project Subcommittee Member. Study related to the impacts of blended effluent. Evaluated impact on receiving waters of blending WWTP flow during wet weather events. 03-CTS-12-PP Characterizing the Quality of Effluent and Other Contributory Sources During Peak Wet Weather Events.

Long-Term Control Plan, City of Louisville, KY. 2002. Technical Advisor. Advised aspects of Long-Term Control Plan development process.

Long-Term Control Plan, City of Jeffersonville, IN. 2002. Performed independent technical, regulatory and feasibility review of Long-Term Control Plan for CSO Control.

CSO Retention Treatment Basins, Wayne County, MI. 1992–1995. Hydraulic/Hydrology Team Leader. Planning and design of three CSO retention basins located in Dearborn Heights, Inkster, and Redford. Work involved the development of design hydrographs, modeling of sewer system transport capacities, development of basin and collector sewer layouts, estimates of overflow volume quantity and distribution, and hydraulic profiles of the sewer system and CSO basins.

Long Term Control Plan, City of Manistee, MI. 1986. Project Engineer. Development of Long-Term CSO Control Plan. Plan evaluated separation and retention alternatives and included considerations for stormwater quality improvements. Plan included an implementation schedule which considered impact on receiving water quality, other infrastructure needs of the City, basement flooding problems, most cost-effective projects, availability of funding, and other City concerns and priorities.

Long Term Control Plan, City of St. Joseph, MI. 1991. Project Engineer. Development of long-term CSO control plan. Project included evaluation of flow monitoring data, system operation, and evaluation of alternatives.

CSO Control Alternatives, City of Lansing, MI. 1989-1990. Project Engineer. Directed efforts to develop CSO control alternatives for all combined sewer areas of the City as part of the project plan. Alternative development included conceptual separation schemes, retention basin evaluation, and evaluation of storm capacity.

Overflow Alternatives, City of Jackson, MI. 1992. Project Engineer. Performed feasibility study to evaluate alternatives for preventing overflow from a sanitary system that had previously been combined. System had a significant amount of inflow and several active overflow points. Alternatives evaluated included retention and removal of inflow sources, including central business district office building roof drainage.

Drainage/Stormwater Management

Stormwater Studies, City of Dearborn, MI. 1988-1991. Project Manager. Series of stormwater studies that included detailed analyses of combined sewer systems. Studies involved detailed modeling with the Illinois Urban Drainage Area Simulation (ILLUDAS) and XP-SWMM model. Implemented alternative involved use of designed street and underground storage to mitigate basement flooding in combined sewer areas.

Stormwater Master Plan, City of Marinette, WI. 1988. Project Engineer. Stormwater master plan for a portion of the City consisting of approximately three-square miles. Alternatives evaluated included no retention, on-site retention for future development, and regional retention. Hydrologic modeling performed with SCS TR-20.

Stormwater Master Plan, City of Brighton, MI. 1987. Project Engineer. Stormwater master plan portion as part of a master utility plan for the entire City. Stormwater report discussed the capacity and condition of the existing system, and proposed stormwater management guidelines for developing areas. Addressed methods to improve stormwater quality.

Stormwater Management Plan, City of Walled Lake, MI. 1989. Project Engineer. Stormwater Management Plan tasks included defining conditions, developing alternatives to reduce or prevent flooding, cost estimations, and establishing priorities of the alternatives.

Stormwater Flooding Evaluation, City of Mount Clemens, MI. 1989. Project Engineer. Stormwater flooding evaluation study involved analysis of overlapping storm and combined sewer systems, development of alternatives to relieve or prevent flooding, and developing associated costs.

Storm Drainage System, Ternes Industrial Park, City of Monroe, MI. 1991. Project Engineer. Designed storm drainage system to serve industrial park development.

Stormwater Management Study, City of Wyoming, MI. 1990. Project Engineer. Performed a stormwater management study that evaluated the adequacy of the City's stormwater facilities. Evaluated the City's storm sewers, open channels, and detention ponds. Developed a master drainage plan for undeveloped areas. Participated in detailed design of recommended improvements.

Wastewater Collection

Conducted studies to determine how sewer service should be extended to previously unserved areas for several communities. Projects were for the following communities: Midland, Charlevoix, Northfield, and Green Oak Townships (all in Michigan).

Paint Creek Interceptor System, SSES Study, Ypsilanti Community Utilities Authority, MI. 2007. Project Manager. Field investigation including manhole inventory, smoke and dye testing, sump pump monitoring and TV inspection intended to locate inflow sources.

North Golfside System Inflow/Infiltration Study, Ypsilanti Community Utilities Authority, MI. 2007. Project Manager. Flow monitoring and data assessment to evaluate whether inflow was excessive in the area.

SSO Control Program, City of Marysville, MI. 2008-9. Project Manager. Following a sewer separation program (implemented by a previous consulting firm), the City was unable to convey and treat all wet weather flows, resulting in SSO discharges. Working with the City, a program was developed to provide short-term remedy for reducing overflow frequency and an ongoing program to identify and remove inflow to the system. Short-term project involved using existing tanks that the City no longer needed for the original purpose. Inflow reduction program used detailed evaluation of the system, storage of the information on GIS based information systems, and flow monitoring to evaluate progress.

Sewer System Study, City of Royal Oak, MI. 1985-1989. Project Engineer. Participated in sewer system study that included investigations in structural condition, system capacity and inflow and infiltration to the system. Conducted in-depth investigation into inadequate capacity problems and alternatives for relief, including various stormwater management options, for a major combined system. Assisted in determining risk factors, which indicate an increased likelihood of problems with sewer infrastructure. Investigated alternate repair methods and evaluated the alternatives. Investigated methods for control of root growth in sewers and prepared contract for extensive root removal program. Detailed internal inspection work and subsequent construction projects consisting of relief and replacement sewers, spot repairs, cured-in-place (CIPP) lining, and internal rehabilitation. Assisted in the development of forms for use in a sewer system database, which was included with the study. Assisted in preparation of five-year budget for sewer improvements to allow the City to plan project financing.

Wet Sanitary Sewer Study, City of Frankenmuth, MI. 1988-1990. Project Manager. Study determined the cause and frequency of SSOs. Report made recommendations for remedial action to reduce occurrences of sanitary sewage bypass. Developed project plan and construction bidding documents for system improvements to control sanitary sewer overflows. System was reactive to prolonged wet weather events. Evaluation included flow monitoring and determination of design storm flow rates and volumes, investigation for inflow sources, and design of relief sewer improvements.

Basement Flooding Analysis, City of North Tonawanda, NY. 1985-1986. Project Engineer. Conducted an analysis of a sanitary sewer system subject to basement flooding. Reviewed flow monitoring data to determine locations that had potential inflow sources. Proposed physical solutions to remove inflow sources.

Sanitary Sewage Master Plan, City of Brighton, MI. 1987. Project Engineer. Portion of an overall master utility plan. Examined sanitary collection system and collection system additions required to provide service to developing areas.

Water

Water Study, City of Tecumseh, MI. 1986. Project Engineer. Study evaluated the need for new pressure districts within the community. Project evaluated water supply availability, new water tower needs, revision of the water system hydraulic grade line, and transmission and distribution system improvements.

Water Transmission and Distribution Study, City of Lapeer, MI. 1988. Project Engineer. The City acquired water directly from the Detroit Water and Sewerage Department. Efforts included evaluating water pressures as received from the DWSD transmission main, whether to continue or discontinue the use of elevated storage in the system, and transmission and distribution system improvements.

Water Transmission and Distribution Study, City of Armada, MI. 1988. Project Engineer. Primary focus of the study was the need for a new, elevated storage facility and the capacity of the City wells.

Water Distribution System Review, Charlevoix, MI. 1985. Project Engineer. Reviewed water distribution system requirements as part of an update to the City's water system master plan, previously prepared by Tetra Tech. Provided information to developers regarding the water pressure and rate available for their fire protection systems.

Transmission System Design, City of Tawas, MI. 1987. Project Engineer. Performed conceptual design of transmission system modifications for the area water system. System consisted of a long, linear system as opposed to a grid network of water transmission facilities. System was being modified in that the water supply from the WTP was being relocated from a central point to an end point on the system. System included two elevated storage tanks and a ground storage tank. System operation was further complicated in that the plant was only intended to operate for limited hours each day. Objectives were to provide adequate water supply for maximum flow conditions, including fire; prevent water stagnation or freezing in elevated tanks; and control impact of increased hydraulic grade line elevations in the system which might adversely impact existing water mains.

Water System Modeling, City of Manistique, MI. 1986. Project Engineer. Assisted in developing and performing computer modeling to assess the transmission and distribution capabilities of the water system.

Water Balance Modeling, City of Portage, MI. 1985. Project Engineer. Assisted in development of a water balance model for use in maintaining desired lake levels.

Hydraulics

WWTP Expansion, City of Lansing, MI. 1988-1990. Hydraulics Engineer. Plant expanded from 30 to 100 mgd. Expansion involved parallel plant construction with fixed hydraulic gradient conditions at the headworks and disinfection portions of the wastewater treatment plant.

Ragnone WWTP Expansion, Genesee County, MI. 1992. Hydraulics Engineer. Expansion included insertion of equalization basin between primary and aeration tanks with available head of less than six inches and flows to equalization of over 90 mgd. Flow split to clarifiers was an issue in the project. Field measurements of head loss under a variety of flow conditions were conducted in order to assess the actual loss conditions.

Market Avenue CSO Basin, City of Grand Rapids, MI. 1989-1990. Hydraulics Engineer. Maximum design flow rate of up to 1,000 mgd. Facility required connection to combined box interceptor, diversion weir with ogee dimensions, physical hydraulic modeling of pump station and extensive weir troughs to move flow between compartments without excessive head loss.

Baby Creek CSO Facility Design, Detroit Water and Sewerage Department, MI. 2000-2002. Conceptual Design Manager/Lead Hydraulic Engineer. Facility is a rapid screening facility to treat flow rates of 5000 cfs. Available head loss was extremely limited.

CSO Facilities Design, Wayne County, MI. 1992-1993. Lead Hydraulic Engineer. Design of three CSO facilities with design flow rates between 190–500 cfs. Passive flow splits designed to accommodate varying flow rates.

Additional Facilities. Various years. Performed hydraulic evaluation of numerous other wastewater facilities and collection systems. Details provided upon request.

Flow Monitoring, Sampling, and Metering

Flow Monitoring Studies, City of Port Huron, MI. 1997–2020. Program Manager/Technical Director. Series of studies that included flow metering and flow evaluation for development of hydraulic models and for assessment of system performance following completion of sewer separation. Projects performed continuously prior to and following implementation of the City's CSO program. Approximately 10 metering sites deployed annually for quantification of rainfall dependent inflow and infiltration as part of this effort.

System Flow Characterization Study, City of Toledo, OH. 2003. Project Manager. Project involved analysis of the collection system to define flow trends, tributary areas, and wet weather response. Metering was deployed at 36 sites for a five-month duration. Additional metering data from previous studies was compiled and analyzed to support system characterization efforts.

Monitoring Efforts, Rouge National Wet Weather Demonstration Project, Wayne County, MI. 1992–2002. Project Manager. Project involved water quality monitoring, sampling, and flow measurement at more than thirty water sampling locations for conventional pollutants, metals, and bacteria. Sampling locations include in-stream ambient sites, pipe discharges and complex pipe configurations and junction chambers. Efforts included developing sampling and analysis plans, development of a Quality Assurance Project Plan (approved by EPA), coordination of field crews and laboratory efforts, data management planning, and general administrative coordination between team members from numerous consulting firms and governmental agencies

SSES Program, Milk River Intercounty Drain Board, Harper Woods, MI. 1990. Project Manager. Program included six flow monitoring locations in a wet sanitary sewer system. Rating curves were developed for each monitoring location based on field measurements during high- and low-flow events in conjunction with theoretical flow estimates.

CSO Study, City of Port Huron, MI. 1986. Project Engineer. Study included continuous flow monitoring and sampling at three locations in CSO chambers with complicated hydraulic characteristics that required significant evaluation. Outfall chambers were affected by backwater conditions and included weir and orifice controls.

CSO Study, City of St. Joseph, MI. 1991. Project Engineer. Study included continuous flow monitoring at a CSO outfall chamber with complicated hydraulic characteristics. Overflow consisted of a weir in a junction chamber that transitioned to an orifice during high-flow conditions.

Flow Monitoring, Macomb County, MI. 1992. Project Engineer. Performed flow monitoring associated with PPC program for a new interceptor. Project required evaluation of a Parshall flume with flows with depth less that the standard range, resulting in special considerations for quantification.

Metering Projects. 1985-2002. Project Engineer. Numerous sewer system flow metering projects including Harper Woods, Port Huron, and Rouge River National Wet Weather Demonstration Program CSO monitoring.

Watershed Evaluation and Environmental Evaluation

Detroit, MI. 1998–2000. Project Manager. Study relating atmospheric deposition quality to stormwater runoff and combined sewer/WWTP pollutant loads. Pollutants of interest were Cd, Hg, and PCBs. As part of study, installed and operated three atmospheric/runoff monitoring stations and six combined sewer/WWTP installations. Samples were collected daily over a six-month period and analyzed at specialized laboratories for low detection levels. Resultant analysis identified approximate contribution of atmospheric pollutants to combined sewage. Study value was $2.5M.

Wayne County, MI. 1993–2002. Project Manager. Design, installation, operation, and data management for a water quality evaluation and monitoring network. Network included continuous instream water quality (DO) monitoring, flow monitoring, sampling of ambient waters, and CSO and stormwater flow monitoring and sampling. Efforts included developing sampling and analysis plans, development of a Quality Assurance Project Plan (approved by EPA), coordination of field crews and laboratory efforts, data management planning, and general administrative coordination between team members from numerous consulting firms and governmental agencies. Network has operated several years and has been modified to assess annual areas of concern.

1993 – Design and installation

1994 – Baseline assessment and load evaluation

1995 – Continued baseline assessment

1996 – Ongoing monitoring and targeted subwatershed evaluation

1997 – 1999 River response to implementation of new CSO control facilities

2000 – 2002 Ongoing river evaluation following implementation of new CSO control facilities

Publications

Gray to Green: The Toledo Swan Creek North Project. Carol Hufnagel, Jamie Brescol, Julie Cousino, WEFTEC 2019.

Prioritizing Green Infrastructure in Detroit's Urban Landscape. Jamie Brescol, Carol Hufnagel, Tom Jackson, Palencia Mobley. WEFTEC 2017

Green Infrastructure in CSO Control Programs: The Dollars Must Make Sense. Carol Hufnagel. WEFTEC 2016. Subsequently published in *Water Environment and Technology Magazine (WET)* July 2017.

The Detroit Green Infrastructure Program. Carol Hufnagel, D. Schechter, P. Mobley, W. Barrott, D. Christian. WEFTEC 2015.

Green Infrastructure Implementation, a Special Publication. Served as Task Force Chair. Water Environment Federation Publication 2015. Lead author for introductory chapter and maintenance chapter.

Implementing Cost Effective Green Infrastructure for CSO Control in Omaha. Carol L. Hufnagel, P.E., S. Struck, J. Theiler. WEFTEC 2014

Prevention and Control of Sewer System Overflows, Manual of Practice FD17 3rd Edition. Lead author chapter 5 (Monitoring and Modeling) and chapter 7 (CSO Control Technologies). WEF 2011.

Accomplishing Dual Objectives: Controlling CSO Discharges While Rebuilding Infrastructure. Carol L. Hufnagel, P.E., Robert E. Clegg, P.E. WEFTEC 2012.

Core Elements of Green Infrastructure Programs for CSO Control. Carol L. Hufnagel, Scott D. Struck. WEF Stormwater Conference 2012.

Prioritizing and Selecting Green Infrastructure in Combined Sewer Service Areas. Carol L. Hufnagel. Michigan Water Environment Association Conference. June 2012.

Prioritization of Green Infrastructure for CSO Communities – Identifying Effective Implementation Opportunities Scott D. Struck, Carol L. Hufnagel, Richard Field. EWRI. May 2012.

Prioritizing and Selecting Green Infrastructure in Combined Sewer System Service Areas. Scott D. Struck, Ph.D., Carol L. Hufnagel, P.E., Megan Monroe, Shannon Gray. For USEPA, Office of Research and Development. January 2012.

"100 Years of CSO Retention Treatment Basin Performance Data – What it Tells Us," C. Hufnagel. WEF Collection System Conference 2011

"Applying Low Impact Development Practices to Meet Multiple Objectives: Case Studies," Scott D. Struck, Ph.D.; Steve Carter, P.E., Jamie Brescol, P.E., Dan Christian, P.E., D.WRE, Carol L. Hufnagel, P.E. WEFTEC 2010

"Point Place Sanitary Sewer Overflow Elimination – Tested in the Real World." J. Brescol, C. Hufnagel, S. Sibley. WEF Collection Systems Conference 2010.

"Selection of an SSO Design Storm with Credibility." J. Brescol, C. Hufnagel, S. Sibley. Ohio Water Environment Federation Conference 2010.

"The Toledo Long Term CSO Plan – The Path to Approval," C. Hufnagel, N. Wheatley, B. Harbron, J. Brescol, K. Bruce. WEFTEC 2009

"The Great Sewer Separation Debate," K. VanderTuig, C. Hufnagel, A. Carrier, D. Christian, S. Struck. WEFTEC 2009

"Theoretical Development of a Wet Weather Design Event." R. Mau, C. Hufnagel, L Hendron. WEFTEC 2008.

"Getting it Right the First Time – Effective Private Property Control Removal in Sewer Separation Projects," Carol L. Hufnagel. WEF Collections System Conference, 2008.

"Preparing for the Unexpected – Cost Management in CSO Control Implementation," Carol L. Hufnagel. WEFTEC 2007.

"Private Property Inflow Removal – A Tale of Two Cities; Lansing and Port Huron, Michigan." Robert E. Clegg, J. Spangler, C. Hufnagel, K. VanderTuig. WEF Wet Weather Conference 2000.

"Atmospheric Deposition and Runoff of Mercury and Trace Metal in an Urban Watershed" Khalil Atasi, Theping Chen, Carol Hufnagel, Vyto Kaunelis, Gerald Keeler. WEFTEC 2000.

"Impact of Atmospheric Deposition on Surface Water Runoff of Toxic Chemicals in Urban Environment." Khalil Atasi, Carol Hufnagel, Theping Chen, Gary Fujita, Geoffrey LePlatte, Gerald Keeler. WEF Watershed Management Conference 2000.

"What Performance Monitoring Tells Us About How to Improve the Design of CSO Storage/Treatment Basins." Carol L. Hufnagel, V. Kaunelis, E. Kluitenberg, J. Neibert. WEFTEC 1999.

"Rouge River National Wet Weather Demonstration Project CSO Basin Evaluation Study." Carol L. Hufnagel, V. Kaunelis, E. Kluitenberg WEFTEC 1998.

"Approaching CSO Control from a Water Quality Perspective: Milk River CSO Control Plan." Vyto P. Kaunelis, Jeffrey W. Reynhout, Carol L. Hufnagel, 1996 WEFTEC.

"Planning and Execution of Large-Scale Monitoring Programs" C. Hufnagel, M. Schermesser, T. Galloway, K. Atasi, D. Horney, 1995 WEFTEC.

EDUCATION

Queen's University, 2013
Bachelor of Applied Science in Civil Engineering - Queens University Dean's List

Computational Hydraulics Int., 2019
PCSWMM Professional Training Workshop

PSMJ Resources, Inc., 2018
Business Development Bootcamp

Innovyze Software, 2018
Introduction to InfoWorks ICM

PSMJ Resources, Inc., 2018
Project Management Bootcamp

DHI Water & Environment Inc.
MIKE FLOOD Training, 2018
Introduction to MIKE URBAN FLOOD Modelling, 2016

XP Solutions Inc., 2015
xpswmm Training Workshop

DHI Water & Environment Inc., 2014
Introduction to MIKE URBAN Collection Systems Modelling

Innovyze Software, 2014
InfoWorks CS Training Course

EMPLOYMENT HISTORY

ISL Engineering and Land Services
2014 to date
Municipal Engineer

City of Toronto, Engineering and Construction Services
2012 to 2013
Summer Trainee - Inspector

St. Michael's Hospital, Toronto, ON
2011
Student Clerk

Apple One Employment Agency, Oakville, ON
2010
Temporary Associate

Alkali Sheet Metal, Oakville, ON
2006 to 2009
Clerk

AFFILIATIONS AND ACTIVITIES

Association of Professional Engineers and Geoscientists of Alberta

Western Canada Water Conference - Chair of the Printing Committee (2015 to 2016)

Big Brothers Big Sisters of Calgary

Sarah Barbosa, P.Eng., ENV SP

Municipal Engineer

Career Highlights

As a Municipal Engineer in ISL's Calgary office, Sarah utilizes her knowledge and expertise in planning, analysis, design and construction to liaise with clients and support Project Managers on municipal infrastructure projects that include water distribution, wastewater collection, and stormwater management. Sarah has a goal-oriented work ethic and brings analytical thinking and innovative solutions to engineering design and construction projects. Sarah has over six years of experience assessing various municipalities' existing infrastructure, determining their future needs to service projected populations, and providing cost estimates to support the recommendations. The information aids in making informed decisions on capital projects, and provides solutions for efficient, economic, and sustainable municipal services to residents.

Sarah routinely completes hydrologic and hydraulic modelling using software such as MIKE URBAN, MIKE FLOOD, XP-SWMM, PC SWMM, WaterCAD, and Infoworks. Sarah also has experience with AutoCAD Civil 3D and ESRI ArcGIS, integrating these platforms with various modelling programs.

Relevant Experience

Wastewater Collection

- Sanitary Forcemain & Lift Station Decommissioning Part 1 & 2 (Town of High River) – 2018 to date
- Water & Wastewater Systems: 2018 & Beyond (City of Beaumont) – 2017 to 2018
- Inflow-Infiltration Program (City of Cold Lake) – 2015 to 2018
- Hinton Wastewater Master Plan (Town of Hinton) – 2016 to 2018
- Airdrie Utility Master Plan (City of Airdrie) – 2015 to 2016
- Moose Jaw Sanitary Flow Monitoring (City of Moose Jaw) – 2016 to date
- Okotoks Sanitary Master Plan (Town of Okotoks) – 2015 to 2016
- Moose Jaw Utility Master Plan (City of Moose Jaw) – 2014 to 2016
- Hinton Flow Monitoring 2015 (Town of Hinton) – 2015

Water Distribution

- Water Master Servicing Study (Town of Strathmore) – 2019 to date
- Spruce Meadows Servicing Study (Linda Southern-Heathcott) – 2018 to 2019
- Water Model (City of Rossland) – 2018
- Hinton Water Master Plan (Town of Hinton) – 2016 to 2017
- High River IMP 2016 Phase 2 Update (Town of High River) – 2015 to 2017
- Glenbow ASP Servicing Study (Rocky View County) – 2015 to 2017
- Airdrie NE Servicing Study (City of Airdrie) – 2014 to 2016

Stormwater Management

- Master Drainage Plan (Town of Crossfield) – 2018 to 2019
- Oak-Marpole Sewershed Conceptual Design & Analysis (City of Vancouver) – 2018 to 2019
- City-Wide Stormwater Model Update (City of Regina) – 2017 to 2019
- East Points CASP Stormwater Master Plan (City of Airdrie) – 2019
- Hinton Stormwater Master Plan (Town of Hinton) – 2015 to 2018
- 14 Street Drainage Improvements (City of Fernie) – 2016
- High River IMP 2015 Phase 1 Update (Town of High River) – 2015

Off-site Levy Review

- Airdrie Off-Site Levy Review (City of Airdrie) – 2016 to 2019
- High River Off-Site Levies - 2018 (Town of High River) – 2017 to 2019
- Town of Olds Off-Site Levy Review (Town of Olds) – 2015 to 2016

CURRICULUM VITAE

Name: Kari Fitzmorris Brisolara

Business Address: Louisiana State University Health Sciences Center – New Orleans
School of Public Health
2020 Gravier Street, 3rd Floor, New Orleans, Louisiana 70112

Business Telephone: (504) 568-5725; Fax: (504) 568-5701

Email: kbriso@lsuhsc.edu

Citizenship: U.S. citizen (Louisiana)

Education:

Undergraduate

BS, Louisiana College, 1997.

Major: Biology *Supporting Areas of Emphasis:* Chemistry and Physics

Graduate

MSPH, Tulane University School of Public Health and Tropical Medicine, 2001.

Major: Environmental Health

Doctor of Science, Tulane University School of Public Health and Tropical Medicine, 2004.

Major: Environmental Health

Dissertation Title: Closed System Alkaline Biosolids Disinfection and the Development of Activated Carbon as a Value Added Product from Municipal and Poultry Wastes

Post-doctoral Fellowship, United States Department of Agriculture, Agriculture Research Service, 2004 – 2006.

Certification

Certified Qualified Environmental Professional. August 11, 2016. Certification No. 09-30-2021 Institute of Professional Environmental Practice.

Academic, Professional, and Research Appointments:

Academic

Associate Dean for Academic Affairs, Louisiana State University Health Sciences Center, School of Public Health, New Orleans, Louisiana (September 1, 2018 – Present)

Graduate Faculty (Associate Member), Louisiana State University Health Sciences Center, School of Graduate Studies, New Orleans, Louisiana (September 19, 2018 – Present)

Associate Professor (tenured) of Environmental and Occupational Health Sciences, Louisiana State University Health Sciences Center, School of Public Health, New Orleans, Louisiana (July 1, 2011 – Present)

Adjunct Assistant Professor, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana. (July 1, 2007 – June 30, 2011).

Assistant Professor (tenure track) of Environmental Health, Jiann-Ping Hsu College of Public Health, Georgia Southern University, Statesboro, Georgia. (August 1, 2006 – June 30, 2011).

Research Assistant, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana. (June 1, 2001 - May 1, 2006).

Professional

Research Physical Scientist, United States Department of Agriculture, Agriculture Research Service, Southern Regional Research Center, New Orleans, Louisiana. (May 3, 2004 - July 1, 2006).

Human Resources Program Consultant, State of Louisiana Department of Civil Service, Baton Rouge, Louisiana. (October 1, 1998 - August 1, 2001).

Environmental Consulting Technician, Biological Surveys, Inc., Mandeville, Louisiana. (October 1, 1997 - October 1, 1998).

Natural Resources Volunteer, U.S. Peace Corps, The Gambia, Africa. (July 1, 1997 - October 1, 1997).

Membership in Professional Organizations:

Institute of Professional Environmental Practice (IPEP, Professional), National. (August 11, 2016 – Present). Certified Qualified Environmental Professional.

Louisiana Water Environment Association (LaWEA, Professional), State. (July 2011 – Present).

North American Agromedicine Consortium (NAAC, Professional), National. (March 6, 2007 - Present).

Water Environment Federation (WEF, Professional), International, Residuals and Biosolids. (April 1, 2002 - Present).

International Association of Emergency Managers, International. (July 2014 – July 2015).

American Water Works Association, International. (December 2014 – January 2016)

Georgia Environmental Health Association (Professional), State. (October 2008 – July 2012).

Georgia Association of Water Professionals (Professional), State. (June 2008 – July 2011).

Georgia Public Health Association (GaPHA, Professional), State, Environmental Health. (April 2007 – July 2011).

Awards and Honors:

Selected for Who's Who in Health Sciences Higher Education (September 14, 2014).

Delegate-at-Large Service Award 2009 – 2012, Water Environment Federation and LaWEA. (April 18, 2013).

Certificate of Appreciation awarded by FEMA and Department of Homeland Security. (September 30, 2012).

Certificate of Appreciation for Meritorious Service, Georgia Environmental Health Association. (July 13, 2011).

Faculty Service Award, Jiann-Ping Hsu College of Public Health, Service, University. (August 11, 2010).

Performance Award, United States Department of Agriculture, Scholarship/Research. (January 1, 2006).

Performance Award, United States Department of Agriculture, Scholarship/Research. (January 1, 2005).

Delta Omega, Public Health Honor Society, Inducted 2002 in Eta Chapter, Tulane University School of Public Health and Tropical Medicine.

Teaching Experience/Responsibilities:

Course/Clerkship/Residency or Fellowship/CME Directorships

2017 – Present: **PUBH 6150 Foundations and Ethics in Public Health** - Course Director [1 credit hour required course for all incoming MPH students, offered in fall]. This course serves as in introduction to the foundations of public health including leadership, communication, interprofessional practice and systems thinking.

Responsibilities: Developed course format and syllabus, design course content with co-instructor, evaluation student performance, integrate new Team UP IPE experience.

2016 – Present: **PUBH 6600 Culminating Experience** – Course Director [3 credit hour required course for all MPH students, offered in spring]. All professional degree programs shall assure that each student demonstrates skills and integration of knowledge through a culminating experience. The student is required to synthesize and integrate knowledge acquired in coursework and other learning experiences and to apply theory and principles in a situation that approximates some aspects of professional practice.

Responsibilities: Developed course format and syllabus, design course content, evaluate student performance, led a 5 member interdisciplinary team of faculty to develop the course.

2014 – Present: **INTER/IPEC 281 Interprofessional Practice I** – Course Facilitator, Public Health Liaison [2 credit hour course for all students in LSUHSC-NO, offered in fall]. Provides an opportunity for students in the LSUHSC Schools of Allied Health, Dentistry, Medicine, Nursing and Public Health and the Xavier College of Pharmacy to participate in an interprofessional education (IPE) learning experience. The course begins with an introduction to IPE and interprofessional practice (IPP) and the reports from the Institute of Medicine and the Interprofessional Education Collaborative (IPEC) will provide the framework for the session topics, team activities and expected student competencies. Students learn about the various scopes of practice, study team-based health care, and discuss patient cases.

Responsibilities: Represent the School of Public Health as a faculty liaison, lead case-based discussions of Interprofessional teams of students and evaluate student performance.

2012 – Present: **ENHS 6238 Principles of Environmental Health Sciences** – Course Director [3 credit hour core course for MPH students, offered in summer and fall]. The course fulfills the environmental health core requirement for MPH students. This course explores the relationships between humans and the natural environment by examining the impact of human activities on air, water, soil, and food quality, and by analyzing the outcomes of encounters between humans and natural events, venomous animals, and toxic plants and fungi.

Responsibilities: Develop course outline and syllabus, design course contents, prepare course materials, provide lectures and evaluate student performance.

2012 – Present: **ENHS 6250 Emergency Response to Disasters and Terrorism** – Course Director [3 credit hour elective course for MPH students, offered in spring]. The purpose of this course is to provide public health students with an overview and awareness of potential threats facing our homeland and to familiarize students with the protocols for response for Public Health employees and for the local, state, and federal agencies associated with response and recovery. Emergency response is multi-faceted and this course includes observation as well as practical experiences in the field.

Responsibilities: Redesign and deliver course including syllabus, lectures, and student evaluation.

2009 – 2011: **PUBH 9999 Dissertation** – Course Director [Variable credit hour required course for DrPH candidates]. The doctoral dissertation is a culminating experience that requires the student to synthesize and integrate knowledge and apply theory and principles learned to an area of public health practice within the area of concentration. A written product must be submitted and must take the form of a manuscript that is suitable for publication in a national-level public health journal, a grant proposal, a technical report, a case analysis, or other similar document. The dissertation must also be presented and successfully defended before the faculty.

Responsibilities: As DrPH Program Director, track student progress through regular reports from the individual dissertation committees.

2007 – 2011: **ENVH 7232 Water Quality** – Course Director [3 credit hour required course for MPH Environmental Health students, offered in spring]. Introduce students to chemical, physical, and biological principles of water quality, as well as potential sources of contamination and the resulting effects. The course also introduces environmental policies pertinent to water issues along with current treatment and remediation strategies to ameliorate pollution.

Responsibilities: Develop and deliver course including syllabus, lectures, and student evaluation.

2006, 2010: **PUBH 5520 Introduction to Public Health** – Co-Instructor (2006), Course Director (2010) [1 – 2 credit hour required course for all MPH students, offered in fall]. This course is designed to give students a foundation in the core functions of the population-based public health

(assessment, policy development and assurance). In addition, this course examines the 10 essential services of public health within these core functions. Defining effective public health practice and providing knowledge about the technical, social, and political parameters related to public health research and practice are goals for this class. Students gain an understanding of public health as a broad area of work that applies the benefits of current biomedical, environmental, social, and behavioral knowledge in ways that maximize the health status of all populations.

Responsibilities: (2006) Provide lectures in public health core knowledge areas, conduct student evaluation; (2010) Redesign and deliver course including syllabus, lectures, and student evaluation including blended offerings (50% online).

2009: **ENVH 7238 Environment, Ethics and Equity** – Course Director [3 credit hour required course for MPH environmental health students, offered in spring]. Introduce students to theory, concepts and methods of ethics and equity related to one's location. Topics addressed include environmental justice, public health ethics, impacts on equity and disparities. Students also employ basic concepts of spatial analysis using applicable Geographic Information Systems software.

Responsibilities: Develop and deliver course including syllabus, lectures, and student evaluation.

2007 – 2008: **PUBH 6132 Environmental Health** – Course Director [3 credit hour required course for all MPH students, offered in fall, spring and summer]. Alternate listing PUBH 6532 in fall 2008. Survey of specific environmental conditions and factors that contribute to the development of health problems in communities. Health effects, policy issues, intervention strategies and control programs for community environmental health protection are discussed.

Responsibilities: Develop and deliver course including syllabus, lectures, and student evaluation including blended offerings (50% online).

2006 – 2007: **ENVH 7233 Environmental Impact Assessment** – Course Director [3 credit hour required course for MPH environmental health students, offered in fall]. Introduce students to appropriate design, implementation, and analysis of primary environmental exposures. Specific topics covered include designing risk profiles, evaluating dose-response relationships, and analyzing field exposures of toxins.

Responsibilities: Develop and deliver course including syllabus, lectures, and student evaluation.

2007: **PUBH 7890 Directed Individual Study** – Course Director [3 credit hour elective course for MPH students, offered in summer]. Research course to introduce upper level environmental health students to translational practices within USDA Agriculture Research Service. Special projects included ammonia adsorption of activated carbon from animal and plant residuals, metal cation adsorption of activated carbon from animal manure, and acid digestion of activated carbon.

Responsibilities: Develop and deliver course including syllabus, lectures, and student evaluation.

2006: **ENVH 7234 Environmental Toxicology** – Course Director [3 credit hour required course for MPH environmental health students, offered in fall]. Introduce students to concepts associated with the lethal and sub-lethal effects of environmental and occupational stressors on humans and other living organisms. Exposure, kinetics and distribution of toxicants, metabolism of toxic agents, factors that affect toxicity, introductory chemical carcinogenesis are discussed.

Responsibilities: Develop and deliver course including syllabus, lectures, and student evaluation.

Curriculum Development/Implementation

- Led a 5-member interdisciplinary team of faculty in the development of the new case-based Culminating Experience for the MPH program.
- E-learning team member for the development of web-based learning platforms for the core courses, LSUHSC-NO School of Public Health.
- Within LSUHSC-NO School of Public Health, I have redesigned the ENHS 6250 course and developed new lectures and student evaluations. In addition, I have taken on the ENHS core course for MPH students. As course director, I have adapted and updated materials from Drs. Dan Harrington and Chih-Yang Hu including creating a mid-course evaluation system.
- As the first environmental health faculty member within the newly created Jiann-Ping Hsu College of Public Health (JPHCOPH) at Georgia Southern University, I developed the environmental health curriculum including 5 courses (PUBH 6132, ENVH 7234, ENVH 7233, ENVH 7238 and ENVH 7232 listed above).
- Over the summer of 2007, I worked with the first cohort of JPHCOPH faculty to develop web-based versions of our core courses.
- In administrative roles at JPHCOPH, I helped develop the MPH and DrPH core competencies and associated curriculum structure.

Creation of Enduring Teaching Materials

- Curriculum developed at GSU is still in place including PUBH 6132 (now 6532), ENVH 7238 and ENVH 7232.

Formal Course Responsibilities – Lecture, Lab, Seminar/DxR/Ethics (all schools and all levels, undergraduate, graduate, resident, fellow, postdoctoral instruction; note number of hours/year and number of years involved in aggregate)

- Guest Lecture, LSUHSC-NO, School of Public Health, PUBH 6301 – Determinants of Global Public Health (2 hours, 2016)
- Guest Lecture, Cornell University - School of Veterinary Medicine, VTMED 6430 - Veterinary Perspectives on Pathogen Control in Animal Manure, “Value Added Products from Waste” (2 hours, 2006; 2 hours, 2007; 2 hours, 2012; 2 hours, 2013; 2 hours, 2014; 2 hours, 2015; 2 hours, 2016; 2 hours, 2017; 2 hours, 2018; 2 hours, 2019).
- Guest Lecture, Tulane University, School of Public Health and Tropical Medicine, GEHS 7000 –Environmental Health Seminar (1 hour, 2016).

- Guest Lecture, LSUHSC-NO, School of Public Health, PUBH 6200 – Essentials of Public Health (2 hours, 2015).
- Guest Lecture, LSUHSC-NO, School of Public Health, BCHS Seminar (1 hour, 2014).
- Guest Lecture, Tulane University, Payson Center, IDEV 4950/6610 – Environment and Development (2 hours, 2014).
- Guest Lecture, Tulane University, School of Public Health and Tropical Medicine, GEHS 6030 – Survey of Environmental Health (2.5 hours, 2014).
- Guest Lecture, LSUHSC-NO, School of Public Health, EPID 6216 – Biologic Basis of Health (1.25 hours, 2013).
- Guest Lecture, LSUHSC-NO, School of Public Health, PUBH 6500 – Special Topics (Essentials of Public Health) (2 hours, 2012; 2 hours, 2014).
- Guest Lecture, LSUHSC-NO, School of Public Health, ENHS 6238 – Principles of Environmental Health Sciences, (6 hours, 2012).
- Guest Lecture, Georgia Southern University, BIOL 5542 - Aquatic Ecology (3 hours, 2010).
- Guest Lecture, Georgia Southern University, TCM 4434 - Site Construction (6 hours, 2009).
- Guest Lecture, Georgia Southern University, EPID 7135 - Epidemiology of Infectious Disease (3 hours, 2008).
- Guest Lecture, Georgia Southern University, PBAD 7337 – Environmental Management and Policy (3 hours, 2008).
- Guest Lecture, Georgia Southern University, GSU 1210 – University Orientation (2 hours, 2007).

Teaching Awards: Not Applicable

Graduate Students Trained (served as Academic Advisor):

Georgia Southern University	Lauren Baker	MPH	2008
	Tiffany Jackson	MPH	2008
	DeAnna Keene	MPH	2009
	Angela Otumfuor	MPH	2011
	Leah Wallach	MPH	2011
LSUHSC-NO	Robin Gruenfeld	MPH	2013
	Rachel Tittle	MPH	2014
	Paolo Richardson	MPH	2014
	Max Miller	MPH	2015
	Suzanne Sicotte	MPH	2016
	Joseph Gilbert	MPH	2016
	Lauren McDaniel	MPH	2016
	Helena Ochoa	MPH	2017
	Haley Capello	MPH	2018
	Ian Walsh	MPH	2019
	Ansley St. Pierre	MPH	2019

Rebecca Warren	MPH	2019
Parth Dave	MPH	Ongoing
Bailey Gentile	MPH	Ongoing

Thesis and Dissertation Committees:

Masters in Applied Engineering, Committee Member, Georgia Southern University, Department of Mechanical & Electrical Engineering Technology 2008. *Advised*: Steven Derriso

Doctor of Public Health, Committee Member, Georgia Southern University, Jiann Ping Hsu College of Public Health, Public Health Leadership 2009 – 2011. *Advised:* Heidi Hulsey

MPH Capstone/Culminating Experience Project Committees:

Georgia Southern University

Lauren Baker: Indoor Air Quality within the Savannah-Chatham County School District

Tiffany Jackson: Factors Affecting Possible Rabies Exposures to Humans in Effingham County, Georgia

DeAnna Keene: Do Best Management Practices (BMPs) Reduce Fecal Coliform in Nevils Creek (Rocky Ford, GA)?

Angela Otumfuor: Survey of Bulloch County Residents on Household Cleaner Usage Based On Application Type

Leah Wallach: Community health perspectives from the remote Indian Himalayan village of Lata, Uttarkhand

LSUHSC-NO

Rachael Tittle: Community Health Improvement through Bucket Air Sampling

Paolo Richardson: Exploring Environmental and Educational Factors of Obesity in Louisiana and the Impact of Government Policies

Carrie Pizzalato: The Efficacy of Biochars for the Removal of Nutrients from the Environment

Yetzia Aponte: Utilization of Plant and Animal Derived Biochar for the Adsorption of Lead from Soil

Kadie Rome: Detection of Heavy Metals from Aqueous Solutions and Sorption by Biochar Derived from Agricultural Feedstocks

Robin Gruenfeld: Health Impact Assessment of Air, Soil, and Blight: Hollygrove, New Orleans

Grants and Contracts (note role on grant; i.e. PI, co PI, consultant, etc.):

Funded

- **Brisolara, Kari Fitzmorris** (PI), Margaret Reams (Co-PI), Stephania Cormier (Co-PI), Adrienne Katner (Investigator), Daniel Harrington (Investigator) "Interprofessional Approach to Developing a Diverse Workforce Ready to Address Emerging Technologies in Occupational Health and Safety" Submitted to NIEHS RFA-ES-15-014. $399,300. (January 2017 – December 2020).

- Katner, Adrienne (PI), **Brisolara, Kari Fitzmorris** (PI) “Empowering Communities to Make Informed Decisions to Reduce Childhood Exposures to Toxic Chemicals in Indoor Environments” Submitted to USEPA RFA EPA-EE16-01. $117,293. (October 2016 – September 2018).
- **Brisolara, Kari Fitzmorris** (PI), James Diaz (Co-PI), Daniel Harrington, (Co-Investigator), Chih-yang Hu (Co-Investigator), Adrienne Katner (Co-Investigator), “LSU-LSU Health Sciences Center Partnership for Undergraduate, Graduate, and Postdoctoral Mentored, Environmental Health Sciences Research Opportunities with EPA Scientists,” Sponsored by USEPA under EPA-G2015-ORD-C1 Cooperative Training Partnership in Environmental Health Sciences Research, $596,104. (January 2016 – January 2019).
- **Brisolara, Kari Fitzmorris** (PI), Grant, “Collaborative Training Education Program for Environmental Health Sciences,” Sponsored by LSUHSC School of Public Health, $7,981. (February 1, 2014 – January 30, 2015).
- Afriyie-Gyawu, Evans (PI), **Brisolara, Kari Fitzmorris** (Co-PI), Grant, “Metal Concentrations in Water and Fish from South Georgia Rivers,” Sponsored by Georgia Southern University, $9,994. (July 1, 2010 – May 1, 2011).
- **Brisolara, Kari Fitzmorris** (PI), Contract, "Testing of the Schwing Bioset Process for National PFRP (Process to Further Reduce Pathogens) Status from EPA’s Pathogen Equivalency Committee (PEC)," Sponsored by Schwing Bioset, Inc., Private, $70,057. (April 1, 2010 - September 30, 2010).
- **Fitzmorris, Kari Beth** (PI), Tedders, Stuart (PI), Sponsored Research, "Environmental Factors Contributing to Cancer in Evans County," Sponsored by Evans County CARES, Local, $15,000. (September 1, 2009 - September 30, 2011).
- **Fitzmorris, Kari Beth** (PI), Charles, Simone Melanie (Co-PI), Grant, "Protocol Development and Evaluation of Experimental Technologies in On-Site Sewage," Sponsored by Georgia Southern University, $7,119. (October 16, 2008 - May 31, 2009).
- **Fitzmorris, Kari Beth** (PI), Charles, Simone Melanie (Co-PI), Contract, "Development of Electronic Version of “Soils, Hydrology, and On-Site Wastewater Disposal”," Sponsored by State of Georgia, State, $10,000. (August 4, 2008 - October 31, 2008).
- **Fitzmorris, Kari Beth** (Co-PI), Peace, Karl E, Tedders, Stuart, Sponsored Research, "Study to assess levels of carcinogens and pesticides in Evans County, Georgia," State, $5,000. (June 30, 2008 - June 30, 2008).
- **Fitzmorris, Kari Beth** (PI), Non-funded Cooperative Agreement, "Evaluation of Activated Carbons from Animal Manure and Plant Residuals for Adsorption of Gaseous Ammonia," Sponsored by USDA-ARS, Federal, $0. (July 2, 2007 - July 2, 2007).
- **Fitzmorris, Kari Beth** (PI), Grant, "Faculty Travel Grant," Sponsored by Faculty Development Committee, Georgia Southern University, $1,564. (January 12, 2007 - April 18, 2007).

- **Fitzmorris, Kari Beth** (Co-PI), Reimers, Robert S. (Co-PI), Contract, "Approval of the Bioset process by EPA Pathogen Equivalency Committee," Sponsored by Schwing Bioset, Inc., Private, $100,000. (February 25, 2005 - August 31, 2006).
- **Fitzmorris, Kari Beth** (PI), Contract, "WEF Residuals and Biosolids Conference Travel," Sponsored by Schwing-Bioset, Inc., Private, $1,667. (January 20, 2006 - March 14, 2006).

Pending funding

- **Brisolara, Kari Fitzmorris** (PI), Sponsored Research, "Disease Prevention and Control Program with a Focus on Degradable Solids, Related to Vector Attraction Control and Sustainable Resource Management: Reusable Treatment of Deadly Human Waste at the Truitier Pit in Haiti " Submitted to Haitian Government in conjunction with William J. Clinton Foundation, Private, $397,489. (Under Review).

Non-funded applications (last three years)

- Diaz, James (MPI), **Brisolara, Kari Fitzmorris** (MPI), Katner, Adrienne (MPI), Grant, "Establishment of a Centers of Excellence for Vector-borne diseases at Louisiana State University," Submitted to CDC VECTOR-BORNE DISEASE REGIONAL CENTERS OF EXCELLENCE, Federal, $9,971,308. 2016.
- **Brisolara, Kari Fitzmorris** (PI), "WERF High Quality Biosolids from Wastewater Project," Subcontract to CDM Smith, Submitted to Water Environment Research Foundation, $39,865. 2015.
- Williams, Donna (Co-Director), **Brisolara, Kari Fitzmorris** (Co-Director), Grant, "Local Performance Site (LPS) for Louisiana for the TALON Public Health Training Center (PHTC) for Region 6," Submitted to RFA - HRSA-14-076 Regional Public Health Training Centers (RPHTC) Program. 2014.
- **Brisolara, Kari Fitzmorris** (PI), James Diaz (Co-PI), Daniel Harrington, (Co-Investigator), Chih-yang Hu (Co-Investigator), "LSU-LSU Health Sciences Center Partnership for Undergraduate, graduate student, and Post-doc Mentored, Environmental Health Sciences Research Opportunities with EPA Scientists," Submitted to EPA-G2014-ORD-T1 Cooperative Training Partnership in Environmental Health Sciences Research. 2014.
- **Brisolara, Kari Fitzmorris** (PI), Robert S. Reimers (Co-PI), "Assessment of Biosolids and Other Residuals for Use as a Sustainable Wetland Soil," Submitted to Coastal Protection Restoration Authority. 2014.
- Maud Walsh (PI), James Diaz (Co-PI), Ephraim Massawe (Co-PI), **Brisolara, Kari Fitzmorris** (Investigator), Stephania Cormier (Investigator), Grant, "Managing Hazards Associated with Emerging Technologies: A Graduate Certificate Program," Submitted to NIEHS. 2013
- James Diaz (PI), **Brisolara, Kari Fitzmorris** (Sr. Key Investigator), Chih-yang Hu (Key Investigator), David Lirette (Key Investigator), Grant, "Speciation and Toxicity of the Neurotoxin BMAA," Submitted to NIH. 2013.
- **Brisolara, Kari Fitzmorris** (PI), Grant, "The Use of Poultry Waste for the Creation of Activated Carbons for the Removal of Ammonia from Poultry Waste Emissions," Submitted to U.S. Poultry Association. 2012.

- **Brisolara, Kari Fitzmorris** (PI), Grant, "The Use of Animal Waste for the Creation of Activated Carbons for the Removal of Ammonia from Poultry Waste Emissions," Submitted to Louisiana Board of Regents. 2012.
- **Brisolara, Kari Fitzmorris** (PI), Grant, "CAREER: The Use of Animal Waste for the Creation of Activated Carbons for the Removal of Ammonia from Animal Waste Emissions," Submitted to National Science Foundation. 2010

Research Review Committee (NIH study section, etc.):

- NIH, NIEHS Grant Review Team, ZES1 LKB-S (R8), October 2019 Council, Summer Research Education Experience Programs (R25), July 30, 209.
- NIH, NIEHS Grant Review Team, ZES1 LKB-S (R6), October 2018 Council, Summer Research Education Experience Programs (R25), June 28, 2018.
- Reviewer, Grant Proposal, Issue Area Team Member, Water Environment Research Foundation. (2007 - 2012).
- Reviewer and Committee Member, Georgia Southern University, Sustainability Committee. (2009 - 2011).
- Reviewer and Committee Member, Georgia Southern University, Faculty Research Committee. (2006 - 2008).

Inventions and Patents:

Not applicable

Papers Presented (include, and ideally segregate, scientific presentations, plenary lectures, refresher courses, CME or society lectures, etc.):

Refereed Conference Presentations

1. Gary, L., **Brisolara, K.,** Reimers, R., Diaz, J., Maal-Bared, R. "Emerging Protocols for Emergency Managers Facing Infectious Disease Outbreaks," Louisiana Emergency Management Conference, Lake Charles, Louisiana (May 6, 2020).
2. **Brisolara, K.** "Public Health Implications of Disinfection Technology." Water Environment Federation Technical Conference, Chicago, Illinois (September 24, 2019).
3. **Brisolara, K.**, Cormier, S., Reams, M. "Interprofessional Continuing Education Program in Occupational and Environmental Health." 2019 VPPPA Safety + Symposium, New Orleans, Louisiana. (August 30, 2019).
4. Brooks, A., **Brisolara, K. F.** "Redacted but not forgotten: Anti-vaccination debate via Facebook." PCAS/ACAS S15.8, New Orleans, Louisiana. (October 6, 2018).
5. Gary, L., Reimers, R., **Brisolara, K.** "Managing Chlorinated Water for Ebola Disinfection," Water Environment Federation, Disinfection and Reuse Symposium 2018, Portland, Oregon. (July 31, 2018).
6. Gunaldo, T., Davis, A., Andrieu, S., **Brisolara, K.,** Sanne, S. "Improving Immunization Rates in Louisiana: A Collaborative Approach Across the Health Industry," IPE Nexus Summit, Minneapolis, Minnesota. (July 30, 2018).
7. Gary, L., Reimers, R., **Brisolara, K.** "EXPERIENCE WITH EBOLA VIRUS IN WEST AFRICA: What Is Next with Other Pathogens? Focus on WASH Operations," Water Environment Federation Technical Conference, New Orleans, Louisiana (September 27, 2016).
8. **Fitzmorris-Brisolara, K.,** Reimers, R., Smith, J., Rubin, A., Parry, D., Donovan, J., Faschan, A., Wanstrom, C., Zappi, P. Water Environment Federation

Residuals and Biosolids Conference, “Management Protocols for Development of Value-Added Products,” WEF, Milwaukee, Wisconsin. (April 5, 2016).

9. Gary, L., Reimers, R., **Brisolara, K.** National Evacuation Conference, “Biothreats with Evacuations,” RES/CON, New Orleans, Louisiana (March 1, 2016).
10. **Fitzmorris-Brisolara, K.** Water Environment Federation Technical Conference 2015, “New Developments in Indicator Organisms,” WEF, Chicago, Illinois. (September 27, 2015).
11. **Fitzmorris-Brisolara, K.** (Workshop Chair) Water Environment Federation Technical Conference 2015, “Fate, Indicators, and Assays: New Developments in Pathogens.” Water Environment Federation, Chicago, Illinois. (September 27, 2015).
12. Gary, L., Reimers, R., **Brisolara, K.** Water Environment Federation Technical Conference 2015, “Operational Infectious Control for Ebola in Developing Countries.” Water Environment Federation, Chicago, Illinois. (September 29, 2015).
13. Reimers, R., **Fitzmorris-Brisolara, K.**, Casson, L., Oleszkiewicz, J., Englande, A., Krishnapura, K. Water Environment Federation Specialty Conference on Water and Energy, “Advances in Biosolids Processes for Resource Recovery,” WEF, Washington D.C. (June, 2015).
14. **Fitzmorris-Brisolara, K.** Mid-South Occupational and Environmental Medicine Annual Education and Business Conference, “Professional Education and Self-Preparedness for Public Health Disaster Response.” MSOEMA, New Orleans, Louisiana. (March 14, 2015).
15. Reimers, R., Gary, L., **Fitzmorris-Brisolara, K.** International Studies Association 56th Annual Convention, “Social Entrepreneurship via Treatment of Human Waste.” ISA, New Orleans, Louisiana. (February 18, 2015).
16. **Fitzmorris-Brisolara, K**. (Moderator/Co-Organizer) Water Environment Federation, “How We “See” Pathogens: Using Better Indicators to Detect Pathogen Presence.” WEF, RBC, Sustainable Residuals Use Committee, Webinar. (November 12, 2014).
17. **Fitzmorris-Brisolara, K.** (Workshop Chair) Water Environment Federation Technical Conference 2014, “Thermo-chemical Conversion of Residuals and Biosolids into Value-added Products and Energy.” Water Environment Federation, New Orleans, Louisiana. (October 1, 2014).
18. **Fitzmorris-Brisolara, K.** Water Environment Federation Technical Conference 2014, “Activated Carbons from Waste Sources.” Water Environment Federation, New Orleans, Louisiana. (October 1, 2014).
19. Reimers, R.S., Gary, L.P., **Fitzmorris-Brisolara, K.B**., Englande, A.J., Fleetwood, P.G. Water Environment Federation Technical Conference 2014, “Assessment of the Effectiveness of Tropical Lagoon Treatment for the Converting of Domestic Septage into a Value-Added Product.” Water Environment Federation, New Orleans, Louisiana. (September 30, 2014).
20. **Fitzmorris-Brisolara, K.**, Yue, X., Reimers, R.S., WEF Workshop on Status of Wetlands Restoration through Wastewater Reuse and Residuals Application 2014, “Wetlands Restoration through Incinerator Ash and Biosolids Application.” Water Environment Federation, New Orleans, Louisiana. (September 28, 2014).

21. Reimers, R. S., **Fitzmorris-Brisolara, K**., Logan, T., Xu, Y. International Workshop on Agricultural Coal Ash Uses, "Utilization of Alkaline Coal Ash in the Treatment of Municipal Sludge – Producing Agricultural Soil Amender." WACAU-2014, Bet Dagan, Israel (May 27, 2014).
22. **Fitzmorris-Brisolara, K**., Reimers, R. S., Water Environment Federation Technical Conference 2013, "Developments in Disinfection Using Advanced Alkaline Stabilization." Water Environment Federation, Chicago, Illinois. (October 8, 2013).
23. **Fitzmorris-Brisolara, K.** (Workshop Chair) Water Environment Federation Technical Conference 2013,"Pathogens for the 21st Century: Assays, Indicators and Fate." Water Environment Federation, Chicago, Illinois. (October 5, 2013).
24. Reimers, R. S., Xu, Y., Oleszkiewicz, J. A., Pillai, S., **Fitzmorris-Brisolara, K. B.**, Seidl, G., International Conference on Holistic Sludge Management 2013, "Future Directions of Biosolids Management in the Second Decade of the 21st Century." International Water Association, Vasteras, Sweden. (May 7, 2013).
25. **Brisolara, K. F.**, Miles, D. M., Lima, I. M., From Waste to Worth: Spreading Science and Solutions, "Litter Generated Ammonia Captured by Activated Carbon Derived from Broiler Litter." Livestock and Poultry Environmental Learning Center, Denver, Colorado. (April 3, 2013).
26. Reimers, R. S., **Brisolara, K. F.**, Disinfection and Public Health 2013, "Developments in Disinfection Using Advanced Alkaline Stabilization." Water Environment Federation, Indianapolis, Indiana. (February 26, 2013).
27. Reimers, R. S., Xu, Y., Pillai, S., **Fitzmorris-Brisolara, K. B.**, Oleszkiewicz, J. A., Seidl, G., Disinfection and Public Health 2013, "Future Directions of Biosolids Management in the Second Decade of the 21st Century." Water Environment Federation, Indianapolis, Indiana. (February 26, 2013).
28. **Brisolara, K. F.**, Reimers, R. S., Water Environment Federation Technical Conference 2012, "Pathogen Inactivation and Equivalency Approval for Advanced Alkaline Process." Water Environment Federation, New Orleans, Louisiana. (October 3, 2012).
29. **Brisolara, K. F.**, Reimers, R.S., 2012 IWA Disinfection of Water, Wastewater and Biosolids Conference, "Potential Indicator Organisms for the Evaluation of Advanced Alkaline Systems," International Water Association, Mexico City, Mexico (Accepted, unable to attend, November 2012).
30. **Brisolara, K. F.**, Reimers, R.S., LWEA Annual Conference, "Biosolids Case Study on Navigating the USEPA Pathogen Equivalency Process," Louisiana Water Environment Association, New Orleans, Louisiana. (May 22, 2012).
31. **Brisolara, K. F.**, Residuals and Biosolids 2012, "Production of Activated Carbon from Manures and Municipal Sludge," Water Environment Federation, Raleigh, North Carolina. (March 25, 2012).
32. **Brisolara, K. F.** (Workshop Chair), Residuals and Biosolids 2012, "Value-Added Green Products from Biosolids and Manure – The Direction of the 21st Century," Water Environment Federation, Raleigh, North Carolina. (March 25, 2012).

33. **Brisolara, K.F.**, Mussari, F., Smith, J.E., Residuals and Biosolids 2011, “The Path to PFRP Approval - Two Case Studies: Alkaline and Acid,” Water Environment Federation, Sacramento, California. (May 23, 2011).
34. **Brisolara, K.F.**, Reimers, R.S. Disinfection 2011, “Pathogen Inactivation in an Advanced Alkaline System,” Water Environment Federation, Cincinnati, Ohio. (April 12, 2011)
35. **Brisolara, K.F.**, Reimers, R.S. (Workshop Co-Chair) Water Environment Federation Technical Conference, “Wastewater Disinfection: Efficiency and Effectiveness,” New Orleans, Louisiana. (October 2, 2010)
36. **Brisolara, K.F.**, Reimers, R.S. (Workshop Speaker) Water Environment Federation Technical Conference, “Controlling Pathogens and Meeting Regulatory Requirements for Land Application of Biosolids,” New Orleans, Louisiana. (October 3, 2010)
37. **Brisolara, K. F.**, Scott, A. J., Residuals and Biosolids 2010: Leveraging Biosolids in the Energy-Climate Era, "Barriers to Implementation of the 2008 Farm Bill Conservation Programs and their Implications in Manure Management," Water Environment Federation, Savannah, Georgia. (May 22, 2010).
38. **Fitzmorris, K. B.**, American Public Health Association 137th Annual Meeting & Exposition, "Emerging Pathogens: The Public Health Impact," American Public Health Association, Philadelphia, Pennsylvania. (November 11, 2009).
39. **Fitzmorris, K. B.**, Reimers, R. S., Pillai, S. D., Bowman, D. D., WEF Residuals and Biosolids Conference, "Physical, Chemical and Biological Agents Impacting Disinfection in Residuals," Water Environment Federation, Portland, Oregon. (May 4, 2009).
40. **Fitzmorris, K. B.**, Reimers, R. S., WEF Disinfection Conference, "Assessment of Indicator Organisms and Long-Term Stability in Advanced Alkaline Systems," Water Environment Federation, Atlanta, Georgia. (March 1, 2009).
41. Reimers, R.S., Acquisto, B.A., **Fitzmorris, K.B.**, Pillai, S.D., WEF Disinfection Conference, “Pertinent Factors Involving Disinfection and Stabilization of Municipal Biosolids,” Water Environment Federation, Atlanta, Georgia. (March 1, 2009).
42. **Fitzmorris, K. B.** (Workshop Coordinator), Water Environment Federation Technical Conference, "Selecting a Class A Physical/Chemical Treatment for Biosolids," Water Environment Federation, Chicago, Illinois. (October 18, 2008).
43. **Fitzmorris, K. B.** (Workshop Coordinator), WEF Residual and Biosolids Conference, "Value-Added Products from Municipal, Agricultural and Industrial Waste Residuals," Water Environment Federation, Philadelphia, Pennsylvania. (March 30, 2008).
44. **Fitzmorris, K. B.,** Miles, D. M., Lima, I. M., International Symposium on Air Quality and Waste Management for Agriculture, “Efficacy of Activated Carbon from Broiler Litter in the Removal of Litter Generated Ammonia.” American Society of Agricultural and Biological Engineers, Broomfield, Colorado CD-ROM. (September 16-19, 2007).

45. **Fitzmorris, K. B.,** GaPHA 78th Annual Meeting, "2007 Farm Bill and Agricultural Waste," Georgia Public Health Association, Savannah, Georgia. (September 5, 2007).
46. **Fitzmorris, K. B.**, Reimers, R. S., Pillai, S., Oleszkiewicz, J. A., Smith, J., Moving Forward Wastewater Biosolids Sustainability: Technical, Managerial, and Public Synergy, "Production of safe biosolids from agricultural and municipal residuals: emerging physical-chemical processes," International Water Association, Moncton, New Brunswick, Canada. (June 2007).
47. **Fitzmorris, K. B.**, Moore, M., Joint Residuals and Biosolids Management Conference, "The Impacts of the 2007 Farm Bill on Agriculture Waste Treatment," Water Environment Federation, Denver, Colorado. (April 17, 2007).
48. Reimers, R. S., **Fitzmorris, K. B.,** Pillai, S. D., Oleszkiewicz, J. A., Smith, J. E., Joint Residuals and Biosolids Management Conference, "Emerging Chemical Processes to produce Value-Added Products (VAPs) from Manure and Municipal Residuals," Water Environment Federation, Denver, Colorado. (April 17, 2007).
49. **Fitzmorris, K. B.,** Reimers, R. S., Oleszkiewicz, J. A., Little, M. D., WEFTEC, "Pathogen Inactivation by a Closed Alkaline System," Water Environment Federation, Dallas, Texas. (October 25, 2006).
50. **Fitzmorris, K. B.**, Lima, I. M., Marshall, W., 16th International Activated Carbon Conference, "The Effects of Acid Washing on Activated Carbon from Poultry Litter," IAC, Pittsburgh, Pennsylvania. (October 2005).
51. **Fitzmorris, K. B.,** Lima, I. M., Marshall, W. E., Reimers, R. S. Joint AWMA and WEF International Conference on Animal Agriculture and Processing: Managing Environmental Impacts. "Anion and Cation Removal from Solution using Activated Carbons from Municipal Sludge and Poultry Manure as Effected by pH." Air and Waste Management Association, St. Louis, Missouri. (August 31, 2005)
52. Pratt, L. S., Reimers, R. S., Jeng, H. W., Bowman, D. D., Oleszkiewicz, J. A., Meckes, M., **Fitzmorris, K. B.** Joint Residuals and Biosolids Management Conference, "Development of Surrogate Indicators to Monitor Pathogens in Biosolids." Water Environment Federation, Nashville, Tennessee. (April 2005).
53. Reimers, R. S., Pillai, S. D., Bowman, D. D., **Fitzmorris, K. B.,** Pratt, L. S. WEF Disinfection, Sharing Disinfection Technologies: Water, Wastewater, and Biosolids, "Stressors Influencing Disinfection in Residuals." Water Environment Federation, Mesa, Arizona. (February 2005).
54. **Fitzmorris, K. B.** (Workshop Coordinator), WEFTEC, "Pathogen Concerns with Residuals Management," Water Environment Federation, New Orleans, Louisiana. (October 2, 2004).
55. **Fitzmorris, K. B.**, Arcemont, M., Reimers, R. S., Boston, R., WEFTEC, "Alkaline Processing by Closed System for Morgan City and Shreveport, Louisiana," Water Environment Federation, New Orleans, Louisiana. (October 2, 2004).
56. Reimers, R. S., **Fitzmorris, K. B.,** Salyer, H. R., Batherson, R. J., Murray, N. K., WEFTEC, "St. Tammany Parish Residuals Program." Water Environment Federation, New Orleans, Louisiana. (October 2, 2004).

57. **Fitzmorris, K. B.**, Reimers, R. S., Oleszkiewicz, J. A., Little, M. D., Residual and Biosolids Management Conference, "Advances in Disinfection in Closed Alkaline Systems," Water Environment Federation, Salt Lake City, Utah. (February 24, 2004).
58. **Fitzmorris, K. B.,** Reimers, R. S., Lima, I. M., Marshall, W. E. Innovative Uses of Biosolids and Animal Manure, "Quality and Cost Analysis of Value Added Products from Animal and Municipal Residuals." Water Environment Federation, Chicago, Illinois. (July 2, 2004).
59. **Fitzmorris, K. B.**, Animal Residuals Conference: Alternative Technologies, Approaches, and Biosecurity, "The Advent of Value-Added Products from Municipal and Agricultural Residuals," Water Environment Federation, Arlington, Virginia. (November 3, 2003).
60. Lima, I. M., Marshall, W. E., **Fitzmorris, K. B.,** Reimers, R. S., Residual and Biosolids Management Conference, "Poultry Biosolids as Granular Activated Carbons for Metal Ion Adsorption," Water Environment Federation, Baltimore, Maryland. (February 2003).
61. **Fitzmorris, K. B.,** Reimers, R. S., Oleszkiewicz, J. A., Shepherd, S., Residual and Biosolids Management Conference, "Developments in Stabilization and Disinfection in Alkaline Systems," Water Environment Federation, Baltimore, Maryland. (February 21, 2003).
62. **Fitzmorris, K. B.,** Reimers, R. S., Little, M. D., Bowman, D. D., Residuals and Biosolids Management Conference, "Advances in Alkaline Stabilization/ Disinfection of Municipal Biosolids," Water Environment Federation, Austin, Texas. (March 5, 2002).
63. Reimers, R. S., Smith, J. E., Bowman, D.D., **Fitzmorris, K. B**., Specialty Conference on Disinfection – Health and Safety Achieving through Disinfectants, "Background of Biosolids Disinfection," Water Environment Federation, St. Petersburg, Florida. (February 19, 2002).

Posters

1. **Brisolara, K.,** Puszykowski, K., Cormier, S., Reams, M. 2019. Implementation of Interprofessional Education Methods for Address Emerging Technologies in Occupational Health and Safety. NIEHS, SRP, Seattle, Washington. (November 18-20).
2. Gilliland A, Pieper K, Straif-Bourgeois S, Rhoads WJ, Edwards M, **Brisolara K,** Katner A. 2019. Recommendations on improving access to safe water in domestic well-reliant communities after the Great Louisiana Flood of 2016. 12th Health Disparities Conference. New Orleans, LA (April 8-10).
3. Gilliland A, Pieper K, Straif-Bourgeois S, Rhoads WJ, Edwards M, **Brisolara K,** Katner A. 2019. Emergency preparedness and recovery lessons after the Great Louisiana Flood of 2016 among domestic well owners. 2019 Louisiana Water Conference. Baton Rouge, LA (April 15-16).
4. **Brisolara, K.,** Cormier, S., Reams, M. IPE Nexus Summit 2018, "Interprofessional Approach to Developing a Diverse Workforce Ready to Address Emerging Technologies in Occupational Health and Safety." IPE Nexus Summit, Minneapolis, Minnesota. (July 30, 2018).

5. **Brisolara, K.,** Cormier, S., Reams, M. NIEHS Superfund Research Program Annual Meeting 2017, “Interprofessional Approach to Developing a Diverse Workforce Ready to Address Emerging Technologies in Occupational Health and Safety.” NIEHS, SRP, Philadelphia, Pennsylvania. (December 8, 2017).
6. **Fitzmorris-Brisolara, K.,** Lima, I., Rome, K. Water Quality Technical Conference 2014, “Quantification and Removal of Metals via Activated Carbons from Municipal and Agricultural Waste.” American Water Works Association, New Orleans, Louisiana. (November 17, 2014).
7. **Fitzmorris, K. B.**, Reimers, R. S., Pillai, S. D., Bowman, D. D., 73rd Annual Educational Conference and Exhibition, "Stressors Influencing the Survival of Pathogens in Biosolids," National Environmental Health Association, Atlanta, Georgia. (June 22, 2009).
8. Jackson, T. M., **Fitzmorris, K. B.**, Lima, I. M., Southeast Regional Collegiate Environmental Science and Health Symposium, "Ammonia Adsorption of Activated Carbon from Animal Residuals," EPA, ATSDR, CDC, Atlanta, Georgia. (November 14, 2007).
9. Keene, D., **Fitzmorris, K. B.**, Lima, I. M., Southeast Regional Collegiate Environmental Science and Health Symposium, "Copper Adsorption of Activated Carbon from Poultry Litter: Water quality improvements from an unconventional source," EPA, ATSDR, CDC, Atlanta, Georgia. (November 14, 2007).
10. Baker, L., **Fitzmorris, K. B.**, Lima, I. M., Southeast Regional Collegiate Environmental Science and Health Symposium, "Evaluation of the chemical composition of poultry manure and its suitability as a source for Activated Carbon," EPA, ATSDR, CDC, Atlanta, Georgia. (November 14, 2007).
11. Parrillo, A. V., Ledlow, G. R., Vogel, R. L., **Fitzmorris, K. B.,** Hardy, C. J., 135th Annual Meeting & Exposition, "Evidence-based decision-making : Assessment of student learning outcomes in public health education programs," American Public Health Association, Washington, DC. (November 5, 2007).

Seminars and Invited Presentations (include visiting professorships):

1. **Brisolara, K.** “Sustainable Sanitation Solutions for Mosquito Vector Control: Infrastructure and Public Health on a Global Scale.” Global Health Symposium, Wilderness Medical Society, Midway, Utah. (August 4, 2018).
2. Gary, L., **Brisolara, K.,** Reimers, R. “Mitigating Impact of Evacuation Waste on Vital Water Sources.” Louisiana Water Environment Association, 12th Annual Conference. (March 27, 2018).
3. **Brisolara, K.F**. “ÉCOLE: Emerging teChnologies in Occupational heaLth and the Environment.” RTC/CEC Monthly Webinar, NIEHS, Superfund Research Program. (June 8, 2017).
4. **Brisolara, K.F.** “Be Better Prepared for Zika: Part 2.What are the Best Largescale Solutions? What about for the Poorest Nations at the Greatest Risks?” Symposium on Zika, Dengue, Chikungunya Fever Health Corps Haiti and WMS Global Health Committee, Co-sponsor The International Association for Medical Assistance for Travelers (IAMAT). Universite d’Etat d’Haiti, Campus Henri Christophe de Limonade Science de Sante. (May 7 – 8, 2017).

5. **Brisolara, K.F**. “Vector Control and Sanitation,” 3rd Meeting of the Zika Health IT Task Force and State of Pernambuco, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana. (April 3, 2017).
6. **Brisolara, K.** “Environmental and Occupational Health Sciences,” Lake Ponchartrain Basin Foundation Workshop, New Orleans, Louisiana (July 8, 2016).
7. Gary, L., **Brisolara, K.**, Reimers, R., Scharf, P., Verges, J., Fleetwood, P., Konde, N., Xu, Y. Louisiana Emergency Preparedness Association & GOHSEP Conference, “At the Center of the Ebola Network,” LEPA/GOHSEP, Lake Charles, Louisiana. (May 4, 2016).
8. **Brisolara, K.F.** “Individual, Social, and Cultural Constraints to Evacuation,” Lake Ponchartrain Basin Foundation, Pontchartrain-Maurepas Surge Consortium, Evacuation Workshop, Destrehan, Louisiana. (December 11, 2015).
9. Reimers, R.S., **Brisolara, K.F.**, Rubin, A.R., Donovan, J.F., Wanstrom, C., WEF Seminar on Addressing Disinfection Needs in the Chesapeake Bay Area, “Future Approaches to Disinfection of Waste Residuals,” Water Environment Federation, Washington, D.C. (June 9, 2015).
10. Diaz, J., **Fitzmorris-Brisolara, K**., Katner, A., Hendricks, M. International Disaster Conference and Expo, “IDCE 322: Superficial and Invasive Infections Following Hurricanes and Major Flooding Events.” IDCE, New Orleans, Louisiana. (February 12, 2015).
11. **Brisolara, K. F**., Georgia Board of Registered Environmental Health Professionals, “Educational Opportunities for Environmental Health Professionals,” GBREHP, Macon, Georgia. (February 25, 2011).
12. **Brisolara, K. F.**, WEFTEC, "Should We Consider Alternative Indicators for Specific Treatments?," Water Environment Federation, New Orleans, Louisiana. (October 3, 2010).
13. **Fitzmorris, K. B.,** Moss, L., Georgia Association of Water Professionals 2010 Industrial Conference, "Legislative Updates on Animal and Municipal Residuals," Georgia Association of Water Professionals, Callaway Gardens, Georgia. (March 16, 2010).
14. **Fitzmorris, K. B.,** Charles, S. M., Southeast Health District - Environmental Health Meeting, "Environmental Health at JPHCOPH," SEHD, Douglas, Georgia. (April 23, 2009).
15. **Fitzmorris, K. B.,** Mercer Public Health Student Association, "Doctor of Public Health Program of JPHCOPH," Mercer University School of Medicine, Macon, Georgia. (January 28, 2009).
16. **Fitzmorris, K. B.,** Hardy, C. J., GEHA 2008 Annual Education Conference, "Environmental Health at JPHCOPH," Georgia Environmental Health Association, Jekyll Island, Georgia. (July 9, 2008).
17. Tedders, S. (Panelist & Moderator), Arroyo, C. (Panelist), **Fitzmorris, K. B.** (Panelist), Gunn, L. H. (Panelist), Hotchkiss, R. (Panelist), Scott, A. J. (Panelist), Annual Meeting of the Georgia Rural Health Association, "What is Public Health?," Georgia Rural Health Association, Athens, GA. (September 18, 2007).

18. **Fitzmorris, K. B.** (Moderator and Panelist), Joint Residuals and Biosolids Management Conference, "Agricultural Issues I," Water Environment Federation, Denver, Colorado. (April 17, 2007).
19. **Fitzmorris, K. B.,** Tedders, S., Environmental Training Workshop, "The Jiann-Ping Hsu College of Public Health," Southeast Health District, Hazelhurst, Georgia. (January 11, 2007).
20. **Fitzmorris, K. B.,** Skidaway Institute of Oceanography Seminar Series, "Agricultural and Municipal Waste – Concerns with Disinfection and Re-use," Skidaway Institute of Oceanography, Savannah, Georgia. (November 10, 2006).
21. **Fitzmorris, K. B.** (Panelist), Biosolids and Residuals Conference, "WEF/WERF Biosolids Management Options: Understanding the Benefits and Costs," Water Environment Federation, Dallas, Texas. (October 21, 2006).
22. **Fitzmorris, K. B.** (Workshop Presenter), Biosolids and Residuals Conference, "New Class A Processes and Regulatory Acceptance," Water Environment Federation, Cincinnati, Ohio. (March 12, 2006).
23. **Fitzmorris, K. B.** (Workshop Presenter), Reimers, R. S., Pratt, L. S., WEFTEC, "Treatment and Survival of Pathogens in Biosolids," Water Environment Federation, New Orleans, Louisiana. (October 2, 2004).
24. **Fitzmorris, K. B.,** Reimers, R. S., Lima, I. M., Marshall, W. E., Animal Residuals Conference: Innovative Uses of Biosolids and Animal Manure, "Quality and Cost Analysis of Value Added Products from Animal and Municipal Residuals," Water Environment Federation, Chicago, Illinois. (July 2, 2004).
25. **Fitzmorris, K. B.,** Workshop on Alkaline Treatment of Wastewater Solids, "The Bioset System," Water Environment Federation, Salt Lake City, Utah. (February 22, 2004).
26. **Fitzmorris, K. B**., Animal Residuals Conference: Alternative Technologies, Approaches, and Biosecurity, "The Advent of Value-Added Products from Municipal and Agricultural Residuals," Water Environment Federation, Arlington, Virginia. (November 3, 2003).
27. Reimers, R. S. (Workshop Presenter), **Fitzmorris, K. B.**, Englande, A. J., Shea, T. G., Smith, P. M., Epstein, E., Workshop on Charting the Future Direction of Bioenergy Technologies, "Value-Added Products from Biosolids," Tulane University and Water Environment Federation, New Orleans, Louisiana. (August 15, 2003).
28. Reimers, R. S. (Workshop Presenter), **Fitzmorris, K. B.,** National Biosolids Issues Part 1: Pathogens and Stabilization, "Treatment and Survival of Pathogens in Biosolids," Water Environment Federation, Chicago, Illinois. (September 28, 2002).
29. Reimers, R. S. (Workshop Presenter), **Fitzmorris, K. B.,** Pre-Conference Workshop on Pathogens in Biosolids, "Emerging Pathogens, Inactivation Mechanisms and Future Directions," Water Environment Federation, Austin, Texas. (March 3, 2002).

Visiting professorships or seminars

- Guest Speaker, LSUHSC SPH 2015-2016 Student Development Series, New Orleans, Louisiana. (November 5, 2015).

- Guest Speaker, Candler County Health Department, Metter, Georgia. (December 1, 2008).
- Guest Speaker, Bulloch County Health Department, Statesboro, Georgia. (September 18, 2008).
- Guest Speaker, Rotary Club of Statesboro, Statesboro, Georgia. (April 2, 2007).
- Interaction with Industry, Coastal Health District - Effingham County Environmental Health, Springfield, Georgia. (February 7, 2008).
- Interaction with Industry, SEHD - Bulloch County Environmental Health, Statesboro, Georgia. (July 18, 2007).
- Guest Speaker, Student Affiliates of the American Chemical Society. (March 11, 2008).
- Guest Speaker, Student Alliance for a Green Earth. (November 7, 2007).
- Guest Speaker, Tri Beta. (November 6, 2007).

Editorial Posts and Activities:

Journal editorships or associate editorships

- Associate Editor, *Water Environment Research*. (December 2012 –October 2018).
    - Guest Editor with Editorial Introduction: Special Issue on Adsorption. (September 2017).
- Editorial Board, *Resources and Environment*. (December 2011 – Present).
- Editor, Special Issue, *Water Practice*. (June 2007 - July 2007).

Reviewer status

- Reviewer, Journal Article, *Journal of the Air and Waste Management Association.* (July 2017 – Present).
- Reviewer, Journal Article, *Environmental Engineering Science.* (2017 – Present).
- Reviewer, Journal Article, *Applied and Environmental Soil Science.* (December 2014 – Present).
- Reviewer, Journal Article, *Parasitology Research.* (April 2013 – Present).
- Reviewer, Journal Article, *Bioresource Technology*. (September 2008 - Present).
- Reviewer, Journal Article, *Industrial and Engineering Chemistry Research*. (July 2008 - Present).
- Reviewer, Journal Article, *Chemosphere*. (October 2007 - Present).
- Reviewer, Journal Article, *Water Practice.* (January 2007 - Present).
- Reviewer, Journal Article, *Atmospheric Environment*. (October 2006 - Present).
- Reviewer, Journal Article, *Environmental Science and Technology.* (September 2006 - Present).

- Reviewer, Conference Paper, Water Environment Federation. (January 2005 - Present).
- Reviewer, Journal Article, Water Environment Research. (January 2005 - Present).
- Reviewer, Book, U.S. EPA/ORD/NRML/LRPCD, Cincinnati, Ohio. (April 25, 2007 – January 1, 2009).

University/Institutional Service (note leadership responsibilities):

School of Public Health committees

LSUHSC, School of Public Health

- Committee Member, SPH Multicultural/Diversity Committee. (July 1, 2015 – Present)
- Committee Member, Evaluation Committee. (August 17, 2011 – Present)
- Committee Member, Curriculum Committee (September 1, 2018 – Present)
- Committee Member, Appointments, Promotions and Tenure. (July 1, 2017 – September 1, 2018).
- Chair, Evaluation Committee. (July 1, 2016 – September 1, 2018).
- Committee Member, Bylaws Committee. (July 1, 2016 – September 1, 2018)
- Judge, LSUHSC SPH Delta Omega Research Day. (April 8, 2016).
- Search Committee, Student Recruitment Specialist. (September 2015).
- Committee Member, Recruiting and Open House Committee. (March 13, 2012 – September 1, 2015)
- Chair, Appointments, Promotions and Tenure. (July 1, 2014 – June 30, 2016).
- Senior Faculty Member Representative, Administrative Council. (July 1, 2012 – June 30, 2016).
- Committee Member, Appointments, Tenure and Promotions. (July 1, 2012 – July 1, 2014).
- Committee Member, Grievance Committee. (July 1, 2012 – June 30, 2014).
- Committee Member, CEPH Instructional Section Committee. (August 9, 2011 – February 20, 2013).
- Committee Member, CEPH Self Study Group. (August 9, 2011 – February 20, 2013).

GSU, Jiann-Ping Hsu College of Public Health (JPHCOPH)

- Committee Member, Public Health Core Laboratory. (August 1, 2009 – June 30, 2011).
- Committee Member, JPHCOPH Research. (August 29, 2007 – June 30, 2011).
- Committee Member, Promotion and Tenure Committee (Observer). (August 2009 - December 2009).

- Committee Member, Environmental Health Search Committee. (August 2008 - May 2009).
- Student Recruiter, Mercer University PH Student Association. (January 28, 2009).
- Faculty Advisor, Graduate Assistant Orientation. (August 14, 2008).
- Committee Chair, Environmental Health Search Committee. (August 1, 2006 - August 1, 2008).
- Faculty Advisor, Public Health Student Association. (August 2007 - May 2008).
- Faculty Advisor, Graduate Assistant Workshop. (October 12, 2007).
- Committee Member, Student Handbook. (September 5, 2006 - May 1, 2007).
- Committee Member, CEPH Accreditation - Section 1.0. (August 30, 2006 - May 1, 2007).
- Committee Member, Evidence Based Decision Making Group. (August 28, 2006 - May 1, 2007).

Campus committees

LSUHSC

- SPH Representative, IPE Curriculum Committee Workgroup. (August 19, 2014 – Present).
- LSUHSC Faculty Senate, SPH Representative (July 1, 2016 – September 1, 2018).
- SPH Representative, SACS Accreditation Team. (August 6, 2013 – March 26, 2015).
- Judge, Graduate Research Day. (November 6, 2016).
- SPH Representative, LSUHSC Branding and Strategy Development Initiative. (October 30, 2014).

GSU

- Committee Member, Faculty Grievance Committee. (August 1, 2010 – June 30, 2011).
- Committee Member, Sustainability Committee. (August 2009 - June 30, 2011).
- Faculty Advisor, Students for Clean Drinking Water. (August 2008 - June 30, 2011).
- Committee Member, Institutional Biosafety Committee. (July 2007 - June 30, 2011).
- Committee Member, Committee for the Development of Undergraduate Environmental Science Minor. (March 22, 2007 - August 1, 2009).
- Committee Member, Faculty Welfare Committee. (August 2007 - August 2008).
- Committee Member, Faculty Research Committee. (September 2006 - August 2008).

- Committee Member, Graduate Committee. (September 2006 - August 2008).
- Committee Member (Alternate), Faculty Senate. (August 2006 - August 2008).
- Committee Member, Recycling and Sustainability Committee. (March 2007 - August 2007).
- Committee Member, College of Science and Technology Dean Search Committee. (September 1, 2006 - March 28, 2007).
- Departmental Representative, Crane Focus Group. (February 15, 2007).
- Attendee, Meeting, HBCU Visit Day - Luncheon & Academic Round Table. (February 6, 2007).

Professional society committees

International

- Delegate-at-Large, Water Environment Federation. (October 2017 – Present).
- Vice Chair, Disinfection and Public Health Committee, Water Environment Federation. (October 2018 – Present).
- Workgroup Chair, Student Chapter Workgroup, Water Environment Federation House of Delegates. (October 2017 – October 2018).
- Second vice Chair, Disinfection and Public Health Committee, Water Environment Federation. (October 2017 – October 2019).
- Session Moderator, Water Environment Federation Technical Conference “Public Health in the Headlines,” New Orleans, Louisiana. (September 27, 2016).
- Session Moderator, Water Environment Federation Technical Conference “211 PAA: Establishing a New Disinfection Technology,” New Orleans, Louisiana. (September 26, 2016).
- Committee Member, Research and Innovation Committee, Academic Subcommittee, Water Environment Federation. (October 5, 2013 – Present).
- Committee Member, Disinfection and Public Health, Water Environment Federation. (March 25, 2013 – Present)
- Committee Member, Academic Committee, Water Environment Federation. (February 4, 2011 – Present)
- Task Force Member, Water Environment Federation. (March 15, 2010 - Present).
- Delegate-at-Large, Water Environment Federation. (October 2009 – October 2012).
- Committee Member, WEF Community of Practice on Sustainability. (May 2008 - Present).
- Committee Member, Climate Change Workgroup - WEF. (January 2008 – January 2010).
- Committee Member, Residuals and Biosolids Committee. (March 2003 - Present).

National

- Member, National Preparedness Coalition, Federal Emergency Management Agency. (September 6, 2012 – Present).
- Academic Advisory Committee, Institute of Professional Environmental Practice. (April 26, 2012).
- Session Moderator, Water Environment Federation, Residuals and Biosolids 2012, Water Environment Federation, Raleigh, North Carolina. (March 27, 2012).
- Committee Member, Specialty Conference Planning Committee. (October 2007 - Present).
- Committee Member, WEF 2008 Residuals and Biosolids Conference Steering Committee, Alexandria, Virginia. (March 2007 - Present).
- Session Chair, Water Environment Federation, Savannah, Georgia. (May 26, 2010).
- Session Chair, American Public Health Association, Philadelphia, Pennsylvania. (November 11, 2009).
- Committee Chair, Agricultural and Industrial Sub-Committee. (August 23, 2006 - October 13, 2009).
- Task Force Member, Farm Bill Task Force, Alexandria, Virginia. (September 6, 2006 - September 7, 2008).
- Session Chair, American Chemical Society, New Orleans, Louisiana. (April 9, 2008).

State

- Committee Member, Migrant Health Clinic. (September 7, 2007 – June 30, 2011).
- Board of Directors, Georgia Environmental Health Association, Georgia. (July 8, 2009 – August 1, 2011).

Special assignments – ad hoc task forces/working groups, projects, etc

- Hispanic Youth Photovoice Project Coordinator, St. Christopher Catholic Church, Claxton, Georgia. (September 2009 – June 2011).
- Coordinator and Spokesperson, Public Health Laboratory. (August 1, 2007 - August 1, 2009).
- Committee Member, Southwest Georgia Community Based Health Initiative. (December 10, 2007 - May 1, 2008).

Administrative Responsibilities:

- Administrative Assignment, Associate Dean for Academic Affairs, LSUHSC-SPH. (September 1, 2018 – Present).
- Administrative Assignment, Interprofessional Education Faculty Liaison for SPH. (August 1, 2015 – Present)
- Administrative Assignment, Bachelor of Public Health Development Team, LSUHSC-SPH. (December 9, 2014 – Present). Development of structure, curriculum and resource requirements for a new bachelor's degree in public health.

- Administrative Assignment, Strategic Planning Team Leader, LSUHSC-SPH. (December 18, 2014 – June 30, 2015). Responsible for Education Committee; develop draft of education related goals and objectives for the SPH; also served on Faculty Development and IT sections.
- Administrative Assignment, CEPH Accreditation Core Team, LSUHSC-SPH. (August 9, 2011 – February 20, 2013). Data collection/collation for the CEPH Self Study including writing responsibility and data supporting the text; review each section of the self-study across all sections to resolve any inconsistencies; co-writer of Criterion 2.0 – Instructional Programs.
- Administrative Assignment, CEPH Accreditation Core Team, GSU-JPHCOPH. (August 1, 2009 – June 30, 2011). Responsible for seven subcommittees devoted to writing the Criteria for the Self Study including data collection and analysis; review the entire document across all sections to resolve any inconsistencies.
- Administrative Assignment, Doctor of Public Health Program Director, GSU-JPHCOPH. (July 2008 – June 30, 2011). Responsible for implementing all policies and procedures of JPHCOPH, of the Graduate Committee and the College of Graduate Studies; also worked with the Academic Affairs leadership team and the Associate Dean to ensure that policies and procedures unique to the programs in the college are followed.
- Departmental Representative, Discipline Liaison for Environmental Health, GSU-JPHCOPH. (August 1, 2007 - August 1, 2008). Primary function was to provide leadership in the delivery of academic programs and research and service activities within the Environmental Health discipline and to support achievement of the College‘s goals and objectives; advocate for the needs of the discipline to the College administration; promote collaboration across the college through open and respectful communication both within and outside of the discipline; management tasks included: curriculum assessment, advising, admissions, communication with and across the disciplines and organizing faculty or student meetings to address discipline-specific issues.
- Administrative Assignment, Environmental Health Program Director, GSU-JPHCOPH. (August 1, 2006 - August 1, 2007). Title change, same responsibilities as above “Discipline Liaison.”

Community Service Activities:

- “Modeling Environmental Health Impacts of I-10 to Engage Residents and Decision Makers” The focus of the Claiborne Ave., New Orleans project was to characterize environmental hazards, exposures, potential health implications and traffic-associated health outcomes for the communities living around Interstate I-10 (also referred to as the I-10 corridor). https://thrivingearthexchange.org/project/claiborne-new-orleans-la/
- Association of Women in Science, “Sci-Fly Mentoring Event.” (July 18, 2016)
- Northshore Community Foundation Water Symposium, Water Institute of the Gulf, dialogue about the Northshore and potential for land loss, (June 18, 2013).

- St. Christopher Catholic Church, Hispanic Youth Photovoice Project Coordinator, Claxton, Georgia, approximately 25 hours spent for the year, (September 2009 – June 2011).
- Migrant Health Clinic, Committee Member, Southeast Georgia, approximately 15 hours spent for the year in addition to the development of three (3) health education posters on environmental health topics including heat stress, pesticide exposure and eye safety, (September 2007 – May 2011).
- Developed and presented three (3) online state-approved continuing education courses for on-site sewage (August 2007 – June 2011).
- "On-Site Sewage Continuing Education", Professional. (April 23, 2010). Jesup, GA for EHS of SEHD Southwest Georgia Community Based Health Initiative, Committee Member. (December 10, 2007 - May 1, 2008).
- Guest Speaker, Candler County Health Department, Metter, Georgia. (December 1, 2008).
- Guest Speaker, "Lead Poisoning: The Silent Menace," Bulloch County Health Department, Statesboro, Georgia. (September 18, 2008).
- Interaction with Industry, Coastal Health District - Effingham County Environmental Health, Springfield, Georgia. (February 7, 2008).
- Guest Speaker, Rotary Club of Statesboro, Statesboro, Georgia. (April 2, 2007).
- Interaction with Industry, SEHD - Bulloch County Environmental Health, Statesboro, Georgia. (July 18, 2007).

Development Activities:

- Navigating a Foodborne Outbreak: Preparation for Interprofessional Practice. APIH, AACN, AAMC, APTR, ASPPH. (February 21, 2018).
- National Public Health Week Special Presentation: Intersection of Disciplines – Reversing Disease for Optimal Health, Jack Kruse, DMD, MD. (April 7, 2017).
- LSUHSC SPH, Dr. Rebekah Gee, MD, MPH, "The State of the State: Proposed Affordable Care Act Changes." (March 13, 2017).
- LSUHCS SPH Faculty Workshop. (February 10, 2017).
- Peer Advocate Liaison Lecture, Jose Calderon-Abbo, "Clinical Mindfulness: Prescriptions and Mechanisms." (February 8, 2017).
- SafeZone Training, School of Medicine. (February 2, 2017).
- Interprofessional Education Day, LSUHSC, Team Leader. (January 25, 2017).
- CIPECP Facilitator Training. (January 9, 2017).
- Water Environment Federation, WEFTEC Abstract Reviewer Training. (December 20, 2016).
- John A. Rock, MD Visiting Scholar, Dr. Susan Ellenberg, "Clinical Trials in the Twenty-First Century: Emerging Issues and Controversies." (November 8, 2016).

- Lake Ponchartrain Basin Foundation, Assimilation Workshop, Southeastern Louisiana University. (October 25 – 26, 2016).
- LSUHSC SPH, Faculty Workshop, Office of Academic Affairs and Office of Research. (September 30, 2016).
- CIPECP, Faculty Training for IPE, Dr. Amy Blue. (September 12, 2016).
- CIPECP/New Orleans Museum of Art, Session on Visual Intelligence. (August 31, 2016).
- Academy for the Advancement of Educational Scholarship (OMERAD), “Back to Basics Summer Teaching Institute,” (July 27, 2016).
- Harvard T.H. Chan School of Public Health Executive and Continuing Professional Education program entitled “Teaching by Case Method: Principles and Practice for Public Health Educators” Boston, Massachusetts. (June 6 – 8, 2016).
- APHA Webinar Series, Part 2, “Public Health's Legal Authority and Safe Drinking Water.” (April 5, 2016).
- LSUHSC SPH Public Health Week, "Public Health is Social Justice: The Louisiana Perspective on Mass Incarceration" (April 4, 2016).
- APHA Webinar Series, Part 1, “Flint and Lead: The Water-Public Health Connection.” (March 24, 2016).
- Recognized Guest, USDA-ARS Southern Regional Research Center 75th Anniversary Celebration. (March 10, 2016).
- Virus Response Workshop: Zika Questions, Dr. James Diaz. (February 25, 2016).
- 2016 #Rallo Tour Higher Education Forum & Information Exchange, Greater New Orleans Tour Stop. (February 16, 2016).
- Louisiana Emergency Preparedness Public-Private Partnership, Meeting. (January 29, 2016).
- Interprofessional Education Day, LSUHSC, Team Leader. (January 27, 2016).
- ATSDR - Safeguarding Communities from Harmful Chemicals, “Advancing Environmental Medicine Practice,” Webinar. (November 17, 2015).
- John Rock Lecture, “Formulating Public Health Measures to Reduce Population Exposure to Radiation and Prevent Radiation-Associated Diseases” by Dr. John Boice. (November 10, 2015).
- LSUHSC School of Public Health SGA Mentor Match-up, (September 18, 2015).
- LSUHSC SPH Faculty Development Series, “Advising” (October 2, 2015).
- Event in Recognition of the 10th Anniversary of Hurricane Katrina, “Hurricane Katrina: The History that Influenced Movements for a Culture of Preparedness and Environmental Activism,” Lt. General Russel L. Honoré (U.S. Army retired), LSUHSC, HDC, (August 31, 2015).
- Louisiana Sea Grant Workshop, “Impacts of the Deepwater Horizon Oil Spill to Gulf Wetlands,” Slidell, Louisiana (August 11, 2015).

- Academy for the Advancement of Educational Scholarship (OMERAD), “Back to Basics Summer Teaching Institute,” (July 28, 2015).
- Special Seminar in Neuroscience, “Intentional Communities for Returning Warriors,” (April 8, 2015).
- LSUHSC School of Public Health SGA Mentor Match-up, (October 30, 2014).
- Academy for the Advancement of Educational Scholarship (OMERAD), “Fall Symposium and Educational Scholarship Day,” (October 9, 2014).
- EPA STAR Innovative Small Water Systems Progress Review, Co-organizer. (October 2, 2014).
- Interprofessional Education Day, LSUHSC, Team Leader. (September 29, 2014).
- E-learning Workshop, LSUHSC-SPH. (July 28 – August 1, 2014).
- SACS COC Institute on Quality Enhancement and Accreditation, LSUHSC Representative. (July 20 – 23, 2014).
- Quality Matters Training, LSUHSC-SPH. (July 1, 2014).
- EPA/NIEHS Children’s 2014 Webinar Series: Protecting Children’s Health for a Lifetime, (June 11, 2014).
- National Center for Farmworker Health, “An Orientation to Migrant Health,” Webinar, (August 1, 2013).
- Academy for the Advancement of Educational Scholarship (OMERAD), “Back to Basics Summer Teaching Institute,” (July 30, 2013).
- DHS, FEMA, Emergency Management Institute, “Preparing for Mass Casualty Incidents: A Guide for Schools, Higher Education, and Houses of Worship,” IS-00360, 0.3 IACET CEU (July 15, 2013).
- Academy for the Advancement of Educational Scholarship (OMERAD), “2013 Spring Symposium and Faculty Development Day,” (March 13, 2013).
- DHS, FEMA, Emergency Management Institute, “Surveillance Awareness: What You Can Do,” IS-00914, 0.1 IACET CEU (February 22, 2013).
- Louisiana Board of Ethics, “Ethics Training for Public Servants,” (February 13, 2013).
- DHS, FEMA, Emergency Management Institute, “Diversity Awareness 2013,” IS-00020.13, 0.1 IACET CEU (February 1, 2013).
- David E. Barmes Global Health Lecture, Sir Mark Walport, “Global Health: From John Snow to Genome Science,” (January 30, 2013).
- Centers for Disease Control and Prevention, “Oil and Water: Toxicology in Emergency Response,” WD1866, 0.7 IACET, (January 8, 2013).
- Centers for Disease Control and Prevention, “ATSDR Case Studies in Environmental Medicine: Taking an Exposure History,” WB1109, 0.15 IACET, (January 8, 2013).
- LSUHSC School of Public Health, Moodle Update and Training Session, (November 28, 2012)

- LSUHSC School of Public Health Mentor Match-up, (November 6, 2012).
- Academy for the Advancement of Educational Scholarship (OMERAD), “Fall Symposium and Educational Scholarship Day,” (October 10, 2012).
- Academy for the Advancement of Educational Scholarship (OMERAD), “Back to Basics Summer Teaching Institute,” (August 7, 2012).
- People Soft Training, Student Access training session LSUHSC-NO, (April 18, 2012).
- American Association for University Professors, “Restoring the Faculty Voice,” Tulane University, (April 14, 2012).
- Academy for the Advancement of Educational Scholarship (OMERAD), “Spring Symposium: Interprofessional Education,” (April 12, 2012).
- Navigating the Challenges of Blended Learning: Best Practices to Chart Your Course for Adoption, Webinar. (April 17, 2012).
- Cultural Competency Curriculum for Disaster Preparedness and Crisis Response, 4 course series, 9.0 CEU, (April 2, 2012)
- 2012 Ethics Training for Public Servants, Louisiana Board of Ethics, (March 16, 2012).
- DHS, FEMA, Emergency Management Institute, “Applications of GIS for Emergency Management,” IS-00922, 0.3 IACET CEU (March 6, 2012).
- DHS, FEMA, Emergency Management Institute, “Emergency Management Preparedness Fundamentals,” IS-00910, 0.3 IACET CEU (March 6, 2012).
- LSUHSC, School of Public Health Mentoring Social, (November 8, 2011).
- Research Commercialization Introductory Online Course (100C-11-2), Seven lecture series and quiz. (Completed October 27, 2011).
- Academy for the Advancement of Educational Scholarship (OMERAD), “Back to Basics Summer Teaching Institute,” (August 2, 2011).
- Water Environment Federation, “Committee Communications,” Webinar, (August 17, 2011).
- NBP-WERF Webcast: Innovative Residuals & Biosolids Management Options for LA's Terminal Island, (July 27, 2011).
- Livestock & Poultry Environmental Learning Center, National Air Emissions Monitoring Study Webcast,(September 16, 2011).
- Recruiting Fair, LSU Baton Rouge, (September 14 – 15, 2011).
- CDC Training Modules: Solid Waste, Vector Control, Wastewater, Potable Water, Disaster Management. Total CEU credits: 9.0 (August 16 – 19, 2011).
- Workshop, "6th Annual WERF Research Forum", Water Environment Research Foundation. (December 7, 2010).
- Workshop, "Business Objects Training", ORSSP, Statesboro, Georgia. (December 6, 2010).

- Seminar, "What to Know to Get the Dough", JPHCOPH and ORSSP, Statesboro, Georgia. (December 1, 2010).
- Webinar, "EPA Grants Award Process," Environmental Protection Agency. (April 1, 2010).
- Workshop, "JPHCOPH Research Retreat," JPHCOPH Office of Research, Statesboro, Georgia. (March 4, 2010).
- Workshop, "NIOSH Funding Process and Opportunities," JPHCOPH Office of Research, Statesboro, GA. (October 28, 2009).
- Workshop, "CDC/APHIS Select Agent Workshop," CDC. (August 12, 2009).
- Workshop, "CEPH Accreditation Orientation Workshop," CEPH, Washington, DC. (July 29, 2009 - July 31, 2009).
- Workshop, "Safe Space Training," GSU Counseling and Career Development, Statesboro, GA. (May 28, 2009).
- Faculty Learning Community, "Teaching Critical and Creative Thinking," Center for Excellence in Teaching - GSU, Statesboro, Georgia. (August 1, 2007 - May 1, 2009).
- Tutorial, "Course Design for GaVIEW," CET - Online Learning, Statesboro, GA. (November 7, 2008).
- Attended Conference, "GAHPERD Convention," Georgia Association of Health, Physical Education, Recreation and Dance, Savannah, Georgia. (November 2, 2008).
- Self-Study Program, "Aerobic Endospores: New Methods of Analysis," Environmental Protection Agency, Cincinnati, Ohio. (June 26, 2008).
- Seminar, "National Environmental Public Health Performance Standards: Using Standards to Improve Practice," National Association of County and City Health Officials, Webinar. (May 21, 2008).
- Workshop, "Master Teacher in Public Health," Administrative Committee on Public Health, Statesboro, Georgia. (April 24, 2008 - April 25, 2008).
- Workshop, "Logic Models," JPHCOPH, Statesboro, Georgia. (April 5, 2008).
- Workshop, "The Value of Poultry Litter as a Fertilizer," GWPPC/GSWCC/NRCS, Perry, Georgia. (March 19, 2008).
- Workshop, "Write Winning Grants," Grant Writers' Seminars and Workshops - GSU, Statesboro, Georgi. (October 26, 2007).
- Seminar, "G.E.D. Assistance," Women's & Gender Studies Program, Statesboro, Georgia. (October 4, 2007).
- Attended Conference, "National Water Conference: Research, Extension and Education for," USDA-CSREES, Savannah, Georgia. (January 30, 2007).
- Workshop, "Grant Writing and Proposal Development Workshop," ORSSP, Statesboro, Georgia. (September 21, 2006).
- Workshop, "Course Design for WebCT Vista," CET, Statesboro, Georgia. (August 30, 2006).

Books

Not Applicable

Book Chapters:

1. **Brisolara, K.F.,** Boudeman, L., Ochoa, H., McDaniel, L., Rubin, A. (2017) Chapter 27 – Use and Disposal of Residuals and Biosolids. In *Design of Water Resource Recovery Facilities (MOP 8, 6th Edition).* WEF Press. ISBN: 978-0-07-166358-8.
2. **Brisolara, K. F.,** Pederson, T., Lawson, J., Matta, I., Gruenfeld, R. (2013) Chapter 1 – Introduction. In *Emergency Planning, Response, and Recovery*. WEF Press. ISBN: 978-1-57278-274-7.
3. Smith, J. E., Barker, M., **Brisolara, K. F**., Doutt, T., Francis, H., Kester, G., Logan, T., Minskey, C., Oerke, D. W., Vidrine, J. K. (2012) Alkaline Treatment. In *Solids Process Design and Management*. WEF Press. June 1, 2012. ISBN 13: 9780071780957, ISBN 10: 0071780955.
4. Smith, J. E., Naylor, L., Acquisto, B., **Brisolara, K. F.,** Cox, A., Farrell, J. B., Francis, H., Gould, B., Meckes, M. C., Mussari, F. P., Pillai, S. D., Wenger, S. (2012) Disinfection and Stabilization Considerations. In *Solids Process Design and Management*. WEF Press. June 1, 2012. ISBN 13: 9780071780957, ISBN 10: 0071780955.
5. **Brisolara, K. F.,** Xu, Y., Reimers, R. S., Smith, J. E. (2012) Assessment of Municipal and Agricultural Waste Residuals. In Robert Friis (Ed.), *Praeger Handbook of Environmental Health*. April 30, 2012. ISBN-10: 0313386005, ISBN-13: 978-0313386008
6. Murthy, S., Schafer, P., **Fitzmorris, K. B.** (2009). Chapter 25: Stabilization. *Design of Municipal Wastewater Treatment Plants (MOP 8)* (ed., vol. 3, pp. 25-1). Alexandria, VA: McGraw Hill.
7. Reimers, R. S., **Fitzmorris, K. B.** (2009). Chapter 25. The Advent of Value-Added Products from Manure and Municipal Biosolids. *Manure Pathogens: Management, Regulations, and Water Quality Protection*. WEF Press and McGraw Hill.

Videos and Multimedia:

Not applicable

Scientific Exhibits:

Not applicable

Journal Publications:

Refereed Journal Articles:

1. Gilliland, A., Pieper, K., Straif-Bourgeois, S., Rhoads, W., Dai, D., Edwards, M., **Brisolara, K.**, Olexia, D., Katner, A. (2020) Evaluation of Preparedness and Recovery Needs of Private Well Users after the Great Louisiana Flood of 2016. J. Public Health Management Practice. (Accepted).
2. Maal-Bared, R., Bibby, K., **Brisolara, K.,** Gary, L., Reimers, R., Schaefer, S., Swift, J. (2020) Lessons from the Ebola outbreak: How the water sector can transition from panic to preparedness. Water Environment Technology. 32(1), 38-45.
3. **Brisolara, K.F.,** Culbertson, R., Levitzky, E., Mercante, D., Smith, D., Gunaldo, T. (2019) Supporting Health System Transformation: The development of an integrated

interprofessional curriculum inclusive of public health students. J. Health Administration Education. Winter, 111-121.

4. **Brisolara, K.F.,** Bourgeois, J. (2019) Biosolids and Sludge Management. Water Environment Research. 91, 1168-1176.
5. **Brisolara, K.F.,** Qi, Y., Kendrick, Q., Davis, Y. (2018) Biosolids and Sludge Management. Water Environment Research. 90, 978-1006.
6. **Brisolara, K.F.,** Gasparini, S., Davis, A., Sanne, S., Andrieu, S., James, J., Mercante, D., DeCarvalho, R. B., Gunaldo, T. (2017) Supporting health system transformation through an interprofessional education experience focused on population health. Journal of Interprofessional Care. Jan-Feb;33(1):125-128..
7. **Brisolara, K.F**. (2017) Biosolids, Phosphorus and Water Quality: Linkages and Solutions. Influents WEAO, 12 (Fall), 26-29.
8. **Brisolara, K. F.,** Qi, Y., Baldassari, M., Bourgeois, M. (2017) Biosolids and Sludge Management. Water Environment Research, 89(10), 1245-1267.
9. Gunaldo, T.G., **Brisolara, K.F.,** Davis, A.H., Moore, R. (2017) Aligning interprofessional education collaborative sub-competencies to a progression of learning. J. Interprofessional Care, DOI: 10.1080/13561820.2017.1285273
10. **Brisolara, K. F.,** Ochoa, H. (2016) Biosolids and Sludge Management. Water Environment Research, 10, 1230-1248.
11. **Brisolara, K. F.,** Qi, Y. (2015) Biosolids and Sludge Management. Water Environment Research, 87(10), 1147-1166.
12. **Brisolara, K. F.,** Sandberg, M. A. (2014) Biosolids and Sludge Management. Water Environment Research, 86(10), 1274-1283.
13. **Brisolara, K. F.,** Lima, I. M., Marshall, W. E. (2014). Cation and Anion Release from Broiler Litter and Cake Activated Carbons and the role of Released Anions in Copper Ion Uptake. Waste and Biomass Valorization, 5(4), 689-697.
14. **Brisolara, K. F**., Qi, Y. (2013) Biosolids and Sludge Management. Water Environment Research, 85(10), 1283-1297.
15. **Brisolara, K. F**. (2012) Biosolids and Sludge Management. Water Environment Research, 84(10), 1310-1324.
16. **Brisolara, K.F**., Reimers, R.S., Whitworth, R.E., Hutcheson, M.J. (2012) Impact of Treatment Temperature Decline on Stability of Advanced Alkaline Biosolids. International Journal of Environmental Research, 6(4), 925-932.
17. **Brisolara, K. F**., Qi, Y. (2011). Biosolids and Sludge Management. Water Environment Research, 83(10), 1351-1375.
18. **Brisolara, K. F.,** Qi, Y. (2010). Biosolids and Sludge Management. Water Environment Research, 82(10), 1311-1326.
19. **Fitzmorris, K. B**., Sarmiento, F., O'Callaghan, P. (2009). Biosolids and Sludge Management. Water Environment Research, 81(10), 1376-1393.
20. Zhou, J., **Fitzmorris, K. B**., Qi, Y. (2008). Biosolids and Sludge Management. Water Environment Research, 80(10), 1241-1261.

21. **Fitzmorris, K. B**., Reimers, R. S., Oleszkiewicz, J. A., Little, M. D. (2007). Decrease of time for pathogen inactivation in alkaline disinfection systems using pressure. Water Environment Research, 79(4), 388-395.
22. **Fitzmorris, K. B.,** Erdal, Z. (2007). The Importance of Sustainability in Biosolids Management. Water Practice, 1(4), 1-2.
23. **Fitzmorris, K. B**., Reimers, R. S., Oleszkiewicz, J. A., Little, M. D. (2007). Pathogen Inactivation by a Closed Alkaline System. Biosolids Technical Bulletin, 12(2), 9-11.
24. **Fitzmorris, K. B.,** Lima, I. M., Marshall, W. E., Reimers, R. S. (2006). Anion and Cation Leaching or Desorption from Activated Carbons from Municipal Sludge and Poultry Manure as Effected by pH. Water Environment Research, 78(12), 2324-2329.
25. **Fitzmorris, K. B.,** Lima, I. M., Marshall, W. E., Reimers, R. S. (2006). Anion and Cation Removal from Solution Using Activated Carbons from Municipal Sludge and Poultry Manure. Journal of Residuals Science and Technology, 3(3), 161-167.
26. Reimers, R. S., Sharma, V., Pillai, S., Reinhart, D. R., Boyd, G. R., **Fitzmorris, K. B.** (2005). The Future is Ferrates. Biosolids Technical Bulletin, 10(6), 1-4.
27. Reimers, R. S., **Fitzmorris, K. B.,** Smith, J. E., Boyd, G. R., Bowman, D. D. (2004). State of the Art in Treatment and Survival of Pathogens in Biosolids. Journal of Residuals Science and Technology, 1(2).

Refereed Publication in Journal Supplement or in Conference Proceedings:

1. Katner, A., Diaz, J., Straif-Bourgeois, S., Pieper, K., **Brisolara, K.,** Edwards, M. "Houston We Have a Problem: Challenges and Lessons in the Aftermath of Hurricane Katrina." Online publication via Daily Climate (http://www.climatechange.ie/houston-we-have-a-problem-challenges-and-lessons-from-the-aftermath-of-hurricane-katrina/)
2. Reimers, R. S., Xu, Y., Oleszkiewicz, J. A., Pillai, S., **Fitzmorris-Brisolara, K. B.**, Seidl, G., International Conference on Holistic Sludge Management 2013, "Future Directions of Biosolids Management in the Second Decade of the 21st Century." International Water Association, London, United Kingdom CD-ROM (May 7, 2013).
3. **Brisolara, K. F.**, Miles, D. M., Lima, I. M., From Waste to Worth: Spreading Science and Solutions, "Litter Generated Ammonia Captured by Activated Carbon Derived from Broiler Litter." Livestock and Poultry Environmental Learning Center, Online Access http://www.extension.org/67575 (April 2013).
4. Reimers, R. S., **Brisolara, K. F.**, Disinfection and Public Health 2013, "Developments in Disinfection Using Advanced Alkaline Stabilization." Water Environment Federation, Alexandria, Virginia CD-ROM (February 2013).
5. Reimers, R. S., Xu, Y., Pillai, S., **Fitzmorris-Brisolara, K. B.**, Oleszkiewicz, J. A., Seidl, G., Disinfection and Public Health 2013, "Future Directions of Biosolids Management in the Second Decade of the 21st Century." Water Environment Federation, Alexandria, Virginia CD-ROM (February 2013).
6. **Brisolara, K. F.,** Reimers, R. S., Water Environment Federation Technical Conference 2012, "Pathogen Inactivation and Equivalency Approval for Advanced Alkaline Process." Water Environment Federation, Alexandria, Virginia CD-ROM (October 2012).
7. **Brisolara, K.F.,** Reimers, R.S. Disinfection 2011, "Pathogen Inactivation in an Advanced Alkaline System," Water Environment Federation, Alexandria, Virginia CD-ROM (April 2011).

8. **Brisolara, K.F.**, Mussari, F., Smith, J.E., Residuals and Biosolids 2011, “The Path to PFRP Approval - Two Case Studies: Alkaline and Acid,” Water Environment Federation, Alexandria, Virginia CD-ROM (May 2011).
9. **Brisolara, K. F**., Scott, A. J., Residuals and Biosolids 2010: Leveraging Biosolids in the Energy-Climate Era, "Barriers to Implementation of the 2008 Farm Bill Conservation Programs and their Implications in Manure Management," Water Environment Federation, Alexandria, Virginia CD-ROM (May 2010).
10. **Fitzmorris, K. B.**, American Public Health Association 137th Annual Meeting & Exposition, "Emerging Pathogens: The Public Health Impact," American Public Health Association, (November 2009). https://apha.confex.com/apha/137am/webprogram/Session27167.html
11. **Fitzmorris, K. B.**, Reimers, R. S., Pillai, S. D., Bowman, D. D., WEF Residuals and Biosolids Conference, "Physical, Chemical and Biological Agents Impacting Disinfection in Residuals," Water Environment Federation, Alexandria, Virginia CD-ROM (May 2009).
12. **Fitzmorris, K. B.**, Reimers, R. S., WEF Disinfection Conference, "Assessment of Indicator Organisms and Long-Term Stability in Advanced Alkaline Systems," Water Environment Federation, Alexandria, Virginia CD-ROM (March 2009).
13. Reimers, R.S., Acquisto, B.A., **Fitzmorris, K.B**., Pillai, S.D., WEF Disinfection Conference, “Pertinent Factors Involving Disinfection and Stabilization of Municipal Biosolids,” Water Environment Federation, Alexandria, Virginia CD-ROM (March 2009).
14. **Fitzmorris, K. B.,** Miles, D. M., Lima, I. M., International Symposium on Air Quality and Waste Management for Agriculture, “Efficacy of Activated Carbon from Broiler Litter in the Removal of Litter Generated Ammonia.” American Society of Agricultural and Biological Engineers, St. Joseph, Michigan CD-ROM. (September 2007).
15. **Fitzmorris, K. B.,** Reimers, R. S., Pillai, S., Oleszkiewicz, J. A., Smith, J., Moving Forward Wastewater Biosolids Sustainability: Technical, Managerial, and Public Synergy, "Production of safe biosolids from agricultural and municipal residuals: emerging physical-chemical processes," International Water Association, London, UK CD-ROM (June 2007).
16. **Fitzmorris, K. B.,** Joint Residuals and Biosolids Management Conference, “The Impacts of the 2007 Farm Bill on Agriculture Waste Treatment” (pp. 768-776). Water Environment Federation, Alexandria, Virginia CD-ROM (April 2007).
17. Reimers, R. S., **Fitzmorris, K. B.,** Pillai, S. D., Oleszkiewicz, J. A., Smith, J. E., WEF/AWWA Joint Residuals and Biosolids Management Conference, “Emerging Chemical Processes to produce Value-Added Products (VAPs) from Manure and Municipal Residuals” (pp. 1-13). Water Environment Federation, Alexandria, Virginia CD-ROM. (2007).
18. **Fitzmorris, K. B**., Reimers, R. S., Oleszkiewicz, J. A., Little, M. D., WEFTEC, "Pathogen Inactivation by a Closed Alkaline System," Water Environment Federation, Alexandria, Virginia CD-ROM (October 2006).
19. **Fitzmorris, K. B.,** Lima, I. M., Marshall, W. E., Reimers, R. S. Joint AWMA and WEF International Conference on Animal Agriculture and Processing: Managing Environmental Impacts. “Anion and Cation Removal from Solution using Activated Carbons from Municipal Sludge and Poultry Manure as Effected by pH.” Air and Waste Management Association, Pittsburgh, Pennsylvania CD-ROM (August 2005)

20. Pratt, L. S., Reimers, R. S., Jeng, H. W., Bowman, D. D., Oleszkiewicz, J. A., Meckes, M., **Fitzmorris, K. B.** Joint Residuals and Biosolids Management Conference, “Development of Surrogate Indicators to Monitor Pathogens in Biosolids.” Water Environment Federation, Alexandria, Virginia CD-ROM. (April 2005).
21. Reimers, R. S., Pillai, S. D., Bowman, D. D., **Fitzmorris, K. B.,** Pratt, L. S. WEF Disinfection, Sharing Disinfection Technologies: Water, Wastewater, and Biosolids, “Stressors Influencing Disinfection in Residuals.” Water Environment Federation, Alexandria, Virginia CD-ROM, pp. 658-672(15) (2005).
22. **Fitzmorris, K. B.,** Arcemont, M., Reimers, R. S., Boston, R., WEFTEC, "Alkaline Processing by Closed System for Morgan City and Shreveport, Louisiana," Water Environment Federation, Alexandria, Virginia CD-ROM. (October 2004).
23. Reimers, R. S., **Fitzmorris, K. B.,** Salyer, H. R., Batherson, R. J., Murray, N. K. WEFTEC, “St. Tammany Parish Residuals Program.” Water Environment Federation, Alexandria, Virginia CD-ROM. (October 2004).
24. **Fitzmorris, K. B.,** Reimers, R. S., Oleszkiewicz, J. A., Little, M. D., Residual and Biosolids Management Conference, "Advances in Disinfection in Closed Alkaline Systems," Water Environment Federation, Alexandria, Virginia CD-ROM. (February 2004).
25. **Fitzmorris, K. B.,** Reimers, R. S., Oleszkiewicz, J. A., Shepherd, S., Residual and Biosolids Management Conference, "Developments in Stabilization and Disinfection in Alkaline Systems," Water Environment Federation, Alexandria, Virginia CD-ROM (11:89-91). (February 2003).
26. Lima, I. M., Marshall, W. E., **Fitzmorris, K. B.,** Reimers, R. S., Residual and Biosolids Management Conference, “Poultry Biosolids as Granular Activated Carbons for Metal Ion Adsorption,” Water Environment Federation, Alexandria, Virginia CD-ROM (15:1119 - 1133). (February 2003).
27. **Fitzmorris, K. B.,** Reimers, R. S., Little, M. D., Bowman, D. D., Residuals and Biosolids Management Conference, "Advances in Alkaline Stabilization/Disinfection of Municipal Biosolids," Water Environment Federation, Alexandria, Virginia CD-ROM (March 2002).
28. Reimers, R. S., Smith, J. E., Bowman, D. D., **Fitzmorris, K. B.**, Specialty Conference on Disinfection – Health and Safety Achieving through Disinfectants, "Background of Biosolids Disinfection," Water Environment Federation, Alexandria, Virginia CD-ROM (February 2002).

Non-Peer-Reviewed Technical Report

1. LeCompte, E., Stallard, C., Walsh, I., Katner, A., **Brisolara, K.** (2019) *Traffic-Related Pollutants and Human Health Within the I-10 Claiborne Corridor, New Orleans, LA: Land Use Implications.* Report presented to the Claiborne Avenue Alliance and the American Geophysical Union’s Thriving Earth Exchange Program. (April 4).
2. Reimers, R., **Fitzmorris-Brisolara, K.**, Gary, L., Seidl, G., Tanneru, C., Englande, A., Fleetwood, P. (2015) *Sustainable Resource Management Program for Fecal Sludge and Wastewater Reuse for Non-centralized Facilities in Panama*. Strategic Management Services report to Government and Agencies in Panama.
3. Fitzmorris-Brisolara, K., Reimers, R. (2014) *Residuals: Waste Conversion and Public Health Protection*. Submitted to National Science Foundation.

4. Reimers, R., **Fitzmorris-Brisolara, K.,** Gary, L., Seidl, G., Tanneru, C., Englande, A., Fleetwood, P. (2014) *Sustainable Resource Management Program for Fecal Sludge and Wastewater Reuse for Non-centralized Facilities in Egypt and Saudi Arabia.* Headworks report to Government and Agencies in Egypt.
5. Fitzmorris-Brisolara, K. et al. (2014) *Risks and Benefits of Tertiary Sewage Effluent as Drinking Water for Livestock in California.* Expert Panel Opinion Paper submitted to the legislature of the State of California.
6. Reimers, R. S., Sandberg, M. A., **Brisolara, K. F.** (2014) *Technical Background Document: Biosolids Exposure and Hazard Assessment*, Submitted to USEPA via Versar.
7. Sustainable Residuals Use Task Force. , Davis, B. (Chair), **Brisolara, K. F.** (member) (2014) *Phosphorus in Biosolids: How to Protect Water Quality While Advancing Biosolids Use*, Submitted to Water Environment Federation.
8. **Brisolara, K. F.,** Reimers, R. S. (2011) *Full Application for Equivalency Recommendation: Schwing Bioset*. Submitted to USEPA, Pathogen Equivalency Committee.
9. **Fitzmorris, K. B.,** Hutcheson, M. J., Whitworth, R. (2009) *Report on the Stabilization of the Schwing Bioset Product*.
10. **Fitzmorris, K. B.** (2007) *For the Public Health: Ag Waste May Prove Good Energy Source* (pp. 1). Statesboro, GA: Statesboro Herald. http://www.statesboroherald.com/news/archive/6361/
11. **Fitzmorris, K. B.,** Reimers, R. S. (2007) *Disinfection Report for Dayton & Knight Ltd. on the Patented Process KDS Micronex Processor*.
12. Reimers, R. S., Little, M. D., **Fitzmorris, K. B.,** Salih, K. (2004) *PEC Application for the National Classification of the Bioset Process to the Category of PFRP*.

Margaret Schneemann

University of Illinois Extension-Illinois Indiana Sea Grant – Chicago Metropolitan Agency for Planning
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Professional Profile

- Economist with 20 years of experience providing research, policy development, higher education, and outreach, currently leading projects to create resilient communities and economies in the Great Lakes region.
- M.S. in Resource Economics and B.A. in Economics. Completed coursework toward a Ph.D. in Economics. Fields of concentration include environmental economics, applied microeconomics, and econometrics.
- Extensive range of experience conducting statistical and econometric analysis, including primary economic data collection (survey research methods), secondary data management, and forecast modelling.
- Ten years regional planning, policy, and extension experience working with diverse stakeholders to create plans (water, strategic, comprehensive), facilitating public meetings, assisting local, county, and state governments with policy development, plan implementation, grants application and management, and program evaluation.

Education

M.S. Resource Economics and Policy *University of Maine*, Orono, ME. 1997
- Thesis: A Meta-Analysis of Response Rates to Contingent Valuation Surveys

B.A. Economics *Grinnell College*, Grinnell, IA. 1993
- Minor: Chinese Studies, including study abroad at Taichung University, Taiwan

Professional Experience

University of Illinois Extension-Illinois-Indiana Sea Grant, *Urbana, IL.*
Chicago Metropolitan Agency for Planning, *Chicago, IL.* ***Water Resource Economist, 8/2008 – present***

Lead economic studies, conduct research and prepare written and oral reports, provide policy recommendations, and deliver technical support to partners and communities.

- Conduct program needs assessments, develop, deliver, and evaluate programs to build capacity of Chicago region communities to better address local and regional water management issues.
- Plan, organize, and implement projects in coordination with partners to address water resource issues in the Great Lakes region; secure funding, develop and maintain partnerships necessary for program implementation.
- Forecast water demands for use in the *Northeastern Illinois Water Supply Plan,* researched, wrote, and implemented water supply planning recommendations.

University of Illinois Chicago
Institute for Health Research and Policy, *Chicago, IL.* ***Policy Analyst, 8/2006 – 5/2008***

Performed economic, policy, and data analysis; managed data and conducted surveys.

- Implemented mail survey for nationwide study on obesity in elementary schools; compiled related school district and elementary school policies, formulated policy recommendations.
- Examined health disparities associated with tobacco use, compiled and cleaned state-level economic and policy data from multiple sources, analyzed and interpreted data.
- Prepared Current Population Survey (CPS) and CPS Tobacco Supplements (U.S. Census Bureau and Bureau of Labor Statistics) for analysis.

Learning Insights, *Chicago, IL.* ***Economics Content Manager, 9/1999 – 4/2001***

Managed the development of online economics, finance, and business courses.

- Supervised development of text and graphic content and created storyboard for an online course providing incoming MBA students with a foundation in business math.
- Developed online training necessary to discuss financial risk management with CFO's, including the ability to perform an analysis of financial statements, understand financial risk exposures and the direction of possible solutions for exposure management.
- Trained instructors in use of multimedia in the classroom for Chartered Financial Analyst (CFA) Test Prep Level 1. Managed subject matter experts, provided quality control, and developed web site supporting student classroom experience.

Eastern Research Group, *Lexington, MA.* *Environmental Policy Economist 6/1997 – 9/1999*

Performed economic and regulatory analyses for the U.S. EPA.

- Trained, supervised, and provided technical feedback to personnel in the development of a comprehensive Internet database of economic valuation studies for benefits transfer applications.
- Managed company support to the U.S. EPA in a cost-effectiveness analysis study, including evaluation of Regulatory Impact Assessments to streamline economic methodologies used in setting effluent guideline standards.
- Provided guidance to risk assessors, scientists, and policy makers to improve human health assessments of drinking water regulations and to reduce opportunities for litigation following regulation proposals.

Kleinschmidt Associates, *Pittsfield, ME.* *Recreation Economist 5/1996 – 5/1997*

Conducted studies used by the U.S. Federal Energy Regulatory Commission in making relicensing decisions for hydroelectric projects.

- Designed and implemented on-site studies to estimate the demand for recreational activities, including training and supervision of recreation and natural resource field personnel.
- Assessed the ability of the supply of recreation resources to meet current and projected demand, determined the effects of dam operation on shoreline recreational facilities.
- Balanced client needs with public agency requests consistent with Federal Energy Regulatory Commission guidelines for hydroelectric project relicensing.

Teaching Experience

University of Chicago School of Social Service Administration *Lecturer, 9/2019 - present*

Courses taught: Economics of Social Welfare

University of Illinois Chicago, *Chicago, IL.* *Adjunct, 8/2009 – 8/2019*

Courses taught: Economic Analysis for Planning & Management, Data Analysis for Planning & Management

University of Chicago Graham School *Chicago, IL.* *Adjunct, 3/2011 – 12/2013*

Courses taught: Sustainable Development, Environmental Economics

Robert Morris University, *Chicago, IL.* *Assistant Professor, 3/2001 – 8/2008*

Courses taught: Money and Banking, Microeconomics, Macroeconomics, International Economics, Statistics

Technical Skills (Selected)

Proficient with SAS, SPSS, ArcGIS, STATA, R, Windows Applications (Word, Excel, Powerpoint)

Reports (3 most recent)

Gallet, Danielle, Pakenham, Caroline, and Schneemann, Margaret. *Water Affordability in Northeastern Illinois: Addressing Water Equity in a Time of Rising Costs*. 2020. Metropolitan Planning Council, Elevate Energy, and Illinois-Indiana Sea Grant. Illinois-Indiana Sea Grant Report IISG20-RCE-RLA-013. iiseagrant.org/publications/water-affordability-in-northeastern-illinois/.

Margaret Schneemann, Lauren Schnoebelen, Leslie Dorworth. 2020. Ecosystem Services Valuation in the Indiana Coastal Zone. Illinois-Indiana Sea Grant Report IISG18-RCE-SCI-010. https://iiseagrant.org/publications/ecosystem-services-valuation-in-the-indiana-coastal-zone/.

Chicago Metropolitan Agency for Planning and Illinois-Indiana Sea Grant. Illinois-Indiana Sea Grant. ON TO 2050 Regional Water Demand Forecast for Northeastern Illinois, 2015-50. www.cmap.illinois.gov/documents/10180/402130/Water+Demand+Report_Final.pdf/ab2e5395-672a-7a6d-d3e0-598c1819fc5a.

Current Service Activities

Cook County Environmental Commission, Environmental Economics Representative
Illinois Section American Water Works Association. Water Conservation Committee
Metropolitan Planning Council Water Resources Committee

EUROPEAN CURRICULUM VITAE

PERSONAL INFORMATION

Name	**di BIASE ALESSANDRO**
Address	**VIA DEL PALAZZO BRUCIATO, 26 FIRENZE (FI), 50133 – ITALY**
	43 FORDHAM BAY, R3T 2B8, WINNIPEG, MANITOBA – CANADA
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E-mail	**alessandro.dibiase.fi@gmail.com; dibiasea@myumanitoba.ca**
Nationality	**Italian**
Date of birth	**26/06/1984**

WORK EXPERIENCE

- *September 2017 – Ongoing*
  University of Manitoba, 15 Gillson Street, Winnipeg – Manitoba (MB) R3T 5V6
  Department of Civil Engineering
  Consultant work at JAAO Environmental
  Transfer the application of a technology previously used in cold climate for post-lagoon treatment to industrial mining water treatment. Feasibility study, its optimization and full-scale application. Solution and optimization of drinking water treatment in a local Canadian community. MBBR technology applied to cold climate for nitrification on pilot-scale.

- *November 2016 – August 2017*
  Universitè catholique de Louvain, Croix du Sud, Wallonia, Belgium
  Department of Bioengineering
  Industrial Scholarship
  Collaborative project with University of Gent (Belgium) on integration of primary fermentation of waste streams and elongation of volatile fatty acids to valuable product through microbial electro-synthesis.

- *September 2014 – October 2016*
  University of Manitoba, 15 Gillson Street, Winnipeg – Manitoba (MB) R3T 5V6
  Department of Civil Engineering
  M.Sc. Scholarship
  Consultant work on performance and design development for an anaerobic moving bed biofilm reactor (AnMBBR) treating brewery wastewater. Performance and inhibition studies on anammox bacteria through membrane bioreactors (MBR). Optimization of aerobic granular sludge (AGS) technology treating both municipal and industrial wastewaters.

- *May 2014 – September 2014*
  University of Manitoba, 15 Gillson Street, Winnipeg – Manitoba (MB) R3T 5V6
  Department of Civil Engineering
  Visiting Researcher
  Start-up and performance evaluation of a lab-scale anaerobic MBBR to treat high

strength industrial wastewaters using media manufactured by Headworks International.

- *April 2013 – April 2014*

  University of Pisa, Via Luca Ghini 13, Pisa – Italy (Department of Biology)
  University of Manitoba, 15 Gillson Street, Winnipeg – Manitoba (MB) R3T 5V6
  Department of Civil Engineering

  International Research Staff Exchange Scheme (IRSES), Marie Curie Action Program. CARBALA ctr. n 295176 – IRSES – 2011

  Performance of nitrogen removal carried out by anammox bacteria through both SBR and MBR processes, and inhibition of the specific anammox activity by chromium and sulfide. Carbon removal and biogas production for brewery wastewater using anaerobic MBBR processes.

EDUCATION AND TRAINING

- *September 2017 – Ongoing*

  University of Manitoba, 15 Gillson Street, Winnipeg – Manitoba (MB) R3T 5V6
  Department of Civil Engineering

  PhD Candidate

  Moving bed biofilm reactor (MBBR) treating synthetic municipal wastewater at cold temperature for both carbon recovery and nitrogen removal.

- *September 2014 – October 2016*

  University of Manitoba, 15 Gillson Street, Winnipeg – Manitoba (MB) R3T 5V6
  Department of Civil Engineering

  Performance of nitrogen removal and inhibition studies on anammox (Anaerobic Ammonium Oxidation) bacteria through both suspended biomass in membrane bioreactor (MBR) and granular biomass in sequencing bioreactor (SBR) processes. Development and performance optimization of a lab-scale anaerobic moving bed biofilm reactor (AnMBBR) treating industrial wastewaters using AC920 media (Headworks International Bio, BC – Canada). Startup and optimization of an aerobic granular sludge reactor treating brewery wastewater with emphasis on nutrient removal performance and kinetics of extracellular polymeric substance production. Teaching Assistant for Environmental Engineering Design.

  Courses: Environmental Engineering Design, Theory of Waste Treatment, Hazardous Waste Treatment, Environmental Engineering Laboratory, Theory of Waste Treatment, Environmental Management Practice.

  M.Sc. in Environmental Engineering
  Thesis title: Industrial wastewater treatment with anaerobic moving bed biofilm reactor

- *February 2012 – March 2012*

  Department of Chemistry, Via della Lastruccia 3, Firenze - Italy
  Department of Analytical Chemistry
  Training in analytical methods

  Method development to determine short-chain organic acids in plant tissues of metal resistant and sensitive species after exposure to copper (HPLC-DAD).

- *October 2009 – June 2011*

  University of Florence - Faculty of Mathematical, Physical and Natural Sciences
  National Research Council (CNR) – Institute of Ecosystems Studies (ISE)

  Phytoremediation processes in pilot-scale of dredged marine sediments of an Italian harbor (Livorno – Italy) focusing on biological means for decontamination from recalcitrant compounds such as hydrocarbons and heavy metals. Monitoring of the physical-chemical properties and biological processes by enzyme analysis. Performance evaluation and identification of the most effective species from a selected pool capable to process and metabolize hydrocarbons and uptake toxic compounds as well as reduce the nutrient yields to legal levels for agricultural reuse of the final

product.

Courses: Environmental Chemistry and Microbiology, Environmental Economics, Statistics, Applied Informatics and Physics, Environmental Geology, Ecotoxicology, Environmental and Applied Hygiene, Population Genetics, Ecology of Aquatic Environments, Animal and Plant Ecophysiology, Plant Ecology, Wildlife Management, Ethology Fundamentals, Biodiversity and Conservation, Plant Taxonomic Methods, Animal Ecology

M.Sc. in Environmental Biology with Distinction (110 cum Laude)

Thesis title: Phytoremediation of dredged marine sediment: experimentation in pilot-scale

- *October 2004 – February 2009*

University of Florence - Faculty of Mathematical, Physical and Natural Sciences

B.Sc. in Biological Science

Thesis title: Formulation and characterization of cationic liposome transport of plasmid DNA

PERSONAL SKILLS AND COMPETENCES

MOTHER TONGUE — **ITALIAN**

OTHER LANGUAGES — **ENGLISH – FLUENT**

SOCIAL SKILLS AND COMPETENCES

Teamwork capability demonstrated during one-year internship at the CNR of Pisa and during the CARBALA Project as well as within the consultant work experience. Initiative, precision, and passion in increasing skills in different areas of knowledge. Adaptive capabilities acquired in different work environments and various residential displacements demonstrated by the Canadian experience followed by the master program abroad and Belgian journey.

VOLUNTEER EXPERIENCE

Involved in volunteer activities at a Mental Health Association, with active participation in team projects. Vice President and Financial Executive volunteer in the University of Manitoba's student chapter of the Water and Environmental Federation.

TECHNICAL SKILLS AND COMPETENCES

Advanced use of Microsoft Office (Word, Excel, PowerPoint)

Advanced web research and internet skills

SBR (Sequence Batch Reactors), MBR (Membrane Bioreactor), moving bed biofilm reactor (MBBR), and aerobic granular sludge technologies. Knowledge and process concepts of PBRs (Photobioreactors). Spectrophotometer technics for enzymatic analysis and different substance identification (COD, EPS, etc.). Flow Injection Analyzer (FIA) for nutrient determination (ammonia, nitrite, nitrate, ortophosphorous). Aerobic and anaerobic respirometry analysis. Electrochemical devices usage and applications. Determination and quantification methods of hydrocarbon and heavy metals. High performance liquid chromatography (HPLC-DAD and HPLC-MS) and gas chromatography (GC-FID and GC-MS). Wide knowledge and experience in biological analysis methods.

Statistical Data management (ANOVA, PCA, etc.)

Autonomy in laboratory analytical methods, proposal drafting and editing, literature reviews, report preparation, project management

ARTISTIC SKILLS AND HOBBIES

Ten years of clarinet studies within conservatory program, member of the youth orchestra of Fiesole (Tuscany – Italy), guitar player. Ten years of Judo (black belt). Passion in working out at gym daily-basis. Brewer of ciders, beers, and wine.

ADDITIONAL INFORMATION

Awards and Distinctions

Petro Canada Resources Graduate Fellowship in Environmental Issues in Engineering (2018 Award)

Edward R. Toporeck Graduate Fellowship in Engineering (2018 Award)

University of Manitoba Graduate Student Fellowship (2017 – 2021 Scholarship)

University of Manitoba Alumni Association Graduate Fellowship (2017 Award)

Edward R. Toporeck Graduate Fellowship in Engineering (2017 Award)

University of Manitoba International Graduate Student (2017 – 2018 Scholarship)

Petro Canada Resources Graduate Fellowship in Environmental Issues in Engineering (2016 Award)

University of Manitoba International Graduate Student Entrance Scholarship (2014)

M.Sc. and PhD RemTech (2011 Award)

Journal Publications

di Biase A., Wei V., Kowalski M., Bratty M., Hilderbrand M., Devlin T.R., Oleszkiewicz J.A. (2019). Cyanate and thiocyanate removal during nitrification with aerobic up-flow submerged attached growth reactor treating gold mine wastewater. Chemosphere (*under review*)**.**

di Biase, A., **Kowalski**, M.S., Devlin, T.R. Oleszkiewicz, J.A., 2019. Moving bed biofilm reactor technology in municipal wastewater treatment: A review., J Environ Manage. 247, 849-866.

Kowalski, M.S., Devlin, T.R., di Biase, A., Oleszkiewicz, J.A., 2019. Effective nitrogen removal in a two-stage partial nitritation-anammox reactor treating municipal wastewater – piloting PN-MBBR/AMX-IFAS configuration. Bioresour. Technol. 121742.

Kowalski, M.S., Devlin, T.R., di Biase, A., Oleszkiewicz, J.A., 2019. Controlling cold temperature partial nitritation in moving bed biofilm reactor. Chemosphere 227, 216–224.

Kowalski, M.S., Devlin, T., di Biase, A., Basu, S., Oleszkiewicz, J.A., 2019. Accelerated start-up of a partial nitritation-anammox moving bed biofilm reactor. Biochem. Eng. J. 145, 83–89.

Devlin, T.R., **Kowalski**, M.S., di Biase, A., Oleszkiewicz, J.A., 2018. Kinetics of aerobic granular sludge treating low-strength synthetic wastewater at high dissolved oxygen. Environ. Technol. 1–9.

Wisniewski K., **di Biase A.**, Munz G., Oleszkiewicz, J.A., Makinia J., 2018. Kinetic characterization of hydrogen sulfide inhibition of suspended anammox biomass from a membrane bioreactor. Biochemical Engineering Journal, 143, 48-57.

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A. 2018. Performance and design considerations for an anaerobic moving bed biofilm reactor treating brewery wastewater: Impact of surface area loading rate and temperature. Journal of environmental management, 216, 392-398.

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A. 2017. Optimization of surface area loading rate for an anaerobic moving bed biofilm reactor treating brewery wastewater. Journal of cleaner production, 172, 1121-1127.

Devlin T.R., **di Biase A.**, Oleszkiewicz J.A. 2017. Granulation of activated sludge under low hydrodynamic shear and different wastewater characteristics. Bioresource Technology, 224, 229-235.

Corsino F.S., **di Biase A.**, Devlin T.R., Torregrossa M., Munz G., Oleszkiweicz J.A. 2017. Effect of extended famine conditions on aerobic granular sludge stability in the treatment of brewery wastewater. Bioresource Technology, 226, 150-157.

Devlin T.R., **di Biase A.**, Wei V., Elektorowicz, M., Oleszkiewicz J.A., 2017. Removal of Soluble Phosphorus from Surface Water using Iron (Fe-Fe) and Aluminum (Al-Al) Electrodes. Environmental Science & Technology, 51, 13825-13833.

di Biase A., Devlin T.R., Oleszkiewicz J.A., 2016. Start-up of anaerobic moving bed biofilm reactor and transition to brewery wastewater treatment, Journal of Environmental Engineering.

Masciandaro G., **di Biase A.**, Macci C., Peruzzi E., Iannelli R., Doni S., 2014. Phytoremediation of dredged marine sediment: a monitoring of the biological processes contributing to sediment reclamation, Journal of Environmental Management. 134, 166-174.

Conference Proceedings

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A. (2019). An overview of three years research on anaerobic moving bed biofilm reactor treating synthetic and brewery wastewater. WEFTEC 2019 (Chicago, USA).

di Biase A., Wei V., Kowalski M., Bratty M., Hilderbrand M., Devlin T.R., Oleszkiewicz J.A. (2019). Treatment of gold mine wastewater with aerobic up-flow submerged attached growth reactor, WEFTEC 2019, (Chicago, USA).

di Biase A., Wei V., Kowalski M., Bratty M., Hilderbrand M., Devlin T.R., Oleszkiewicz J.A. (2019). Treatment of gold mine wastewater with aerobic up-flow submerged attached growth reactor, WEF, (Minneapolis, USA).

Kowalski, M.S., Devlin, T.R., di Biase, A., Oleszkiewicz, J.A, 2019. Piloting mainstream partial nitritation-anammox in a two-stage configuration., Nutrient Removal and Recovery Symposium, WEF, Poster section (Minneapolis, USA).

Kowalski, M.S., Devlin, T., di Biase, Paetkau, M., Griffin, D., A., Basu, S., Oleszkiewicz, J.A., Piloting side-stream deammonification MBBR at North End Water Pollution Control Centre. 2018. Western Canada Water Conference (Winnipeg, Canada).

di Biase A., Corsino F.S., Devlin T.R., Torregrossa M., Munz G., Oleszkiewicz J.A., 2018. Aerobic granular sludge reactor treating anaerobically pretreated brewery wastewater at different loading rates. WEFTEC 2018 (New Orleans, LA, USA).

Bratty M., **di Biase A.**, Wei V., Hildebrand M., Oleszkiewicz J.A., 2018. Application of SAGR bioreactors for ammonia treatment in mining effluents. Mine Water Solution, 2018 (Vancouver, Canada).

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A. (2017). Impact of temperature on moving bed biofilm reactor treating brewery wastewater: Performance and design implications. WEFTEC 2017 (Chicago, IL, USA).

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A., (2016). Anaerobic moving bed biofilm reactor treating brewery wastewater. WEFTEC 2016 (New Orleans – LA, USA).

Devlin T.R., **di Biase A.**, Oleszkiewicz J.A., (2016). Aerobic granulation: A Shear Necessity? WEFTECH 2016 (New Orleans, LA, USA).

di Biase A., Devlin T.R., Oleszkiewicz J.A. (2016). Impact of HRT on an anaerobic moving bed biofilm reactor treating brewery wastewater. 13th Specialized conference on small water and wastewater systems (International Water Association – IWA). Athens, Greece.

di Biase A., Corsino F.S., Devlin T.R., Torregrossa M., Munz G., Oleszkiewicz J.A. (2016). Start-up of an aerobic granular sludge reactor treating brewery wastewater at different loading rates. IWA/WEF Nutrient removal and recover, Denver 2016 – CO, U.S.A.

di Biase A., Devlin T.R., Angappan S., Seidl G., Reimers R.S., Oleszkiewicz J.A., (2015). Start-up of anaerobic moving bed biofilm reactor and transition to brewery wastewater treatment. WEFTEC 2015 (Chicago – IL, USA).

di Biase A., T.R. Devlin, J.A. Oleszkiewicz (2015). Treating brewery wastewater with anaerobic moving bed-biofilm reactor technology. National Water and Wastewater Conference in Whistler, BC – Canada.

Magazine publications

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A. (2017). Using anaerobic moving bed biofilm reactors for brewery wastewaters. Environmental Science & Engineering. February issue.

di Biase A., Doni S., Macci C., Peruzzi E., Iannelli R., Masciandaro G., 2013. Phytoremediation of marine dredged sediments: Pilot-scale Trail, ECO – Bonifiche Rifiuti Demolizioni. 22, 56-59.

Conferences Presentations

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A. (2019). An overview of three years research on anaerobic moving bed biofilm reactor treating synthetic and brewery wastewater. WEFTEC 2019 (Chicago, USA).

di Biase A., Wei V., Kowalski M., Bratty M., Hilderbrand M., Devlin T.R., Oleszkiewicz J.A. (2019). Treatment of gold mine wastewater with aerobic up-flow submerged attached growth reactor, WEFEC 2019, (Chicago, USA).

di Biase A., Wei V., Kowalski M., Bratty M., Hilderbrand M., Devlin T.R., Oleszkiewicz J.A. (2019). Treatment of gold mine wastewater with aerobic up-flow submerged attached growth reactor, WEF, (Minneapolis, USA).

Devlin T.R., Kowalski M., **di Biase A.**, Paetkau M., Griffin D., Oleszkiewicz J.A., 2018. Granular sludge for municipal wastewater treatment. 70th Western Canada Water (WCW) conference and exhibition 2018 (Winnipeg, MB, CA).

Kowalski M., Devlin T.R., **di Biase A.**, Paetkau M., Griffin D., Oleszkiewicz J.A., 2018. Piloting side-stream deammonification MBBR at North End Water Pollution Control Centre. 70th Western Canada Water (WCW) conference and exhibition 2018 (Winnipeg, MB, CA).

Wei V., **di Biase A.**, Oleszkiewicz J.A., 2018. Treatment kinetics and quantification of cyanide. 70th Western Canada Water (WCW) conference and exhibition 2018 (Winnipeg, MB, CA).

di Biase A., Corsino F.S., Devlin T.R., Torregrossa M., Munz G., Oleszkiewicz J.A., 2018. Aerobic granular sludge reactor treating anaerobically pretreated brewery wastewater at different loading rates. WEFTECH 2018 (New Orleans, LA, USA).

Bratty M., **di Biase A.**, Wei V., Hildebrand M., Oleszkiewicz J.A., 2018. Application of SAGR bioreactors for ammonia treatment in mining effluents. Mine Water Solution, 2018 (Vancouver, Canada).

di Biase A., Devlin T.R., Kowalski M., Oleszkiewicz J.A. 2017. Impact of temperature on moving bed biofilm reactor treating brewery wastewater: Performance and design implications. WEFTEC 2017 (Chicago, IL, USA).

Wisniewski K., **di Biase A.**, Oleszkiewicz J.A., Makinia J., 2017. Start-up of the anammox process with low concentrations of suspended biomass in a membrane bioreactor: Experimental and modelling results. The 9th eastern European young water professionals conference, Budapest, Hungary).

di Biase A., Devlin T.R., Oleszkiewicz J.A., (2016). Impact of hydraulic retention time on an anaerobic moving bed biofilm reactor treating brewery wastewater, 13th IWA Specialized conference on small water and wastewater systems (Athens, Greece).

di Biase A., Devlin T.R., Oleszkiewicz J.A., (2016). Anaerobic moving bed biofilm reactor treating brewery wastewater (WEFTECH 2016, New Orleans, LA, USA).

Devlin T.R., **di Biase A.**, Oleszkiewicz J.A., (2016). Aerobic granulation: A Shear Necessity? (WEFTECH 2016, New Orleans, LA, USA).

di Biase A., Corsino S.F., Devlin T.R., Torregrossa M., Munz G., Oleszkiewicz J.A. (2016). Aerobic granular sludge treating brewery wastewater at different loading rates. WEF/IWA Nutrient Removal and Recovery 2016 (Denver – CO, USA).

di Biase A., Devlin T.R., Angappan S., Seidl G., Reimers R.S., Oleszkiewicz J.A., 2015. Start-up of anaerobic moving bed biofilm reactor and transition to brewery wastewater treatment. WEFTEC 2015 (Chicago – IL, USA).

Devlin T.R., **di Biase A.**, Wei V., Oleszkiewicz J.A., 2015. A Shocking Solution? Electrochemical methods to address eutrophication in situ. WCW 2015 (Western Canada Water, Winnipeg – MB, Canada).

di Biase A., Devlin T.R., Oleszkiewicz J.A., 2015. Treating brewery wastewater with anaerobic moving bed biofilm reactor (AMBBR) technology. National water and wastewater conference by Canadian water and wastewater association (CWWA 2015, Whistler – BC, Canada).

James D. Fitzpatrick, P.E.

As a chemical engineer currently assigned to the Wastewater Treatment Technology Department of Black & Veatch's Water Technology Group, Mr. Fitzpatrick has extensive process engineering experience on water and wastewater treatment projects for municipal, utility and industrial clients. His background includes planning, piloting, studies, design, commissioning and post-construction performance testing of both conventional and advanced treatment processes and technologies, including: chemically enhanced settling (CES/CEPT), solids contact clarification/thickening (e.g. DensaDeg®), ballasted flocculation (e.g. Actiflo®), compressible media filtration (e.g. FlexFilter™), pile cloth filtration (e.g. AquaPrime®), secondary clarifiers in activated sludge and fixed-film applications, nutrient removal and recovery, ultralow phosphorus removal, oxyanion removal, and high-rate effluent disinfection alternatives.

Jim routinely shares his expertise through publications, presentations and panel discussions at seminars and workshops, including dozens sponsored by WEF, WERF, NACWA, IWA, USEPA as well as regional and state associations and regulatory agencies. He was lead chapter author of Identifying and Managing Risks in WEF's Nutrient Roadmap, lead chapter author of High Rate Treatment in WEF's Wet Weather Design and Operation in Water Resource Recovery Facilities, and a technical reviewer of WEF's Manual of Practice No. 8 (Design of Municipal Wastewater Treatment Plants) and Guide for Municipal Wet Weather Strategies.

He also has experience with industrial pretreatment programs (IPPs) including: surveying industrial users, determining significant industrial user (SIU) status, developing industrial user discharge permits, assessing compliance with permit limits, conducting facility inspections, developing and evaluating technically based local limits (TBLLs), conducting sampling studies, overseeing various treatability and demonstration studies, and providing overall program coordination.

PROJECT EXPERIENCE

Delaware County Regional Sewer District ; OECC Collection System Odor Study; Delaware County, Ohio, United States; 2018-In-Progress

Technical Advisor - Black & Veatch. Study to identify alternative approaches to meet collection system odor reduction objectives while reducing costs and WWTP impacts. Develop air and wastewater sampling program, evaluate results and write findings, conclusions and recommendations.

Delaware County Regional Sewer District ; Central Alum Creek Water Reclamation Facility Plan; Delaware County, Ohio, United States; 2018-In-Progress

Lead Treatment Engineer - Black & Veatch. Long-term planning and studies of treatment facilities, operations and practice alternatives for

CHEMICAL ENGINEER

Expertise:
Enhanced Primary Treatment; High-Rate Treatment Technologies; Industrial Pretreatment; NPDES Permitting; Nutrient Removal; Phosphorus Removal and Recovery; Water Treatment Technologies; Wet Weather Treatment

Education
Master of Science, Chemical Engineering, University of Louisville, 1993, United States
Bachelor of Science, Engineering Science, Chemical Engineering, University of Louisville, 1992, United States

Professional Registration
License, Professional Engineer, Chemical, #28631, Missouri, United States, 1997

Total Years of Experience
26.4

Black & Veatch Years of Experience
26.4

Professional Associations
Missouri Association of Cleanwater Agencies - Member
Missouri Water Environment Association - Member
Water Environment Federation - Member
Tau Beta Pi - Member

Language Capabilities
English

Office Location
Kansas City, Missouri, USA: United States

new BNR facility. 0.8 mgd average design flow with 10 mg TN/L and 1 mg TP/L limits expandable to 3.65 mgd in future phases. Develop influent characteristics, dynamic process modeling (GPS-X), evaluate process and technology alternatives, conceptual and preliminary designs and studies, CAPEX and OPEX estimates, implementation plan.

Little Rock Water Reclamation Authority ; Adams Field WRF Parallel Treatment and Nutrient Removal Upgrades; Little Rock, Arkansas, United States; 2017-In-Progress

Senior Process Engineer - Black & Veatch. Study and design services to upgrade 36-mgd WRF to treat peak wet-weather flows up to 94-mgd and meet future ammonia and nutrient limits. Includes dynamic process modeling with GPS-X, influent characterization (C, N and P fractions), wet-weather flow characterization, bid evaluation of auxiliary EHRT and UV technologies, and design of retrofits for step-feed nitrification/denitrification, clarifier upgrades, dual-purpose pile cloth filter, UV disinfection and effluent pump station.

The Pequannock, Lincoln Park, and Fairfield (Two Bridges) Sewerage Authority; Wastewater Treatment Master Plan Update; Lincoln Park, New Jersey, United States; 2017-In-Progress

Senior Process Engineer - Black & Veatch. Long-term planning and studies of treatment facilities, operations and practice alternatives for existing 2-stage nitrifying activated sludge POTW. Evaluation of monitoring data, development of process model (GPS-X), and evaluation of operational changes and capital improvements to increase average capacity from 7.25 to 9.64 mgd and meet new TP limits.

Clean Water Services; Durham AWWTF Secondary Treatment System Expansion; Hillsboro, Oregon, United States; 2017-In-Progress

Senior Process Engineer - Black & Veatch. Study and design to expand and upgrade biological nutrient removal including new aeration basin (3-stage, West Bank Bardenpho with S2EBPR), new 145-ft diameter secondary clarifier, and new RAS/WAS pump station.

Orange County Sanitation District; A-Side Primary Clarifiers Replacement at Plant 2; Orange County, California, United States; 2017-In-Progress

Senior Process Engineer - Black & Veatch. Design and alternatives evaluations for four new 140-ft diameter primary clarifiers.

Rivanna Water and Sewer Authority; Phosphorus Control Study; Charlottesville, Virginia, United States; 2017-In-Progress

Senior Process Engineer - Black & Veatch. Evaluation of alternatives to remove orthophosphate and total phosphorus to below 10 ppb and 20 ppb respectively in transfers from South Fork Rivanna River Reservoir to Ragged Mountain Reservoir. Evaluated silicate ballasted

flocculation, pile cloth filtration and continuous backwash deep-bed sand filters.

City of Danbury; Danbury WPCP Upgrade; Danbury, Connecticut, United States; 2017-In-Progress

Senior Process Engineer - Black & Veatch. Conceptual design and evaluation of ballasted flocculation and deep-bed sand filter alternatives for 28-mgd tertiary system to achieve <0.077 mg TP/L. Detailed facility design based on ballasted flocculation technology.

Everglades Foundation; George Barley Water Prize; United States; 2016-In-Progress

Judge - Black & Veatch. Served on judging panel evaluating and scoring technology entries in contest to treat water to achieve TP<0.01 mg/L at radically less cost than current state-of-the-art.

City of Portland; Tryon Creek WWTP Headworks, Clarifier and Odor Control Improvements; Portland, Oregon, United States; 2016-In-Progress

Senior Process Engineer - Black & Veatch. Study and design services for new screens, grit removal units, circular primary clarifiers, and odor control facilities to expand capacity to 7.7-mgd ADF / 50-mgd PHF. Evaluation of rectangular and circular clarifiers and pile cloth media filtration conceptual alternatives for primary treatment.

Johnson County Wastewater ; Tomahawk Creek WWTF Expansion and Upgrade; Johnson County, Kansas, United States; 2016-In-Progress

Wet Weather Process Specialist - Black & Veatch. Study and design services to expand from 10-mgd average to 19-mgd average / 172-mgd peak hourly. Upgrade trickling filter process to 5-stage Bardenpho with S2EBPR and dual-use filtration to meet 10 mg TN/L and 0.5 mg TP/L annual average goals. Design and evaluate compressible media and pile cloth media filtration alternatives in dual-purpose configurations.

City of Columbus ; Overall Engineering Consultant; Columbus, Ohio, United States; 2016-In-Progress

Senior Process Engineer - Black & Veatch. Multiyear consulting program to optimize wastewater treatment operations and evaluate capital and operational alternatives. Facilities include the 114-mgd Southerly WWTP, 68-mgd Jackson Pike WWTP, and biosolids Compost Facility. Tasks include struvite control study for dewatering centrifuges, effluent pH evaluation, influent sampling alternatives, emerging technology workshop, and other consulting services.

Pinellas County; South Cross Bayou WRF Assessment and Treatment Process Model; Pinellas County, Florida, United States; 2015-In-Progress

Senior Process Engineer - Black & Veatch. Assessment of existing

treatment facilities, operations and practices for 33-mgd WRF. Study of alternatives to Thioguard for odor control; evaluation of vortex grit removal alternatives; review and evaluation of monitoring data; development of treatment process model using GPS-X software; update of GPS-X model from Level 2 to Level 4 calibration; evaluation of copper removal alternatives; evaluation of potential operational changes and capital improvements.

County of Pinellas, Florida; Utility Assessment and Optimization Program; Pinellas, Florida, United States; 2015-In-Progress

Senior Process Engineer - Black & Veatch. Multiyear consulting services program to optimize water, sewer and reclaimed water systems using the Envision Process. Facilities include the 33-mgd South Cross Bayou WRF, 9-mgd W.E. Dunn WRF, Logan Laboratory and Pumping Station, and drinking water and reclaimed water distribution systems.Tasks include onsite observations and assessments, evaluation of treatment monitoring data, dynamic treatment process modeling (GPS-X), evaluation of operational alternatives, capital improvement studies, prioritization of CIP projects, and other consulting services.

Metropolitan St. Louis Sewer District; Comprehensive Ammonia and Nutrient Removal Master Plan; St. Louis, Missouri, United States; 2015-In-Progress

Senior Process Engineer - Black & Veatch. Studies and development of master plan for ammonia and nutrient removal for overall utility that includes combined and separate sewers and seven wastewater treatment facilities ranging from 6 to 167 mgd average daily flow. Includes review of operating data, GPS-X process modeling, influent characterization (C, N and P fractions), wet-weather operations, regulatory strategies, and evaluation of alternatives.

Unified Government of Wyandotte County and Kansas City, Kansas; Integrated Overflow Control Plan; Kansas City, Kansas, United States; 2014-In-Progress

Senior Process Engineer - Black & Veatch. Conceptual designs and alternatives evaluations to expand the existing 56-mgd Kaw Point Wastewater Treatment Plant to treat additional wet weather flows up to 95 mgd in one scenario and up to 382 mgd in another scenario. Field testing and stress testing of secondary clarifiers. Process modeling of high purity oxygen activated sludge (HPOAS) system using GPS-X software.

City of Springfield, Missouri; Sanitary Sewer Overflow Control Program; Springfield, Missouri, United States; 2011-In-Progress

Senor Process Engineer - Black & Veatch. Planning, study and conceptual designs to evaluate different wet-weather flow treatment alternatives for sanitary sewer overflow control at the 50-mgd Southwest Wastewater Treatment Plant and 7-mgd Northwest Wastewater Treatment Plant. Services include: dry-weather and wet-weather influent characterization and projections, jar testing of

chemically enhanced sedimentation (CES), full-scale wet-weather stress testing of CES and compressible media filtration (CMF), dynamic treatment process modeling (GPS-X), capacity assessments, and process and technology alternatives evaluations.

City of Toledo, Ohio; Toledo Waterways Initiative Pathogen Study; Toledo, Ohio, United States; 2011-In-Progress

Principal Inivestigator - Black & Veatch. Side-by-side post-construction monitoring study of pathogen reduction across 205-mgd DensaDeg train and 195-mgd nitrifying activated sludge treatment train followed by chlorination and dechlorination. Developed study QAPP and protocols, evaluated sampling data, coordinated with sampling team and laboratories, and prepared annual reports to USEPA as part of final approved Combined Sewer Overflow Long Term Control Plan.

United States Environmental Protection Agency Region 10; North Boeing Field Stormwater Treatment; Seattle, Washington, United States; 2010-In-Progress

Senior Process Engineer - Black & Veatch. Peer review of study, plan and design documents for short-term and long-term treatment facilities for the removal of PCBs from stormwater discharged from the North Boeing Field to the Lower Duwamish Waterway Superfund Site using chitosan-enhanced sand filtration (CESF).

Johnson County Wastewater; Response to Environmental Protection Agency 308(a) Request; Johnson County, Kansas, United States; 2009-In-Progress

Treatment Consultant - Black & Veatch. Evaluations and other technical services to support ongoing regulatory negotiations with United States Environmental Protection Agency Region 7 in regards to Peak Excess Flow Treatment Facilities.

Metropolitan Sewer District of Greater Cincinnati; Werk-Welbourne Enhanced High Rate Treatmetn Facility Wet Weather Improvement Program; Cincinnati, Ohio, United States; 2009-In-Progress

Senior Process Engineer - Black & Veatch. Study, planning, conceptual design and detailed design for a 106-mgd satellite combined sewer overflow (CSO) treatment facility consisting of chemically enhanced high-rate sedimentation followed by high-rate sodium hypochlorite and bisulfite disinfection. Evaluations included CSO flow monitoring and sampling to confirm design pollutographs and onsite jar testing of coagulant (ferric and PACl) and polymer (aPAM and chitosan) alternatives along with E. coli dose response testing of effluents with NaOCl and PAA. Design features included self-cleaning influent pump station, first-flush capture mode, tipping buckets for basin cleaning, and 10-min contact time for disinfection

Delaware County Regional Sewer District; Lower Scioto WRF Treatability Study; Delaware County, Ohio, United States; 2018

Principal Process Engineer - Black & Veatch. Supervised data analysis and development of a process model of the existing treatment facilities using GPS-X software. Evaluated alternatives for current and future flows/loads including minor operational changes and capital improvements.

City of Akron; Akron WRF Headworks Improvements; Akron, Ohio, United States; 2016-2017

Technical Advisor - Black & Veatch. Alternatives evaluations, preliminary design studies and detailed design of 280-mgd screening and grit removal facility. Grit characterization of dry-weather and wet-weather influents, evaluation of aerated grit basins, velocity control channels, induced and hydraulic vortex units, and detritors. Detailed facility design with 4 x 55-ft detritors, grit removal augers, belt conveyor and dumpster haul-off.

Confidential; FGD Wastewater Pilot Testing; Alabama, United States; 2016-2017

Senior Process Engineer - Black & Veatch. Oversight and evaluation of 6-month onsite pilot treatment facilities to remove selenium, arsenic, mercury and nitrite/nitrate to meet EPA's proposed ELG rule for coal combustion steam power plant. Consisted of physical-chemical pretreatment system followed by two parallel polishing units: one using zero-valent iron and one using anoxic biofiltration. Oversaw development of study protocols; pilot system design; coordination with client operators, technology vendors and contract laboratory; evaluation of study data.

Pinellas County ; William E. Dunn WRF Assessment and Treatment Process Model; Pinellas County, Florida, United States; 2017

Senior Process Engineer - Black & Veatch. Assessment of existing treatment facilities, operations and practices for 9-mgd WRF. Evaluation of monitoring data, development of treatment process model using GPS-X software, and evaluation of potential operational changes and capital improvements.

Des Moines Wastewater Reclamation Authority; WRF Secondary Treatment Alternatives Evaluation Study; Des Moines, Iowa, United States; 2017

Senior Process Engineer - Black & Veatch. Conceptual design study of alternatives to upgrade existing 200-mgd secondary treatment process and expand to treat additional 200-mgd of peak wet-weather flows with provisions for future TN and TP removal. Includes dynamic process modeling (BioWin); technology screening for wet-weather, nutrient removal, disinfection and effluent pumping; evaluation of alternative facility designs; development of facility conceptual design, opinion of costs and implementation plan.

City of Toronto ; Ashbridges Bay Treatment Plant Integrated Pump Station and Satellite Treatment Plant; Toronto, Ontario, Canada; 2016

Technical Advisor - Black & Veatch. Study, preliminary design and advanced facility planning for a 600-MLD satellite wet-weather treatment facility expandable to 900-MLD capacity including headworks, enhanced clarification, effluent disinfection and sludge management processes.

Metropolitan St. Louis Sewer District ; Bissell Point WWTF Chemically Enhanced Primary Treatment Upgrades; St. Louis, Missouri, United States; 2016

Senior Process Engineer - Black & Veatch. Study and preliminary design of ferric chloride and polymer feed systems to chemically enhance settling in existing primary clarifiers at the 150-mgd WWTF. Review operating data, develop influent characterization, oversee and evaluate onsite jar testing, design of chemical storage and feed facilities.

Johnson County Wastewater; D.L. Smith Middle Basin WWTP Clarifier Upgrades; Johnson County, Kansas, United States; 2016

Senior Process Engineer - Black & Veatch. Design and performance testing of basin rehabilitation and equipment retrofits for Final Clarifiers No. 2 and 3.

Fox River Water Reclamation District ; Phosphorus Removal Improvements Preliminary Design; South Elgin, Illinois, United States; 2016

Technical Advisor - Black & Veatch. Alternatives evaluations, preliminary designs and advanced facility planning for phosphorus removal improvements at the 7.75-mgd North, 10-mgd West, and 25-mgd A.D. Pagorski WRFs. Evaluated clarifier stress testing procedures and results.

City of Toronto ; Ashbridges Bay Treatment Plant Process Roadmap; Toronto, Ontario, Canada; 2016

CEPT Process Specialist - Black & Veatch. Studies and long-term facility planning for upgrade alternatives to the existing 818-MLD treatment plant and capacity expansions to 1000-MLD including sidestream treatment, aeration improvements, solids digestion, odour control and chemically enhanced primary treatment.

Tejon Castac Water District ; Source Control Program Development; Lebec, California, United States; 2016

Industrial Pretreatment Specialist - Black & Veatch. Various services to develop a source control program to help prevent upsets to the 50,000-gpd Westside WWTF, including: review of existing sewer use ordinance, WWTF capacity and influent monitoring data; survey

and inspect potential industrial users; evaluate findings and summarize recommendations for future source control.

Little Rock Wastewater; Adams Field and Fourche Creek Nutrient Removal and Parallel Treatment Study; Little Rock, Arkansas, United States; 2015-2016

Senior Process Engineer - Black & Veatch. Conceptual design study of upgrade alternatives to treat peak wet-weather flows and ammonia with provisions for future total nitrogen and total phosphorus removal. Includes GPS-X modeling of both facilities, characterization of influent fractions (C, N and P), wet-weather flow characterization, piloting of compressible media and pile cloth filters, and bid evaluations of silicate ballasted flocculation, magnetite ballasted flocculation, compressible media filtration, and pile cloth media filtration alternatives.

Johnson County, Kansas Wastewater; Tomahawk Creek Wastewater Treatment Facility Project Definiation; Johnson County, Kansas, United States; 2015

Wet Weather Process Specialist - Black & Veatch. Conceptual designs and advanced facility planning to expand WWTF from 10-mgd average to 19-mgd average / 172-mgd peak hourly. Triple bottom line evaluation of various process and technology alternatives for treating wet-weather flows, including silicate ballasted flocculation, magnetite ballasted flocculation, compressible media filtration, and cloth media filtration in both stand-alone and dual-use applications.

New York State Energy Research and Development Authority; Flatline Enhanced Primare Treatment Demonstration; Ithaca, New York, United States; 2014-2015

Technical Advisor - Black & Veatch. Member of project advisory committee reviewing procedures and results from pilot testing of new treatment technology developed by Clear Cove consisting of chemically enhanced sedimentation and primary effluent filtration to increase total suspended solids capture and subsequent energy recovery potential through primary sludge digestion and biogas generation.

City of Atlanta, Georgia; South River Water Reclamation Center; Atlanta, Georgia, United States; 2014-2015

Senior Process Engineer - Black & Veatch. Study and design of upgrades to treat anticipated flows and loads including future decommissioning of Intrenchment Creek Water Reclamation Center. Included primary clarifiers (with and without CEPT), field testing of existing secondary clarifiers (6 @ 140’ dia) and BioWin modeling of activated sludge.

Singapore Public Utilities Board; Deep Tunnel Sewerage System Phase 2; Singapore; 2014-2015

Wet Weather Treatment Advisor - Black & Veatch. Conceptual design and study of expansion and upgrade alternatives at the Tuas

Water Reclamation Plant (TWRP) to treat peak wet weather flows and loads from the extension of the Deep Tunnel Sewerage System (DTSS).

City of Fort Wayne, Indiana; Combined Sewer Overflows Long Term Control Plan; Fort Wayne, Indiana, United States; 2013-2015

Technical Advisor - Black & Veatch. Evaluations and other technical services to support NPDES permitting negotiations to implement the City's combined sewer overflow (CSO) long term control plan (LTCP). Services include development and evaluation of static and flow-tiered effluent limits for the water pollution control plant and water quality modeling of the upper Maumee River for ammonia toxicity criteria and dissolved oxygen (QUAL2K).

Metropolitan Sewer District of Greater Cincinnati; Combined Sewer Overflow Treatment Innovation and Watershed Operations Initiatives; Cincinnati, Ohio, United States; 2013-2015

Technical Advisor - Black & Veatch. Workshop participation, evaluations and consulting services to support the development of the utility's Watershed Operations Division and Combined Sewer Overflow Treatment Innovation initiative.

Metropolitan St. Louis Sewer District; Lemay Wastewater Treatment Plant, Secondary Improvements; St. Louis, Missouri, United States; 2012-2015

Process Engineer - Black & Veatch. Study, design and construction-phase services to increase the wet-weather flow capacity of the existing activated sludge system from 167 to 210 mgd. Evaluate wastewater treatment plant operating data, conduct process modeling (GPS-X), coordinate diffuser testing, evaluate modification alternatives and conceptual designs.

City of Springfield, Ohio; Wastewater Wet Weather and Capacity Improvements; Springfield, Ohio, United States; 2009-2015

Senior Process Engineer - Black & Veatch. Study, design and construction-phase services to add a 100-mgd high-rate treatment (HRT) facility to increase the capacity of existing treatment facilities for combined sewer overflow control. Evaluation of the following HRT alternatives: Actiflo ballasted flocculation, DensaDeg high-rate clarification and WWETCO compressible media filtration followed by sodium hypochlorite and bisulfite for high-rate disinfection. Project proceeded with WesTech/WWETCO FlexFilter technology along with upgrades to headworks screening and grit removal, a new secondary clarifier, and a new anaerobic digester.

Milwaukee Metropolitan Sewer District; South Shore Process Enhancement Demonstration; Milwaukee, Wisconsin, United States; 2010-2014

Senior Process Engineer - Black & Veatch. Study and design services to conduct side-by-side trials of the following treatment technologies

during actual wet-weather excess flow events: full-scale (50-75 mgd) chemically enhanced sedimentation, pilot-scale biocontact and pilot-scale compressible media filtration.

Floriad Keys Aqueduct Authority; Cudjoe Key Advanced Water Reclamation Facility; Florida, United States; 2009-2014

Process Engineer - Black & Veatch. Study and design of new facility with influent screens, equalization, 5-stage Bardenpho basins, secondary clarifiers, cloth disk filters and chlorine contact.

Butler County Water and Sewer; Biosolids Management Evaluation; Butler County, Ohio, United States; 2013

Senior Process Engineer - Black & Veatch. Evaluation of operational changes and modifications to reduce odors attributed to the delivery of dewatered biosolids from the Upper Mill Creek and LeSourdsville Water Reclamation Facilities. Peer review and use of existing BioWin model to assess changes to liquid stream treatment procedures including wasting and dewatering schedules.

City of Riverside, California; Plant 2 Secondary Clarifier Upgrades; Riverside, California, United States; 2012

Senior Process Engineer - Black & Veatch. Study and design of upgrades to existing secondary clarifiers (2 @ 100’ dia x 10.3 SWD + 2 @ 130’ dia x 13’ SWD). Evaluated performance data and conducted state point analysis (SPA) for current and future operating scenarios. Developed, evaluated and recommended alternatives for clarifier upgrades including energy dissipating inlets (EDI), reuse of existing inboard launder supports for new peripheral launder with density current baffles, replacement of organ-pipe sludge collector with uni-tube header, scum collection and removal and algae control.

District of Columbia Water and Sewer Authority; Filtrate Treatment Facility; Washington, District of Columbia, United States; 2012

Senior Process Engineer - Black & Veatch. Developed design criteria and conceptual design alternatives for chemically enhanced lamella settling pretreatment system to treat belt filter press filtrate from a Cambi-enhanced anaerobic digestion process.

Metropolitan Sewer District of Greater Cincinnati; Mill Creek Wastewater Treatmetn Plant Secondary Process Operations optimization Support; Cincinnati, Ohio, United States; 2012

Senior Process Engineer - Black & Veatch. Periodic review and evaluation of process monitoring data. Recommendations of operational procedures and changes to parameters to optimize performance of the activated sludge system and WAS thickening centrifuges.

City of Fort Wayne, Indiana; Water Pollution Control Plant Hydraulic and Process Analysis and Effluent Pump Station

Evaluation; Fort Wayne, Indiana, United States; 2011

Senior Process Engineer - Black & Veatch. Planning, study and conceptual designs of alternatives to increase peak wet-weather capacity to 100 mgd for CSO control. Services include: review and analysis of historical operations data, development of design influent hydrograph and pollutographs, jar testing of chemically enhanced sedimentation (CES), dynamic treatment process modeling (GPS-X) of various wet-weather treatment scenarios, capacity assessments of existing facilities and upgrades, and process and technology alternatives evaluations.

City of Salem, Oregon; River Road Wet Weather Treatment Facility; Salem, Oregon, United States; 2008-2011

Process Engineer - Black & Veatch. Operator training, commissioning and performance certification assistance for satellite 50-mgd peak excess flow treatment facility consisting of fine screens, Actiflo ballasted flocculation and UV disinfection for SSO control.

City of Toledo, Ohio; Bay View Water Reclamation Plant, Wet Weather Treatment; Toledo, Ohio, United States; 2002-2011

Process Engineer - Black & Veatch. Providing process engineering assistance during the side-by-side pilot plant study of wet weather treatment systems using Actiflo and DensaDeg high-rate clarification followed by MP and LPHO ultraviolet disinfection technologies. Includes: design of the pilot plant study, establishing protocols, on site start-up and operational assistance, data evaluation and preparing study report. Continued to assist local office staff as needed during planning, design, construction and commissioning of 232-mgd wet-weather flow treatment facility with vortex grit removal, DensaDeg high-rate clarification, chlorination, dechlorination and reaeration.

Asahi Kasei Chemicals Corporation; Phosphorus Adsorption and Recovery System Pilot Study; United States; 2009-2010

Senior Process Engineer - Black & Veatch. First pilot study in the United States of an integrated phosphorus removal and recovery process featuring a new phosphorus adsorbent media, in situ regeneration, and recovery process. Project included bench-scale testing, pilot system design and fabrication, developing test protocols, pilot system operations, performance testing, monitoring and sampling, data evaluation, and reporting.

Orange County Utilities; Northwest Water Reclamation Facility; Orange County, Florida, United States; 2008-2010

Process Engineer - Black & Veatch. Study and design to double capacity and upgrade to 5-stage Bardenpho process. Included field testing and assessment of the existing secondary clarifiers (4 @ 105' dia x 14' SWD) in accordance with WERF/CRTC protocols to determine case-specific Vesilind flux curve; state point analysis; discrete and flocculated suspended solids (DSS/FSS); capacity evaluation; and upgrade recommendations.

City of St. Joseph, Missouri; Combined Sewer Overflow Long Term Control Plan Facilities Plan; St. Joseph, Missouri, United States; 2008-2010

Process Engineer - Black & Veatch. Study, planning and conceptual design to approximately double peak flow treatment capacity for Combined Sewer Overflow control. Treatment facilities assessment included evaluations and side-by-side bench-scale pilot tests of Chemically Enhanced Primary Treatment (CEPT), Actiflo ballasted flocculation, DensaDeg high-rate solids contact clarification and WWETCO compressible media filtration followed by E. coli dose response testing of effluents using hypochlorite and UV disinfection.

City of Grand Island, Nebraska; Primary Clarifier Upgrades; Grand Island, Nebraska, United States; 2009

Process Engineer - Black & Veatch. Evaluated existing primary clarifiers (2 @ 90' dia) and performance data. Developed, evaluated and recommended process and technology alternatives for clarifier upgrades including, chemically enhanced primary treatment (CEPT), energy dissipating inlets (EDI), density current baffles, sludge collection and removal, and scum collection and removal.

Metropolitan Sewer District of Buncombe County; French Broad River Water Reclamation Facility; Buncombe County, North Carolina, United States; 2008-2009

Process Engineer - Black & Veatch. Field testing of existing clarifiers (4 @ 130' x 34' x 16' SWD) in accordance with WERF/CRTC protocols to evaluate potential tank flocculation and hydrodynamic upgrades. Bench and full-scale pilot trials of chemically enhanced clarification alternatives, including: ferric chloride, ferric sulfate, alum, polyaluminum chloride, cationic polyacrylamide (cPAM) and anionic polyacrylamide (aPam).

City of Dayton, Ohio; Advanced Wastewater Treatment Facility Process Model and Nutrient Removal Assessment; Dayton, Ohio, United States; 2008-2009

Process Engineer - Black & Veatch. Study and conceptual designs of nutrient removal alternatives. Included: analysis of historical operational data, development of design influent characteristics, review and comparisons of processes and technologies, development of upgrade alternatives and opinion of probable costs.

Johnson County Wastewater; Turkey and Brush Creek Wet Weather Facilities; Johnson County, Kansas, United States; 2007-2009

Process Engineer - Black & Veatch. Evaluated upgrades to peak excess flow treatment facilities. Services included bench-scale jar testing and full-scale testing of chemically enhanced sedimentation; analysis of historical treatment performance data; and regulatory

assistance. Evaluated alternatives included: conventional sedimentation, chemically enhanced primary treatment (CEPT), lamella plate settlers, high rate clarification, disk filters and compressed media filtration.

Metropolitan Sewer District of Greater Cincinnati; Mill Creek Wastewater Treatment Plant; Cincinnati, Ohio, United States; 2007-2009

Process Engineer - Black & Veatch. Several projects to increase peak flow capacity to 240 mgd, including extensive modifications to existing secondary clarifiers (6 @ 105' x 315' x 12.7' SWD triple squircles), aeration basin upgrades, and facility master plan. Evaluations included: review of CFD modeling results, alternative designs for secondary settling tanks, BioWin modeling of full plant, characterization of raw and secondary influent, aeration basin modifications for wet-weather step-feed operation, nutrient removal capacity assessment, aeration diffuser alternatives, primary treatment capacity assessment, and peak wet-weather treatment capacity assessment.

Metropolitan Council Environmental Services; Blue Lake Wastewater Treatment Plant Primary and Secondary Clarifier Upgrades; Shakopee, Minnesota, United States; 2008

Process Engineer - Black & Veatch. Study and design of upgrades to existing secondary clarifiers (8 @ 125' dia x 16' SWD) and primary clarifiers (4 @ 80' dia) along with plans for additional clarifiers. Developed and recommended process design criteria and technology alternatives for clarifier upgrades including energy dissipating inlets (EDI), flocculating feedwell, density current baffles, sludge collection and removal, scum collection and removal and effluent launder algae control.

Metropolitan Sewer District of Greater Cincinnati; SSO 700; Cincinnati, Ohio, United States; 2007-2008

Process Engineer - Black & Veatch. Peer review of 2-year effectiveness study of a 30-mgd peak excess flow storage and treatment facility consisting of storage tanks, fine screens, Actiflo ballasted flocculation and UV disinfection. Evaluated and recommended facility upgrades to meet permanent remedial measures plan.

City of St. Joseph, Missouri; Industrial Pretreatment Program (IPP) Services; St. Joseph, Missouri, United States; 2002-2008

Consultant - Black & Veatch. Provide various services to administer the City of St. Joseph's Industrial Pretreatment Program (IPP). Includes: providing overall IPP management and coordination; preparing Pretreatment Implementation Annual Report; inspecting existing and potential SIUs; developing wastewater contribution permits; evaluating IU compliance status; initiating enforcement activities; negotiating compliance schedules; implementing program enhancements; staff training.

City of Columbia, South Carolina; Sewer Use Ordinance Review; Columbia, South Carolina, United States; 2007

Industrial Pretreatment Specialist - Black & Veatch. Evaluated and reviewed various aspects of the City's sewer use ordinance and policies, including: wastewater discharge limits, surcharge program and high strength customer discharge data, hauled waste program.

Montana Economic Revitalization and Development Institute; Polysilicon Recycling Plant Evaluation; Butte, Montana, United States; 2007

Senior Process Engineer - Black & Veatch. Developed conceptual design for polysilicon recycling facility, including: evaluation of production processes; waste stream characterization; local and federal pretreatment regulatory review; and preliminary design of wastewater treatment system.

City of Kansas City, Missouri; Overflow Control Program; Kansas City, Missouri, United States; 2006-2007

Process Engineer - Black & Veatch. Preliminary evaluation of treatment alternatives for wet weather excess flows to control combined sewer overflows (CSOs), including chemically enhanced high rate treatment processes such as Actiflo.

City of Lawrence, Kansas; Wakarusa Water Reclamation Facility; Lawrence, Kansas, United States; 2006-2007

Process Engineer - Black & Veatch. Evaluating the basis of design and developing process design criteria for liquid treatment facilities including: analyzing raw wastewater sampling results, determining design influent wastewater characteristics, developing and evaluating treatment alternatives, BioWin modeling of alternatives.

City of Omaha, Nebraska; Combined Sewer Overflow Control Program; Omaha, Nebraska, United States; 2006-2007

Process Engineer - Black & Veatch. Preliminary evaluation of treatment alternatives for wet weather excess flows to control combined sewer overflows (CSOs), including chemically enhanced high rate treatment processes such as Actiflo.

City of Reading, Pennsylvania; Evaluation of Technically Based Local Limits (TBLLs); Reading, Pennsylvania, United States; 2006

Industrial Pretreatment Specialist - Black & Veatch. Evaluation of technically based local limits for the City of Reading's Fritz Island Wastewater Treatment Plant. Includes: evaluating domestic and wastewater treatment plant sampling results; evaluating criteria for inhibition, sludge quality standards and water quality standards; calculating maximum allowable headworks load (MAHL) and maximum allowable industrial load (MAIL).

City of Lawrence, Kansas; Wakarusa Water Reclamation Facility Siting Study; Lawrence, Kansas, United States; 2006

Process Engineer - Black & Veatch. Preliminary treatment plant sizing, process evaluations and related conceptual design studies.

City of Lawrence, Kansas; Kansas River Wastewater Treatment Plant Anaerobic Digester Improvements Study; Lawrence, Kansas, United States; 2006

Process Engineer - Black & Veatch. Evaluate treatment capacity of existing anaerobic digester facility, develop and evaluate alternatives for increasing the capacity, present study findings in a pre-design report.

Binghamton-Johnson City Joint Sewage Board; Optimization of Chemically Enhanced Primary Treatment Facilities; Vestal, New York, United States; 2005-2006

Process Engineer - Black & Veatch. Evaluated capabilities of existing chemically enhanced primary treatment (CEPT) facilities and recommended modifications to optimize treatment performance. Evaluation included bench-scale jar testing and analysis of historical full-scale performance monitoring data.

Fountain Sanitation District; Master Plan Enhancement Study; Fountain, Colorado, United States; 2005

Process Engineer - Black & Veatch. Process evaluation of activated sludge and aerobic sludge digestion. Used in-house developed, spreadsheet-based kinetic models to estimate existing organic loading capacity and evaluate expansion alternatives.

City of Kansas City, Missouri Water Services Department; Wastewater Treatment Plant Disinfection Study; Kansas City, Missouri, United States; 2005

Process Engineer - Black & Veatch. Conducted a preliminary feasibility assessment comparing effluent chlorination and ultraviolet (UV) disinfection. The study involved bench-scale chlorination testing and a 30-day sampling program for UV transmittance of the effluent from the Birmingham, Blue River and Westside Wastewater Treatment Plants.

City of Bloomington, Indiana Utilities; Blucher Poole Wastewater Treatment Plant Improvements; Bloomington, Indiana, United States; 2005

Process Engineer - Black & Veatch. Conducted a bench-scale treatability study of chemically enhanced primary treatment (CEPT) to establish chemical doses and process design parameters to retrofit CEPT into the existing primary clarifiers. Developed process design criteria, equipment specifications and construction drawings.

Wheaton Sanitary District; Wet Weather Facility Plan; Wheaton,

Illinois, United States; 2005

Process Engineer - Black & Veatch. Evaluated the wet weather treatment capabilities of the existing Wastewater Treatment Plant and recommended future alternatives for further consideration. Technologies included conventional sedimentation, chemically enhanced primary treatment (CEPT), ballasted flocculation and filtration.

Johnson County Wastewater; Indian Creek Middle Basin Wastewater Treatment Plant Excess Flow Improvements Pre-Design Study; Johnson County, Kansas, United States; 2004-2005

Process Engineer - Black & Veatch. Provided process engineering to improve excess flow treatment capacity of the publically owned treatment works. Tasks included: final clarifier settleability testing and state point analysis; bench-scale treatability study of CES/CEPT, Actiflo ballasted flocculation, DensaDeg solids contact clarification/thickening, bio-CES and disinfection; wet weather influent characterization via discrete sampling during “first flush”; treatment process modeling with GPS-X software.

Orange County Sanitation District; Secondary Activated Sludge System at Plant No. 1; Orange County, California, United States; 2004-2005

Process Engineer - Black & Veatch. Conducted peer survey-based studies to support detailed design of secondary clarifiers to evaluate two types of scum removal systems: dipping skimmer with rotating scum trough vs. beaching skimmer. Another study evaluated the effluent turbidity anticipated from a conservatively sized clarifier with state-of-the-art internal design compared to tertiary filtration.

Black & Veatch; Surfactants and Foaming Potential with Ballasted Flocculation Treatment of Wastewater; United States; 2003-2005

Principal Investigator - Black & Veatch. Self-funded study to evaluate foaming from wet-weather flow treatment with ballasted flocculation. Develop study scopes, develop study protocols, coordinate with participating publically owned treatment works, resolve technical issues, evaluate analytical data, draft study reports and present findings.

Metropolitan St. Louis Sewer District; Lemay Wastewater Treatment Plant, Wet Weather Expansion; St. Louis, Missouri, United States; 2003-2005

Process Engineer - Black & Veatch. Expand the publically owned treatment works ability to treat excess wet-weather flows from 167 to 340 mgd. Evaluate wastewater treatment plant operating data, develop treatment process model (GPS-X), evaluate applicable treatment technologies, conduct bench-scale treatment studies, develop conceptual designs, and coordinate treatment modifications with collection system expansion plans.

Mizkan Americas, Inc.; Industsrial Pretreatment Services; Kansas City, Missouri, United States; 2004

Consultant - Black & Veatch. Provide environmental engineering services to respond to compliance issues raised during a surprise inspection conducted by the City to resolve low pH conditions found in the public owned treatment works. Services include: audit of facility and operations, identification of low pH sources, troubleshooting existing pH control systems, recommending modifications to facility and operations, corresponding with the City's Industrial Pretreatment Program, completing a survey/permit application and developing an Accidental/Slug Discharge Control Plan, successfully negotiating with the City to deem the industry a nonsignificant industrial user (waiving routine sampling and analyses and allowing the industry to continue to discharge without a Wastewater Discharge Permit).

JEA; Engineering Services for the Industrial Pretreatment Program; Jacksonville, Florida, United States; 2001-2004

Consultant - Black & Veatch. Train JEA staff on permitting of industrial users and other program components. Review and edit draft permits and other program documents. Audit the technical review of various submittals including survey questionnaires, permit applications, baseline-monitoring reports (particularly for transportation equipment cleaners and centralized waste treaters), and initial certification statements for centralized waste treaters. Conduct preliminary research and present results on potential impacts of the proposed pretreatment standards for the Metal Products and Machinery point source category. Develop and enhance departmental procedures and policies.

Black & Veatch Enterprise Consulting Division; Pretreatment Information Management System (PIMS); United States; 2001-2004

Industrial Pretreatment Specialist - Black & Veatch. Act as programmatic expert during the development and implementation of Black & Veatch's PIMS software for various external clients (Including Los Angeles, CA; Chicago, IL; Denver, CO; Detroit, MI). Includes: determining software functionality needs, liaising between pretreatment staff and information technology staff, evaluating software performance, providing regulatory updates, troubleshooting data conversion and implementation issues, and assessing compliance with regulatory requirements (40 CFR 403, etc.).

Las Vegas Wash Coordination Committee (LVWCC); SCOP Process Improvements, Perchlorate Removal System Study; Las Vegas, Nevada, United States; 2003

Process Engineer - Black & Veatch. Conduct a conceptual design study of perchlorate treatment systems for the Las Vegas Wash. Includes: researching treatment technologies, developing a pollutant mass balance model for the Las Vegas Wash/Lake Mead/Colorado River system, conducting model parameter sensitivity analysis,

determining performance criteria, and estimating budgetary treatment costs.

City of Lawrence, Kansas; Lawrence Wastewater Treatment Plant; Lawrence, Kansas, United States; 2003

Process Engineer - Black & Veatch. Providing process engineering assistance during commissioning of 40-mgd wet-weather excess flow treatment system consisting of fine screens, Actiflo ballasted flocculation, hypochlorite disinfection and bisulfite dechlorination. Includes: bench-scale treatment studies, full-scale demonstration studies, system troubleshooting and performance testing.

Hodgdon Power Co., Inc.; Pyrodex Wastewater Treatment System; Herrington, Kansas, United States; 2002-2003

Process Engineer - Black & Veatch. Process design of wastewater treatment system to remove and destroy perchlorate from gunpowder manufacturing wastewater. Includes: preparing RFP, bid evaluation, reviewing bench-scale treatability study, reviewing and modifying system design, evaluating impacts of discharge to publicly owned treatment works, evaluating impacts of discharge to receiving stream water quality, negotiating with regulatory agencies (KDHE), providing installation and start-up assistance.

Dallas Water Utilities; Pretreatment Redevelopment of Technically Based Local Limits (TBLLs); Dallas, Texas, United States; 2001-2003

Industrial Pretreatment Specialist - Black & Veatch. Assist in the evaluation of DWU's TBLLs. Includes: identifying pollutants of concern; coordinating sampling efforts; evaluating sampling results; calculating MAHLs and MAILs; determining TBLLs; and participating in various presentations and stakeholder meetings. Deliverables include: Pollutant of Concern Report, Monitoring Plan, and TBLL Report.

Las Vegas Wash Coordination Committee (LVWCC); Alternate Discharge Study; Las Vegas, Nevada, United States; 2001-2003

Process Engineer - Black & Veatch. Develop a spreadsheet based water quality model to predict the treatment performance anticipated from a series of wetlands being established along the Las Vegas Wash. Parameters to be predicted by the model include flow rate, temperature, BOD, NH3, NO2/NO3, TN, TP, TSS, TDS and fecal coliform.

Ajman City, United Arab Emirates; Ajman Wastewater System; Ajman, United Arab Emirates; 2002

Process Engineer - Black & Veatch. Preliminary design of constructed wetlands intended to receive treated effluent from a 20-MGD wastewater treatment plant.

City of Yankton, South Dakota; Wastewater Treatment Plant Improvements; Yankton, South Dakota, United States; 2002

Process Engineer - Black & Veatch. Witnessed performance testing

of UV disinfection system and evaluated data from test

Johnson Controls, Inc.; Sewer Identification Project; St. Joseph, Missouri, United States; 2001-2002

Industrial Pretreatment Specialist - Black & Veatch. Provide engineering services to meet local lead limit and achieve full compliance with the wastewater contribution permit issued to them by the City of St. Joseph. Services include: audit of facility and operations, identification of lead sources, dye tracing study, TV inspection of sewer lines, recommending modifications to facility and operations.

JEA; Engineer for Industrial Pretreatment Program; Jacksonville, Florida, United States; 1999-2001

Staff Engineer - Black & Veatch. Resident staff member of JEA's Industrial Pretreatment Department. Responsibilities include: general program management and coordination; reviewing various technical submittals from industrial users; determining applicable pretreatment standards for various industrial users; developing discharge permit limits, including calculating alternate limits; writing and administering industrial user discharge permits; conducting inspections of various industries to support permitting and compliance monitoring activities; corresponding with industrial users, regulatory agencies, and other stakeholders; developing and enhancing departmental procedures and policies.

Black & Veatch Power Division; Multiple; Global; 1993-1999

Chemical Engineer - Black & Veatch. Conduct engineering analyses; prepare design calculations; draft and review engineering documents; evaluate bids; review vendor drawings; and provide start-up, commissioning and troubleshooting for a variety of electrical power plant water and wastewater treatment systems including: demineralized water makeup treatment systems; NOX injection water treatment systems (reverse osmosis and electrodeionization) regeneration waste neutralization systems; steam cycle chemical feed systems; condensate polishing systems; steam cycle sampling systems. Projects included:

Tri Energy Company, Ltd. - IPP Project, Ratchaburi, Thailand
HEI Power Corp. Guam - Tanguisson Repair Project, Tanguisson, Guam
Gulf Electric Company, Ltd. - Kui Buri Power Project, Kui Buri, Thailand
MTP Cogeneration Company, Ltd. - Map Ta Phut Cogeneration Plant Phase III, Thailand
Electricity Generating Authority of Thailand - South Bangkok Combined Cycle Phase II, Bangkok, Thailand
Electricity Generating Authority of Thailand - South Bangkok Combined Cycle Phase II, Bangkok, Thailand
Electricity Generating Authority of Thailand - Ratchaburi Thermal Units 1 & 2, Ratchaburi, Thailand
AES Barry Operations, Ltd. - AES Barry Power Station, Barry, Wales, UK
Omaha Public Power District - Sarpy County Combustion Turbine No.

3, Omaha, NE
Brunei Department of Electrical Services - Gadong Power Station Extension, Gadong, Bruneid

PRESENTATIONS & PUBLICATIONS

T. Lorenzen, A. Szerwinski, M. Bushouse, C. Perry, N. White. "Enhancing Phosphorus Removal and Auxiliary Wet Weather Capacity with Dual-Purpose Filtration." Proceedings from the Water Environment Federation 90th Annual Technical Exhibition and Conference. October 2017.

J. Barnard. "More Affordable, Reliable and Recoverable Nutrient Removal." Northwest District Arkansas Water Works and Water Environment Association Conference. September 2017.

T. Lorenzen. "Dual-Purpose Filtration for Auxiliary Wet-Weather Capacity and Phosphorus Polishing." Kansas Water Environment Association & American Water Works Association Joint Annual Conference. August 2017.

"More Affordable, Reliable and Recoverable Nutrient Removal." Ohio Water Environment Association Conference. June 2017.

"Dual-Use High-Rate Filter to Expand Wet-Weather Capacity and Reuse Opportunities." Arkansas Water Works and Water Environment Association Conference. May 2017.

Dr. James Barnard. "More Affordable, Reliable and Recoverable Nutrient Removal." Arkansas Water Works and Water Environment Association Conference. May 2017.

"Innovative Wet Weather Technology in Illinois Also Moving Forward in USEPA Region 6." Illinois Wastewater Professionals Conference. April 2017.

"Dual-Use Filters Piloted in EPA Region 7 Expand to Region 6." Missouri Water Environment Association & American Water Works Association Joint Annual Conference. March 2017.

"Meeting Stringent Phosphorus Limits and Recovery Goals." New York Water Environment Association Annual Conference. February 2017.

M. Boner. "Auxiliary CSO Treatment with Compressed Media Filtration." New Jersey Department of Environmental Protection CSO/CMF Workshop. November 2016.

J. Broz, J. Cousino, B. Harbron, R. Ives, K. Martin, C. McGibbeny, J. Rose. "Enhanced Pathogen Reduction of Urban Wet Weather Flows." Proceedings from the Water Environment Federation 89th Annual Technical Exhibition and Conference. September 2016.

"Proven and Emerging Alternatives for Stringent Phosphorus Limits." Kansas Water Environment Association & American Water Works

Association Joint Annual Conference. August 2016.

R. Jezek, P. Dunlap, G. Chalas, M. Steichen. "The lowdown on meeting low phosphorus limits." NEWEA Journal. August 2016.

Dr. James Barnard. "Successful Nutrient Management in the Midwest and Great Lakes Regions." Michigan Water Environment Association Annual Conference. June 2016.

"Advances in High-Rate Treatment." Wet Weather Partnership Annual Conference. May 2016.

"Compressible Media Filtration of Urban Wet Weather Flows to Improve Water Quality." University of Kansas Environmental Engineering Conference. April 2016.

"Taking a New Wet Weather Treatment Technology from Concept to 100-mgd Reality." Missouri Water Environment Association & American Water Works Association Joint Annual Conference. March 2016.

"Enhanced Primary Treatment Alternatives and Applications." New Jersey Water Environment Association Technology Transfer Seminar Energy Workshop. March 2016.

"Optimizing Clarifier Performance - Are We Designing the Clarifiers Right?." Presented at the New England Water Environment Association Annual Conference & Exhibit. January 2016.

"Proven and Emerging Alternatives for Stringent Phosphorus Limits." New England Water Environment Association Annual Conference & Exhibit. January 2016.

M. Boner. "Wet Weather Water Quality and Infrastructure Alternatives." The Engineers Club of St. Louis, Missouri. January 2015.

"Infrastructure and Operations for Nutrient Management." The Engineers Club of St. Louis, Missouri. January 2015.

"Avoiding Unintended Compliance Quagmires and Regulatory Pitfalls." Illinois Water Environment Association Annual Conference. January 2015.

"BNR Planning." CSWEA Government Affairs Seminar and IAWA Mini-Conference. January 2015.

T. Lu. "Deammonification: Is it right for you?." Ohio WAter Environment Association Annual Conference. January 2015.

J. Macrina, J. Waddington, T. Richardson, L. McNeil, R. Booker, K. Hartzog, A. Blissit, T. O'Brian, B. Sabherwall. "Final Clarifier Performance Evaluation and Capacity Assessment at the City of Atlanta's South River Water Reclamation Center." Proceedings from teh Water Environment Federation 88th Annual Technical Exhibition and

Conference. January 2015.

"LIFT - Innovative Advanced Primary Treatment for the Utility of the Future." Mobile Session 231 of the Water Environment Federation 88th Annual Technical Exhibition and Conference. January 2015.

T. Weaver, J. Ussher, W. Young, J. Champion, J. Hutchins, S. McCreary, C. O'Bryan. "Taking an Emerging Enhanced High-Rate Treatment Technology from Concept to 100-mgd Reality." Proceedings from the Water Environment Federation 88th Annual Technical Exhibition and Conference. January 2015.

J. Ussher, T. Weaver, J. Champion, J. Hutchins, B. O'Bryan. "Clearing the Waters to Eliminate Overflows." Water Environment & Technology, 27(6), 46-50. January 2015.

F. Cubas, H. Phillips, M. Tate. "Identifying and Managing Risks, Chapter 6 of Nutrient Roadmap." Water Environment Federation. January 2015.

K. Bell, D. Gray, J. Sandino, D. Wagner. "Blending and Wet Weather Operations: An Engineering Perspective." U.S. EPA Experts Forum on Public Health Impacts of Blending, Fairfax, Virginia. January 2014.

M. Crow, T. Lyon, C.R. O'Bryan. "High-Rate Treatment." Chapter 14 of Facility Wet Weather Design and Operation, Water Environment Federation, Alexandria, Virginia. January 2014.

"Adding Phosphorus Rercovery Increases Value of BNR and Helps Avoid Struvite Headaches." Kansas Water Environment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2014.

"New 100-mgd Non-Biological Peak Flow Secondary Treatment Facilities Help Eliminate Wet-Weather Overflows." Kansas Water Environment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2014.

"Helping Phosphorus Recovery Become More Prosperous." Ohio Water Environment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2014.

"Wet Weather Blending and Auxiliary Treatment." 4-State Government Affairs Meeting, USEPA Region 7, Lenexa, Kansas. January 2014.

E. Esping, D. Parker, J. Jiminez, R. Schroedel, S. Arant, B. Krill, T. Bate. "Evaluation of Wet Weather Auxiliary Alternatives to Increase Plant Capacity." Water Environment Federation 87th Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2014.

C. deBarbadillo, E. Kobylinski, H. Phillips, P. Schauer, A. Shaw. "Turning BNR Lemons Into Lemonade." Water Environment & Technology, 26(10), 34-39. January 2014.

"Show Me Successful BNR in the GLUMR Region." Association of

Missouri Cleanwater Agencies Fall Meeting, Jefferson City, Missouri. January 2014.

"Piloting EHRT Technologies at the Southwest Clean Water Plant." Missouri water Environment Association Fall Technical Conference, Columbia, Missouri. January 2014.

"Keys to Successful BNR in the Midweswt and Great Lakes Regions." Indiana Water Environment Association Annual Conference, Indianapolis, Indiana. January 2014.

"Current Trends in Wet-Weather Treatment." Illinois Water Environment Association and Central States Water Environment Association Government Affairs Seminar, Willowbrook, Illinois. January 2013.

"Did You Say Prosperous Recovery or Phosphorus Recovery?." New England Water Environment Association Annual Conference & Exhibit, Boston, Massachusetts. January 2013.

"Wet Weather Treatment Considerations." Association of Missouri Cleanwater Agencies, Quarterly Meeting, Jefferson City, Missouri. January 2013.

"Decades of Pathogen Protection with Auxiliary High-Rate Treatment Facilities." Kansas Water Environment Association & American Water Works Association Joint Annual Conference, Wichita, KS. January 2013.

T. Lu, V. Kapoor, D. Wendell, M. Lodor, B. George, D. Metz, G. Hunter. "Fecal Coliforms, E. coli or Alternative Pathogens, What is the Right Indicator for Water Quality Monitoring?." Water Environment Federation 86th Annual Technical Exhibition and Conference, Chicago, Illinois. January 2013.

J. Broz, S. Eisner, B. George, G. Hunter, T. Lu, G. Robinson, A. Sheilds. "Decades of Pathogen Protection with Auxiliary High-Rate Treatment Technologies." Proceedings from the Water Environment Federation 86th Annual Technical Exhibition and Conference, Chicago, Illinois. January 2013.

T. Lu, B. George, M. Lodor; D. Metz, J. Parrott; G. Hunter, V. Kapoor, D. Wendell. "What is the right biomarker for water quality monitoring?." Water Environment & Technology, 25(10), pp 52-55. January 2013.

"Biological Nutrient Removal." Ohio WAter Environment Association, Southwest Section 12th Annual Plant Operations Seminar, Mason, Ohio. January 2013.

J. Hutchins, A. Kadava, J. Keller, C.R. O'Bryan. "Why Wet-Weather Treatment Facilities Are Special." Kansas Water Environment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2012.

"Current Trends in Wet-Weather Treatment." Illinois Association of Wastewater Agencies 88th Annual Conference, Normal, Illinois. January 2012.

T. Lu, A. Shaw, A. Kadava, S. Reed, D. Linn. "Using a Dynamic Process Model to Investigate Full-Scale Upgrades to Maximize Secondary Wet Weather Treatment Using Step-Feed." Water Environment Federation 85th Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2012.

D. Esping, B. Krill, D. Parker, J. Jimenez, F. Yang, T. Bate. "Comparison of Three Wet Weather Flow Treatment Alternatives to Increase Plant Capacity." Water Environment Federation 85th Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2012.

P.J. Bradley, C.R. Duchene, J. Gellner, C.R. O'Bryan, D. Ott, J. Sandino, C.W. Tabor, S. Tarallo. "Preparing for a Rainy Day - Overview of Treatment Technology Options for Wet-Weather Flow Management." Water Environment Federation 85th Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2012.

N.J. Tetrick, S. Sengupta, D. Martin, A. Gelderloos, A. Kadava, A.R. Shaw. "Accurate Wet-Weather Flow Characterization and Dynamic Modeling Help Optimize Treatment Designs and Operations." Proceedings from the Water Environment Federation 85th Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2012.

N. Tetrick. "Enhanced High-Rate Treatment for Your Wet Weather Program." Five Cities Plus Conference, Columbus, Ohio. January 2012.

S. DeWeese. "Preparing for a Rainy Day - Overview of Treatment Technology Options for Wet-Weather Flow Management." Missouri Water Environment Association 16th Annual Fall Technical Conference, Columbia, Missouri. January 2012.

H. Aoki, S. Koh, C. deBarbadillo, I. Midorikawa, M. Miyazaki, A. Omori, T. Shimizu. "Phosphorus Recovery witih New Ultra-Low Adsorption Process." Water Environment Federation and International Water Association Nutrient Recovery and Management Conference, Miami, Florida. January 2011.

D. Ott, J. Theerman. "What's on the Drawing Board for Wet Weather Management." Insight H2O Webcast, Black & Veatch. January 2011.

"A Case for Keeping High-Rate Auxiliary Treatment Facilities in the Secondary Treatment Picture." Central States Water Environment Association 16th Annual Education Seminar, Madison, Wisconsin. January 2011.

"Getting Wet-Weather Treatment Policies Up to Speed with State-of-the-Art Technologies." University of Kansas 61st Annual Environmental Engineering Conference, Lawrence, Kansas. January 2011.

S. Koh, P. Schauer, C. deBarbadillo, J. Barnard, J. Klamm. "Did You Say Prosperous Recovery or Phosphorus Recovery?." Kansas Water Environment Association & American Water Works Association Joint Annual Conference, Topeka, Kanasas. January 2011.

C. deBarbadillo, J. Barnard, S. Levesque. "Reaching New Lows - Proven and Emerging Strategies Merit Consideration as Utilities Strive to Achieve Ultralow Phosphorus Limits." Water Environment & Technology, 23(10), pp 52-55. January 2011.

T. WEaver, M. Boner, M. Anderson, C. O'Bryan, S. Tarallo. "Wet Weather Piloting Toward the Largest Compressible Media Filter on the Planet." Water Environment Federation 84th Annual Technical Exhibition and Conference, Los Angeles, California. January 2011.

A. Kadava, J. Schlaman, D. Gilpin, J. Hood. "Wet Weather Testing of Compressible Media Filtration in the Show-Me State." Missouri Water Environment Association & American Water Works Association Joiont Annual Conference, Osage Beach, MO. March 2010.

"Does Our Current Regulatory Framework Actually Support Proven Wet Weather Treatment Strategies?." New England Water Environment Association Annual Conference, Boston, Massachusetts. January 2010.

"Implementing Proven State-of-the-Art Wet Weather Treatment Stratetgies in the Face of Regulatory Uncertainty." 31st Annual Illinois Water Environment Association Annual Conference, East Peoria, Illinois. January 2010.

A. Kadava, J. Schlaman. "Wet-Weather Pilot Testing of Compressible Media Filtration for CSO Control." 54th Annual Great Plains Waste Management Conference, Omaha, Nebraska. January 2010.

"The Triple Squircle . . . Improving Mill Creek Wastewater Treatment Plant's Secondary Treatment Facilities." Ohio Water Environment Assocation Southwest Section Meeting, Cincinnati, Ohio. January 2010.

"Wet-Weather Flows." 91st Annual KDHE/KU Water & Wastewater Operators School, Lawrence, Kansas. January 2010.

T. Weaver. "Compressible Media Filtration and Your Triple Bottom Line." Five Cities Plus Conference, Cincinnati, Ohio. January 2010.

D. Ott, A. Shields, F. Andes. "Midwestern Perspectives on the Latest Wet-Weather Treatment Regulatory Issues, Panel Discussion." Kansas Water ENvironment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2010.

S. Koh, C. deBarbadillo, J. Klamm, H. Aoki, M. Miyazaki. "First U.S. Pilot of a New Adsorption Media for Phosphorus Removal and Recovery." Kansas Water Environment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2010.

S. Pekarek, D. Nolkemper, A. Kliewer, A. Kadava. "Wet Weather Piloting of High-Rate Filtration Technologies." Kansas Water Environment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2010.

"Case Study: High-Rate Clarification with Solids Recirculation and Ballasted Flocculation." Workshop 103, Water Environment Federation 83rd Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2010.

T. Kunetz, C. Wallis-Lage, M. Schiltz, T. Johnson, J. Barnard, C. deBarbadillo, A. Shaw, G. Shimp, K. Pagilla, D. Bunch. "Blue Sky Evaluations Produce Innovative Ideas for Future of Sustainable Wastewater Treatment." Proceedings from the Water Environment Federation 83rd Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2010.

H. Aoki, S. Koh, C. deBarbadillo, I. Midorikawa, M. Miyazaki, A. Omori, T. Shimizu. "First U.S. Pilot of a New Media for Phosphorus Removal and Recovery." Proceedings from the Water Environment Federation 83rd Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2010.

H. Andrews, A. Bahar, L. Jaworski, S. Tarallo, D. Wagner. "A Case for Keeping High-Rate Auxiliary Treatment Facilities in the Secondary Treatment Picture." Proceedings from the Water Environment Federation 83rd Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2010.

D. Gilpin, A. Kadava, A. Kliewer, S. Pekarek, J. Schlaman, S. Tarallo. "Wet Weather Pilot Studies Demonstrate Effectiveness of High-Rate Filtration Technologies." Proceedings from teh Water Environment Federation 83rd Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2010.

"Design of Municipal Wastewater Treatment Plants, 5th Edition reviewer." WEF, ASCE and EWRI. January 2010.

L. Jaworski, H. Andrews, D.M. Bond. "Wet Weather Excess Flow Management." NPDES States Meeting and Wet Weather Workshop, USEPA Region 7, Kansas City, Kansas. January 2009.

D.M. Bond. "Wet Weather Excess Flow Management." MDNR Wet Weather Advisory Group Meeting, Jefferson City, Missouri. January 2009.

"Wet Weather Treatment." 24th Annual NPDES States Meeting and CSO Training, USEPA Region 3, Gettysburg, Pennsylvania. January 2009.

"Successful Wet Weather Excess Flow Management." Kansas Wate rEnvironment Association & American Water Works Association Joint Annual Conference, Topeka, Kansas. January 2009.

"Wet Weather Design Issues." WEF Government Affairs Committee Wet Weather Workgroup Meeting, Orlando, Florida. January 2009.

H. Aoki, C. deBarbadillo, A. Kubota, A. Omori, I. Midorikawa, T. Shimizu. "Pilot Testing of a High Efficiency Adsorbent System for Phosphorus Removal and Recovery to Meet Ultra-Low Phosphorus Limits." Water Environment Federation Nutrient Removal Conference, Washington, D.C.. January 2009.

B. Hurley, C. Ellenberger, S. Benner, K. Blanton. "WERF/CRTC Testing Indicates that No New Clarifier Basins are Needed to Double Plant's Capacity." Water Environment Federation 82nd Annual Technical Exhibition and Conference, Orlando, Florida. January 2009.

C. deBarbadillo, H. Aoki, A. Kubota, A. Omori, I. Midorikawa, T. Shimizu. "Pilot Testing of a High Efficiency Adsorbent System for Phosphorus Removal and Recovery to Meet Ultra-Low Phosphorus Limits." Water Environment Federation 82nd Annual Technical Exhibition and Conference, Orlando, Florida. January 2009.

"High Rate Auxiliary Wet-Weather Treatment Technologies." Exploring New Technologies and Approaches for Wet Weather In-Plant Management, Web Seminar, Water Environment Research Foundation. January 2009.

M. Long. "Stepping Up to the Challenge of Secondary Effluent Limits During Wet Weather." California Water Environment Association 80th Annual Conference, Sacramento, California. January 2008.

P. Scanlan, J. Klamm. "Plant Desigin for System Flexibility - Minimizing Process Modification Requirements in a Changing Biosolids Environment." Water Environment Federation Residuals and Biosolids Conference, Philadelphia, Pennsylvania. January 2008.

P. Scanlan, J. Klamm. "Stop a Moving Target - Minimizing Process Modification Requirements in a Changing Biosolids Environment." Biosolids Technical Bulletin, Water Environment Federation. January 2008.

M. Long, D. Wagner, C. Middlebrough. "Meeting Secondary Effluent Standards at Peaking Factors of Five and Higher." Water Environment Federation 81st Annual Technical Exhibition and Conference, Chicago, Illinois. January 2008.

G. Hunter, H. Phillps, B. Williamson. "Wet Weather Disinfection Along the Muddy Missouri . . . Piloting for Success." Water Environment Federation Disinfection Specialty Conference, Pittsburgh, Pennsylvania. January 2007.

"Compliance by the Numbers . . . UV Disiinfection . . . Ammonia & Total Nitrogen." City of St. Joseph 3rd Annual Industrial Wastewater Summit, St. Joseph, Missouri. January 2007.

"CSO Control Case Study - Bay View Wastewater Treatment Plant." USEPA/ORSANCO Wet Weather Workshop, Florence, Kentucky. January 2007.

J.L. Barnard, J. White, M.T. Steichen. "How Important is the EDI in Final Clarifiers." Water Environment Federation 80th Annual Technical Exhibition and Conference, San Diego, California. January 2007.

"Clarifying Secondary Effluent Limits During Wet Weather . . . A Tale of Two Cities." Missouri Water Environment Association Plant Manager's Workshop, Columbia, Missouri. January 2007.

M. Steichen, C. Wallis-Lage, M. Francucci. "Wet Weather Treatment: Do we have any choices?." New England Water Environment Association Annual Conference, Boston, Massachusetts. January 2006.

G. Hunter. "What's on the Horizon? Will it Affect Industry?." Missouri Water Environment Association & Missouri Section American Water Works Association Joint Annual Meeting, Osage Beach, Missouri. January 2006.

E. Kobylinski, D. Nolkemper. "Wet Weather Treatment: Do We Have Any Choices?." Kansas Water Environment Association 61st Annual Conference, Topeka, Kansas. January 2006.

E. Kobylinski, G. Hunter. "Lost in the FOG?." Water Environment & Technology, 18(9), pp 101-104. January 2006.

"Sewage Treatment . . . What's There to Worry About?." City of St. Joseph 2nd Annual Industrial Wastewater Summit, St. Joseph, Missouri. January 2006.

B. Sabherwal, G. Hunter, A. Srirama, B. Williamson. "Disiinfection Along the Muddy Mo . . . What Evil Lurks in These Waters?." Water Environment Federation 79th Annual Technical Exhibition and Conference, Dallas, Texas. January 2006.

G. Hunter, E. Kobylinski. "UV Disinfection & Industrial Pretreatment: A Marriage Made in Heaven?." Kansas Water Environment Association 60th Annual Conference, Topeka, Kansas. January 2005.

C. Wallis-Lage, A. Bhandari, M. Palomo. "Ballasted Flocculation - Surfactants and Effluent Foaming Potential." Water Environment Federation 78th Annual Technical Exhibition and Conference, Washington, D.C.. January 2005.

C. Wallis-Lage, A. Bhandari, M. Palomo. "Bubble Trouble." Water Environment & Technology, 17(12), pp 58-63. January 2005.

C. Wallis-Lage. "Ballasted Flocculation for Excess Flow Treatment: Full-Scale and Pilot-Scale Demonstrations." 76th Annual California Water Environment Association Conference, Fresno, California. January 2004.

D. Nitz, T. Lyon. "Wet Weather Treatment Pilot Testing: High Rate

Clarification and UV Disinfection in a Cold Climate." Water Environment Federation 77th Annual Technical Exhibition and Conference, New Orleans, Louisiana. January 2004.

"Las Vegas Wash Wetlands Model." Clean Water Coalition - Stakeholder Workshop, Henderson, Nevada. January 2002.

G. Pulliam. "Proposed Metal Products & Machinery Rule - Implications for POTWs and Industry." Joint Industrial User Group Meeting, EPA Region 7, Kansas City, Kansas. January 2002.

"A Pilot Plant Study of Activated Sludge Wastewater Treatment in Tropical Third World Countries." Master of Engineering Thesis, University of Louisville, Louisville, Kentucky. January 1993.

Mark W. Miller, PhD, PE

Experience Summary

Mark Miller is a Process Engineer, with 10 years of experience, who has been involved with numerous Water Environment Research Foundation projects including evaluation of nutrient removal technologies meeting stringent discharge limits, development of a mainstream deammonification pilot process, and carbon capture from wastewater for energy production. His technical expertise includes biological nitrogen and phosphorus removal, high-rate activated sludge processes, full-plant modeling, and instrumentation, control, and automation of water resource recovery facilities.

McAlpine Wastewater Management Facility Reliability and Process Improvements, CLT Water, Charlotte, North Carolina

Process Engineer. Contributed to the design of a demonstration scale return activated sludge fermentation process and advanced aeration controls within the existing aeration basins. Mark will be conducting the process modeling and optimization of the demonstration study and the whole plant. His duties will include laboratory tests, data collection and evaluation, and collaboration with the design build team, client, and owner's advisor.

Assignment

Process Engineer

Education

Ph.D., Civil Engineering, Virginia Polytechnic Institute and State University, 2015

M.S., Civil Engineering, Virginia Polytechnic Institute and State University, 2011

B.S., Civil Engineering, Virginia Military Institute, 2009

Registration

Professional Engineer, No. 045265, North Carolina

Experience

10 years

Joined Firm

2015

Relevant Expertise

- *Nitrification-denitrification*
- *Process simulation modeling*
- *High-rate activated sludge processes*
- *Mainstream shortcut nitrogen removal processes*
- *Innovative wastewater treatment technologies*
- *Carbon management and energy neutrality*

Metro Water Services Central WWTP Upgrades, Nashville, Tennessee

Process Engineer. Conducted process modeling and process evaluation for the upgrades of a 125 MGD CSO facility. Upgrades include a new headworks, modifications to the existing primary and secondary clarifiers, and converting draft tube aeration to fine-pore diffused aeration in deep tanks. Mark utilized biological process modeling and 2D and 3D computation fluid dynamics modeling to optimize the process design which includes the addition of an anaerobic selector, ammonia-based aeration control, degassing zone for supersaturated gases, and a classifying selector for foaming and settling control.

Big Creek Expansion, Fulton County, Georgia

Process Engineer. Assisted with the evaluation of process alternatives to convert the existing conventional activated sludge plant to a 38 MGD membrane bioreactor facility with enhanced biological nutrient removal. Upgrades will include converting the existing secondary clarifiers to equalization basins, constructing a new ENR/MBR facility, solids digesters, and post aeration. Mark utilized biological process modeling to develop the process configuration and to evaluate ammonia-based aeration control that will be utilized.

Mallard Creek and Back Creek Basin Study, Charlotte Water, Charlotte, North Carolina

Process Engineer. Performed the evaluation of treatment process capacity requirements and process alternative development for this basin study effort. This project involved developing a plan for ensuring adequate conveyance and treatment capacity for the growing area. The study included population and flow projections, assessment of potential regulatory changes, evaluation of conveyance capacity, assessment of reuse potential, evaluation of treatment capacity, and the development of a capital improvement plan.

Big Coppitt WWTP Expansion Pre-design, Florida Keys Aqueduct Authority, Big Coppitt, Florida

Process Engineer. Developed influent flow and load projections and assisted

with major equipment selection and preliminary sizing for the planned expansion of the Big Coppitt WWTP.

Sawgrass WWTP Improvements, City of Sunrise, Florida

Process Engineer. Conducted simulation modeling of the 20-mgd activated sludge plant to develop alternative options to convert existing surge tanks into activated sludge capacity and replace the aging fine-bubble diffused aeration system. The project included a preliminary investigation and facility assessment to establish the capacity and efficiency of the of the proposed plant improvements. The assessment also defined the nature of the facility operating and design criteria to govern the subsequent design of the proposed improvements.

Sawgrass WWTP Improvements, City of Sunrise, Florida

Process Engineer. Conducted process simulation modeling of the 20-MGD activated sludge plant to develop alternative options to convert existing surge tanks into activated sludge capacity and replace the aging fine-bubble diffused aeration system. The project included a preliminary investigation and facility assessment to establish the capacity and efficiency of the proposed plant improvements. The assessment also defined the nature of the facility operating and design criteria to govern the subsequent design of the proposed improvements. The subsequent design includes detailed wastewater characterization to develop a calibrated process model and process design to upgrade the facility. Upgrades will include converting the existing process from nitrifying activated sludge to biological phosphorus removal with ammonia-based aeration control.

Regional Wet Weather Management Plan, Hampton Roads Sanitation District, Virginia Beach, Virginia

Process Engineer. Conducted process evaluation to determine the wet-weather capacity of the District's Williamsburg WWTP.

Salisbury WWTP BNR/ENR Upgrades, Salisbury, Maryland

Process Engineer. Developed the seeding and startup plan for the 4-stage Bardenpho enhanced nitrogen removal process. Also developed several process control plans for the new facilities including the primary clarifiers, biological process, filtration, disinfection, and other ancillary processes. He continues to provide process support to assist with optimization of current operations and maintain permit compliance during construction.

Automation and Energy MP Phase II, Orange County Utilities Dept., Orlando, Florida

Process Engineer. Assisted in the development of an Automation and Energy Savings Master Plan for OCU's Water Reclamation Facilities. The objective was to identify opportunities to reduce operating costs with a focus on labor and energy. This included energy and process data analysis, process modeling, and providing automation and control recommendations.

WERF Source Separation, Hampton Roads Sanitation District, Virginia Beach, Virginia

Process Engineer. The Water Environment and Research Foundation (WERF), as part of the EPA's National Center for Resource Recovery and Nutrient Management (EPA-G2012-STAR-H1) grant, awarded a research project (STAR_N1R14) to complete the following activities: (i) provide design and permitting guidelines to address practical issues related to the implementation of urine separation and collection systems in a high occupancy building; (ii) understand how urine pretreatments (e.g., storage, precipitation) impact pharmaceutical and biological contaminant concentrations; (iii) compare the efficacy of using natural urine and urine derived product (e.g., struvite) as agricultural fertilizers; and (iv) evaluate the fate of nutrients, pharmaceuticals and biological contaminants once urine products are land applied. Dr. Miller provided a review of resource recovery technologies to address nitrogen removal from source separated urine.

Special Projects, Hampton Roads Sanitation District, Virginia Beach, Virginia

Lead Graduate Researcher (Ph.D.): Dr. Miller led the pilot-scale investigation of mainstream deammonification where he developed innovative process control strategies aimed at managing carbon capture and removal from high-rate activated sludge processes. In addition, he mentored several graduate students from the Old Dominion University and Virginia Tech on their thesis research.

WERF/WEF Study Quantifying Nutrient Removal Technology Performance

Graduate Researcher (M.S.): This unique joint effort of the Water Research Foundation and the Water Environment Federation surveyed the best performing nutrient removal plants in the US (22 plants), using both the plant data, design data and operating schemes to identify the LOT (Limit of Technology) for conventional nutrient removal technologies. LOT has previously loosely been described as meeting a TN of 3.0 mg/L or a TP of 0.1 mg/L without specifying any averaging period. Results from the investigation impacted the wastewater industry broadly, in terms of establishing technology rankings, guidance for features or operating schemes that enhance reliability, and the appropriate use of performance statistics in permit writing.

Memberships

Water Environment Federation, Member

International Water Association, Member

WWRmod 2018 Scientific Committee

WEF Nutrient Removal and Recovery 2018 Steering Committee

WEF MEGA Sub-committee

WEF MRRDC Committee

WEF Plant Operations and Maintenance Program Committee

LIFT technology reviewer

WS&T Reviewer

International Journal of Water and Wastewater Treatment Reviewer

Publications / Presentations

1. **Miller, M.W.,** Elliott, M., DeArmond, J., Kinyua, M., Wett, B., Sudhir, M., and Bott, C.B. (2017) Controlling the COD removal of an A-stage pilot study with instrumentation and automatic process control. *Water Science & Technology*, 75(10).
2. Kinyua, M., **Miller, M.W.**, Wett, B., Murthy, S., Chandran, K., and Bott, C.B. (2017) Polyhydroxyalkanoates, triacylglycerides and glycogen in a high rate activated sludge A-stage system. *Chemical Engineering Journal,* 316, 350-360.
3. **Miller, M.W.**, Jimenez, J., Murthy, S., Wett, B., and Bott, C.B. (2016) Controlling organic carbon removal of a highly-loaded activated sludge process. *Proceedings of the 89th Annual Water Environment Federation Technical Exposition and Conference*, New Orleans, Louisiana, September 24-28, 2016.
4. **Miller, M.W.**, DeArmond, J., Elliott, M., Kinyua, M., Kinnear, D., Wett, B., Murthy, S., and Bott, C.B. (2016) Settling and dewatering characteristics of an A-stage activated sludge process proceeded by shortcut biological nitrogen removal. *International Journal of Water and Wastewater Treatment,* 2(5).
5. Nogaj, T., Randall, A., Jimenez, J., Takács, I., Bott, C.B., **Miller, M.W.**, Murthy, S., and Wett, B. (2015) Modeling of organic substrate transformation in the high-rate activated sludge process. *Water Science & Technology*, 71(7), 971-979.
6. Regmi, P., Holgate, B. Fredericks, **Miller, M.W.**, Wett, B., Murthy, S., and Bott, C.B. (2015) Optimization of a mainstream nitritation-denitritation process and anammox polishing. *Water Science & Technology,* 72(4), 632-642.
7. Regmi, P., Bunce, R., **Miller, M.W.**, Park, H., Chandran, K., Wett, B., Murthy, S., and Bott, C.B. (2015) Ammonia-based intermittent aeration control optimized for efficient nitrogen removal. *Biotechnology and Bioengineering,* doi: 10.1002/bit.25611.
8. Regmi, P., Holgate, B., **Miller, M.W.**, Park, H., Chandran, K., Wett, B., Murthy, S., and Bott, C.B. (2015) Nitrogen polishing in a fully anoxic anammox MBBR treating mainstream nitritation-denitritation effluent. *Biotechnology and Bioengineering,* doi: 10.1002/bit.25826.
9. **Miller, M.W.**, Elliott, M., Jimenez, J., Wett, B., Murthy, S., and Bott, C.B. (2015) Adsorption-style high-rate activated sludge for carbon management and diversion. *Proceedings of the 88th Annual Water Environment Federation Technical Exposition and Conference*, Chicago, Illinois, September 26-30, 2015.
10. **Miller, M.W.**, Regmi, P., Wett, B., Murthy, S., and Bott, C.B. (2015) Combining high-rate activated sludge and shortcut nitrogen removal for efficient carbon and energy utilization. *Proceedings of the WEF Water and Energy Conference,* Washington DC, June 7-10, 2015.
11. Regmi, P., **Miller, M.W.**, Holgate, B., Bunce, R., Park, H., Chandran, K., Wett, B., Murthy, S., and Bott, C.B. (2014) Control of aeration, aerobic SRT and COD input for mainstream nitritation/denitritation, *Water Research*, doi: 10.1016/j.watres.2014.03.035.

12. Miller, M.W., Regmi, P., Jimenez, J., Murthy, S., Wett, B., and Bott, C.B. (2014) Optimizing adsorption-style high rate activated sludge for BNR and energy recovery. *Proceedings of the IWA Specialist Conference Global Challenges: Sustainable Wastewater Treatment and Resource Recovery,* Kathmandu, Nepal, October 26-30, 2014.
13. **Miller, M.W**., Regmi, P., Wett, B., Murthy, S., and Bott, C.B. (2014) On-line sensors for the control and optimization of an adsorption-style HRAS pilot study. *Proceedings of the IWA World Water Congress & Exhibition,* Lisbon, Portugal, September 21-26, 2014.
14. **Miller, M.W.**, Jimenez, J., Murthy, S., Kinnear, D., Wett, B., and Bott, C.B. (2013) Mechanisms of COD removal in the adsorption stage of the A/B process. *Proceedings of the 86th Annual Water Environment Federation Technical Exposition and Conference*, Chicago, Illinois, October 5-9, 2013.
15. **Miller, M.W.**, Bunce, R., Regmi, P., Hingley, D.M., Kinnear, D., Murthy, S., Wett, B., and Bott, C.B. (2012) A/B process pilot optimized for nitrite shunt: high rate carbon removal followed by BNR with ammonia-based cyclic aeration control. *Proceedings of the 85th Annual Water Environment Federation Technical Exposition and Conference*, New Orleans, Louisiana, September 29-October 3, 2012.
16. Bott, C.B., Parker, D.S., Jimenez, J., **Miller, M.W.**, and Neethling, J.B. (2012) WEF/WERF study of BNR plants achieving very low N and P limits: evaluation of technology performance and process reliability, *Water Science & Technology*, doi: 10.2166/wst.2012.949.
17. Bott, C.B., Parker, D.S., Jimenez, J., and **Miller, M.W.** (2010) WEF/WERF study quantifying nutrient removal technology performance, *Water Environment Research Foundation*, WERF Report NUTRIR06h.

Experience Summary

John L. Willis has over 30 years of professional experience passionately attacking inefficiency and waste and developing innovative solutions for municipal utilities. He has served as principal investigator for WERF's Barriers to Energy Efficiency, Barriers to Biogas Use, WaterWatts, Conveyance Asset Prediction System, and Undocumented Sources of Methane from Wastewater Treatment and Conveyance research; and EPA's Evaluation of CHP Technologies for Wastewater Treatment Facilities. His ground-breaking biosolids work includes the USA's first Class-A thermophilic anaerobic digestion facilities at OWASA's Mason Farm WWTP; the CBFT^3 Class-A digestion and renewable power demonstration project for Columbus Water Works; St. Petersburg's Class-A digestion and biogas-to-vehicle-fuel upgrades; thermal hydrolysis/digestion/gas-use projects for DC Water, HRSD, Raleigh, SFPUC, and WSSC; and life-cycle GHG lead for WRF's HYPOWERS hydrothermal liquefaction demonstration. He is currently Chair of WEF's Residuals and Biosolids Committee and a member of the Water Research Foundation's (WRF) Research Advisory Committee. He completed his Ph.D. on wastewater-treatment and -conveyance greenhouse gas emissions at The University of Queensland's Advanced Water Management Center in 2017.

Education

Ph.D., Chemical Engineering, The University of Queensland, 2017

M.S., Environmental Engineering, Duke University, 1990

B.S.E., Electrical Engineering, Duke University, 1988

Registration

Professional Engineer 21097, Georgia, 1994

Professional Engineer 20322, North Carolina, 1994

Professional Engineer 20750, Kentucky, 1999

Professional Engineer 34347, Virginia, 2000

Professional Engineer 26201, Maryland, 2001

Professional Engineer PE900388, District of Columbia, 2001

Professional Engineer 64297, Florida, 2006

Professional Engineer 094208, New York, 2014

American Academy of Environmental Engineers: BCEE, 2004

Experience

29 years

Joined Firm

1990

Relevant Expertise

- *Wastewater Treatment Design*
- *Energy Conservation and Renewable Energy Production*
- *Biosolids Management*

Biosolids

HYPOWERS– Water Environment Research Foundation (WRF) – Genifuel Hydrothermal Liquefaction Demonstration

Technical Lead. BC participated in a WRF-led project as part of a consortium on a Department of Energy (DOE) / California Energy Commission (CEC) funded demonstration of Genifuel's hydrothermal liquefaction and catalytic hydrothermal gasification processes at Central Contra Costa (CA). The process converts dewatered sludge into biological/renewable crude oil and renewable natural gas (rNG). BC was responsible for documenting the life-cycle greenhouse gas (GHG) emissions for the products (rNG and renewable diesel and naptha or "jet fuel"). New templates were created in CA-GREET 3.0 for each fuel's low-carbon-fuel-standard (LCFS in CA) "score" and renewable indication number (RIN) quality (likely D3). BC then negotiated these pathways with California Air Resource Board (CARB) and USEPA, respectively.

Solids Handling Master Plan – Metropolitan Sewer District of Greater Cincinnati (MSD) – Solids Master Plan

Technical Lead. BC developed comprehensive scenarios for handling all of MSD solids produced at 7 facilities ranging in size from ~1 to ~100mgd average treated flows. Operating, capital, and present-worth costs for over 40 options were developed including a "universe" of technologies (that included fluid-bed incineration (FBI), 4 thickening and 3 dewatering options, 5 digestion processes, combined heat and power (CHP), biogas to rCNG vehicle fuel, and consolidated solids-treatment) with emphasis on lowering costs and reducing odors. The recommend solution includes features to optimize the Mill Creek FBIs and regional, Class-A, advanced digestion with gas-upgrading to vehicle fuel at Little Miami for the solids generated at two or three other WRRFs.

Biosolids Management – Hillsborough County, FL – Business Case Evaluation (BCE)

Technical Lead. BC developed 5 comprehensive scenarios for replacement/ upgrading the moth-balled dryer and aging thickening, dewatering, and storage equipment and tankage at the County's Northwest Biosolids Handling Facility (BMF). Options included combinations of: A) Thermal hydrolysis + digestion; B) Class-A (with EPA time-and-temperature batch tanks) temperature-phased digestion ("TPAD"; thermophilic followed by mesophilic digestion); C) Biogas-

and/or natural-gas-fueled combined heat and power (CHP) using an already under construction, 7MW combustion turbine; and D) Biogas upgrading to rNG for vehicle fuel use. The evaluation showed that Class-A TPAD and production of rNG vehicle fuel would pay for the nominally $25-million in additional capital and return an additional $10-million over a 20-year present worth.

Lulu Island Pilot Digestion Optimization Study – Metro Vancouver, Richmond, British Columbia

Technical Reviewer and Resource. BC developed predesign and detailed design for a pilot-scale digestion facility at the Lulu Island WWTP. The pilot facility will accommodate testing of emerging technologies that have high potential, but limited information as to their actual full-scale performance. By using a pilot-scale facility, the Metro Vancouver will be able to: Evaluate process operations on specific sludges; Run a new-process "incubator" for staff training, testing operational controls and regimes; and develop design metrics for full-scale implementation. The detailed design is being finalized in 2019 with process tie-in plans and operational guidelines for construction soon after.

Bioenergy Facilities – Washington Suburban Sanitary Commission (WSSC) – Gas-Use Evaluation and Progressive Design Build Program Management/Review

Technical Lead. Evaluated options for meeting steam demand for thermal-hydrolysis at WSSC's Regional Bioenergy Facilities at the Piscataway WRRF as part of a Program Management Contract (with BC as a subconsultant to HDR). The resulting technology included natural-gas-fueled engines for power, steam and hot water production; composite boilers; water-solvent gas upgrading; with rNG pipeline injection for conveyance to bus fleet fuel. Personally assisted in/guided negotiations with the USEPA; Washington Gas (developing their first-ever rNG-injection "special contract" at attractive, site-specific rates); Montgomery-County Transit for sale/use of rNG to fuel their bus fleet; and other necessary 3rd-party contracts.

Hunts Point Digester Replacement, New York City Department of Environmental Protection (DEP) – Alternatives Evaluation

Technical Lead for Alternatives Evaluation. As the first step in DEP's design process, facility planning is intended to "identify all feasible alternatives and conduct a comprehensive evaluation and ranking of each alternative". BC's alternatives evaluation for the Hunts Point digestion upgrade design included three workshops and multiple intermediary meetings. An initial set of 26 options was developed; each with a SWEET mass and energy balance linked to a calibrated-to-DEP-cost, present-worth economic model. Review of the first iteration led to consolidation, leveraged hybridization, and development of another 23 options. The results justified addition of enhanced thickening in the scope; state-of-good-repair projects for both processes could be done for considerably less capital cost than digestion improvements alone. The effort also informed DEP of the costs and benefits of various food waste receiving and gas-use options. Because of the City's GHG reduction goals, an annual GHG emissions estimate was developed for each of the 49 options.

Solids-Water-Energy Evaluation Tool (SWEET) Development and Re-Invention of Solids Master-Planning, Brown and Caldwell

Technical Lead. John led the development of BC's re-invigorated approach to biosolids and energy master-planning. Conventional (predominantly solids) master plans have resulted in soft recommendations for very large capital expenditures without clear identification of the resulting benefits; these plans often "sit on the shelf" as they fail to motivate implementation. John developed an approach, and the SWET tool to enable cost-effective development of many options, that allows options to be optimized and results in recommended solutions that can save 15-25% off a program's 20-year present worth. Key approach fundamentals include: 1) calibration of a baseline mass and energy balance that is also calibrated to the utility's actual annual costs; 2) iterative development, evaluation, and optimization of options (often 30 to 50 options) in at least three workshops; 3) possible inclusion of triple-bottom-line (TBL) metrics; and 3) "live" testing of recommended solutions and their sensitivities to assumed unit-cost and TBL valuations. The results create broad consensus on the developed option; save considerable costs; and provide recommendations with readily quantified and understood benefits – often accelerating these normally "discretionary"/non-core-business projects.

Neuse River Resource Recovery Facility (NRRRF) Bioenergy Recovery Program – Preliminary Design, City of Raleigh Public Utilities Department (CORPUD), Raleigh, NC

Project Technical Lead. BC has one of two design contracts for the CORPUD's Bioenergy Recovery Program, and is responsible for primary sludge degritting; GBT upgrades; sludge blending; centrifuge pre-dewatering;

pre-dewatered cake storage and loadout; thermal hydrolysis; and anaerobic digestion; and odor control associated with these facilities. BC is working closely with Hazen who holds the other design contract and is responsible for post-dewatering and sidestream treatment; Black & Veatch is responsible for biogas use as a sub to Hazen.

Digester Operational Review for Tallman Island and Hunts Point WPCPs, New York City Department of Environmental Protection (DEP), New York, NY

Technical Lead. An initial investigation was performed at the Tallman Island Water Pollution Control Plant (WPCP) to assess causes and potential mitigating options for catastrophic digester cover failures of recently-commissioned digester improvements. Failures were attributed to accumulation of low-specific-gravity material on the digester surface and/or sudden-volume-expansion. DEP was pleased with the results and recommendations of the Tallman Island investigation and requested a similar investigation at the Hunts Point WPCP. Both efforts were completed on time, within budget, and to the satisfaction of DEP staff.

Energy Recovery from Biosolids and Class-A TPAD Detailed Design, City of St. Petersburg, FL

Project Manager. BC was selected through a competitive process to develop the detailed design from the Energy Recovery from Biosolids and Yard Waste Feasibility Study. The project was further enhanced to include a digester-gas-to-renewable-compressed-natural gas (rCNG) vehicle fuel for use in the City's sanitation truck fleet. BC is responsible for design of new primary treatment, contact stabilization improvements to increased liquid treatment peak capacity, replacement digesters to operate in a TPAD mode, Class-A batch tanks, centralized odor control, FOG receiving, and the digester gas upgrading system to remove carbon dioxide and all traditional contaminates. The project is now being implemented as Construction Manager at Risk delivery method. Three other consultants are designing the 1) thickening upgrades; 2) a new dewatering building; 3) engines and a new plant 12kV distribution system.

Class-A Digestion Detailed Design, City of Savannah, GA

Technical Advisor/Reviewer. BC is currently developing a detailed design to upgrade thickening and implement a Class-A temperature-phased digestion design to replace the aging multiple hearth incinerators.

San Francisco Biosolids Digester Facilities Project, San Francisco Public Utilities Commission, San Francisco, CA

Expert Reviewer. Provided technical review of the following draft Technical Memoranda: 1) Biogas Incentive Potential and 2) Initial Screening of Biogas End Use and Energy Recovery Alternatives for the solids upgrade program at the Southeast Water Pollution Control Plant.

Atlantic WWTP Cambi Upgrades - Detailed Design, Hampton Roads Sanitation District (HRSD), Hampton Roads, VA

Technical Lead for FOG and Technical Reviewer. As a sub-consultant to HDR, BC is responsible for preliminary and detailed design of the thermal hydrolysis (Cambi) process, anaerobic digestion, heating and cooling, and FOG-receiving aspects of upgrades at HRSD's largest WWTP: the 54-mgd Atlantic WWTP.

Barriers to Energy Conservation, WERF, Alexandria, VA

Principal Investigator. As a follow-on project with linkage to Barriers to Biogas Use, this project sought to determine the factors that impede adaptation of energy efficiency improvements for wastewater utilities. Tasks include an electronic survey of utility staff, four focus groups to solicit/collect first-hand input, a thorough review of all plants' electrical profile in the State of NY, a comparison of efficiency incentives and program in three states with varying degrees of regulatory and incentivizing practices to encouraging enhancements, among other tasks.

Energy Recovery from Biosolids - Detailed Design, City of St. Petersburg, FL

Project Manager. BC was selected through a competitive process to develop the detailed design from the Energy Recovery from Biosolids and Yard Waste Feasibility Study. The project was further enhanced to include a digester-gas-to-renewable-compressed-natural gas (rCNG) vehicle fuel for use in the City's sanitation truck fleet. John was the primary architect of the design scope that included new primary treatment, contact stabilization improvements to increased liquid treatment peak capacity, replacement digesters to operate in a TPAD mode, Class-A batch tanks, centralized odor control, FOG receiving, and the digester gas upgrading

system to remove carbon dioxide and all traditional contaminates. The project is now being implemented as Construction Manager at Risk delivery method. Three other consultants are designing the 1) thickening upgrades; 2) a new dewatering building; 3) engines and a new plant 12kV distribution system.

Energy Program, Metropolitan Government of Nashville and Davidson County, Tennessee

Expert Guidance. Provided senior guidance for a project that assessed opportunities for Nashville Metro to save energy and leverage renewable resources produced by three major WWTPs and landfill assets. Options considered and recommended included CHP, vehicle fuel production, Class-A temperature-phased digestion, diagnoses of water plant residuals impact on Central WWTP solids processing effectiveness, and leveraging imported digester feedstocks, among other options.

Acoustic Doppler Digester Diagnostics and Mainline Anaerobic Treatment, WERF, Alexandria, VA

Co-Principal Investigator. BC was selected by WERF to investigate two innovative approaches. The first uses an acoustic Doppler meter to measure 3-dimensional velocity gradients within an active digester. To our knowledge this would be first source of primary data as to the actual effectiveness of various mixing systems. Additionally, it is envisioned that this approach could be used to detect areas of zero velocity and suggest when digester cleaning is needed without removing a digester from service. As a second task, BC is working with the University of Queensland to investigate the effectiveness of UASBs for mainstream anaerobic treatment of domestic wastewater.

Biosolids Planning Effort, Metropolitan Council Environmental Services, MCES, Minneapolis and St. Paul, MN

Visioning Panel Expert. Served as a member of a three-expert team in a quality assurance/quality control role for solids, energy, and resource recovery planning at MCES' seven WWTPs (currently treating 240 mgd). Effort included development of a sustainable vision for the Council's future facility needs. Specific technologies included various form of incineration, advanced digestion, and drying.

Hartford WPCF Solids Design Projects, Metropolitan District (MDC) Hartford, CT.

Technical Advisor. The 80-mgd Hartford WPCF currently treats its own primary and secondary solids and approximately 50 percent additional solids imported from other plants using DAFT and gravity thickening, centrifuge dewatering and multiple hearth incineration. The MHIs have recently been retrofit to produce 1.5MW of renewable power using a waste-heat boiler and steam turbine. BC's ongoing projects will add solids processing capacity and further optimize the overall performance. As an initial task, BC used the Solids-Water-Energy Tool (SWET) to identify opportunities for system-wide performance optimization.

Energy Recovery from Biosolids and Yard Waste Feasibility Study, City of St. Petersburg, FL

Technical Lead. Used a business case evaluation format to evaluate the feasibility to derive renewable energy from sludge generated at the City's four WWTPs and collected yard waste. Brown and Caldwell's Solids-Water-Energy Tool (SWET) to develop solids/energy balances and present worth analyses for over 30 options. Technologies considered included Class-A and phased anaerobic digestion, gasification, fluid bed incineration, screw-press dewatering, generation of electricity using either reciprocating engines or steam turbines, solar drying, and sewer conveyance of WAS to consolidate treatment at one of four, nominally 20-mgd WRFs. The recommended solution included Phase-1 project to convey WAS from the northern WRFs to the SWWRF for consolidated treatment. The digestion process at the SWWRF would be upgraded to a Class-A TPAD process and the digester gas used to fuel an engine and produce 1 to 1.4MW of power. Phase-2 would be deferred until such time as the recommended technology was better proven: gasification of yard waste solids (and possibly biosolids) to fuel syngas-fueled internal combustion engine(s) for added power production. The Phase-1 improvements are projected to save the City $30 million over the next 20 years.

Biogas Use Alternative Evaluation, Orange Water and Sewer Authority (OWASA), Chapel Hill, NC

Project Manager. Performed a business case evaluation to determine the best use of OWASA's currently flared digester gas. The effort was supported by use of BC's Solids-Water-Energy Tool (SWET) to develop present worth analyses and solids/energy balances for 21 options with various combinations of reciprocating engines, microturbines, cell lysing technologies, FOG and food waste receiving, and conversion of biogas to a renewable compressed natural gas for vehicle fuel. The recommended project would save $480,000 of the utility's $580,000 annual operating cost for solids and recycle processing.

Barrier to Biogas Research, WERF, Alexandria, VA

Principal Investigator. This effort used an online survey and four separate focus groups in Miami, New York City, Sacramento, and Chicago to investigate the barriers that inhibit wastewater utilities from using digester gas that is currently wasted/flared and success stories where other utilities have overcome similar barriers. A key finding of this research was the importance of properly valuing the long-term benefits of biogas utilization projects in order to support credible "go" decisions.

Biosolids and Odor Control Master Plan, City of Savannah, GA

Expert Technical Resource. The City of Savannah's 26-mgd President Street WWTP currently uses 40-year-old multiple hearth incinerators (MHIs) for solids disposal. This master plan evaluated long-term options in light of the EPA's revised MACT emissions standards that would likely curtail the useful life of the existing MHIs. Options considered included continuation with multiple hearth incineration, fluid bed incineration, conventional and Class-A anaerobic digestion, and heat drying as well as various thickening, dewatering, and green power technologies and beneficial reuse/disposal options. The master plan also considered plant-wide odor

Biosolids Program Management, District of Columbia Water and Sewer Authority, Washington, D.C.

Senior Technical Resource. Participated in the development of the Biosolids Program to implement Cambi/Anaerobic digestion/CHP improvements to replace the aging lime-stabilization system at the 370-mgd Blue Plains AWTP. Principal focus included procuring a design-build-operate combustion turbine installation with gas treatment and steam production for Cambi. The system included five ultra-high-efficiency Solar Mercury 50 combustion turbines, a steam turbine for supplemental power generation, HRSGs for steam production, duct burners for production of additional heat when needed, back-up boilers in case of turbine failure, and flexibility to operate on either digester or natural gas fuel. Also led the development of DCWASA's utility-wide greenhouse gas inventory and subsequent audit and certification of that inventory with the Climate Registry. Determined that the upgrades would reduce DCWASA's "carbon footprint" by 73,000 MT of CO_2e/yr or 38 percent.

Technology Evaluation for Digester-Gas-Fueled Combined Heat and Power (CHP), United Stated Environmental Protection Agency (US EPA), Washington, D.C.

Principal Investigator. Secured a sole-source grant from US EPA to author a Technology Evaluation for Digester-Gas-Fueled CHP. This manual provides guidance to utility management and engineers considering options for beneficial use of anaerobic digester gas. Combustion turbines, reciprocating engines, microturbines, fuel cells, cleaning to pipeline-quality natural gas quality, and other technologies are discussed in detail. The document provides guidance in the context of emissions requirements, capital and operating costs, electrical and thermal efficiencies, gas cleaning requirements, and operational track record.

Wastewater Treatment Plant Design and Operation Modifications to Improve Management of Biosolids Odors and Sudden Increases in Indicator Organisms, Water Environment Research Foundation (WERF), Alexandria, Virginia

Technical Advisor. This project, led by Bucknell and Virginia Tech researchers, investigated mechanisms for sudden increases in indicator organism densities and odors in anaerobically digested biosolids. Mr. Willis's support for this project centered on review and understanding of bacterial sudden increase phenomenon and identification of possible mitigating techniques

Developing Better Indicators for Pathogen Presence in Sewage Sludges, Water Environment Research Foundation (WERF), Alexandria, Virginia

Technical Advisor. Part of a team led by Texas A&M and US EPA researchers to identify pathogen and potential surrogate indicator densities in raw and digested sludges from various parts of the country. Project identified and determined inactivation levels for potential surrogates using thermophilic anaerobic digestion that represent complete inactivation of pathogenic strains found in raw sludge feedstocks.

Biosolids Master Plan and Technology Evaluation, Reedy Creek Improvement District, Orlando, Florida

Technical Resource. The Reedy Creek Improvement District provides water and sewer services for the Walt Disney Corporation in Orlando, Florida. Reviewed and planned the best option for disposal of the WWTP sludges, residual food wastes from eating establishments, collection system FOG, and manures from the

Animal Kingdom and other parks. Historically, these materials had been composted and beneficially reused for sod farming. Due to odor concerns from park visitors, alternatives were to be considered to improve the sustainability of Reedy Creek's solids disposal. Technologies considered included: advanced anaerobic digestion with CHP, gasification, landfilling, fluid bed incineration, and continued or modified composting. Drivers for the study included a desire to reduce odors from the existing composting facilities, renewable energy generation, and the need for a long-term, sustainable solution.

Biosolids Master Plan, City of Lynchburg, Virginia

Senior Technical Resource. Participated in the development of the Biosolids Management Study for the 26-mgd Lynchburg Regional Wastewater Treatment Plant. Options considered included composting, lime stabilization, fluid bed incineration, conventional and Class-A anaerobic digestion, and heat drying. The recommended solution recommended a combination of landfill and land application using their existing lime stabilization equipment with transition to anaerobic digestion and with combined heat and power. Product diversity was emphasized including the possible use of lime (even with a digested product) for alkalinity addition on farms that require positive pH adjustment.

Digestion Evaluation, Northeast WPCP, Philadelphia Water Department, Philadelphia, Pennsylvania

Technical Lead. An innovative research project was conducted to determine the benefits that could be derived from adding mixing to the Philadelphia Water Department's 40 million gallons of unmixed, pancake-shaped anaerobic digestion volume at the Northeast and Southeast WPCPs. A pilot-scale digestion system was assembled and run by research partners at Villanova University to test a factorial experimental design determining the relative impacts of interrelated variables of feedstock concentration, residence time, and mixing intensity. Serum bottle tests were also performed to determine nutrient deficiencies and the digestibility of supplemental feedstock such as aircraft deicing fluid and sludge from the Sunoco refinery. A feasibility study evaluated modifications required for accommodating hauled grease trap waste and primary scum from the three WPCPs so that it could be digested and contribute to the gas produced.

Biosolids Master Plan, Portsmouth, New Hampshire

Expert Project Advisor. This Master Plan considered options for beneficial reuse of biosolids in support of objectives to discontinue landfilling practices. Among many options considered, a public-private partnership was explored to use waste heat from a power plant for sludge drying and use of the dried pellets as a renewable fuel source.

Fournier Press Design, Snapfinger WWTP, DeKalb County, Georgia

Technical Advisor. Designed installation details for four Fournier presses to dewater raw primary and secondary sludges at the 36-mgd Snapfinger WWTP. The installation replaces maintenance-intensive, plate-and-frame presses and associated drag conveyors with energy efficient equipment. The new presses were pilot tested prior to their selection.

Biosolids Master Plan, City of North Port, Florida

Senior Technical Advisor. Master Plan evaluated over 30 options for consolidated treatment of sludge produced from the City's three wastewater treatment plants. Options considered included solar and thermal drying and various thickening and dewatering technologies. Trucked and pumped conveyance were also considered.

Class A Digestion Assessment, F. Wayne Hill Environmental Center, Gwinnett County, Georgia

Project Manager. Evaluated options to convert the 60-mgd Environmental Center's five 1.5-million-gallon, egg-shaped digesters from mesophilic to Class A thermophilic anaerobic digestion.

Biosolids Blue Ribbon Panel, Jacksonville Electrical Authority, Jacksonville, Florida

Sludge Treatment/Biosolids Expert. Participated in three-person Blue Ribbon Panel to identify the best approach to handling the sludge produced by JEA's 80 mgd of raw sewage that is treated at 12 plants. Panel has addressed optimized anaerobic digestion, grease trap waste handling, heat drying, dewatering, transportation, land application, green power generation, production of biodiesel, and use of sludge in coal-fired power plants, among other options.

Biosolids Flow-Through Thermophilic Treatment Class A Demonstration Project, Columbus Water Works, Columbus, Georgia

Principal Investigator. Led the development of a new Class A process to produce pathogen-free biosolids. Development included pilot-scale testing with helminth, poliovirus, salmonella and fecal coliform and full-scale testing of a plug-flow digestion system. System was designed to reduce required batch time to as little as 30 minutes at 53 degrees C downstream of a thermophilic digester. This is considerably less than the 24 hours at 55 degrees C required in the CFR 40, Part 503 Regulations' time and temperature equations. The project also included conceptual design of the first thermophilic anaerobic digestion process heated entirely with co-generation heat. New Advanced Reciprocating Engine Systems are proposed that will produce roughly 20 percent more power than conventional lean burn engines at emissions levels similar to those of microturbines. This project was peer reviewed by WERF. Provided technical support in securing grant monies and assisted CWW in administering the grant funds: Congressmen Mac Collins, Sanford Bishop, and Phil Gingrey secured federal grant monies to date of $5.3 million of the overall $15 million project budget. This project won the IWA's Superior Achievement (as the top project in the world for the previous two years) and Grand Prize for Research in 2008; ACEC's Grand Conceptor Award (top honor) for the State of Georgia in 2005 and an Honor Award in ACEC's National competition that same year. The project also won the American Academy of Environmental Engineers' (AAEE's) Grand Prize for Research in 2007.

Blue Plains Advanced Wastewater Treatment Plant Egg-Shaped Digesters Facility Preliminary Design, District of Columbia Water and Sewer Authority, Washington, D.C.

Task Manager. Project consisted of preliminary design for addition of the world's largest egg-shaped digesters. Eight 4.5-million-gallon eggs are planned with options for thermophilic, temperature-phased, acid-phased, and Class A operation. Use of digester gas in regenerative turbines and/or for sludge drying was considered.

Short-Term Critical Needs Study, Town of Hanover, New Hampshire

Technical Lead. A study was performed to identify short-term critical needs at an aging anaerobic digestion facility. Other recommendations included options for process optimization and other elements to be included in a longer-term improvement project.

Biosolids Program Review, Metropolitan Government of Nashville and Davidson County, Tennessee

Technical Reviewer. Provided senior review and guidance for preliminary design for the City's biosolids program. Projects that were reviewed included design build of improvements at the 125-mgd Central WWTP and the design-bid-build of digestion upgrades at the 24-mgd Dry Creek WWTP. The project at the Central WWTP included DAFT co-thickening, anaerobic digestion, centrifuge dewatering, heat drying, odor control and centralized hauled waste receiving and treatment. The Dry Creek project included consideration of GBT co-thickening, anaerobic digestion, and multiple dewatering technologies.

South Columbus Water Resource Facility Odor Control and Digester Gas Handling Expansion, Columbus Water Works, Columbus, Georgia

Project Manager. Developed plans and specifications and administered construction of primary sedimentation tank cover retrofits to allow odor control of tank emissions. Also expanded the digester gas piping to accommodate peak gas production. Converted gravity belt thickeners to co-thicken primary and waste active sludge, effectively increasing the available digester capacity by over 80 percent.

Conversion to Class A Thermophilic Anaerobic Digestion Study, Columbus Water Works, Columbus, Georgia

Project Manager. Performed a study exploring cost-effective options for conversion to Class A thermophilic anaerobic digestion processes. An evaluation of the impact on land application programs was included in this effort.

Floating Digester Covers Study, Columbus Water Works, Columbus, Georgia

Project Manager. Performed study to assess the causes of significant tilting in floating digester covers. Study recommendations included liquid stream and solids treatment process modifications and other improvements that eliminated the tilting problem.

RFP Specifications Development, City of Toronto, Canada
Biosolids Conveyance and Storage Specialty Consultant. Provided specialized expertise to the lead consultant and the City in drafting a request for proposals soliciting design/build bids for the construction of $50 million in dewatered sludge storage and conveyance facilities at the Ash Bridges Bay WWTP. The facilities were to provide 4 days' worth on storage at 500 metric tons per day of dry solids production. Developed RFP specifications, plans and design criteria for publication to bidders. Coordination was critical between this project, a digester gas boiler/plant hot-water-loop design/build project and a design/build/operate proposal request for biosolids drying.

Sludge Storage and Dewatering System Design, Cobb County Water System, Cobb County, Georgia
Project Manager. Designed a 35 dry-ton/day sludge storage and dewatering system for the expanded 40-mgd South Cobb WRF. This effort was negotiated as a sole source change order with the contractor performing the balance of the construction project. Equipment was prepurchased in order to fast-track the project completion. Design included retrofits providing 1.5 million gallons of thickened sludge storage and a biofilter for odor control.

Remote Sludge Storage Expansion, Orange Water and Sewer Authority, Chapel Hill, North Carolina
Project Manager. Designed a 1.5-million-gallon expansion to the remote sludge storage facility, including sludge pumping and mixing systems, and pre-negotiated sole-source equipment costs.

Remote Sludge Storage, Orange Water and Sewer Authority, Chapel Hill, North Carolina
Project Manager. Designed a 1-million-gallon remote sludge storage facility, including sludge pumping and mixing systems and a sludge force main. Pre-negotiated sole-source equipment costs.

Sludge Treatment and Biosolids Master Plan, City of Phoenix, Arizona and SROG
Project Engineer. Performed study evaluating options for sludge disposal and/or reuse, including co-incineration with municipal solid waste, agricultural land application, nonagricultural land application, dedicated land disposal, and sludge dewatering and transportation.

Inter-plant Sludge Capacity Evaluation, City of Phoenix, Arizona and SROG
Project Engineer. Evaluated the impacts of sludge handling at the 23rd Avenue Wastewater Treatment Plant on operations at the 91st Avenue Wastewater Treatment Plant.

Municipal Wastewater

Energy Program, Metropolitan Government of Nashville and Davidson County, Tennessee
Expert Guidance. Provided senior guidance for a project that assessed opportunities for Nashville Metro to save energy and leverage renewable resources produced by three major WWTPs and landfill assets. Options considered and recommended included CHP, vehicle fuel production, Class-A temperature-phased digestion, diagnoses of water plant residuals impact on Central WWTP solids processing effectiveness, and leveraging imported digester feedstocks, among other options.

Capacity Assessment of the Southwest WRF, City of St. Petersburg, Florida
Technical Guidance. Effort included development of calibrated BioWin™ and hydraulic plant models and an assessment of the SWWRF's ability to process flows from both its own service area and the service area of the adjacent Albert Whitted WRF that was to be decommissioned. In addition, CFD modeling was used to assess capacity of new primary clarifiers to both capture sewer-conveyed waste activated solids from the NEWRF and NWWRF and reduce the raw sewage load. Recommendations included contact stabilization for peak wet weather capacity, and CFD-modeling for design configuration for improved primary solids capture.

Chesapeake-Elizabeth WWTP Conversion to Equalization Assessment, Hampton Roads Sanitation District (HRSD), Hampton Roads, Virginia
Technical Reviewer. Lead technical reviewer for options to convert the infrastructure at the Chesapeake-Elizabeth WWTP to a peak wet weather storage facility. Primary efforts were developed by a BC sub consultant under our direction, review and program integration.

Blue Plains Advanced Wastewater Treatment Plant Enhanced Nitrogen Removal Design, District of Columbia Water and Sewer Authority, Washington, D.C.

Preliminary Design Manager. Led efforts on the enhanced nitrogen removal upgrades to the 370-mgd AWTP to achieve effluent total nitrogen levels of 3.0 to 3.5 mg/L, including assistance in process design and detailed design of gallery and sedimentation improvements. Detailed design also included the world's largest methanol storage system at a wastewater treatment plant with over 210,000 gallons of total storage capacity (60,000 are dedicated to methanol; 90,000 are dedicated to alternative carbon sources; and 60,000 are available for use with either material). The system allows receipt and processing of a variety of alternative carbon substrates, providing economic flexibility and potential to use biogenic sources of carbon rather than fossil-fuel-derived methanol and reduce the associated carbon footprint of the AWTP's operation.

Professional Engineering Services, DeKalb County Department of Watershed Management, Georgia

Lead Mechanical Engineer. Providing as-needed services and assistance for the design, study and construction associated with water and sewer systems. Task orders have included: lift station analysis and design improvements for the Lower Crooked Creek No. 1, 2, and 3 lift stations, structural evaluation construction support for the Snapfinger Influent Lift Station, Snapfinger AWTP Influent Lift Station design and construction management, and design of a new dewatering system at the Snapfinger AWTP.

Johns Creek Environmental Campus, Fulton County, Georgia

Lead Solids Management Design. Designed a first-in-the-state-of-Georgia below ground, state-of-the-art, 15-mgd Membrane Bioreactor (MBR) water reclamation facility. Using a design–build approach, the design includes an influent pump station, bar screens, vortex-type grit removal systems, double entry-type fine screens, primary clarification basins, biological nutrient removal, membrane bioreactors, UV disinfection, and post-aeration, as well as aerobic digesters and centrifuge dewatering.

South Columbus Water Resource Facility Master Plan, Columbus Water Works, Columbus, Georgia

Project Manager. Effort included development of calibrated BioWin™ and hydraulic plant models and an assessment of the SCWRF's ability to process an additional 7 mgd of flow from Fort Benning and accommodate growth in the Muscogee County Basin through 2030. Recommendations addressed aeration, secondary clarification, solids handling and hydraulic capacity limitations.

Quigg Branch WWTP Capacity Review, Rockdale Water Resources, Georgia

Technical Lead. Reviewed plans for phased expansion of the Quigg Branch WWTP using BioWin modeling and discussion with the engineer or record. Determined that the capacity of the WWTP was simultaneously constrained by two separate factors: oxygen transfer capacity and aeration basin volume to accommodate mixed liquor to allow winter nitrification without overloading the clarifiers during peak flows.

Snapfinger Creek Advanced WWTP Capacity Assessment, DeKalb County, Georgia

Project Manager. Developed calibrated BioWin™ and hydraulic plant models in order to identify critical, capacity-limiting features that could be addressed, allowing optimization of the available plant tankage. Low-cost solutions were identified to increase the AWTPs from a present dry weather flow capacity of 33 to 44 mgd for a cost of roughly $20 million.

Cedar Creek WWTP, Athens-Clarke County, Georgia

Project Manager. Designing a new 4-mgd facility to replace the existing 2-mgd Cedar Creek WWTP. The project includes a new headworks, activated sludge with anaerobic selectors, low-pressure/high-intensity UV disinfection, aerobic digestion and dewatering centrifuges.

Lynchburg Regional Wastewater Treatment Plant, City of Lynchburg, Virginia

Technical Lead, Nutrient Treatment Basis of Design and Capacity Assessment. Analyzed the capacity of Lynchburg's existing 22-mgd treatment plant and evaluated options to reduce effluent nitrogen and phosphorus to the James River in accordance with the Chesapeake Bay Initiative. Four tiers of treatment effectiveness were evaluated (for N and P limits as low as 3.0 and 0.1 mg/L, respectively), along with options for further enhanced treatment for nutrient trading that would allow cost-effective nutrient trading.

Nancy Creek Capacity Management Facility, City of Atlanta, Georgia

Project Manager, Preliminary Design. Designed by Brown and Caldwell and constructed by Western Summit Constructors, Inc. (prime contractor) using a design–build delivery approach, the 100-mgd station provides relief to the existing Nancy Creek Trunk sewer and provides capacity for growth in the basin. The tunnel provides a large transport capacity and approximately 60 million gallons of wastewater storage. The pumping station will be used to dewater the tunnel at a rate to maximize the available capacity of the R.M. Clayton WRC. The pumping station is 150 feet deep with a flow range from 15 to 100 mgd, odor control facilities for the pumping station and tunnel, and an 85-foot-diameter shaft. In addition to design services, permit applications were prepared.

Blue Plains Advanced Wastewater Treatment Plant, District of Columbia Water and Sewer Authority, Washington, D.C.

Task Leader. Designed improvements to the nitrification reactors and sedimentation tanks at the 370-mgd plant. Improvements included enhancements to extremely poor hydraulic and solids distribution to available sedimentation tanks. Other elements included rehabilitation of sludge collectors, gates, and RAS pumps, and addition of instruments to allow improved process control.

Mason Farm Wastewater Treatment Plant Expansion II, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Providing preliminary and detailed design of facilities to expand capacity from 12 to 14.5 mgd. Facilities include deep bed filtration, ultraviolet disinfection, and expansion of the patented OWASA biological phosphorus system. The expanded facilities are designed to meet an effluent total nitrogen limit of 4.5 mg/L and effluent phosphorus of 0.23 mg/L. Use of gravity belt thickeners will separate solids from the primary sludge fermentation stream to reduce solids loading on the secondary process. The process also upgraded the country's first Class A thermophilic anaerobic digestion system with five tank retrofits: conversion of two floating covers to fixed covers; replacement of third and fourth floating covers with one concrete cover and one gas-holding membrane-type cover; and replacement of the aging membrane-type, fermenter cover with a PVC-lined corrosion-resistant concrete cover for high acid concentrations in the fermenter offgasses.

Wastewater Master Plan, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Project included developing a dynamic sewer model of the client's collection and transmission mains, an assessment of plant expansion options, and an estimate of capital expenditures for the next 10 years within the context of the utility's needs in 50 years.

Mason Farm Wastewater Treatment Plant Expansion I, Orange Water and Sewer Authority, Chapel Hill, North Carolina

Project Manager. Designed the expansion of the plant from 8 to 12 mgd, including patented secondary treatment processes and the country's first Class A thermophilic anaerobic digestion system.

Utoy Creek Water Reclamation Center Expansion, City of Atlanta, Georgia

Senior Technical Reviewer. Performed the final review of the hydraulic profile for the Utoy Creek WRC and recommended minor modifications for improved flow splitting features. Plant is designed to treat average flow rates of 44 mgd and peak wet weather flow rates of 90 mgd. Design included tertiary filtration, medium-pressure ultraviolet disinfection, bar screens, vortex grit removal, fine drum screens, phosphorus removal system, filter influent pumping station, and deep-bed sand filters. The phosphorus removal system included biological treatment as well as physical/chemical treatment (PCT) with ferric chloride. The expansion also included a LEED-certified administration/laboratory building.

South Cobb Water Reclamation Facility, Cobb County Water System, Cobb County, Georgia

Project Manager. Design included traveling bridge filters to treat peak flows of 75 mgd and an additional 135-foot-diameter secondary clarifier. Plant features also included a 100-mgd filtered effluent pumping station and a 15-mgd pumping station to handle stormwater, site sanitary flows, and recycles from thickening and dewatering.

South Cobb Water Reclamation Facility Expansion, Cobb County Water System, Cobb County, Georgia

Project Manager. Provided project management, preliminary and detailed design, bidding services and office engineering during construction for this 40-mgd expansion project. Responsibilities included detailed design of the screenings building, aeration basins, aeration blower building, and secondary gallery; coordination of plant hydraulics and layout; and supervision of the efforts of other design engineers and subconsultants. Additional responsibilities included budgeting cost to complete, managing project through production of finished construction documents, and signing and sealing final general, mechanical, and civil drawings and specifications. In 2002, the expanded South Cobb WRF to 40 mgd won EPA's National First Place Award for Operations Excellence. The design also received a State of Georgia, ACEC Honor Award in 1999.

Camp Creek Water Pollution Control Plant Upgrade, Fulton County, Georgia

Engineer of Record. Designed the aeration basins and single-stage blower facilities for a secondary process upgrade to 24 mgd. Process features included biological phosphorus removal, fine-bubble diffusion, foam wasting system, and use of "fermented" thickener effluent as a readily available carbon source.

Medford Wastewater Treatment Plant Expansion Study, City of Medford, Oregon

Project Engineer. Performed study on plant expansion through the year 2040. Included work on cost estimates, necessary unit expansion, and evaluations of alternative nutrient removal, solids handling, and effluent reuse alternatives.

President Street Water Quality Control Plant Expansion, City of Savannah, Georgia

Project Engineer. Performed office engineering for construction of the plant expansion. Features of the expansion included bar screens, grit removal, physical/chemical treatment (PCT) in rectangular primary sedimentation tanks.

Kachina Village Improvement District, Flagstaff, Arizona

Project Engineer. Designed a 200-gpm raw sewage lift station.

Northwest Wastewater Treatment Plant Upgrade, City of El Paso, Texas

Project Engineer. Provided detailed design of headworks, including grit and screenings removal, aeration basins, secondary clarifiers, plant service air system, and dissolved air flotation thickeners for upgrade of the plant from 5 to 17.5 mgd. Included modeling of solids balance and hydraulic profile for both new and existing facilities.

Haskell Street Wastewater Treatment Plant Study, City of El Paso, Texas

Project Engineer. Performed a study evaluating design versus actual loading rates.

Non-Hazardous Liquid Waste Master Plan, City of Phoenix, Arizona and the Sub-Regional Operating Group (SROG)

Project Engineer. Evaluated the current liquid waste hauling forms, practices, and regulations, and provided recommendations for future modification and standardization.

Pilot Studies, 23rd Avenue Wastewater Treatment Plant, City of Phoenix, Arizona

Project Engineer. Performed filtration pilot studies including evaluation of filter media performance and recommendations concerning polymer and coagulant type and dosage.

Sustainability/Green House Gases

Energy Recovery from Biosolids – 3rd-Party Contracting Support, City of St. Petersburg, FL

Utility Advisor. Advised on and assisted with negotiations with 3rd-party entities on the City's renewable-natural-gas (rNG) for vehicle fuel and power-production facilities for operations after start-up. Contracted entities included: 1) Natural gas provider (TECO) for rNG injection and NG delivery; 2) Petroleum companies (BP and

Valero) for D3-RIN trading; 3) Contract O&M vendors (various - to be bid) of engine-CHP and gas-upgrading facilities; 4) RIN verifiers (various - to be selected); and 5) RIN-pricing information services (Argus and OPIS).

Doctorate of Philosophy, School of Chemical Engineering – The University of Queensland, Advanced Water Management Centre, St. Lucia, Australia

Researcher. Completed Ph.D. thesis entitled "GHG Methodologies for Sewer CH_4, Methanol-Use CO2, and Biogas-Combustion CH_4 and their Significance for Centralized Wastewater Treatment". Emphasis was on wastewater-related GHG emissions sources that were either poorly defined, inaccurate, or unrecognized by most, if not all GHG Protocols. Specific research included: A) Development of a new sewer- CH_4 method that was applied to DC Water's collection system and those results extrapolated to estimate that this GHG source represents at least 55% of the industry's Scope-1 emissions; B) Application of ICLEI's method WW.9 for anthropogenic CO_2 from methanol feed for nutrient removal – this source was similarly estimated to represent roughly 11% of the industry's Scope-1 emissions; C) Development of a new, more accurate, use-specific method for estimating fugitive digester-gas CH_4 emissions; and D) Analysis of the suitability of electricity-intensity metrics as a function of load- and flow parameters for blower- and total-power consumption.

GHG Inventory Update, DC Water, Washington, D.C.

Technical Lead. BC updated DC Water's greenhouse gas (GHG) inventory template and data-mining software in 2017 to include new emissions sources that DC Water added since their original development in 2009. New GHG sources include: 1) CH_4, N_2O, and CO_2 (only CO_2 from natural gas combustion and methanol-CH_4 are "counted" but all combustion-derived CO_2 is recorded) from biogas and/or natural gas combustion in the new turbines, flares, and auxiliary boilers; 2) fugitive CH_4 from new digesters, digested-biosolids storage tanks, and dewatering; 3) sewer CH_4 and sewer-generated CH_4 that is emitted from preliminary pumping and treatment and dissolved CH_4 in primary influent; 4) new N_2O emissions rates for the new mainstream denitrification and new sidestream deammonification processes; 5) revisited land-application-related carbon sequestration and N_2O release; and 6) new chemicals that are being used or are considered for use with Scope-1 or Scope-3 impacts like ethanol as a methanol surrogate. The template is also being reconfigured for improved monthly and by-operating-unit emissions summaries and adding other features to meet DC Water's needs.

Water Watts, WERF, Alexandria, VA

Principal Investigator. An investigation of over 45 WRRFs with various process configurations and effluent requirements is being conducted to correlate actual power consumption by process area with actual process performance under varying process conditions over the course of at least 365 consecutive days. Each of the plants analyzed has some form of sub-metered power monitoring which will be compared with daily process and laboratory data. This is believed to be the first analysis ever conducted on actual power use rather than modeled/simulated predictions and as such, is expected to shed new light on something that we have somewhat naively believed that we fully understood.

Barriers to Energy Efficiency and Solutions to Promote These Practices, WERF, Alexandria, VA

Principal Investigator. As a follow-on project with linkage to Barriers to Biogas Use, this project sought to determine the factors that impede adaptation of energy efficiency improvements for wastewater utilities. Tasks include an electronic survey of utility staff, four focus groups to solicit/collect first-hand input, a thorough review of all plants' electrical profiles in the State of NY, a comparison of efficiency incentives and program in three states with varying degrees of regulatory and incentivizing practices to encouraging enhancements, among other tasks.

Conveyance Asset Prediction System (CAPS), WERF, Alexandria, VA

Principal Investigator. This investigation, in cooperation with DC Water and the University of Queensland has developed a calibrated sewer-process model based on full-scale data collected at Potomac Interceptor and Potomac Forcemain. Collected data covered the range of winter and summer temperatures for extrapolation of the developed kinetics over a year-round operation. The model is used to simulate how ferrous sulfate affects sulfur and carbon cycles within the PI as a demonstration of its application to other potentially hydrogen-sulfide- and methane-mitigating chemicals. Finally, an algorithm for predicting methane generation and release from gravity sewers and force mains is developed and applied to the majority of the DC Water collection system. This projection, when considered in the context of the utility's already-developed carbon

footprint, provides the first-ever determination of the significance of collection-system methane on the greenhouse gas emissions of a wastewater operation.

Energy Recovery Project, City of St. Petersburg, Florida

Technical Lead. Conducted a feasibility study to determine the preferred citywide solution to process biomass (10,000 dt/yr of solids from four wastewater plants and 35,000 dt/yr of yard waste) for energy recovery. Options included integration with existing digestion, regionalization, gasification and fluid-bed combustion. This project was partially funded by a Department of Energy ARRA grant.

Barriers to Biogas Utilization for Renewable Energy, WERF

Principal Investigator. Led the effort to determine real and perceived barriers that discourage utilities with anaerobic digestion from implementing some form of biogas use. Effort included an online survey, four work sessions to discuss the topic with WERF subscribers, and development of a final report.

Utility-wide GHG Inventory, District of Columbia Water and Sewer Authority, Washington, D.C.

Technical Lead. Developed DCWASA's (now "DC Water") baseline greenhouse gas (GHG) inventories for calendar 2007 and 2008. This effort was done in accordance with The Climate Registry's General Reporting Protocol. GHG reductions and increases were also predicted for significant projects planned by DCWASA including the Cambi/Anaerobic Digestion/CHP Upgrades; Enhanced Nitrogen Removal Upgrades; fine bubble diffused air retrofits as part of the Nitrification/Denitrification Upgrades; and the Long-Term Control Plan. A subsequent task included development of data mining software that DC Water uses to semi-automatically populate GHG inventories using billing and process data.

Methane Emissions from Wastewater Treatment and Conveyance, Water Environment Research Foundation (WERF), Alexandria, Virginia

Principal Investigator. This study was awarded as one of only four projects out of almost 100 submissions under WERF's 2008 "Unsolicited Solicitation." The project tackled four aspects of currently undocumented methane generation, specifically:

A case study of methane emissions from sewers in DeKalb County, Georgia's 600,000-person service area using grab and continuous liquid- and gaseous-phase monitoring. The project leveraged collection-system inventory data previously collected by Brown and Caldwell and a prototype methane generation process model developed by the University of Queensland (Australia) Advanced Water Management Centre.

A series of case studies using a standardized review of installations of various digester-gas-fueled CHP installations including combustion turbines, reciprocating engines, microturbines, fuel cells, and steam turbines. The effort included development of a standard reporting form or datasheet that can be used by others in the industry to compare these various installations on an "apples-to-apples" basis.

A paper study predicting the fugitive emissions from conventional, candlestick digester and landfill gas flares. This study leveraged previous at-scale research by the University of Alberta on natural gas flare efficiencies under a wide variety of climate and fuel conditions.

An initial assessment of fugitive methane emissions from low-energy, apparently sustainable technologies of photosynthetic oxidation ponds and facultative sludge lagoons. While managed by Brown and Caldwell, the testing was actually performed by NASA's Ames Laboratory.

Industrial Wastewater

Major Confidential Food Processing Client

Technical Reviewer/Engineer. Visited a bakery and developed recommendations for elimination of foam in the pretreatment plant's secondary process and other improvements related to process and mechanical reliability on a system that had been operating for less than 1 year.

Major Confidential Food Processing Client

Technical Reviewer/Engineer. Services for this design/build project included optimizing the performance of the existing biological process and increasing the capacity of the pretreatment facility to double the influent flow and meet more stringent effluent limits.

Major Confidential Pulp and Paper Client
Technical Reviewer/Interim Project Manager. Services for this design/build project included increasing the capacity of the existing biological process. In order to fast-track the project completion, the project was bid using 25 percent complete plans and specifications. The design was completed while construction was ongoing in a design/build model without the contractual obligations normally present between design/build designers and constructors. This $8 million project was completed within 8 months of design notice-to-proceed.

Major Confidential University Client
Engineer of Record. Provided design of a surface water VOC removal system. System included equalization, bag filtration and activated carbon filtration processes.

Major Confidential Metals and Machinery Client
Expert Consultant. Services included review of a sanitary treatment plant on site at a manufacturing and rehabilitation plant in Latin America. The sanitary treatment was reviewed for compliance with both national standards and client-specific standards and tolerances. Recommendations were implemented to increase overall process effectiveness and capacity.

Water

Sherrard Water Treatment Plant Expansion, City of Cheyenne, Wyoming
Senior Technical Reviewer. Performed final review of the hydraulic profile and design features for the Sherrard Water Treatment Plant expansion. The design included high-rate sedimentation and filtration.

Squaw Peak Water Treatment Plant, City of Phoenix, Arizona
Project Engineer. Provided detailed design of grit removal area, sludge blending tank, flow splitting structure, and used water recovery pumping station. Work included modeling of proposed hydraulic profile.

Squaw Peak Water Treatment Plant, City of Phoenix, Arizona
Project Engineer. Provided preliminary design on Squaw Peak Water Treatment Plant solids handling facility.

Deer Valley Water Treatment Plant, City of Phoenix, Arizona
Project Engineer. Supervised pilot testing for sludge dewatering equipment, specifically centrifuge and belt filter press.

Squaw Peak Water Treatment Plant, City of Phoenix, Arizona
Project Engineer. Developed and executed the solids sidestream sampling program.

Water Residuals Master Plan, City of Phoenix, Arizona
Project Engineer. Performed study work evaluating alternative disposal methods for water treatment plant sludges.

Water Distribution System, Forest Lakes Improvement District, Forest Lakes, Arizona
Project Engineer. Modeled existing water distribution system with recommendations to provide adequate fire flow and eliminate system dead ends.

Office Administration

Southeast Regional Wastewater Practice Leader
Responsible of general oversight of all wastewater treatment project delivery and pursuits in the southeastern region, representing between $9 and $12 million in annual revenue.

Municipal Department Manager, Atlanta Office
Managed performance and staffing of the Atlanta office's 25- to 30-person Municipal Department, dedicated to serving city and county utility clients.

Operations Manager, Atlanta Office
Responsible for forecasting and evaluating office performance in the 90- to 100-person Atlanta office. Other duties included development of the annual business plan and quarterly updates to that business plan. Also responsible for coordinating the import and export of work and labor to support other business units.

Department Manager, Engineering and Technical Services Department
Managed department of 25 to 35 individuals consisting of structural, electrical, and HVAC discipline staff, CADD group, and junior engineering staff in BC's Atlanta office. Position is part of the Atlanta Leadership Team responsible for office performance and growth.

Standards Coordination, Brown and Caldwell, Atlanta
Position required coordination of company and office design standard specifications, details, and procedures. Responsibilities included development of new company standards and region-specific standards.

Professional Organizations and Volunteer Efforts

Water Environment Federation (WEF) Residuals and Biosolids Committee (RBC) – Vice Chair/Chair
Became Vice Chair of the 200+ person RBC in 2016. The Vice-Chair supports Committee objectives and leads specific tasks for a period of four years prior to a 2-year term as Committee Chair (promoted to Committee Chair in fall-2019. These positions also include active leadership roles on the RBC leadership committee.

National Renewable Energy Laboratory's (NREL) Strategic Energy Analysis Center (SEAC) – Waste-to-Energy System Simulation (WESyS) Project – Expert Reviewer
One of three invited wastewater-industry expert reviewers for NREL-SEAC's WESyS project.

Water Environment Research Foundation (WERF), Water Environment & Reuse Foundation (WE&RF), Water Environment Foundation (WRF) – Research (Advisory) Council Member
Provided technical leadership to iterations of Research Councils as industry research foundations were consolidated to the current WRF structure. Participation began in spring-2016 with emphasis on wastewater, nutrients, energy, optimization, solids-handling and GHG.

WEFTEC Workshop Program Committee – Utility Management Symposium
RBC representative for the WEFTEC program committee on Workshops from 2009 through 2019. Effort includes soliciting, qualifying, and assisting/facilitating preparation of RBC-sponsored workshops. Also includes development of WEFTEC workshop program and attendance at the WEF mid-year meeting.

USDOE Bioenergy Technology Office's (BETO) Energy Efficiency and Renewable Energy (EERE) – Expert Reviewer and Selection-Guidance Committee Member
Participated in BETO's EERE selection process during the summer of 2019. Effort included review of technical and cost proposals for up to $5-million grants from the US-DOE under Area of Interest 6: Renewable Energy from Urban and Suburban Wastes. Participation culminated in an NREL-hosted, selection-guidance-committee meeting in Denver during the week of August 26, 2019 where consensus-based guidance was finalized.

WEFTEC Workshop Program Committee – Workshop-Program Committee
RBC representative for the WEFTEC program committee on Workshops from 2009 through 2019. Effort includes soliciting, qualifying, and assisting/facilitating preparation of RBC-sponsored workshops. Also includes development of WEFTEC workshop program and attendance at the WEF mid-year meeting.

National Science Foundation (NSF)/EPA/DOE, Energy-Positive Water Resource Recovery Workshop – Invited Participant
Attended (and moderated a break-out session) at a joint NSF, EPA, and DOE workshop at the NSF in Arlington, VA over April 28 and 29, 2015. The workshop examined the role of Federal research and development to enhance WRRF energy recovery.

WERF, Technology Maturity Expert Panel – Principal Investigator and Program Lead
Chaired and led the program development for a Technology Maturity Expert Panel that was convened in Arlington, VA on June 11, 2015. The summary publication, Assessment of Technology Advancements for Future Energy Reduction was developed under John's leadership as Principal Investigator.

WEF Biosolids Convening – Invited Participant
Attended the WEF Biosolids Convening in Alexandria, VA over November 20 and 21, 2019 to determine the top policy, communication, and research needs to ensure sustainable biosolids practices into the future.

US-DOE, Biofuels and Bioproducts from Wet and Gaseous Feedstocks: Market Barriers and Opportunities Workshop – Invited Participant
Participated in a by-invitation, DOE biofuels facilitated workshop over June 6 and 7, 2017 in Berkeley, CA. Topics included policy obstacles and enablers and identifying potential customers and feedstocks.

WEF RBC –Bioenergy Subcommittee Chair
Chair of the 80-120 person Bioenergy Subcommittee from 2013 to 2016 with emphasis on Digestion and biogas use, sludge drying, incineration, gasification, resource recovery from solids, and other thermal processes. Position also includes participation on the RBC leadership committee.

US-DOE BETO, Hydrogen, Hydrocarbons, and Bioproduct Precursors from Wastewaters – Invited Participant
Attended a workshop at the NREL offices in Washington, DC over March 18 and 19, 2015 on renewable energy recovery from wastewater treatment. Technologies discussed included mainstream anaerobic treatment and mainstream/sidestream microbial fuel and electrolysis cells.

Global Methane Initiative (GMI) Methane Expo 2013 – WERF Representative
Served as WERF's Representative on the Program Committee for Methane Expo, in Vancouver, BC over March 12 through 15, 2013 including presentations on related personal and other WERF methane research.

WEF RBC, Bioenergy Subcommittee – High-Performance Digestion Taskforce Chair
Chair of the High-Performance Digestion Task Force from 2009 to 2013 with emphasis on anaerobic digestion, including advanced processes like thermal hydrolysis, TPAD, thermophilic, acid-phased; codigestion; and biogas use.

WEF Energy and Water Specialty Conference (July 2011, Chicago) - Conference Chair
Conference Chair of WEF's inaugural Water and Energy Conference that occurred in Chicago in the summer of 2011. Collaborated with EPA, US-DOE and others to provide broad perspectives on energy and wastewater.

Gates Foundation's Water Sanitation & Hygiene Team – Waste-to-Energy Small-Group Meeting
Participated in a by-invitation meeting in New Orleans on October 6, 2010 to provide input to the Gates Foundation to identify:

- Categories of waste-to-energy technologies that could/should be transferred to developing countries;
- Institutional pathways and obstacles to moving promising technologies into widespread use;
- Technological obstacles and research opportunities to improve the efficiency, robustness, and affordability of transforming human waste into energy in the developing world.

ICLEI, U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions – Wastewater and Water Technical Advisory Committee
Participated as an expert advisor on wastewater-related elements of ICLEI's 2012 U.S. Community Protocol. Additionally, served as lead author for WW.9 methodology for estimating anthropogenic CO_2 emissions from use of fossil-fuel-derived methanol as a nutrient-removal carbon source.

National Biosolids Partnership (NBP) Charting the Future of Biosolids Management – Participant
Participated in a WEF-/NBP-hosted two-day session over December 1 and 2, 2010 in Alexandria, VA to identify trends in technology, operations and management; regulatory and public policy drivers; research needs; and professional and training needs, within the context of biosolids-derived products.

Electric Power Research Institute (EPRI) Western Electric Power/Water Sector Collaboration Workshop – Invited Participant/Volunteer

Participated in a two-day, EPRI hosted workshop in Irwindale, CA over November 8 and 9, 2010 to explore synergies between the water and power industries in the water-scarce western US. Provided input for better-integrated water/energy/waste for centralized and distributed power generation.

WEF Residuals and Biosolids Conference (April 2010, Savannah, GA) – Conference Chair

Conference Chair of WEF's Residuals and Biosolids Specialty Conference in Savannah in 2010. Savannah-Biosolids was the first WEF conference to exceed budgeted attendance in over two years of conferences following the 2008 economic downturn.

WEF Residuals and Biosolids Specialty Conferences – Program Committee

Beginning in 2004 and continuing through today, Participated in development of the technical program for the annual WEF Residuals and Biosolids Specialty Conferences.

Publications/Presentations

1. "Evaluation of Alternative Thermophilic Anaerobic Digestion Configurations for Class A Sludge Treatment at the Mason Farm WWTP, Carrboro, North Carolina," Lead with Gottschalk; NC American Water Works Association (AWWA)/Water Environment Association (WEA) Annual Conference, 1995.
2. "Developing a Useful Computerized Operations Manual for the South Cobb Water Reclamation Facility," Lead with Hall & Riddle; Fall Georgia Water Pollution Control Association (GWPCA) Conference, Athens, GA, 1996.
3. "Thermophilic Anaerobic Digestion to Produce Class A Biosolids at the Mason Farm WWTP in Chapel Hill, North Carolina," Lead with Farrell & Kalb; Water Environment Federation (WEF) Residuals & Biosolids, Denver, CO, 1996.
4. "Start-up of OWASA's Thermophilic, Anaerobic, Class A, Digestion Process at the Mason Farm WWTP," Lead with Gottschalk; GWPCA Annual Conference, Columbus, GA, 2000.
5. "Ten Years of Design and Operating Experience with Classifying Selectors for Foam Control in the Activated Sludge Process in the USA," Contributor with Parker, Jones, McIntyre, Oppenheim, Pedregon, Pope, Richards, Volpe & Witzgall; WEFTEC, Atlanta, GA, 2001.
6. "Operational Improvements from Start-up of OWASA's Class A Thermophilic Anaerobic Digestion System," Lead with Gottschalk; WEFTEC, Atlanta, GA, 2001.
7. "Field Data and Experience Summary from Ashbridges Bay Treatment Plant Biosolids Loadout Facility Expansion in Toronto" Lead with Narareth, Rupke, Saknenko & Witzgall; WEF Residuals & Biosolids, Austin, TX, 2002.
8. "Anaerobic Digestion – Rebirth in the Making," Lead with Schafer; KT-TN WEA Conference, Knoxville, Tennessee, 2002.
9. "Columbus Biosolids Flow-Through Thermophilic Treatment (CBFT3) as a Cost-Effective Means to accomplish Class A Digestion" Lead with Aitken, Arnett, Hull, Schafer & Turner; WEF Residuals & Biosolids, Baltimore, MD, 2003.
10. "Early 2004: The State of the Practice of Class A Anaerobic Digestion" Lead with Schafer & Switzenbaum; WEF Residuals & Biosolids, Salt Lake City, Utah, 2004.
11. "An Update on the Longest Running Class A Thermophilic Anaerobic System in the USA", Lead with Gottschalk & Schuler; WEF Residuals & Biosolids, Nashville, Tennessee, 2005.
12. "The State of the Practice of Class A Anaerobic Digestion: Update for 2005", Lead with Schafer & Switzenbaum, WEFTEC, Washington, DC, 2005.
13. "Laboratory Evaluation of Thermophilic-Anaerobic digestion to Produce Class A Biosolids; 1. Stabilization Performance of a Continuous-Flow Reactor at Low Residence Time", Contributor with Aitken, Walters, Crunk, Farrell, Schafer, Arnett & Turner; Water Environment Research (WER, 77.7), 2005.
14. "Upgrading to Class A Anaerobic Digestion: Is Your Biosolids Program Ready To Make The Move?", Lead with Schafer; Public Works (137.1), 2006.
15. "Got Gas??? – Maximize the Mileage of your Methane", Lead with Arnett, Davis, Schettler, Shah & Shaw; WEF Residuals & Biosolids, Covington, KY, 2006.
16. "Advances in Thermophilic Anaerobic Digestion", Lead with Schafer; WEFTEC, Dallas, Texas, 2006.
17. "Fecal Coliform Reactivation and Regrowth: Process Perspective"; Presented at WEFTEC, Dallas, Texas, 2006.
18. "Advances in Thermophilic Anaerobic Digestion", Contributor with Durden, Shah, Shah, Shaw, Schettler, Arnett & Davis; WEFTEC, Dallas, Texas, 2006.
19. "Maximizing Methane", Lead with Arnett, Davis, Schettler, Shah & Shaw; Water Environment and Technology (WE&T) (19.2), 2007.

20. "How Pathogens are Destroyed in Thermophilic Anaerobic Digestion", Lead with Farrell, Murthy & Schafer; WEF Residuals & Biosolids, Denver, Colorado, 2007.
21. "A Comparison of the Carbon Footprint of Aerobic and Anaerobic Digestion", Lead with Arnett, Radcliffe & Toffey; WEF Residuals & Biosolids, Philadelphia, PA, April 2007.
22. "Carbon Footprint Analysis and Opportunities for Industry-wide Efficiency-Gain Tracking", Lead with Davis, Hull & Kerwin; 1st WEF Sustainability Conference, National Harbor, MD, 2007.
23. "JEA's Path out of Biosolids Purgatory through Anaerobic Digestion and Drying Enhancements", Lead with Bullard, Donovan, Schultz & Shaw; WEFTEC, San Diego, California, 2007.
24. "Pathogen Destruction in Anaerobic Digestion", Presented at WEF Disinfection, Atlanta, GA, 2009.
25. "DCWASA's Certifiable, Utility-Wide GHG Inventory", Lead with Bailey, Jolly, Murthy, Peot & Trueblood; WEFTEC, Orlando, FL, 2009.
26. "Quantifying Methane Evolution from Sewers: Phase 1 Results of the Water Environment Research Foundation (WERF) DeKalb County, Georgia, Case Study", Lead with Barnes, Fillmore & Shah; WEFTEC, New Orleans, LA, 2010.
27. Evaluation of Combined Heat and Power Technologies for Wastewater Treatment Facilities, Contributor with Wiser & Schettler; United Stated Environmental Protection Agency (EPA)/WERF/Columbus Water Works, 2010.
28. N_2O and CH_4 emission from wastewater collection and treatment systems – Technical Report, Contributor with Chandran, Foley, Keller, Senante, Shah, vanLoosdrecht, vanVoorthuizen & Yuan, Global Water Research Coalition, 2011.
29. N_2O and CH_4 emission from wastewater collection and treatment systems – State of the Science Report, Contributor with Chandran, Foley, Keller, Senante, Shah, vanLoosdrecht, vanVoorthuizen & Yuan, Global Water Research Coalition, 2011.
30. "Implications of the EPA's Endangerment Finding, Reporting Rule and Tailoring Rule for POTWs", Lead with Trueblood; WEF Residuals & Biosolids, Sacramento, CA, 2011.
31. "Energy and Water: Innovations Keep Moving the Bar", Lead with Turgeon; Presented at 1st WEF Energy & Water, Chicago, IL, 2011.
32. "Quantifying Methane Emissions from Gas Flares: WERF's New Flare Efficiency Estimator", Lead with Checkel, Fillmore, Handford, Joiner & Shah; 1st WEF Energy & Water, Chicago, IL, 2011.
33. "Anaerobic Digestion at an ENR Plant: Implications for Energy, Carbon, and GHG", Lead with Murthy, Peot & Wett; WEFTEC, Los Angeles, CA, 2011.
34. "Barriers to Biogas Utilization for WWTPs – A Summary of WERF's Project on Biogas Use Barriers", Lead with Beecher, Durden, Fillmore, Hemenway, O'Connor, & Stone; WEFTEC, Los Angeles, CA, 2011.
35. "Quantifying Methane Evolution from Sewers: Results from WERF/DeKalb Phase 2 – Continuous Monitoring", Lead with Fillmore, Shah, Sharma & Yuan; WEFTEC, Los Angeles, CA, 2011.
36. Methane Evolution from Wastewater Conveyance, Principal Investigator (PI) with Shah, Yuan, Sharma, Joiner & Bocarro, WERF, 2012.
37. Barriers to Biogas Use for Renewable Energy, PI with Stone, Durden, Beecher, Hemenway & Greenwood; WERF, 2012.
38. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Contributor and Lead with Griffith & Murthy for "Method WW.9: Process Carbon Dioxide Emissions from the Use of Fossil-Fuel-Derived Methanol for Biological Nitrogen Removal"; ICLEI – Local Governments for Sustainability USA, 2012.
39. Evaluation of Combined Heat and Power Technologies for Wastewater Treatment Facilities, Updated/Final Edition, Contributor with Wiser & Schettler; EPA/WERF/Columbus Water Works, 2012.
40. "The St. Petersburg Biosolids Planning Effort", Lead with Leavitt, Marshall & Bosso; WEFTEC, New Orleans, LA, 2012.
41. "Reframing the Economics of Combined Heat and Power Projects - Creating a Better Business Case Through Holistic Benefit and Cost Analysis", PI with Stone, Durden, Walch, Hajnosz, Elenbaas, & Patil; WERF Fact Sheet, WERF, 2013.
42. "Economic Methods Matter – Appropriate Analysis can Overcome the Biggest Barrier to Biogas Use", Lead with Durden, Elenbaas, Fillmore, Stone & Walch; WEF Residuals & Biosolids, Nashville, TN, 2013.
43. "Fresh financial options – Using the right economic analyses to overcome the biggest barrier to biogas use", Lead with Stone, Filmore, Durden, Elenbaas, Hajnosz, O'Connor & Walch; WE&T, 2013.
44. Flare Efficiency Estimator and Case Studies, PI with Checkel, Handford, Shah & Joiner, WERF, 2013.
45. "Energy-Recovery from Solids in St. Petersburg, FL: Biogas to Vehicle Fuel and CHP", Lead with Jacobsen & Marshall; WEF Energy & Water, Nashville, TN, 2013.
46. "Technology-Based Methodology for Calculating Digester-Gas-Related Greenhouse-Gas Emissions", Lead with Checkel, Griffith, Trueblood & Yuan; WEFTEC, Chicago, IL, 2013.
47. Identification of Barriers to Energy Efficiency and Solutions to Promote these Practices, PI with Andrews, Stone, Cantwell & Greenwood; WERF, 2015

48. Current Energy Position of New York State Wastewater Treatment Facilities, Original PI with Andrews & Nascimento; WERF, 2015
49. "DC Water's Sewer-Methane Carbon Footprint", Lead with DeClippelier, Graf, Kumar, Melsew, Murthy, Peot, Regmi, Satayev, Sharma, & Yuan; WEFTEC, Chicago, IL, 2015.
50. "Got Gas? Use it for Vehicle Fuel under the Updated Renewable Fuel Standard", Lead with Babson, Finley, Leavitt & Marshall; WEFTEC, Chicago, IL, 2015.
51. Assessment of Technology Advancements for Future Energy Reduction, co-PI with Andrews & Muller; WERF, 2015.
52. "Wastewater GHG Accounting Protocols as Compared to the State of GHG Science", Lead with Yuan & Murthy, WER (88.8), 2016.
53. "Are Your Digesters Burping, Frothing, or Otherwise Not Behaving? Let's talk about Solutions and NOT REPEAT the 'Digester Foam' Paper you've already Heard Five Times", Lead with Carrio, Chapman, Keaney, Newman, McNeal, Muller, Pianelli, Salerno, Schafer; WEFTEC, New Orleans, LA, 2016.
54. "DC Water's Sewer-Methane Carbon Footprint", Lead with Brower, De Clippeleir, Graf, Kumar, Murthy, Peot, Regmi, Satyadev, Sharma, Tanner & Yuan; WEFTEC, New Orleans, LA, 2016.
55. "Wastewater Methanol Use: A Surprisingly Significant Scope-1 GHG Emission Source", Lead with Bastian, Brower, DeBarbadillo, Murthy, Al-Omari, Peot & Yuan; WEFTEC, New Orleans, LA, 2016.
56. "High Performance Anaerobic Digestion (HPAD): Fundamentals and Decision Criteria", Presented at WEFTEC, New Orleans, LA, 2016.
57. "How an Overly-Conservative Biosolids Master Plan Can Make You Fat", Presented at WEFTEC, New Orleans, LA, 2016.
58. "A greenhouse gas source of surprising significance: anthropogenic CO2 emissions from use of methanol in sewage treatment", Lead with Al-Omari, Bastian, Brower, deBarbadillo, Murthy, Peot & Yuan, Water Science &Technology (Vol. 75, Issue 9), 2017.
59. WaterWatts: A Modern Look at Wastewater Power-Metering Data, Original-PI with Andrews & Cramer; Water Environment and Reuse Foundation, 2017.
60. "The National Implications of Adding Sewer CH4 and Methanol-Derived CO2 to Wastewater Treatment and Conveyance GHG Inventories", Lead with Brower, Murthy, Peot, Sharma & Yuan; WEFTEC, Chicago, IL, 2017.
61. "Road Trip: Arriving at a New Vehicle Fuel Production System for Biogas Use", Contributor with Hull, Taylor & Holland, WEFTEC, Chicago, IL, 2017.
62. "Quantifying the GHG-Emission Reductions from DC Water's Digestion/Cambi/CHP Upgrades", Lead with Brower, Graf, Murthy, Peot, Regmi, Sharma & Yuan; WEFTEC, New Orleans, LA, 2019.
63. "New GHG Methodology to Quantify Sewer Methane", Lead with Brower, Donkreo, Gerbert, Mulacek, Peot, Ramirez & Regmi; WEFTEC, New Orleans, LA, 2019.
64. "New GHG Methodology for Estimation of Methane Emissions from Digested-Biosolids Storage and Dewatering", Lead with Brower, Donkreo, Fotouhi, Peot & Regmi; WEFTEC, Chicago, IL, 2019.
65. "Sewer CH_4, Methanol CO_2, and Biogas Combustion CH_4", Presented at WEFTEC, Chicago, IL, 2019.
66. "Turning RINs into Money: How are RINs Generated, Transferred, and Used", Presented at WEFTEC, Chicago, IL, 2019.

ARCADIS Design & Consultancy for natural and built assets

Education
BSE Chemical Engineering
University of Pennsylvania
1984

Years of Experience
Total – 35
With ARCADIS – 23

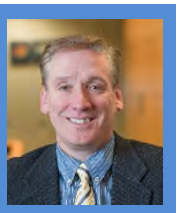
Professional Registrations
Professional Engineer – OH, NJ, PA, DE, DC, NC, SC, MD, VA, AR, MI, NY
Licensed Water and Sewer Contractor – SC, NC
NASSCO Pipeline Assessment and Certification Program
Project Management Certificate

Health & Safety Training
24-Hr Supervised Field Training
Construction Safety Awareness
Confined Space Entry
Trenching and Excavation Practical
e-RAILSAfe
Railroad Worker Protection
UPRR Rail Safety
MTS Rail Safety
40 Hour Hazardous Waste Operations Safety Training
Hazardous Waste Operations Site Supervisor

Professional Affiliations
Chesapeake Water Environment Association
Pennsylvania Water Environment Association
National Association of Sewer Service Companies
North American Society for Trenchless Technology
Water Environment Federation

Jim Shelton, PE

National Practice Leader – Buried Infrastructure



Mr. Shelton is the National Technical Director for Buried Infrastructure, specializing in condition assessment and rehabilitation using trenchless technologies. He is/has been Program Manager for seven large multi-year programs encompassing investigation, regulatory negotiation, condition assessment, engineering and capital planning, design, inspection, and construction for capacity assurance and/or rehabilitation of water and sanitary, combined, and storm sewer infrastructure in urban, suburban, and industrial systems. He leads a team of 20 engineers and technicians that develop and implement inspection, leak detection, assessment, planning, modeling, permitting, design, construction management, and O&M consulting for public water utilities. Rehabilitation methods designed and/or constructed under these programs/projects for which he had engineering responsibilities include chemical grouting, spray-on coatings, centrifugally cast geopolymer concrete lining, cured in place lining, lateral lining, hard pipe slip lining, soft pipe slip lining, pipe bursting, open cut sewer replacement, jack and bore, microtunneling, tunneling, horizontal directional drilling, force main piping and replacement, and manhole grouting, lining, and chimney coating.

Mr. Shelton's program experience includes extensive knowledge of utility O&M programs, especially regarding preventative maintenance programs, blue-collar crew organization, equipment selection, field work process optimization, and work order management, leading to CMOM program development.

Mr. Shelton's municipal engineering experience includes concept through detailed construction design of wastewater treatment facilities, inflow/infiltration studies and infrastructure evaluations, leak detection, gravity sewers force mains, pump stations, spray irrigation systems, the preparation of construction documents, construction services, NPDES and MIPP permitting, Municipal Wasteload Management (Chapter 94) reports, and Municipal Facilities Planning (Act 537) reports.

Mr. Shelton is a licensed water and sewer contractor and leads ARCADIS's Pipeline Construction and Rehabilitation Practice. He specializes in the delivery of turnkey pipeline rehabilitation projects focused on leakage reduction (water and sewer) using alternative project delivery approaches such as Construction Manager at Risk and Collaborative Design-Build. He works closely with utilities to conceive, develop, and implement rehabilitation solutions that provide measurable capacity assurance, asset management, and long lasting effectiveness benefits.

Mr. Shelton has also has civil/environmental engineering experience in industrial and environmental remediation, including construction management, design engineering,

planning, and consulting for industrial facilities includes industrial facility planning, environmental permitting, treatment system design and construction, industrial waste minimization, process optimization, and safety and emergency planning. He has expertise in hazardous waste treatment (water, soil, and sludge), site assessment, evaluation, and closure, remediation permitting, and remediation construction management.

Detailed Experience

Aiken: Sand River Basin Sewer Rehab Design Build Project / City of Aiken, SC.
Program developer, engineering design lead, and construction manager for a design-build project to stabilize, repair, and reduce I&I from 49 miles of 100 year old 6”-24” clay and concrete sanitary sewers featuring ARCADIS’s Expedited Rehabilitation Approach. ARCADIS engaged one open cut and five trenchless subcontractors, providing significant overlap of capabilities to minimize performance risks. This turnkey work featured the capital grouting techniques that addressed all aspects of the mains, tap, laterals, and manholes, cured in place pipe lining, chemical root control, pipe bursting, open cut replacement, and manhole frame and cover replacement.

Akron: Little Cuyahoga Interceptor Rehabilitation and Replacement / Akron OH.
Technical Design Lead for the rehabilitation of a 3000 lf section of an 63” and 87” brick combined sewer interceptor. The LCI was constructed in 1928 in the bed of the Cuyahoga Canal, running parallel and immediately adjacent to the River, including one river crossing. Construction activities related to new tunnel and below ground storage tank construction were expected to impose significant loads and subsurface vibrations that could cause collapse of the LCI. A reverse slope in the LCI that resulted in near full pipe flow during dry weather flow and surcharged flow for typical year storm events was also of concern. A basis of design evaluation that considered the constructability and cost of rehabilitation using hard pipe sliplining, cured in place lining, same trench relay, and parallel trench relay was completed. This work included structural evaluations using LIDAR Redzone data and internal inspections, hydraulic modeling for both rehabilitated hydraulic capacity and construction bypass requirements for both the main flow and for the six trunkline and collector lines connected to this portion of the interceptor, easement acquisition and construction access, geotechnical investigations and interpretations, and permits (USACE NWP-12 and 401 permits, Stormwater Pollution Prevention Plan, Endangered or Threatened Species evaluation, and FEMA floodplain). The selected approach included hard pipe segmental sliplining with 78” Hobas of the majority of the pipe, and same trench replacement of the sag. All work was designed to be constructed “in the wet”, with bypass pumping limited to dry weather work for making connections. The work as also evaluated for alternative project delivery methods, including CMAR, DB, and progressive DB; Akron elected to produce this project using traditional Design-Bid-Build in order to exert the highest level of control over the works.

Akron: Mud Run Trunk Sewer Rehabilitation / Akron OH. Technical Design Consultant for the rehabilitation of a 13000 lf section of 30”-36” RCP combined sewer trunk line using CIPP and 51 manholes using spray applied epoxy liners.

BASF: Outfall 003 Industrial Storm Sewer Evaluation and Rehab / Wyandotte, MI. Lead engineer for the investigation and condition assessment of 70 stormwater and non-contact cooling water sewer segments and associated inlets, manholes, and laterals. Condition assessment included operating and structural condition, rehabilitation methods, and access/implementability constraints. Lead investigator for bench scale testing of 6 materials to determine chemical compatability for rehabilitating pipes and structures to deal with elevated temperatures, high pH, and contaminated groundwater constituents. Recommended materials of construction, installation methods, contract procurement, and technical specifications.

BASF: Outfall 001 Industrial Storm Sewer Evaluation / Wyandotte, MI. Lead engineer for the investigation and condition assessment of 185 combined stormwater and process sewers segments and associated inlets, manholes, and laterals. Condition assessment included locating and mapping the infrastructure, determining methods for cleaning, dewatering, and disposing of a variety of wastes from the heavily clogged sewers, determining storm conveyance capacity requirements/ limitations/needed improvements, segregation of storm and process streams where practical, and corrective measures to prevent ongoing exfiltration of process waste into the soils and infiltration of contaminated soils and groundwater into the sewers.

BASF: Fire Water System Condition Assessment and Master Plan / Wyandotte, MI. Project manager for the investigation and condition assessment of 4 miles of high pressure fire suppression buried infrastructure. Work involved identifying and prioritizing areas of the fire water system that are at high risk of breakage/failure, developing a mitigation plan for rehabilitating at-risk segments, developing pipe isolation strategies in case of unanticipated loss of section of the fire water system due to breaks, and developing a master plan to improve reliability and, where needed, fire flow delivery performance, of the fire water system upon which capital and operating resources can based be applied. A GIS-based fire water system inventory map and geodatabase was prepared, lines were sonde located, all valves and hydrants operated and tested for seal, leak detection of the entire system conducted, and C factor and confirmed delivery pressure testing conducted. A hydraulic model of the system was built and calibrated to establish pressure zones, establish firm delivery capacity, design a unidirectional flushing maintenance program, and support flow isolation and looping analysis for contingency planning. Pipes were exposed, drained, cut to conduct internal inspections and provide coupons for testing. A master plan that detailed capital and operating budget plans for 20 years was prepared.

Baxter Pharmaceuticals: Process Sewer Condition Assessment and Rehabilitation Plan / Marion, NC. Project manager for the investigation and condition assessment of 2 miles of process sewers prior to change in clean in place chemical processes. All sewerswere located and mapped using GPS, cleaned, and inspected. All drains and process connections were dye traced to confirm connectivity. Tools used included push mini-cameras, sondes, robotic cameras, and jet-vac cleaners. The physical condition assessment findings were presented in GIS figures depicting lateral tap locations, flow direction, and aerial orthophotography, critical defects observed in the pipes, including sags, collapses, deformation, faulty taps, and fractures/breaks, recommended corrective measures, and cost estimates.

Bryn Athyn Township: Wastewater Treatment Facility Design / Bryn Athyn Township PA. Project engineer for the concept design, evaluation, and engineering cost estimate of an aeration basin 30,000-gpd biological treatment system with spray irrigation discharge.

Caln Township: Act 537 Submission / Caln Township PA. As lead engineer, responsible for evaluating existing wastewater treatment and conveyance systems, forecasting growth and increases in sewerage, identifying existing and potential treatment and conveyance needs, evaluating alternatives to meet those needs, and establishing an implementation schedule for the recommended plan.

Caln Township: Brandywine Sewage Pump Station Study / Caln Township PA. Project engineer responsible for the operational and upgrade evaluation a 150-gpm sewage pump station.

Caln Township: Infiltration and Inflow Study / Caln Township PA. Lead engineer for an infiltration and inflow study for 48 miles of sewage collection system. Responsible for study design, installation and data gathering from flow monitoring during dry- and storm weather conditions, and system evaluation to determine specific remediation measures. Subsequent to this I/I study, was project manager for a focused infiltration study for 32 miles of sewage collection system. Supervised study design, installation and data gathering from 42 nighttime weiring locations, and system evaluation to determine specific remediation measures.

Caln Township: Sanitary Sewer Cleaning, Inspection, and Repair / Caln PA. Project Manager for the preparation of bid documents and subsequent television inspection, cleaning, and grout repair of 6 miles of 8"-36" clay and concrete gravity sewer.

Caln Township: Sanitary Sewer Standard Specifications / Caln PA. Lead engineer for the preparation of standard construction specifications and plans for sanitary sewer construction.

Cheltenham Township: Infiltration/Inflow Study / Cheltenham Township PA. Lead engineer for an inflow/infiltration study for 88 miles of sewage collection system. Responsible for study design, installation and data gathering from 22 flowmeters, and system modeling to determine conveyance system's I/I characteristics and recommend cost-effective rehabilitative efforts. Subsequently led focused infiltration study for 35 miles of sewage collection system.

Responsible for study design, installation and data gathering from 340 weir points, and system evaluation to determine specific remediation measures for each run of deteriorating sewer pipe.

Cheltenham Township: Sewer Inspection and Rehabilitation / Cheltenham Township PA. Lead engineer for preparation of construction documents and oversight of television inspection, cleaning, and grouting of 8 miles of sanitary sewer and manholes.

Chevron: East Yard Basin, North Field Basin, and Surge Pond Remediation / Perth Amboy NJ. Managed the preparation of the engineering design, remediation work plan, PPC plan, QA plan, soil erosion & sediment control plan, NJPDES treatment works application, and air emission permits for the removal and treatment of 63,000 cu yd of contaminated sludge and underlying soils from three RCRA hazardous lagoons at an active oil refinery. Treatment including dredging, sludge conditioning, pressing / centrifugation, wastewater pretreatment, sheeting, and stabilization.

Chevron: Salt Lake Refinery Sludge Removal and Treatment / Salt Lake City, UT. Designed and constructed temporary wastewater treatment system to support the removal and treatment of contaminated sludges and sediments from refinery lagoons, pipes, and ditches.

Conoco: Carteret Agrico Feasibility Study / Carteret NJ. Developed work plan and managed feasibility study for a 40-acre former chemical fertilizer site

Conoco: Carteret Agrico Remedial Investigation / Carteret NJ. Managed laboratory and data validation requirements for a 300-plus sample remedial investigation.

Conoco: Carteret Agrico Treatability Study / Carteret NJ. Developed and conducted an innovative state-of-the-art treatability study to evaluate no action, consolidation, stabilization, and washing/flushing technologies for 90,000 cu yd of soil contaminated with metals.

Crompton & Knowles Colors: Lagoon Sludge Stabilization and Landfill Construction / Reading PA. Engineered and managed the in-situ solidification of 23,000 cu yd of salty dye sludge and its subsequent placement into and capping of an on-site landfill storage cell. Project included the management of over 10,000 tons of reagent.

City of Dayton: Great Miami River Parallel Interceptor / Dayton, OH. Technical expert advising the design of a new 108” diameter parallel interceptor. The parallel interceptor provides redundancy to the 1930 era interceptor. The existing interceptor is corroding and, following construction of the parallel interceptor, will be rehabilitated. Design requires solutions for continued transportation of 45 MGD of dry weather flow throughout construction. Design includes sewer connections, siphon connections, river and stream crossing, river bed construction, tributary connections, construction under river levees, in-line storage using real time controls, shunting of flow from original pipe during wet weather flow, and tractive force flushing analysis. Design solutions for the new pipe include open cut, deep and shallow

mixed condition tunneling, shallow-riverbank in the wet construction using fabric cofferdams, and live flow connection to existing pipelines. Design solutions to for the existing pipe include CIPPL, spray applied cementious and epoxy liners, gunite/shotcrete, formed segment liners, and hard pipe segmental sliplining.

DC Water: Sewer System Program Management / Washington DC. Program Manager overseeing the development and implementation of DC Water's $1.6B sewer system capital improvement program. Program was operated as a multiple sub-programs focused on condition assessment, planning, engineering, rehabilitation, and upgrade of its separate sanitary sewer, storm sewer and combined sewer systems. Working as extensions to DC Water Engineering staff, oversaw 30 embedded staff members, including teammates from 8 subconsultants, on-site at DC Water's Blue Plains offices, with staff in 15 other offices participating on a part-time basis. Primary role was management of the inspection, planning, and design activities required for assessing, rehabilitating, upgrading and otherwise improving DC Water's sanitary, combined, and storm water conveyance systems inclusive of pipelines, pumping stations, and related infrastructure. Fundamentally, this work is both an Asset Management Program and a CMOM program. At any given point, oversaw 75 independent projects within the program. Project directed and overseen included flow and rain metering; modeling; inspections and inspections management; Sewer System Evaluation Survey (SSES); master planning; condition assessments; environmental impact studies; geotechnical studies, GIS development and management, MS4 permitting, planning, and inspections; emergency response planning; emergency response management; basis of design and rehabilitation for pipelines; design scoping, design and design management; design standards development; new process/product vetting; permitting; public relations support; easement acquisitions; operations support; data and documents management; management systems development and implementation; inspection prioritization/criticality protocols and tools development for determining the order in which the 1863 miles of gravity pipe, forcemains, manholes, inlets, outfalls, and structures should be inspected; annual inspection of 75 to 150 miles per year; annual reprioritization of inspection based on criticality and previous findings; Capital Improvement Plan development; preliminary design of trenchless rehabilitation (mainline and lateral lining, manhole rehab, pipe bursting, hard pipe and HDPE slip lining, test and seal, shotcreting) and replacement (open cut, tunneling, directional drilling) projects; hydraulic basis of design modeling (Mike Urban); permit and easement constraints identification/negotiation; alignment evaluations; cost estimating; constructability reviews; design management of other A/E consultants; emergency response assistance; identifying capital solutions to chronic operating problems; Emergency Response Plans for sewer and forcemain failures, road collapses, sewage in basements, and flooding; DOT and watermain coordination plans for Integrated Asset Management; specific Asset Master Plans for large components such as the 108" PCCP Anacostia Force Main, the twin 72"/96" Potomac Force Mains, the four 10'-12' Influent Sewer, the several miles of 16'-22' cunette combined sewers,

and the 50 mile long Potomac Interceptor; specialty plans for Sewers Under Buildings, Sewers in Streams; annual Capital Budget preparation in Primavera.

DC Water: Sewer Condition Assessment Program / Washington DC. Program Manager overseeing the development and implementation of DC Water's ongoing storm, sanitary, and combined sewer inspection, assessment, and rehabilitation prioritization program. Project directed and overseen included flow and rain metering; inspections and inspections management; Sewer System Evaluation Survey (SSES); condition assessments; GIS development and management, inspection prioritization/criticality protocols and tools development for determining the order in which the 1863 miles of 8"-23' diameter gravity pipes, 48"-96" forcemains, manholes, inlets, outfalls, and structures should be inspected; annual inspection of 75 to 150 miles per year; annual reprioritization of inspection based on criticality and previous findings; and Capital Improvement Plan development.

DC Water: Anacostia Force Main Condition Assessment / Washington DC. Technical expert and project manager for the evaluation of a 5 mile long 102" PCCP forcemain. This force main conveyed the vast majority of flow from two surrounding counties directly to the head works of the WWTP. Built with Interpace Class IV wire, the force main was determined to be compromised upon commissioning and had been operated at a significantly reduced operating pressure for 20 years. Technologies evaluated under this study included PURE Pipe Diver, PURE, Smartball, and high resolution transient pressure wave monitoring. Additionally, the original cathodic protecion system was designed using magnesium anodes which may damage hydrogen sensitive wire. The anodes were found to have been spent and the level of protection provided inadequate at many locations. A cathodic protection system search and evaluation was conducted and spot excavations were made at key accessible locations to conduct wall thickness measurements and soundings.

DC Water: Potomac Force Mains Condition Assessment / Washington DC. Technical expert and project manager for the evaluation of a 5 mile long 102" PCCP forcemain. This force main conveyed the vast majority of flow from two surrounding counties directly to the head works of the WWTP. Built with Interpace Class IV wire, the force main was determined to be compromised upon commissioning and had been operated at a significantly reduced operating pressure for 20 years. Technologies evaluated under this study included PURE Pipe Diver, PURE, Smartball, and high resolution transient pressure wave monitoring. Additionally, the original cathodic protecion system was designed using magnesium anodes which may damage hydrogen sensitive wire. The anodes were found to have been spent and the level of protection provided inadequate at many locations. A cathodic protection system search and evaluation was conducted and spot excavations were made at key accessible locations to conduct wall thickness measurements and soundings.

DC Water: B Street New Jersey Avenue Trunk Sewer Condition Assessment / Washington DC. Technical expert and project manager for the evaluation of 1883 vintage 4

mile long, 8' round to 26' arch unreinforced concrete, brick lined combined sewer running from the Watergate complex under Constitution Avenue and the National Mall to the Main Street Pump Station. Inspection planning accounted for dewatering plans, bypass planning, air management, contingency rescue, quick demobilization for storms, scaffold construction and movement for roof inspection, manned entry inspections, Redzone Robotics inspections, pipe penetrating radar, ground penetrating radar, and ultrasonic wall thickness and strength testing.

DC Water: Potomac Interceptor Condition Assessment / Washington DC. Technical expert for the evaluation of the 22 mile long Potomac Interceptor. This 4' to 8' diameter RCP sanitary interceptor conveys flows across two counties. Difficulties included typical 75% pipe full flows, off road access, and residential properties developed after construction of the interceptor.

DC Water: East Side Interceptor Rehabilitation at National Arboretum / Washington DC. Program Manager and technical expert for the rehabilitation of 4800 lf of failed 54" RCP interceptor running through the National Arboretum. Rehab methods used include carbon fiber external wrapping of aerial crossings and cured in place lining.

DC Water: East Side Interceptor Condition Assessment / Washington DC. Assessment lead for condition assessment of 15,400 lf of 54"-72" reinforced concrete sanitary interceptor.

DC Water: Georgetown Sewer Rehab / Washington DC. Program manager and principal design reviewer for the physical condition assessment, selection of rehabilitation methods, and design of 5700 lf of non-round storm and combined brick, rock, and cast in place sewers and manholes in Georgetown's metropolitan center.

DC Water: G100 Sewer Rehab / Washington DC. Program manager and principal design reviewer for the physical condition assessment, selection of rehabilitation methods, and design of 23,500 lf of sanitary and combined sewers and manholes in throughout Washington, DC.

DC Water: Sewer Emergency Response Plan / Washington DC. Program manager overseeing the development of multi-faceted plan to deal with sewer emergencies from simple basement backups and manhole overflows to sinkholes in urban centers, 102" single line force main ruptures, and under-river force main leaks, under highway siphon clogs, and brick and unreinforced concrete tunnel collapses. This plan identified potential failures, response plans, pre-positioned materials and equipment, bypass and containment procedures, public and regulatory response and management, safety, and lines of authority and communication between engineering and field services.

DC Water: Multi-Jurisdictional Use Facilities Operational Cost Share Basis Evaluation / Washington DC. Project manager for the development of flow metering and cost sharing

rationale plan to allocate operational costs for interceptors and pump stations used by multiple jurisdictions to convey wastewater under the Inter Municipal Agreement.

DC Water: Inflatable Dams Inspection and Replacement/Repair Design / Washington DC. Project manager for the inspection of 6 inflatable dams in 16'-23' diameter combined sewers. Work involved diversion of flow, in-pipe kayak inspections, fabric and frame integrity evaluation, and replacement design.

DC Water: Spring Place Water, Storm, and Sanitary Sewer and Lateral Rehabilitation / Washington DC. Project manager for the rehabilitation design 3500 lf of 50' deep storm sewers, 4000 lf of 8"-12" 15' deep sanitary sewers, 125 laterals, and 800 lf of 8" water main. This project was driven by a water main break that created a 35' deep sinkhole in very low blow count fill material upon which was constructed a tightly spaced row home community. The selected rehabilitation included lateral lining, sanitary sewer lining, deep manhole structural lining, and watermain lining.

DC Water: Sewers under Buildings Inspection and Rehabilitation / Washington DC. Program manager and primary design engineer for the evaluation of 600 sewer lines found to underlay buildings throughout the District of Columbia. About half of these lines were founc to be inactive but unfilled. The inspection resulted in a risk assessment of pipeline collapse and potential impact on building foundation and structure, an identification of rehabilation or abandonment method, and design and permitting.

DC Water: Low Area Trunk Sewer Rehabilitation / Washington DC. Program manager and primary design review engineer for the rehabilitation of 11,700 lf of 42" brick and cast in place unreinforced concrete pipe under Pennsylvania Avenue. Rehabilitation methods included cured in place lining, grouting, and manhole lining.

DC Water: Piney Branch Trunk Sewer Rehabilitation / Washington DC. Program manager and primary oversight engineer for the inspection, hydraulic modeling, and rehabilitation design of 11300' of 96" to 120" brick and cast in place unreinforced concrete combined sewer interceptors that run practically the entire length of northwest DC, including through several NPS parks. Project included establishing hydraulic basis of design, CCTV inspection to establish physical condition and basis of rehabilitation, and preliminary design.

DC Water: Oxon Run Trunk Sewer Rehabilitation Concept Design / Washington DC. Project manager for the rehabilitation of 8 miles of parallel 24" and 42" reinforced concrete sewer. This open-cut replacement, hard rock tunnelling, multiple stream crossings, culvert crossings, and the abandonment of existing sewers through a City forest. The project involved predesign activities including topographical surveys, location of buried utilities, geotechnical investigation and data report, wetland delineation, identification of property issues, CCTV inspections, hydraulic modeling, and alignment evaluations.

DC Water: Blue Plains Influent Main Lift Force Main Rehab/ Washington DC. Design engineer for the pulled in place, cured in place lining of 6 variable diameter forcemains from the primary lift station pumps into the screenings building. Piping from pumps eccentrically expanded from 54" to 66" to 72" with multiple custom welded bends angles in each forcemain. Existing steel pipes were leaking from corrosion loss and needed to be replaced while service was maintained in balance of the pump house. Access difficulties included valves and fittings that could not be removed or actuated, a drop distance of 4 stories through narrow openings in the motor house floor, structural beams and multiple pipes interfering, and limited access on the B-side for pulling into the bar screen well.

Deep Run Packing: NPDES Permit Compliance Treatability Study / Dublin PA. Lead engineer for evaluating wastewater treatment technology alternatives of a dog food manufacturing facility. Study involves the collection of process samples and on-site bench-scale treatability studies to improve the performance of the facility's noncompliant wastewater treatment system.

Du Pont-Merck Pharmaceuticals: Glenolden Labs Nitrobenzene Contamination Remediation / Glenolden PA. Designed and remediated an interior excavation to remove nitrobenzene from below the basement floor of an active medical research laboratory

E.I. du Pont de Nemours & Company: A/B Basin Closure / Deep Water NJ. Projected the impact of closure of two 17-acre RCRA hazardous basins on chemical manufacturer's NJPDES permit compliance.

E.I. du Pont de Nemours & Company: Fuel Oil Release Interim Remedial Measure / Linden NJ. Developed IRM work plan, designed, permitted, and managed the construction of an innovative free product barrier wall and recovery system.

E.I. du Pont de Nemours & Company: Groundwater Extraction and Treatment System / East Chicago IN. Lead engineer for the evaluation of alternatives for the extraction, treatment, and discharge of contaminated groundwater to prevent continuing releases from the site.

E.I. du Pont de Nemours & Company: Groundwater Remediation / Parkersburg WV. Designed, constructed, and operated two 90-gpm treatment systems to remediate methylene chloride contaminated groundwater.

E.I. du Pont de Nemours & Company: Lagoon Remediation and Renovation / Parlin NJ. Designed the remediation and renovation of three chlorinated-organic-compound-contaminated lagoons into a single percolation basin.

E.I. du Pont de Nemours & Company: Louviers Solar Ponds Remediation / Louviers CO. Developed regulatory strategy and conceptual remediation design for two 4-acre lagoons contaminated with 120,000 lbs of explosives (PETN).

E.I. du Pont de Nemours & Company: Mercury Fulminate Plant IRM / Pompton Lakes NJ. Designed the removal operation and prepared the IRM work plan for 60,000 cu yd of RCRA hazardous soil containing mercury, lead, mercury fulminate, and explosives.

E.I. du Pont de Nemours & Company: Necco Park Landfill Feasibility Study / Niagara Falls NY. Developed work plan and managed CERCLA feasibility study for a 535-acre site surrounding a former industrial waste (chlorinated organics) disposal facility.

E.I. du Pont de Nemours & Company: Newport Sewer Assessment / New Castle DE. Project Engineer for the television inspection and evaluation of 5 miles of abandoned gravity storm, sanitary, and process sewers at a chemical factory.

East Vincent Township: Act 537 Sewage Facilities Planning Study / East Vincent Township PA. Lead engineer for evaluation of wastewater treatment and conveyance systems for a completely unsewered township, forecasting growth and increases in sewerage, identifying existing and potential treatment and conveyance needs, evaluating alternatives to meet those needs, and establishing an implementation schedule for the recommended plan.

East Vincent Township: PennVest Grant Application / East Vincent Township PA. Prepared grant application for Pennsylvania PennVest funding for sewer system construction and repairs.

Emerald Coast Utilities Authority: Sewer Rehabilitation Program / Pensacola FL. Served as program developer for ECUA's ongoing sewer rehabilitation program for their 856 mile, 347 pump station sanitary sewer system. Managed engineering services for multiple projects to identify, prioritize, design, construct, and implement cost-effective solutions during the first 5 years of the program, then acted as program consultant afterward. This comprehensive program involved hydraulic and physical condition assessment, including flow monitoring, inspections, cleaning, internal testing, and engineering evaluations to identify and prioritize areas for rehabilitation and provide a benchmark for determining the effectiveness of implemented solutions. Activities included a complete evaluation of the existing systems and data, then development of monitoring programs intended to identify the nature, extent, and sources of I/I, cross connections, and structural failures. These were accomplished through a 50+ flow metering network whose data informed SSES investigations that included nighttime weiring, above-grade storm inflow observations, smoke testing, and pipeline inspections. Based on these hydraulic integrity condition assessments, the rehabilitation was prioritized based on contribution of I/I, anticipated failure period, and other criteria. This prioritization identified projects requiring R&R, which in turn were prioritized, then scoped, budgeted, designed, and constructed. Program development included the development and maintenance of a master program schedule, capital improvement plan and budget, public involvement plan, ongoing community relations and public meetings, and program management. Continues to act as Program Consultant during the ongoing implementation phases of this work.

Emerald Coast Utilities Authority: CMOM Development / Pensacola FL. As technical lead, conducted an assessment of all phases of ECUA's sewer operations, engineering, management, and support departments. Assessed all systems, practices, information management systems, organization, and practice vs. documentation of this 957 mile, 357 pump station sewer system utility. This evaluation included multiple field observations of pump station O&M and gravity pipe O&M practices. Additionally, conducted numerious highly focused interview with engineering, finance, IT, customer care, and asset management division and department heads. These findings were used to scope the initial CMOM Program Development, which while framing all aspects of CMOM Planning, focused on detailed development of key performance indicators, preventative maintenance, reactive maintenance, equipment and spare parts, staffing, information management, program auditing, and implementation plans for the force main, lift station, and gravity sewer O&M teams and for the flow monitoring programs, force main and gravity condition assessment programs, and capacity/modeling programs of the Wastewater Infrastructure Department.

Emerald Coast Utilities Authority: Forcemain Assessment Program / Pensacola FL. As technical advisor, conducted a data inventory and prepared an evaluation workplan for a 380 pump station system with multiple manifolded forcemains constructed of primarily of PVC, HDPE, steel, cast iron, and ductile iron. Conducted multiple technology inspection/assessments for more than 40 forcemains using technologies such as SmartBall, coupon testing, BEM, and ultrasonic thickness testing. Developed risk based recommendations for prioritizing remaining forcemains for inspection, testing, and rehabilitation. Major findings included cyclic near-pump station stress failures in PVC pipe, near-ARV and gravity HGL breakpoint failure at water line in epoxy coated ductile iron, and misplacement of ARVs during original design and construction.

EnviroSafe Service of Ohio, Inc.: Contact Storm Water Surge Volume Evaluation / Toledo OH. Project manager for the calculation of the volume of runoff generated during various phases of Cell M waste placement that occur above surrounding grade. This included the examination of the various waste placement options and sequences, identifying the total volume to be generated inside the cell in response to various rainfall and runoff scenarios, calculating the holding volume necessary to contain these flows, and recommending potential engineering and operational solutions to leachate handling and facility issues identified.

EnviroSafe Service of Ohio: Compliance Improvement Program Work Plan / Toledo OH. Developed a comprehensive compliance improvement program to define all operating requirements for a RCRA TSD facility. The program included a complete evaluation of site operations, a review of all operating permit requirements, the development of standard operating procedures, and the implementation of a continuous improvement program to achieve excellence in performance.

EnviroSafe Service of Ohio: Compliance Monitoring Program Operations Manual / Toledo OH. Developed program manuals for the NPDES, leachate management, groundwater protection, and explosive gas compliance monitoring programs at a RCRA hazardous waste treatment and landfill facility. Program manuals covered regulatory and permitting requirements, operating requirements, inspections, performance monitoring, sampling plans, analysis plans, reporting, and recordkeeping. Included in each program was the development of standard operating procedures, forms, logs, and reporting formats in both electronic and paper formats.

EnviroSafe Service of Ohio: Compliance Monitoring Requirements Summary Database and Automated Schedule / Toledo OH. Developed a comprehensive compliance monitoring requirements summary for a RCRA hazardous waste treatment and landfill facility. This included over 2,100 separate monitoring, inspection, sampling, reporting, and recordkeeping events required each year to comply with the facility's state and federal RCRA Part B permits, NPDES permits, Title V, etc., permits. Included in these requirements were programs such as surface water discharge, groundwater, leachate, emissions, explosive gas, water supply protection, waste management, waste treatment, closure, and postclosure. To track the 2100 separate compliance activities, an electronic schedule and planning tool based on MicroSoft Schedule+ was developed and implemented at the facility.

EnviroSafe Service of Ohio: Containment Building Air Handling System Evaluation / Toledo OH. Lead engineer for an engineering evaluation of air handling systems for a RCRA Subtitle DD containment building.

EnviroSafe Service of Ohio: Containment Building Response Action Plan and Leachate Removal System / Toledo OH. Lead engineer for the evaluation of a RCRA Subtitle DD containment building leak detection system. Developed appropriate SOPs for operation, maintenance, monitoring, sampling and reporting for the liner system. Developed appropriate Action Leakage Rates for the unit, and designed a Response Action Plan to address the unit's unique contingency planning requirements. Managed the operation of the liner system for six months.

EnviroSafe Service of Ohio: North Sanitary Landfill Corrective Measures Study / Toledo OH. Lead engineer for a RCRA Corrective Measures Study for an abandoned sanitary/hazardous waste landfill.

EnviroSafe Service of Ohio: On-site Compliance Support / Toledo OH. Directed a four-month long, daily on-site compliance audit program for a RCRA TSD facility. The work included assessment of all waste handling, treatment, and management procedures, determination of compliance with RCRA Part B permit conditions, and completion of routine and targeted inspections intended to improve regulatory compliance. On the basis of the compliance audit, developed a Work Order documentation and database system to facilitate management and tracking of outstanding compliance issues at the facility.

EnviroSafe Service of Ohio: RCRA Part B Permit Renewal Application - Section D Revision and NOD Response / Toledo OH. Project manager for the preparation of Section D of a RCRA Part B Permit Application renewal revision and Notice of Deficiency response. Response involved issues such as container storage areas, freeze/thaw protection, leachate management, cap design, and waste filling plans.

EnviroSafe Service of Ohio: RCRA TSDF Permit Requirements Database / Toledo OH. Directed the development of an interactive electronic database (MS Access) that contained all RCRA, NDPES, air, and local permit requirements for a RCRA TSD facility.

EnviroSafe Services of Idaho: RCRA Part B Renewal Application / Grand View ID. Project manager for the preparation of a RCRA Part B Permit Application renewal (all sections except groundwater protection) for a hazardous waste treatment and disposal facility.

EnviroSafe Services of Ohio, Inc.: Leachate Removal, Storage, and Disposal System Performance Evaluation / Toledo OH. Project manager for the comprehensive evaluation of past and projected performance of the leachate handling system for a RCRA Subtitle C hazardous waste landfill. The evaluation included analysis of historic operating records; interviews with management and operations personnel regarding the current operation of the LRSD system; assessment of the impact of current practices on permit compliance; analysis of the relationship between cell-filling patterns, rainfall intensity, leachate removal rate, and depth of leachate on the primary liner; evaluation of the current leachate removal and storage procedures ability to reliably handle the storm water / leachate flows; and assessment of availability and/or capacity limitations of the off-site wastewater treatment / disposal facility.

EnviroSafe Services of Ohio, Inc.: Phase 3 - Phase 4 Tie-in Evaluation / Toledo OH. Project manager for the evaluation of potential for run-in from uncompleted Phase 4 into completed Phase 3 through the LDCRS, PCRS, overtopping, or degradation of the intercell berm. This evaluation included calculating the volume of water expected to accumulate in the Phase 4 sump during a variety of rainfall events.

Fairfax County MSMD: Storm Sewer System Rehabilitation Program / Fairfax VA. Program manager for multi-year, multi-million dollar storm sewer system condition assessment and rehabilitation program. As MSMD's Storm System Rehabilitation Program Manager, oversaw a team of 30 engineers and technicians from 5 MP offices and and 6 subconsultants to conceive and develop the program, identify and develop the tools and processes needed to support and sustain the program, develop the program and project management framework to support the 50 projects resulting from the first 2 years of the work, and implementing each of these projects. Work included annually inspecting 75 miles of the 2000 mile storm sewer system to determine its physical condition, identifying and prioritizing rehabilitation projects, developing and implementing a Physical Condition Assessment rating/ranking system and a Basis of Rehabilitation philosophy to determine if a system component should be rehabilitated and to identify the most appropriate and cost effective

rehabilitation methods based on capital and life cycle costs for different asset defects, developing design drawings, permits, easements, specifications for formal bid pack-ages, or developing short-form design drawings with notes for contractors with whom Fairfax MSMD had indefinite delivery and quantity contracts, for all rehabilitation projects, managing the construction of the designed improvements, and managing the vast amounts of data that generated by the Storm Sewer Rehabilitation Program to support future asset management decisions.

Ford Motor: Livonia Transmission Storm Sewer System Design-Build Rehabilitation / Livonia, MI. Project Design Leader for storm sewer assessment, engineering design and construction management services, including site-wide inventory and GIS mapping of storm water system assets, site-wide identification and delineation of storm water drainage patterns and various loadpoints (catch basins or manholes) that generate flow for the conveyance system, survey of sewer pipe invert elevations, PCA based on NASSCO program and using the PACP system, and review CCTV video of more than 19,000 linear feet of storm sewer lines on the east side of the facility, development of a Preliminary Basis of Rehabilitation (PBOR) report and budgetary cost estimates for specialty trenchless pipeline rehabilitation of damaged storm sewer infrastructure. Rehabilitation technologies designed included chemical grouting, cured in place pipe (CIPPL), cured in place lateral lining (CIPLL), centrifugaly cast cement pipe liner (CCCPL), and spiral-wound PVC pipe liner (SWPPL). Project director for design/build construction management at risk (CMAR) for approximately 3,000 linear feet of damaged/deteriorated oval and round 36”-60” storm drain pipe and eight manholes that need to major rehabilitated (or replaced), and approximately 16,000 linear feet and associated manholes of trunk and collector sewers that need minor rehabilitation and/or joints sealed.

Ford Motor: Lio Ho Assembly Plant Water Loss Assessment / Taoyuan City, Taiwan. Investigation lead for water loss program to eliminate water leaks from site-wide potable, process, and fire water system. Using Sewerin SeCorrPhon AC200 piezo microphones and correlators, assessed over 100 points on the system and identified 3 significant sources of leakage.

City of Frederick: Hillcrest Orchards Sewer Rehabilitation and Construction Management / Frederick MD. Oversaw technical program and quality assessment for the physical condition assessment of 22,000 linear feet of 8" and 10" gravity sewers, hydraulic condition assessment of the system, design of cured-in-place lining of the mains and laterals, packer injection grouting (test and seal) of the mains and laterals, excavated point repairs, and manhole rehabilitation. The work included CCTV review, field inspections, AutoCAD design drawings, specifications, cost estimating, and bid package preparation. Also the Construction Manager for the rehabilitation of 22,000 linear feet of sanitary sewer mains through the use of cured-in-place pipeline lining (CIPPL), cured-in-place lateral lining (CIPLL), packer injection grouting (test and seal), excavated point repairs, and manhole rehabilitation.

Was responsible for the coordination of several different contractors on a multiple-prime construction project and held biweekly progress meetings.

GAF Chemicals: Waste Minimization Study / Calvert City KY. Lead engineer for the identification and characterization of in-plant source waste streams to minimize the organic load to the chemical manufacturer's 1-mgd industrial wastewater treatment facility. Conducted a process evaluation and recommended of operation, control, and process modifications to minimize waste generation.

General Electric: Process Sewer Condition Assessment and Rehabilitation Plan / Lukin, TX. Project manager for the investigation and condition assessment of 2 miles of process sewers to identify suspended solids permit violation sources, determine physical condition of sewers, and provide separation of waste streams between the foundry and the machining factories. All sewers were located and mapped using GPS, cleaned, and inspected. All drains and process connections were dye traced to confirm connectivity, and each sewer segment was sampled over the course of various operating periods to identify the source of solids. Tools used included push mini-cameras, sondes, robotic cameras, and jet-vac cleaners. The physical condition assessment findings were presented in GIS figures depicting lateral tap locations, flow direction, and aerial orthophotography, critical defects observed in the pipes, including sags, collapses, deformation, faulty taps, and fractures/breaks, recommended corrective measures, and cost estimates.

Greater New Haven Water Pollution Control Authority: East Haven and Hamden Collection System Review / Hamden CT. As lead engineer, conducted a preliminary assessment of the Town of Hamden and Town of East Haven collection system's structural condition, O&M condition, system inventory/attribute databases, and I/I control status to facilitate regionalization plans for the Greater New Haven Water Pollution Control Authority (GNHWPCA) and contract negotiations with privatized system operator (OMI). This collection system review focused on how the system has been managed over the last decade to gain a better understanding of the capital and operating programs that the GNHWPCA will have to implement to achieve a sustainable system. These field evaluations were conducted primarily for the purpose of evaluating the need for and focusing subsequent scoping efforts for:

- Equipment, manpower and practices to maintain the system.
- Physical condition assessment.
- Hydraulic condition assessment and I&I control.
- Software development and integration.

Hampton Roads Sanitation District: Virginia Beach Basin 340 Design-Build Sewer Rehabilitation / Virginia Beach, VA. Engineering design lead and construction manager for Design-Build of a Buried Infrastructure Guaranteed Outcome (BINGO) RDII project using ARCADIS's Grout First approach. This project required a guarantee of 20% reduction in peak 1 hour flows from the basin during a 10 year design event. Under this contract, no payment

for profit is made unless this goal is reached; only costs were covered. Arcadis additionally provided a 10 year guarantee of performance. Of the 5 miles of pipe in the basin, only 2 were public and available for this project, dictating a >50% removal requirement from the available assets. ARCADIS engaged five trenchless subcontractors, providing significant overlap of capabilities to minimize performance risks. This turnkey work featured the testing of 1743 mainline joints, 310 lateral tap connections (8' and 20' lengths), and 1153 laterals joints tested through the cleanout. 30% of the pipe joints, 19% of the lateral joints and 35% of the tap connections failed the air test and were successfully grouted. 66 laterals connected to manholes were also tested and grouted. Only 2 cured in place point repairs were required, and no mainline lining or lateral lining was needed. The project was completed for 93% of budget. Rainfall derived inflow and infiltration volume was reduced by 36%.

Handy and Harmon Tube Company: Montvale Groundwater Remediation System / Montvale NJ. Lead engineer responsible for the design of a ECRA-driven groundwater removal and treatment system. Treatment system included air stripping and liquid phase carbon adsorption components.

Handy and Harmon Tube Company: Permit-by-Rule Application / Norristown PA. Project engineer for the preparation of a Permit-by-Rule Application for an industrial wastewater discharge from a tube manufacturer.

Handy and Harmon Tube Company: Prevention, Preparedness, and Contingency Plan / Norristown PA. Lead engineer for the preparation of the PPC Plan for a tube manufacturer.

Harford County Department of Public Works: Bynum Run Hydraulic Condition Assessment and I/I Abatement Development Program / Bel Air MD. Project Director responsible for preparing recommendations for an I/I abatement program for a 260-mile sanitary sewer system. Responsibilities included project planning, field team management, flow data interpretation, development of recommendations, site walks, budgetary cost estimating, technical memo, client meetings, and tracking project progress and schedule as well as budget. (Prof. Services: Ongoing, Construction: N/A)

Harsco: Group Storm Water Permit / Plant City FL. Project engineer for the preparation of a group storm water permit for seven steel tank manufacturing facilities.

Hatfield Quality Meats: Prevention, Preparedness, and Contingency Plan / Hatfield PA. Lead engineer for the preparation of the PPC Plan for a meat packing plant.

ICI Americas: Atlas Point Sludge Lagoon Closure / New Castle DE. Engineered and managed the thermal desorption and stabilization of 2,400 cu yd of benzene contaminated sediments to meet UTS. Managed the preparation of the RCRA Closure Plan, the Soil Erosion & Sediment Control Plan, and the Air Emissions Permit.

ICI Americas: Atlas Point Remediation Program / New Castle DE. Program manager for 17 SWMUs and AOCs on a 75 year old chemical manufacturing site actively operated by

three different chemical companies. Directed groundwater, soil, sediment, and surface water sampling and characterization reports, ecological risk assessments, and determination of cleanup and control technologies. Directed the implementation of four separate cleanout and capping activities. Assessed wastewater treatment process corrections for the site's NPDES WWTP.

Jacksonville: Sanitary Sewer Rehabilitation / Jacksonville NC. Performed condition assessment; constructability considerations; cost-effective rehab/replacement analysis; and designs for CIPP liner, lateral lining and manhole rehabilitation. The condition assessment involved a review of CCTV and inspection data for 150,000 LF of pipeline.

Jacksonville EA: 32nd Street Interceptor Rehab and Replacement / Jacksonville FL. Technical advisor for evaluating rehabilitation or replacement of 60-inch trunk sewer failing because of gross H2S attack on the reinforced concrete pipe and manholes. Identified and led the alignment layout and costing of open cut and trenchless techniques including spiral lining, centrifugally cast cementitious lining, cured-in-place lining, hard-pipe sliplining, spin-cast geopolymer lining, spray applied epoxy lining, pipe swallowing, open cut paralleling, and open cut same trench replacement, including variations using different methods were site conditions warranted. Several options were considered feasible and of similar cost. Hard-pipe sliplining was the primary method selected, with a portion to be conducted using open-cut replacement and another using pipe swallowing to replace sewer located deep under a major highway. Bypass was designed using two existing force mains tied into the bypass plus manifolded smaller bypasses for tributary systems.

Jefferson County Environmental Service Department: Organizational Diagnostic and Roadmap Forward for Change / Birmingham AL. Serving as lead investigator for the performance of an organizational diagnostic of the wastewater utility serving Birmingham and the balance of Jefferson County (population of 662,000). The organizational diagnostic is designed to assess the utility's structure, its management, its major functions - decision making, planning, capital project implementation, operations, technology utilization, financial management, regulatory compliance, public relations - and determine its overall efficiency and effectiveness in performing its mission. Responsibilities included review, evaluation, and recommendations for corrective actions for engineering, planning, construction support, line maintenancne and operations, CIP program management, project management, and survey departments. ESD is transitioning from an organization geared to support a 12-year (1996-2008) $3.1 multibillion dollar capital program to comply with a federal consent decree addressing sewer system overflows (SSOs), Clean Water Act compliance, and the simultaneous consolidation of wastewater collection systems serving 21 communities (3200 miles of collection system in total now). This work is intended to identify changes needed at

ESD to transition from its very significant focus on capital projects implementation to a sustainable utility.

Lancaster, Ohio: River Valley Highlands Design Build Sewer Rehabilitation / Lancaster, OH. Lead investigator, engineer, and construction manager for the

Lehigh County Authority: Western Lehigh Interceptor Rehabilitation/ Allentown PA. Project manager for the design and trenchless rehabilitation using cured in place liners and cured in place point repair of 3 miles of 21”-27” RCP and DIP sanitary sewer interceptor, much of which lies in the floodway and repeatedly crosses the Little Lehigh River.

Lehigh County Authority: Iron Run Pump Station and Force Main / Lehigh County PA. Identified and evaluated sites for a new 5-mgd sewage relief pump station, referred to as the Iron Run Pumping Station (IRPS), and routing alternatives for its associated force main. This evaluation included determining conceptual design of the IRPS layout, construction methods and costs, and integration with existing relief systems, and effect on surcharge conditions in the Western Lehigh Interceptor (WLI) immediately upstream and downstream of the township line. This assessment formed the basis of design for the planned IRPS, which was presented in a technical design memorandum at the completion of the assessment.

Lehigh County Authority: Western Lehigh Interceptor Condition Assessment and Basis of Rehabilitation Evaluation / Allentown PA. Project manager for the inspection and physical condition assessment of 15 miles of 24”-36” RCP sanitary sewer interceptor, all of which lies in the floodway and repeatedly crosses the Little Lehigh River. Investigation work included in-line CCTV using PACP coding as well as manual manhole inspections and man-entries into segments that exhibited high levels of concrete loss to evaluate whether corrosion was historic or ongoing. Recommended 1 mile of 24” and 3 miles of 36” be rehabilitated with cured in place liners.

Lehigh County Authority: Spring Creek Force Main Evaluation / Allentown PA. Technical lead and project manager for the inspection and physical condition assessment of 14,150 lf of 20” – 24” ductile iron sewage force main with 9 major grade inverses and more than a dozen minor grad changes. Evaluated operability and condition of 9 ARVs, all of which were found to be inoperable. Implemented a Smartball evaluation to identify gas pockets, then conducted excavations and BEM wall thickness testing to determine pipe repair and rehabilitation methods. Developed rehabilitation and repair recommendations for ARVs and pipeline.

Lehigh County Authority: Park Force Main Evaluation / Allentown PA. Technical lead and project manager for the inspection and physical condition assessment of 9,797 lf of 24” – 36” PCCP sewage force main with 1 major grade inverse and multiple flat sections.

Evaluated operability and condition of 10 ARVs, all but one of which were found to be operable. Developed a pump station shutdown process using an equalization tank 10 miles upstream to allow the forcemain to be drained, opened, and entered. Conducted off-tether manned entry inspections using pipe crawlers to inspect and test the interior pipe mortar and cylinder shell for wall loss, punkiness, disbanding, and cylinder corrosion using hammer soundings, Schmidt hammer testing, and hands-on integrity testing. Developed rehabilitation and repair recommendations for ARVs and pipeline.

Little Rock Water Reclamation Authority: Park Force Main Evaluation Little Rock Large Diameter Sewer Assessment and Rehabilitation Program / Little Rock, AR. Technical director for inspection and rehabilitation of entire 130 large diameter (18-60") sanitary sewer inventory. Pre-inspection manned entry evaluations were conducted to put hands on the pipe to tactilely assess pipe wall conditions in ways that remote entry inspections could never accomplish. These entries also served to identify pipe materials and debris depth so that appropriate remote tools could be assigned. Remote tools used included Cleanflow Fly-Eye HD Profiler, CUES SolidFX MultiSensor platform, Redzone Robotics Responder and Profiler platforms, and standard large tractor pan and tilt CCTV. Lidar, sonar, 2D laser profiling, and virtual mandrel were conducted were appropriate. A ranking system was developed to equate Years Remaining Service Life and, where rehabilitation was not immediately required, a Re-Inspection Cycle frequency across the inventory of PCCP, RCP, DIP, VCP, Brick, and CIPP pipes within the large sewer inventory. Emergency and expedited rehabilitation work was conducted by Arcadis. Seven Priority 1 projects have been designed and inspected by Arcadis to date.

Marathon Oil: Detroit / Robinson IL. Engi

Marathon Oil: SWMU Remediation and CAMU Operation / Robinson IL. Engineered and managed the dewatering, removal, and bioremediation of 75,000 cu yd of F037 sludge from a lagoon and 30,000 cu yd of contaminated soil from surrounding areas. Directly supervised the construction of the wastewater pretreatment system and operations startup.

Medford Meats: Hatfield Packing / PA. Conducted multimedia environmental compliance and health and safety audits of multiple meat slaughter/packing/rendering facilities.

Medford Meats: Industrial Wastewater Pretreatment Compliance Evaluation / Chester PA. Lead engineer for the assessment of wastewater noncompliance and negotiation of municipal industrial pretreatment permit for a meat processing facility.

Medford Meats: Industrial Wastewater Pretreatment System Redesign / Chester PA. Project manager for the redesign of an existing industrial wastewater pretreatment system to meet discharge requirements necessitated by changing influent characteristics.

Medford Meats: Waste Minimization and Process Optimization Study / Chester PA. Lead engineer for sampling and analyzing in-plant waste streams, evaluating current process methods, and recommending process modifications to minimize waste generation and energy usage at a meat processing facility.

Metropolitan Sewer District of Greater Cincinnati: Sewer 937 Dry Weather Cunette Installation and Interceptor Repair/ Cincinnati OH. (00167515.P001). Design Consultant for the design of a post-installed cunnete for an 11'x15' combined sewer, including structural construction, dry weather conduct of flow, managing acceptance of tributary flows at or near the cunnettes invert, internal point repairs to walls and ceiling, installation of new bench/floor, and constructability analysis.

Monroe County: Irondequot Pump Station Forcemain Rehabilitation / Rochester NY. Technical expert for the rehabilitation of two parallel 42-inch and 60-inch diameter welded steel force mains. Each force main was 1,300 feet long and provides all flow to the Monroe County WWTP. The force mains were designated for rehabilitation due to their age and a failure that occurred on the 42-inch force main. Originally designed and bid as a cured in place lining project, a value engineering proposition based on a spray applied structural epoxy lining system was installed. Selection of the epoxy lining system considered tensile, flexural, and compressive strength; hardness and abrasion resistance; chemical resistance; anticipated design life; application requirements; access limitations; safety; pipe downtime; and cost. During the course of substrate preparation for rehabilitation, the metal corrosion observed after sandblasting revealed more extensive deterioration than was visible in pre-design visual inspections. Also, the type of corrosion differed in the two pipes. The majority of the corrosion in the 60-inch force main was localized pitting, believe to be from gas corrosion resulting from sporadic use of that forcemain. The majority of the corrosion observed in the 42-inch force main was erosion corrosion resulting from the higher operating velocities. Key design considerations included implementing extended temporary shut downs of each force main; isolating one force main while keeping the pump station and other force main in operation; maintaining the environmental conditions inside the pipe required for application of the epoxy lining system; and providing access to the interior of the pipes.

Monsanto: PDA-1 Remedial Strategy Evaluation / Bridgeport NJ. Developed feasibility study, negotiated closure, and completed concept design of cap and slurry wall for a five-acre mixed (TSCA-RCRA) waste disposal area under New Jersey's ISRA program.

NAVFAC, Northern Division: Naval Shipyard Tank Farm Feasibility Study / Philadelphia PA. Served as lead construction cost estimator for preparation of an evaluation of alternative conceptual designs for demolition of existing fuel and distilled water tank farms, remediation

of contaminated soils, and construction of replacement facilities at the Philadelphia Naval Shipyard's Ship Systems Engineering Station.

New Castle County: Ashbourne Hills Sewer Rehabilitation / New Castle County DE. Program Manager and PE for the rehabilitation of a suburban sewer system, which involved the construction of 9500 lf of cured-in-place pipe lining, 130 cured-in-place lateral liners and cleanouts, and 34 manhole rehabs. The project involved predesign activities including identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations, access and construction negotiations with 135 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Brandywine Phase 1 Sewer Rehabilitation / New Castle County DE. Program Manager for the rehabilitation of a suburban sewer system, which involved the development of 5 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation, Lateral Lining, and Manhole Rehabilitation) and construction of 24400 lf of cured-in-place pipe lining, 13100 lf of grouted mains, 126 taps grouted, 183 cured-in-place lateral liners, 123 cleanouts, 3 excavated point repairs, and 211 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations, and access and construction negotiations with 150 private property owners, bid phase services to include attendance at the prebid meeting, review of contractor qualifications and proposal, construction administration, and resident engineering.

New Castle County: Brandywine Hundred Sewer Rehabilitation and Capacity Assurance Program / New Castle DE. Program manager for the development and implementation of a $405 million, 18 year sewer rehabilitation to eliminate stream discharges, basement backups, and manhole overflows during rain events from an aging suburban sanitary sewer system. Managed engineering services for nearly 200 separate projects to identify, prioritize, design, construct, and implement cost-effective solutions to the leaking sewer problems in the 420-mile Brandywine Hundred Sewer System. This comprehensive program involved investigation, regulatory negotiation, condition assessment, engineering and capital planning, design, and construction oversight. Work included manhole, pipe, and lateral inspection and assessment, I&I data interpretation, pipeline inspection and SSES, infrastructure rehabilitation prioritization, hydraulic modeling (XP-SWMM and InfoWorks), and regulatory negotiation and planning prior to design and construction of more than 135 miles of mainline rehabilitation and replacement, 4800 manhole repairs, 9400 laterals rehabilitated, 3800 cleanouts installed on private property, and hundreds of private property clearwater

connections (sumps, floor drains, and roof drains) identified and disconnected, all with less than a 1% change order value. Rehabilitation methods designed and/or constructed under these programs/projects include chemical grouting, spray-on coatings, cured in place lining, lateral lining, slip lining, pipe bursting, open cut sewer replacement, jack and bore, microtunneling, tunneling, horizontal directional drilling, force main piping and replacement, and manhole grouting, lining, and chimney coating. Implementation of this program entailed more than 100 public presentations and the successful negotiation of more than 3000 easements and temporary access agreements for private property work. All work was conducted as close partners with the New Castle County engineering team.

New Castle County: Brandywood Trunkline Realignment and Enlargement / Wilmington DE. Design Lead and Project Manager for the replacement of the Brandywood Trunkline with a larger, deeper, realigned trunkline. This involved the construction of 3600 linear feet of 15" to 24" VCP via open-cut replacement, jack and bored tunneling of 700 linear feet of new 18" sewer interceptor, 24 manholes, and 23 laterals along stream beds, through back yards, and through a shopping center. The project involved predesign activities including topographical surveys, geotechnical investigation and data report, wetland delineation, location of buried utilities, identification of property issues, CCTV inspections, hydraulic modeling, public meetings, alignment evaluations, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, easement negotiations with 23 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Brandywine Hundred Sewer Capacity Model / Wilmington DE. Project manager for the development and calibration of a dynamic hydraulic model using XP-SWMM was developed for the 420 mile Brandywine Hundred sanitary system to assess sewer capacity, to better understand current system performance during record period storm events, to assess where potential capacity improvements (e.g., pump station upgrades, construction of relief or replacement interceptors, storage) might be needed, and to estimate what impact I/I reduction projects might have on overflows and level of service, all with the goal of eliminating two overflow structures, basement backups, and manhole overflows. All pipes 15 inches and larger were physically modeled. Analysis of flow data from 50 flow meters and 3 rain gauges were used to develop typical diurnal flow patterns that were be applied throughout the model. As XP-SWMM did not have a groundwater module at that time, the model was iwet weather calibrated using extremely wet spring data from 2003, during the dry 2004 period, and during the normal wet period of 2005 to provide an understand of varying hydrologic impacts on RDII flows in the system. The model was subsequently used to model various capacity and I&I reduction alternatives to support the knee of the curve feasibility analysis that resulted in a 3 year 24 hour Type 2 SCS storm (LOP design basis) as the accepted regulatory basis for compliance with the DNREC Secretary's Order for Brandywine Hundred. In 2005, techniques were also developed to project benefit of I&I

source reduction programs. In 2013, the model was recalibrated in InfoWorks to determine the accuracy of the 2005 projections; the LOP design basis modeled conditions were found to be within 10% of the 2005 predictions.

New Castle County: Brandywine Hundred SSO Reduction Plan / Wilmington DE. Project manager for the preparation of the Brandywine Hundred SSO Elimination Plan, a consent order required work plan governing the elimination of two overflow structures, manhole overflows, and basement backups for a 420 mile sanitary sewer system discharging to a third party wastewater treatment plant with no additional peak wet weather capacity available (due to that plant's capacity being dedicated to Wilmington's CSO long term control plan). The initial plan was prepared and accepted by DNREC in 2004 and contained a 3 phase, 25 year implementation schedule. In 2008, USEPA dictated a revision to the plan that maintained the established level of control requirements but required compliance within 10 years.

New Castle County: Branmar Shopping Center Sewer Replacement / Wilmington DE. Program Manager and PE for the replacement of the sewers in an active shopping center, which involved the construction of 3700 linear feet of 8" VCP via open-cut replacement, 21 manholes, and 57 laterals in an active multi-use shopping center. The project involved predesign activities including topographical surveys, location of buried utilities, identification of property issues, CCTV inspections, meetings with commercial business operators, alignment evaluations, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, easement negotiations with 2 commercial property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Bringhurst Interceptor Realignment and Enlargement / Wilmington DE. Design Lead and Project Manager for the replacement of the dual pipe Bringhurst Interceptor with a single, larger capacity, realigned interceptor. This involved the development of 2 construction packages (to accommodate highway reconstruction issues) and construction of 4000 linear feet of 33"-48" Hobas via open-cut replacement, hard rock tunnelling of 1600 linear feet of 33"-42" cased Hobas, 2 stream crossings, 1 culvert crossing, blasting for 1000' in 30' deep gneiss, 27 manholes, and the abandonment of the existing parallel interceptors through a City forest. The project involved predesign activities including topographical surveys, location of buried utilities, geotechnical investigation and data report, wetland delineation, identification of property issues, CCTV inspections, hydraulic modeling, public meetings, alignment evaluations, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, easement negotiations with 23 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Brandywine Interceptor Modeling and Basis of Rehabilitation Evaluation / Wilmington DE. Program Manager for the XP-SWMM modeling of this 16,000

l.f. 15'-36" sanitary sewer interceptor. The project involved installation and maintenance of open channel flow meters, data interpretation, development and calibration of a dynamic model to predict performance of the interceptor under various storm conditions, and establishment of hydraulic basis of design for the rehabililiation, replaceement, and enlargement of the interceptor, as varied along the length of the alignment.

New Castle County: Claymont Sewer Rehabilitation / Claymont DE. Program Manager for the rehabilitation of a suburban sewer system, which involved construction of 33400 lf of cured-in-place pipe lining, 4500 lf of grouted mains, 151 taps grouted, 750 cured-in-place lateral liners, 222 cleanouts, 5 excavated point repairs, and 87 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations, and access and construction negotiations with 240 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Claymont Heights Sewer Rehabilitation / New Castle County DE. Program Manager and PE for the replacement of a suburban sewer system, which involved the construction of 3700 linear feet of 8" PVC via open-cut replacement, 18 manholes, and 63 laterals. The project involved predesign activities including topographical surveys, location of buried utilities, identification of property issues, CCTV inspections, meetings with property operators, alignment evaluations, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, easement negotiations with 4 property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Clearwater Elimination Pilot Program and Program Development / New Castle DE. Program manager for the pilot program to eliminate of illegal clearwater connections in several neighborhoods of North Brandywine. These neighborhoods include more than 600 residences. Eliminating illegal sump pump and punctured basement floor drain connection to the sanitary sewer will reduce the total flow in the system, especially during rain events. The Pilot Program involved basement inspections of approximately 500 homes to identify clearwater connections; storm water analyses to assess relative impact of new sump pump discharges on the overall storm water flows in the various neighborhoods; presentation of the Pilot Pro-gram to the neighborhood Civic Associations; follow-up inspections of homes with clearwater connections and preparation of an Agreement between NCC and individual property owners to provide the property owner's consent to the clearwater disconnection work; subcontracting the disconnection of more than 40 clearwater connections to local contractors and overseeing the disconnection work; receiving follow-up calls from res-idents to identify and resolve any issues with the disconnection work; and assessing the

effectiveness of the Pilot Program and identify issues that must be addressed to implement future NCC policies and programs regarding clearwater disconnections. Lessons learned during this Pilot Program were used to plan a system-wide program to eliminate illegal clearwater connections by identifying and addressing financial, legal, technical, property owner, stormwater, and political issues that would impact the success of a larger program.

New Castle County: County Sewer System CMOM Evaluation / New Castle DE. Project manager for an assessment of the New Castle County's sewer system management program, including engineering, day-to-day operations and maintenance, data management, planning, organization, capacity assurance, and general management functions. New Castle County owns and operates approximately 1,800 miles of gravity sewer and interceptors, 38,000 manholes, and more than 100 pump stations. This assessment identified effective practices and programs as well as those requiring improvement to optimize utility operations and to meet NPDES collection system requirements (CMOM and SSO regulations). Reviewed existing policies, programs, and procedures for managing, operating, and maintaining the sewer system, compared them to effective industry practices, assessed performance of these in actually achieving their stated objectives, and identified ways to improve overall utility operation. A detailed review of New Castle's O&M procedures, equipment, personnel, and preventative maintenance practices and programs was the key feature of this evaluation. A suggested path forward for the preparation of a formal CMOM program was provided; as a result of this evaluation, New Castle hired a CMOM manager and prepared a formal CMOM Plan.

New Castle County: Edgemoor Gardens Sewer Replacement / Claymont DE. Program Manager and PE for the replacement and realignment of an urban row home sewer system, which involved the construction of 6650 linear feet of 8"-18" VCP via open-cut replacement, 44 manholes, and 394 laterals. The project involved predesign activities including topographical surveys, location of buried utilities, identification of property issues, CCTV inspections, meetings with property operators, alignment evaluations, geotechnical investigation and data report, wetland delineation, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, easement negotiations with 5 property owners, eminent domain condemnation of 3 properties, temporary construction easement negotiations with 370 property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Edgemoor, Governor Printz and North Delaware Interceptors Condition Assessment / New Castle County DE. Served as project manager for inspection and physical condition assessment of 32,000 of 42" – 66" RCP sanitary sewer interceptor. Investigation work including night time zoom camera inspection, man entries into approximately 1/3rd of the pipe to evaluate the ongoing corrosion attack, and in-line CCTV. Condition assessment included basis of cleaning evaluation (which included estimates of

gravel/debris to be removed and cleaning sequence and equipment requirements) and structural condition assessment using a 1-5 rating system akin to PACP.

New Castle County: Fairfax Sewer Rehabilitation / Wilmington DE. Program Manager for the rehabilitation of a suburban sewer system, which involved the development of 5 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation, Lateral Lining, and Manhole Rehabilitation) and construction of 35200 lf of cured-in-place pipe lining, 5400 lf of grouted mains, 151 taps grouted, 687 cured-in-place lateral liners, 371 cleanouts, 2 excavated point repairs,and 178 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 390 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Governor Printz Interceptor Replacement / New Castle County DE. Program Manager for the replacement of the dual pipe Governor Printz Interceptor with a new dual pipe, larger capacity, realigned interceptor. This involved design of 12,000 linear feet of parallel 48” and 78” Flowtite pipes installed in a single trench via open-cut replacement, 25 manholes, and the abandonment of the existing parallel interceptors, all under an active 4 lane highway. The project involved predesign activities including topographical surveys, location of buried utilities, identification of property issues, hydraulic modeling to establish pipe diameter/slope, alignment evaluations, bypass control, geotechnical investigations and dewatering studies, detailed design, negotiation with highway department, and design oversight of other consultants.

New Castle County: Highland Woods - Pennrose –ND Trunklines Sewer Rehabilitation / New Castle County DE. Program Manager for the rehabilitation of two suburban sewer systems and four suburban stream following trunklines, which involved the development of 5 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation, Lateral Lining, and Manhole Rehabilitation) and construction of 14400 lf of cured-in-place pipe lining, 9800 lf of grouted mains, 269 taps grouted, 195 cured-in-place lateral liners, 120 cleanouts, and 59 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 98 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Indefinite Quantity Indefinite Deliver/On Call Contract Development / New Castle County DE. Program manager for the development of specifications and detail packages for contractors to provide unit pricing for various methods of sewr rehabilitation. Separate contracts were prepared for CIPPL, Excavation and Backfill, Test and Seal/CCTV/Cleaning/CIPPR; Manhole Replacement or Rehabilitation, and Disconnection of Clearwater Connections. These contracts provide NCC with resources for works that exceed their in-house capabilities but which are either too small to warrant bidding or of an emergency nature. The work under these contracts have an indeterminate quantity and are completed on an as-needed basis. The specifications and details broadly describe the methods of construction and rehabilitation and provide measurement and payment parameters for each task order issued under these contracts.

New Castle County: Brandywine Hundred Hydraulic Condition Assessment / Wilmington DE. Program manager for the development and implementation of a 2 year long comprehensive investigation to determine the nature, extent, and location of Inflow and Infiltration in the 420-mile Brandywine Hundred Sewer System, with the goal of eliminating two direct stream discharges and hundreds of basement backups and manhole overflows that occurred during severe rain events from an aging suburban sanitary sewer system. This hydraulic integrity condition assessment (HICA) began with a comprehensive flow metering program. Replacing older New Castle County owned/maintained flowmeters and ADS permanent meters, we installed 39 flowmeters and 3 rain gauges to delineate 30 basins. Data collected from these were analyzed using our Time Series Analyzer (TSA). Quantitative evaluations for baseline infiltration, dry day flow patterns, wet weather peaking factors, RDII volumes, and determination of groundwater regime change factors affecting RDII response were conducted. We also conducted qualitative evaluations of storm hydrograph shape/response to identify likely causes of I&I (e.g., rainfall induced infiltration, roof drains, sump pumps, manhole inundation, stream inundation, etc.) to provide focus for the subsequent SSES phase and scatter graph analyses to identify operating features like partial line blockages, upstream or downstream indicators of surcharge or overflow, and flow data inconsistencies. Subsequent SSES work driven by the flow analysis included nighttime weiring (as a surrogate for RII) at 660 locations for a total of 2300 measurements, smoke testing of 360 miles of sewer. During smoke testing, basement inspection were attempted at all adjacent houses to locate illegally connected sump pumps and punctured floor drains; approximately 15% of the houses were accessed and inspected. From the weiring work, 190 separate rehabilation project areas were identified and prioritized. From the smoke testing work, 33 storm sewer cross connections, 169 sheared cleanouts, 259 smoking laterals/mains, and 124 roof drains were identified. From the basement inspections, it wa determined that 15 percent of the homes had illegal clearwater connections.

New Castle County: Lower Valley Run Interceptor Rehabilitation / New Castle County DE. Design Lead and Project Manager for the replacement and enlargement of the Lower

Valley Run Interceptor, which involved the construction of 4,200 linear feet via double upsize pipebursting (12” to 18”), open-cut replacement of 1,500 linear feet of 15” and 18” sewer with new HDPE pipeline via open cut, and encased tunneling of 350 linear feet of new 18” sewer interceptor along stream beds and through back yards. The project involved predesign activities including topographical surveys, location of buried utilities, identification of property issues, CCTV inspections, hydraulic modeling, public meetings, and review and selection of rehabilitation strategies including microtunneling, pipe bursting, cured-in-place lining, and open-cut excavation and backfill, geotechnical investigation and data report, wetland delineation, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, and access and construction easement negotiations with 42 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Sewer Rehabilitation Projects / New Castle DE. Program Manager for sewer rehabilitation projects for 730,000 LF of sewer in eight sewer basins within New Castle County. Rehabilitation methods designed and/or constructed under these programs/projects include chemical grouting, spray-on coatings, cured in place lining, lateral lining, slip lining, pipe bursting, open cut sewer replacement, jack and bore, microtunneling, tunneling, horizontal directional drilling, force main piping and replacement, and manhole grouting, lining, and chimney coating. The projects included approximately 77 miles of cured-in-place pipe lining (CIPPL), 62 miles of test and seal, 5 miles of open cut collection, trunkline, and interceptors, nearly 10,000 cured in place lateral liniers, and rehabilitation of more than 2000 manholes.

New Castle County: NA2 Sewer Rehabilitation / New Castle County DE. Program Manager and PE for the rehabilitation of a suburban sewer system, which involved the development of 4 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation and Lateral Lining, and Manhole Rehabilitation) and construction of 12400 lf of cured-in-place pipe lining, 18600 lf of grouted mains, 300 taps grouted, 61 cured-in-place lateral liners, 54 cleanouts, 2 excavated point repairs, and 152 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 390 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: NB 05 Rehab / Wilmington DE. Program Manager and PE for the rehabilitation of a suburban sewer system, which involved the construction of 8000 lf of cured-in-place pipe lining, 191 cured-in-place lateral liners, 172 cleanouts, 3100 lf of grouted mains, 95 taps grouted, and 50 manhole rehabs. The project involved predesign activities including

identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations, access and construction negotiations with 135 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: NB 2007 Rehab / Wilmington DE. Program Manager and PE for the rehabilitation of a suburban sewer system, which involved the development of 5 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation, Lateral Lining, and Manhole Rehabilitation) and construction of 40,000 lf of cured-in-place pipe lining, 28800 lf of grouted mains, 296 taps grouted, 536 cured-in-place lateral liners, 254 cleanouts, 7 excavated point repairs, and 192 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 390 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Naamans Interceptor Condition Assessment and Re-opening / New Castle County DE. Served as project manager for the inspection and physical condition assessment of 9,000’ of parallel and interconnected 24”-36” RCP sanitary sewer interceptor, including two siphons and approximately 2000’ of 15’-20’ elevated stack manholes located in the middle of a stream/wetland. Work was located in an active steel mill/scrap recycling processing yard parallel to both Amtrak/Conrail railroad tracks and tidal streams. Investigation work locating and uncovering buried manholes, constructing a accurate location map, and televising. Subsequent work to jet clean and bucket clean the pipes to remove boulders, sand, and gravel resulting in the reopening of the smaller liner.

New Castle County: ND13 Rehab / Wilmington DE. Program Manager for the rehabilitation of a suburban sewer system, which involved the development of 5 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation, Lateral Lining, and Manhole Rehabilitation) and construction of 24,800 lf of cured-in-place pipe lining, 20300 lf of grouted mains, 195 taps grouted, 380 cured-in-place lateral liners, 274 cleanouts, 1 excavated point repairs, and 90 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 280 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: North Delaware Interceptor Replacement / New Castle County DE. Program Manager for the replacement of the dual pipe North Delaware Interceptor with a single, larger capacity, realigned interceptor. This involved the construction of 6300 linear feet of 48" – 66" Hobas via open-cut replacement, soft soil tunnelling, 2 culvert crossing, 20 manholes, and the abandonment of the existing parallel interceptors, all under an active 4 lane highway. The project involved topographical surveys, location of buried utilities, identification of property issues, hydraulic modeling to establish pipe diameter/slope, establishing acceptable operating parameters, basis of design constraints, alignment evaluations, bypass control, geotechnical investigations and dewatering studies, detailed design, negotiation with highway department, easement negotiations with 5 private property owners, and design oversight of other consultants,

New Castle County: Northcrest: Afton Sewer Rehabilitation / New Castle County DE. Program Manager and PE for the rehabilitation of a suburban sewer system, which involved the construction of 5200 lf of cured-in-place pipe lining, 3600 lf of grouted mains, 58 taps grouted, 66 cured-in-place lateral liners, 61 cleanouts, 1 excavated point repair, and 45 manhole rehabs. The project involved predesign activities including identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations, access and construction negotiations with 54 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: North Hills – Blue Rock Manor Sewer Rehab / Wilmington DE. Program Manager for the rehabilitation of a suburban sewer system, which involved the development of 5 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation, Lateral Lining, and Manhole Rehabilitation) and construction of 12400 lf of cured-in-place pipe lining, 13600 lf of grouted mains, 134 taps grouted, 198 cured-in-place lateral liners, 146 cleanouts, 1 excavated point repairs, and 44 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 204 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: O&M Program Development / Wilmington DE. Project Director for the development a new approach to Operations and Maintenance of New Castle County's 1,800-mile sanitary sewer collection system aimed at reducing overflows and blockages while managing increasing costs by optimizing the frequency of cleaning and inspection activities. This included program elements addressing issues such as fats, oils, and grease (FOG),

mainline blockages and overflows, roots, trunklines, interceptors, and preventive maintenance of collection sewers.

New Castle County: Old Shellpot Rehab / Wilmington DE. Program Manager and PE for the rehabilitation of two parallel VCP and RCP sewer interceptors, diameters varying from 15" to 42", following the course of Shellpot Creek. These interceptors were built decades ago, and the easements over the pipes had never been maintained, largely due to a lack of access to the easements. As such, the easements were overgrown with 60 year old trees. Access easements were negotiated with more than 70 property owners, accessways and the easements were cleared and turf roads were installed as required to conduct the rehabilaiton and to maintain the interceptors. The rehabiliation consisted of 19950 lf of cured-in-place pipe lining, 10850 lf of grouted mains, and 131 manhole rehabs. The project involved predesign activities including identification of property issues, CCTV inspections, wetland delineation, PACP-based physical condition assessment and determination of the basis of rehabilitation, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations, bid phase services, construction administration, and resident engineering. Work was built using EPA grant money. Project included the design of 9,000 l.f. of access roads for contractor access during construction and client access for future maintenance. This work was contracted as three contracts in accordance with state grants monies for the work.

New Castle County: Brandywine Hundred Sewer Inspection and Physical Condition Assessment / Wilmington DE. Project manager for the inspection of 150 miles of hydraulic condition assessment prioritized sewers with diameters up to 66". Using 4 subcontractors, sewers were inspected in accordance with PACP requirements in order to determine the physical condition and establish basis of rehabilation. To assess the condition of the pipes and determine the rehabilitation-driving defect that will establish the minimum basis of rehabilitation for the pipe segment, we use our TRIAD software package to takes data directly from PACP compliant databases, amke correction and additions to defect codes and header information based on the engineer's viewing, assess various rehab approaches/technologies by both initial capital and life cycle cost, automatically output the data into GIS with such critical data as lateral tap locations, flow direction, right-of-way/easement limits, and aerial orthophotography, and a basis of rehabilation (BOR), This BOR, which is essentially the 30% design, was exported into AutoCad as the base mapping for design package used to build design and contracting packages. This AutoCad export automatically showed flow directions, tap locations/orientation, footages, manhole depths, pipe ovality, and physical features such as easement width, property lines, etc.

New Castle County: SP23/SP27 Sewer Rehabilitation / Wilmington DE. Program Manager for the rehabilitation of two suburban sewer systems, which involved the development of 5

technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation, Lateral Lining, and Manhole Rehabilitation) and construction of 38300 lf of cured-in-place pipe lining, 19800 lf of grouted mains, 262 taps grouted, 431 cured-in-place lateral liners, 259 cleanouts, 8 excavated point repairs, and 134 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 240 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: SP24 Sewer Rehabilitation / Wilmington DE. Program Manager and PE for the rehabilitation of a suburban sewer systems, which involved the development of 4 technology specific bid packages (Mainline Lining, Test and Seal/ Point Repairs, Cleanout Installation and Lateral Lining, and Manhole Rehabilitation) and construction of 32300 lf of cured-in-place pipe lining, 13200 lf of grouted mains, 171 taps grouted, 441 cured-in-place lateral liners, 390 cleanouts, 3 excavated point repairs, and 54 manhole rehabs. The project involved predesign activities including location of buried utilities, identification of property issues, and CCTV inspections, PACP-based physical condition assessment and determination of the basis of rehabilitation, dye testing, design of rehabilitation and preparation of drawings, technical specifications, and contract documents, preparation of permit applications, public relations and access and construction negotiations with 410 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Sunny Brae Trunkline Realignment and Enlargement / Wilmington DE. Design Lead and Project Manager for the replacement of the Sunny Brae Trunkline with a larger, realigned trunkline. This involved the construction of 5100 linear feet of 15” to 24” VCP via open-cut replacement, jack and bored tunneling of 500 linear feet of new 21” sewer interceptor, 40 manholes, and 40 laterals along stream beds and through back yards in soil, boulder filled rock, and solid gneiss and granite at depths up to 30’. The project involved predesign activities including topographical surveys, location of buried utilities, identification of property issues, geotechnical investigation and data report, wetland delineation, CCTV inspections, hydraulic modeling, public meetings, alignment evaluations, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, easement negotiations with 35 private property owners, bid phase services, construction administration, and resident engineering.

New Castle County: Winterset Farm Trailer Park Sewer Replacement / Wilmington DE. Program Manager and PE for the replacement and realignment of the sewers in a trailer park, which involved the construction of 8400 linear feet of 8” PVC via open-cut, 37 manholes, and 277 laterals in a tightly constructed mobile home park. The project involved predesign

activities including topographical surveys, location of buried utilities, geotechnical data report, identification of property issues, CCTV inspections, alignment evaluations, design activities including preparation of plan and profile drawings, technical specifications, and contract documents, preparation of permit applications, public relations, easement negotiations with the trailer park owner, bid phase services, construction administration, and resident engineering.

New Castle County: Upper Valley Run Interceptor Rehabilitation / New Castle County DE. Program Manager and PE for the rehabilitation of the Upper Valley Run Interceptor, which involved the construction of cured-in-place pipe lining of 2100 lf of 12-inch clay pipe.

New Castle County: Southern Sewer Service Area Sewerage Plan / New Castle County DE. Project Manager for the .

New Haven Water Pollution Control Authority: New Haven Collection System O&M Program and Practices Review / New Haven CT. Lead engineer for a review of the WPCA privatized contractor's (OMI) performance regarding the management, maintenance, and operation of the WPCA's wastewater collection system. There are 240 miles of sewers and approximately 10,000 catch basins within the existing New Haven WPCA collection system. This review focused on how the system was being managed in order to offer recommendations for improving collection system performance, both for the existing City of New Haven (New Haven WPCA) system and with an eye toward the increased operation demands of the pending larger regional system. The review report presented a summary of the observations made during on-site review and offered recommendations for increasing collection system operation effectiveness. These issues and recommendation for correction were provided in a written report to the WPCA.

New Jersey Department of Environmental Protection: Denzer and Schaefer X-Ray Superfund Feasibility Study / Bayville NJ. Lead engineer for a metal reclamation facility Superfund feasibility study.

Pennsylvania Department of Environmental Resources: Welsh Road Superfund Feasibility Study / Honey Brook PA. Project engineer for a contaminated solid waste landfill Superfund feasibility study.

Pennsylvania Power and Light Company: Hauto SES Remediation / Nesquehoning PA. Managed the stabilization and landfill shipment of 36,000 tons of lead- and arsenic-contaminated soils under Pennsylvania's Land Recycling Program (Act 2). Managed the preparation of the Act 2 Remedial Action Plan and the Erosion and Sediment Control Plan.

Philadelphia Electric Company: NPDES Permit Application / PA. Lead engineer for the volume and pollutant characterizations of industrial wastewater discharges from the Muddy Run, Cromby, Richmond, Eddystone, Delaware, and Peach Bottom (nuclear) generating stations (38 outfalls/intakes) and the subsequent preparation of NPDES applications for each of these facilities.

Philadelphia Water Department: Northeast Water Pollution Control Plant Rotating Biological Contactor (RBC) Demolition / Philadelphia PA. Managed the preparation of drawings and specifications for the demolition and removal of nearly 300 RBCs from the aeration basins at the Northeast Water Pollution Control Plant.

Philadelphia Water Department: Sandyford Run Regulator Overflow Treatment and Floodplain Greening / Philadelphia PA. Developed point of discharge treatment concepts to treat CSO flows that coupled with stream improvements (plunge pools, vanes and riffles, and natural bank stabilization) would transform an inner city CSO discharge into a community park and ecological education center.

Pfizer / Hnischu City, Taiwan. Technical lead for entire facility's firewater protection system leakage and structural condition evaluation. Conducted leakage tests under multiple operating pressures scenarios, located all pipe using induce current location, conducted system-wide leak acoustical leak detection using multiple Sewerin SeCorPhon microphones and leak location correlators to identify leaks as low as 2 liters per minute in 3" – 12" wrapped galvanized steel water lines. Directed the excavation, removal of coupons, and internal inspection of pipes at 12 locations to assess internal body, butt joint, and longitudinal joint corrosion. Recommeded replacement of all 4" and smaller components minimized leakage to less than 1 lpm system-wide.

Phoenixville Township: Sanitary Sewers and Water Main Replacement / Phoenixville Township PA. Project engineer responsible for the detailed construction design of 7,400 lf of 10-in. sanitary sewer and manholes and 7,600 lf of 6-in. water force main, valves, hydrants, and service connections.

Phoenixville Township: Sewer Ordinance / Phoenixville Township PA. Wrote the entire sewer ordinance regulations controlling connection, use, and rate structure for township's wastewater collection and treatment system.

Phoenixville Township: Water and Sewer Extension / Phoenixville Township PA. Project engineer responsible for the detailed construction design of 600 ft of water pipe, 600 ft of small-diameter sewage force main, and three grinder pump stations with controls.

Plymouth Tube Company: Prevention, Preparedness, and Contingency Plan / Horsham PA. Lead engineer for the preparation of the PPC Plan for a tube manufacturer.

Redev Auth of the Cty of Montgomery: Norristown Reg Sew / Norristown PA. Project manager for the evaluation of wastewater treatment and conveyance regionalization solutions

for 6 townships. Evaluated value and upgrade costs of consolidating 4 existing POTWs and 5 separate operations departments, identified new POTW sites, analyzed impediments to regionalization utilizing a pairwise comparison, developed cost plans and management and labor consolidation plans, and facilitated the negotiation of regionalization schemes between the 6 players.

SABIC

City of San Diego: El Monte Raw Water Transmission Tunnel and Pipeline Condition Assessment: San Diego, CA. Lead investigator for the design and implementation of a multi-approach investigation of the 13 mile long 48"-72" PCCP and tunnel raw water line for the first time since construction during WWII. Investigation began with locating the pipeline and its valves, manways, and ARVs. The primary method of inspection was manned entry. Developed a safety and inspection plan that allowed off-tether inspection of pipes with 30% slopes, 35' deep water filled section, and connection lines as small as 21" diameter. Key considerations were lock out of valves and pumps over a 4 town area, air supply, fall protection while negotiating steep slippery slopes, deep water pockets, condition documentation, communication for inspections that required up to 7500' long single entry inspections, and contingency planning for emergencies. Team developed specialized bike and cart tools to facilitated passage of the various diameter pipes.

Schmidt Bakers: Facility Review and Compliance Audit / Northeastern U.S.. Lead engineer for a facility wide environmental program compliance audit for food processing industry clients. Also, conducted compliance audits for Small Tube Audit.

Seabrook Bros. & Sons: NPDES Applications / Seabrook NJ. Lead engineer for the preparation of NPDES permits for thermal surface water discharge, land application of industrial waste residuals, and spray irrigation.

Seabrook Bros. & Sons: NPDES Industrial Wastewater Compliance Evaluation / Seabrook NJ. Project engineer for the assessment of discharge to groundwater wastewater noncompliance, treatment system and spray irrigation evaluation, raw water system evaluation, and receiving stream impact evaluation.

Skippack Township Authority: Sanitary Sewer Extensions / Skippack PA. Project engineer for the review of sanitary sewer and pump station construction designs and inspection of constructed components.

Skippack: Evansburg Pump Station Force Main Replacement / Skippack PA. Inspecting engineer responsible for construction oversight, client/contractor relations, submittal review,

change orders, pay estimate review, punchlist, and closeout for a 1-in. 1,400 lin ft ductile iron sewage force main and valve station replacement project.

Skippack: Infiltration/Inflow Study / Skippack PA. Lead engineer for temporary flow metering of three sewage pump stations to evaluate drainage basin I/I characteristics and to evaluate wet well surcharges.

Skippack: Sewer Rehabilitation / Skippack PA. Project manager for the manhole inspection, logging, reporting, and rehabilitation recommendations for entire sewer system (appr. 35 miles of sewer and more than 500 manholes).

Small Tube Products, Inc.: Act 2 Remedial Investigation and Closure / Altoona PA. Project Manager for the remedial investigation, risk assessment, feasibility study, and risk-based closure under Pennsylvania's Act 2 Land Recycling Program for five pre-RCRA residuals waste percolation lagoons at an active copper tube manufacturing site.

Small Tube Products, Inc.: Discharge Monitoring Station Design and Construction Management / Altoona PA. Project Manager for the design and construction management of an automatic discharge monitoring station. As designed, the discharge monitoring station includes an ultrasonic flow meter, trapezoidal weir, and automatic sampler. Construction management included preparation of rough-in installation sketches, preparation of purchase orders for acquisition of major equipment components, on-site direction of the contractors, and training of the owner in the proper operation of all equipment.

Small Tube Products, Inc.: Industrial Wastewater Pretreatment System Design and Construction / Altoona PA. Project Manager of the design, construction administration, and start-up and testing of industrial pretreatment systems for metals removal for a copper tube redraw manufacturing facility discharging to a POTW. This included development of process and piping construction plans, detailed bill of materials, and specification. Project also included start-up services which included equipment testing, development of a detailed operation and maintenance manual, and instruction of the Owner's operating personnel.

Small Tube Products, Inc.: Wastewater Pretreatment Evaluation / Altoona PA. Small Tube Products, a copper forming and manufacturing facility, discharges from nearly twenty separate categorical discharges, including alkaline cleaning wash, alkaline rinse, pickling rinse, and spent drawing lubricants. Under the requirements of two Administrative Consent Orders, they retained Malcolm Pirnie to recommend how to achieve compliance with both local industrial pretreatment limits (40CFR403) and federal categorical pretreatment limits (40CFR468). Malcolm Pirnie designed a wastewater characterization plan, developed and trained Small Tube personnel in sample collection, characterized the waste load from the various processes at the facility, assessed how compliance with the production-based categorical pretreatment standards was to be determined, evaluated existing pretreatment system capabilities and performance, and recommended new processes to achieve regulatory compliance. The results of this investigation were integral to future phases of work

including re-negotiation of the Industrial Wastewater Discharge to POTW permit, reduction in resources allocated to regulatory compliance, improved regulatory compliance, and partnering with regulatory agencies.

Stroehmann Bakeries: Industrial Wastewater Baseline Monitoring Report / Harrisburg PA. Lead engineer for the characterization of industrial wastewater flows and preparation of baseline monitoring report.

Stroehmann Bakeries: Industrial Wastewater Discharge Compliance / PA. Lead engineer responsible for addressing Notice of Violations for three facilities.

Stroehmann Bakeries: Industrial Wastewater Permit Renewal / Williamsport PA. Lead engineer for the preparation of a municipal industrial pretreatment discharge permit application.

Stroehmann Bakeries: Industrial Wastewater Pretreatment Permitting / Norristown PA. Lead engineer for the characterization of industrial wastewater flows, preparation of municipal-industrial pretreatment permit application, and negotiation of effluent limits and permit conditions.

Stroehmann Bakeries: Waste Minimization Study / Williamsport PA. Lead engineer responsible for identifying process and operational changes to minimize industrial wastewater discharge violations and surcharges.

Sullivan's Island: Sewer Rehabilitation CMAR Project / Sullivan's Island, SC. Program developer, engineering design lead, and construction manager for two a construction management at risk project featuring ARCADIS's Expedited Holistic Rehabilitation approach to reduce leakage and structurally secure 15 miles of badly leaking sanitary sewers on a sandy barrier island. (68% of the starting average daily flow was attributed to I&I using water use records). ARCADIS engaged one open cut and seven trenchless subcontractors, providing significant overlap of capabilities to minimize performance risks. This turnkey work included development of new capital grouting techniques and tools to address longitudinal defects and laterals from property line to the main. 38% of the pipe joints and 87% of the laterals failed the air test and were successfully grouted. Additionally, approximately 700 pipe fractures and cracks were successfully sealed, some using a new technology developed by ARCADIS specifically to seal previously ungroutable longitudinal fractures, called Long Sock Fracture Grouting. 200 laterals connected to manholes were also tested and grouted. Nearly 1000 laterals were sonded and televise inspected from the main to the house (average length 55'). Cured in place point repairs, mainline lining, manhole lining, and excavated point repairs were used sparingly as the grouting work proved to be overwhelmingly successful. Rainfall derived inflow and infiltration was reduced by 47%, as measured using control basin methodology.

Program developer, engineering design lead, and construction manager for a design-build project to stabilize, repair, and reduce I&I from 49 miles of 100 year old 6”-24” clay and concrete sanitary sewers featuring ARCADIS’s Expedited Rehabilitation Approach. ARCADIS engaged one open cut and five trenchless subcontractors, providing significant overlap of capabilities to minimize performance risks. This turnkey work featured the capital grouting techniques that addressed all aspects of the mains, tap, laterals, and manholes, cured in place pipe lining, chemical root control, pipe bursting, open cut replacement, and manhole frame and cover replacement.

Teledyne McKay: Wastewater Process Optimization / York PA. Lead engineer for the concept design effort to consolidate and optimize three industrial wastewater treatment systems at a welding electrode manufacturing facility.

Township of Mahwah: Sanitary Sewer Extensions / Mahwah NJ. Project Manager for the conversion of 200 residential properties from an on-site septic system to a combination of conventional municipal gravity and pressure sewers. The project consisted of construction of 22,000 feet of new gravity and pressure sewers, and the rehabilitation of 3,000 feet of existing inactive/dry gravity sewers.

U.S. Army Corps of Engineers, Baltimore District: Defense Supply Center - Philadelphia Combined Sewer Inspection / Philadelphia PA. Television and manual inspection of 1 mile of 8'x 12' concrete box combined sewer and tributary brick eggshaped sewers for contaminated groundwater and petroleum infiltration.

Uniqema: Sitewide HSCA Voluntary Cleanup Program / New Castle DE. Lead engineer for the remedial action objectives, remedial action work plans, remedial design, permitting, and remedial action phases of several AOCs at an active chemical manufacturing site under Delaware's HSCA program.

Upper Merion Municipal Utilities Authority: Act 537 Sewage Facilities Planning Study for the Matsunk Drainage Basin / Upper Merion Township PA. As lead engineer, responsible for evaluating existing wastewater treatment and conveyance systems, forecasting growth and increases in sewerage, identifying existing and potential treatment and conveyance needs, evaluating alternatives to meet those needs, and establishing an implementation schedule for the recommended plan.

Upper Merion Municipal Utilities Authority: Balligomingo Pump Station / Upper Merion Township PA. Engineer responsible for shop drawing review and inspection services for pump station expansion, which included two 100-hp pumps, level controls, electrical systems, flow meter, wet well, electrical controls, emergency generator, 800 lin ft of new force main, architectural expansion, and HVAC.

Upper Merion Municipal Utilities Authority: Swedesburg Pump Station / Upper Merion Township PA. Inspecting engineer responsible for construction oversight, client/contractor relations, submittal review, change orders, pay estimate review, punchlist, and closeout for pump station refurbishment that included two 15-hp pumps, level controls, electrical systems, and HVAC.

Upper Merion Township: Infiltration/Inflow Study / Upper Merion Township PA. Lead engineer for an inflow/infiltration study for 139 miles of sewage collection system. Responsible for study design, installation and data gathering from 36 flowmeters, and system modeling to determine conveyance system's I/I characteristics and recommend cost-effective rehabilitative efforts. Subsequently led focused SSES for 38 miles of sewage collection system. Responsible for study design, installation and data gathering from 204 weir points, and system evaluation to determine specific remediation measures for each run of deteriorating sewer pipe.

Upper Merion Township: Maschellmac Interceptor Stream Crossing Repair / Upper Merion Township PA. Project engineer responsible for the investigation of a 24-in sewer interceptor failure under a stream and the subsequent construction design of the replacement interceptor, including stream damming and bypass and sewage diversion and bypass.

Upper Merion Township: Swedeland Pump Station Renovation / Upper Merion Township PA. Project engineer responsible for the detailed construction design and construction services for the wet well renovation, which included installation of a new wet well, level controls, comminutor, HVAC, lights, and controls.

Upper Merion Township: Trout Run Chlorination and Pumping System Upgrade / Upper Merion Township PA. Project engineer responsible for the detailed construction design of a new pump house and chlorination system for the Trout Run POTW.

Upper Merion Township: Trout Run Mechanical and Electrical Renovation / Upper Merion Township PA. Project engineer responsible for the detailed construction design and construction inspection of various pumping and mechanical components of the scum and sludge thickening systems of the Trout Run POTW.

Upper Moreland-Hatboro Sewer Authority: Sewer Replacement / PA. Lead engineer responsible for the detailed construction design of the replacement of 1,600 lin ft of 8-in. sanitary sewer and manholes.

Upper Uwchlan Township: Marsh Harbour Wastewater Treatment Facility / Upper Uwchlan Township PA. Inspecting engineer responsible for construction oversight, client/contractor relations, submittal review, change orders, pay estimate review, release of escrow, punchlist, and closeout for the wastewater treatment, pumping, storage, and discharge construction project, which included the construction of a lift station and force main,

complete SBR biological treatment system, lined effluent storage lagoon, and spray irrigation discharge system.

Upper Uwchlan Township: Sewer Ordinances / Upper Uwchlan Township PA. Prepared ordinances for adoption by township board for the control and use of on-site sewerage systems.

Various Clients: Water and Wastewater Regulatory Engineering. Water Resources Engineer at Delaware River Basin Commission: responsible for the development of water quality standards, evaluation of discharge permit limits, compliance monitoring, NPDES review, preparation of contracts and cost evaluation, and data acquisition and analysis, and quality assurance programs. Extensive written and oral communication with industrial, municipal, and regulatory groups.

Various Municipal Utilities: Wasteload Management Reports / Montgomery County PA. Project engineer for the completion of the Chapter 94 Municipal Wasteload Management Reports for the Upper Merion Trout Run POTW, the Upper Merion Matsunk POTW, and the West Norriton Municipal Utilities Authority.

W.L.Gore: Infiltration System Design / Cherry Hill MD. Lead engineer for the pilot testing and design of a infiltration system for discharge of treated TCE-contaminated groundwater.

Washington Suburban Sanitation Commission: Sanitary Sewer Rehabilitation Program. Project manager for assessment and rehabilitation of large portions of the sanitary sewer system. Work involves evaluation of priority one sewer mains, laterals and manholes to confirm locations (if within roads) and develop repair recommendations; development of access routes capable of accommodating various sizes of sewer manhole and pipe rehabilitation mobile equipment; and supporting WSSC's community outreach program, when required.

Washington Suburban Sanitation Commission: Private Sewer Clearwater Source Removal Program Pilot. Program developer for _____.

Western Lehigh Sewer Partnership: Sewer Capacity Assurance and Rehabilitation Program / Lehigh County PA. In response to PADEP and USEPA regulatory orders regarding SSOs and future capacity, developed a partnership between 10 different communities and municipal utility authorities to evaluate current and future flow conditions, assess I&I impact on the 270 miles of pipe within the various systems, determined a collaborative corrective action plan, and implemented that plan. Work was begun by repairing broken relationships, establishing trust, and negotiating an MOU between the 10 partners to conduct the assessment phase of the work. Acting a program consultant and trusted advisor, worked with the individual community staffs and their engineering firms to implement a consistent SSES, project future development impacts, and prioritize and track sewer rehabilitation and capital improvements over more than a decade. Developed an InfoWorks

model to support multiple level of protection evaluation and alternatives analysis. Developed 20 alternative scenarios and worked with municipal leadership to select the best approach: a $226M capital plan featuring both wet weather storage and source removal via sewer rehab and basement sump pump disconnections followed by paralleling of critical sections of the primary interceptors and construction of a new wet weather pump station. Developed a preferred collaborative relationship with the City of Allentown. Developed and negotiated with Allentown and five other satellite systems using the Allentown WWTP to shift pay basis from base allocation to peak flow. Orchestrated the implementation of consistent rehabilitation works between 5 different engineering firms engaged directly by Partners to deliver consistent, highly effective, long lasting I&I removal projects over a 15-year period. Negotiated a 4-year extension to the original 5 year USEPA Administrative Order, then negotiated two separated consent orders with both PADEP and USEPA Region 3 governing the 25-year compliance schedule to achieve the required 10-year overflow frequency.

West Norriton Municipal Utilities Authority: Act 537 Sewage Facilities Planning Study / West Norriton PA. As lead engineer, responsible for evaluating existing wastewater treatment and conveyance systems, forecasting growth and increases in sewerage, identifying existing and potential treatment and conveyance needs, evaluating alternatives to meet those needs, and establishing an implementation schedule for the recommended plan.

West Norriton Municipal Utilities Authority: Connection Fee Analysis / West Norriton PA. Project engineer for the analysis of sewer connection fee structures.

West Norriton Municipal Utilities Authority: Forrest Avenue Sewage Pump Station / West Norriton PA. Inspecting engineer responsible for construction oversight, client/contractor relations, submittal review, change orders, pay estimate review, punchlist, and closeout for the pump station upgrade construction, which included two 30-hp pumps, emergency generator, UST, flow meter, level controls, and HVAC .

West Norriton Municipal Utilities Authority: Infiltration/Inflow Study / West Norriton PA. Lead engineer for an inflow/infiltration study for 32 miles of sewage collection system. Responsible for study design, installation and data gathering from 14 flowmeters, and system modeling to determine conveyance system's I/I characteristics and recommend cost-effective rehabilitative efforts. Subsequently led focused infiltration study for 16 miles of sewage collection system. Responsible for study design, installation, and data gathering from 105 weir points, and system evaluation to determine specific remediation measures for each run of deteriorating sewer pipe.

West Norriton Municipal Utilities Authority: Municipal Industrial Pretreatment Program / West Norriton PA. Lead engineer for the development and implementation of the program.

West Norriton Municipal Utilities Authority: Parkview Drive Sewer Subsidence Investigation / West Norriton PA. Project engineer for the investigation and sewer replacement design of a road subsidence resulting from a failed sanitary sewer.

West Norriton Municipal Utilities Authority: Main Interceptor Replacement / West Norriton PA. Project manager responsible for the design engineer's report and detailed construction design of the replacement of 7,000 linear feet of 21- and 27-in concrete sanitary sewer main and manholes.

West Norriton Municipal Utilities Authority: Rittenhouse Pump Station / West Norriton PA. Project engineer responsible for the detailed construction design of the overflow bypass chlorination system.

West Norriton Municipal Utilities Authority: Sanitary Sewer Construction Standards / West Norriton PA. Lead engineer for the preparation of standard construction specifications and plans for sanitary sewer construction.

West Norriton Municipal Utilities Authority: Sanitary Sewer Extensions / West Norriton PA. Project engineer for the review of sanitary sewer and pump station construction designs and inspection of constructed components.

West Norriton Municipal Utilities Authority: Sanitary Sewer Rehabilitation / West Norriton PA. Project manager for the preparation of bid documents and subsequent television inspection, cleaning, and grout repair of 9 miles of 8"-21" sanitary sewer.

City of Wilmington: 48-inch Water Main / Wilmington DE. Served as project manager for the design and construction of 9,800 feet of new 48-inch transmission main in an intercity setting. Project includes selection of an alignment for the new 48-inch finished water main in very old and crowded city streets, coordination with other utilities, acquisition of easements, obtaining state, county, and soil conservation district approvals, preparation of bid document, financial aid applications, permit application preparation, and bidding assistance. The work required microtunnelling under active railroad tracks, an interstate highway (I-95), and a six-point intersection where 24 lanes of urban traffic converge. It also involved a number of interconnections to the existing distribution system, relocation of existing utilities, a 3/4-mile access road for work in an unaccessible area between I-95 and the CSX railroad tracks, design and permitting of a bridge to cross a ravine/stream, and connection of the new water main to an existing, in-service finished water reservoir tank.

Woodloch Springs: Wastewater Treatment Plant / Woodloch Springs PA. Project engineer responsible for the detailed construction design of facility that included a SBR, sludge handling, chlorination, and stream discharge components.

Woodloch Springs: Water Treatment Plant / Woodloch Springs PA. Project engineer responsible for the detailed construction design of a facility that included three groundwater

extraction wells and force mains, water softening, phosphorus sequestering, vertical storage tank, and controls.

New Castle County,DE vs. City of Wilmington, DE Inter-municipal Agreement dispute. These two municipal entities sued each other regarding justified costs of wastewater treatment. I was an expert witness for New Castle County during the binding arbitration phase of this dispute. In that role, I evaluated flow, BOD, and TSS loading records provided by the two litigants, visited the various facilities involved, and prepared a written independent findings report. I was deposed in person for 3 hours by the City's legal and consulting engineer.

Municipal Pipe Tools vs. City of State Center, Iowa Change Order Betterment dispute. While conducting sewer rehabilitation work for the city of State Center, Municipal Pipe Tools damage some sewer pipe lateral tap connections. Their offered repair method was rejected by the City, and Municipal Pipe Tools completed the work as requested by the City but claimed a betterment. I prepared an independent expert evaluation of the appropriateness of the two repair methods, considering the damage that required repair, the effectiveness, longevity, and cost effectiveness of two repair methods. I was deposed via web meeting for 4 hours by the City's legal team.

Publications

Shelton, J.W., **“Rehabilitation for RDII Control – Understanding Cause, Effect, and Optimization"** presented at Houston, TX.

Shelton, J.W., **“HRSD and Virginia Beach 340 Sewer Rehabilitation Design-Build Guaranteed Outcome Pilot Project"** presented at WaterJam 2016, Virginia Beach, VA.

Shelton, J.W., Sadowsky, E; Travis, JP., **“Conducting Safe Extended Off-Tether Manned Entry Pipeline and Tunnel Inspections"** published and presented at a ISTT 2016, Beijing, China.

Shelton, J.W., **“Lateral and Private-side RDII Source Removal Issues "** presented at Columbus, OH.

Shelton, J.W., Gress, G., **"Alternative Project Deliver for Sewer Collections Systems - Developing and Implementing the Sullivan's Island Turnkey Sewer Rehab Construction Program"** published and presented at a WEFTEC 2015, Chicago, IL.

Shelton, J.W., Sadowsky, E., Rigby, D., Fleetwood, P., Anctil, M., **"When Engineers, Contractors, and Manufacturers Collaborate – Improvements in Chemical Grouting Practices from the Sullivan’s Island Construction Management at Risk Project"** published and presented at a WEFTEC 2015, Chicago, IL.

Shelton, J.W., "**Inspection, Condition Assessment, and Repair of Reinforced Concrete Storm Sewers**" presented at American Concrete Pipe Association School, 2015, Orlando, FL.

Shelton, J.W., Roff, R., **"O&M Practices Modifications Reduce SSOs – An 30 year evaluation of practices and results, and the steps required to achieve 21st Century service expectations"** published and presented at a WEFTEC 2014, New Orleans, LA.

Shelton, J.W., Travis, JP, **"Measured I&I Reductions using Various Trenchless Technologies"** published and presented at NASTT No Dig 2014, Orlando, FL and at ISTT No Dig 2014, Madrid, Spain.

Shelton, J.W., "**Pipe Grouting Longevity Effectiveness Evaluation**" published and presented at NASTT No Dig 2014, Orlando, FL and at ISTT No Dig 2014, Madrid, Spain.

Shelton, J.W., "**Crossing the Line – Secrets to Successful Private-side Lateral Rehabilitation Programs**" presented at Illinois Water Environment Association Conference, 2014, Springfield, IL.

Einhorn, J, Shelton, J.W., Russell, J., "**Inspection Prioritization Modeling**" published and presented at NASTT No Dig 2013, Sacremento, CA.

Shelton, J.W., **"Sewer Operations and CMOM – Leveraging the CMOM process for Operational Benefits**," presented at WWET Pumper Show 2013, Indianapolis, IN.

Shelton, J.W., Hofer, D., **" Lateral Rehabilitation Options and their Cost:Benefit Comparison- One Utility's Perspective**," published and presented at NASTT No Dig 2012, Nashville, TN and at ISTT No Dig 2012, Sao Paulo, Brazil.

Shelton, J.W., **" Cured In Place Liner Defects- Three Studies of Installed Liner Performance Quality**," published and presented at NASTT No Dig 2012, Nashville, TN and at ISTT No Dig 2012, Sao Paulo, Brazil.

Travis, JP, Shelton, J.W., **"Laser Profiling – A Case Study in Field Accuracy**," published and presented at NASTT No Dig 2012, Nashville, TN.

Schiff, C., Shelton, J.W., Blackwell, E., **"Trenchless As-Builts: Planning For The Next Generation**," published and presented at NASTT No Dig 2012, Nashville, TN.

Mechler, K, Shelton, J.W., Dill, A., Lennon, B, Hofer, D., **" New Castle County's Clearwater Disconnection Pilot Program,"** published and presented at WEFTEC 2011, Los Angeles, CA.

Batman, P, Shelton, J.W., Travis, JP., "**Holisitic Sewer Rehabiliation – Measures of Effectiveness**," published and presented at WEFTEC 2011, Los Angeles, CA.

Shelton, J.W., Hofer, D., **"Private Lateral Rehabilitation Program,"** published and presented at WEFTEC 2010, New Orleans, LA.

Shelton, J.W., **"To Build Bigger or to Rehab….That is the Question,"** presented at Chesapeake WEA TriCon 2010, Ocean City, MD.

Shelton, J.W., Garvey-Mechler, K.R., Batman, P.J., **"Maximum Flow Reduction: SP24 Sewer Rehabilitation Projects, New Castle County, Delaware,"** presented at a Technical Conference, Pennsylvania College of Technology (Penn Tec 2010), State College PA, June 15, 2010.

Nelson, J.A., Batman, P.J., Shelton, J.W., **"Lights, Camera, Action! A Play in Three Acts - Where the Benefits of Zoom Cameras Combined with Traditional In-Line CCTV are Revealed,"** *Trenchless Technology* January 2010.

Shelton, J.W., Garvey-Mechler, K.R., Dill, A.J., **"Lateral Rehabilitation - Start to Finish,"** presented at WEFTEC 2009, Orlando FL, October 10-14, 2009.

Shelton, J.W., Lee, R.K., **"Pipe Line Grouting: Designing for Longevity,"** *Proceedings*, No-Dig Conference and Exhibition, North American Society for Trenchless Technology (NASTT) and International Society for Trenchless Technology (ISTT), Toronto ON, March 29-April 3, 2009. B-3-03.

Dill, A.J., Shelton, J.W., **"Pre-Qualifying Trenchless Rehabilitation,"** *Proceedings*, No-Dig Conference and Exhibition, North American Society for Trenchless Technology (NASTT) and International Society for Trenchless Technology (ISTT), Toronto ON, March 29-April 3, 2009. F-4-02.

Batman, P.J., Shelton, J.W., **"Project Examines Benefits of Blending Zoom Technology with CCTV,"** *WaterWorld*, November 2008. Penn Wells Corporation.

Batman, P.J., Finnicum, S.A., Shelton, J.W., **"Storm Sewer Rehabilitation Pilot Program: Results of Condition Assessment and Rehabilitation,"** *Proceedings*, Conference of the North American Society for Trenchless Technology (NO-DIG 2008), Dallas TX, April 27-May 2, 2008.

Batman, P.J., Shelton, J.W., **"Working Outside the Right-of-Way: Social, Political, and Legal Implications,"** *Proceedings*, Conference of the North American Society for Trenchless Technology (NO-DIG 2008), Dallas TX, April 27-May 2, 2008.

Williams, T.C., Shelton, J.W., **"Multiple Condition Assessment Technologies for Buried Infrastructure,"** *Proceedings*, Annual Virginia Water Conference, Virginia Lakes and Watershed Association, Richmond VA, March 9-11, 2008.

Williams, T.C., Shelton, J.W., **"Strategies and Tools for Buried Infrastructure Management,"** *Proceedings*, Conference of the Virginia Association of Municipal Wastewater Agencies, Richmond VA, December 4, 2007.

Williams, T.C., Shelton, J.W., **"Multiple Condition Assessment Technologies for Buried Infrastructure,"** *Proceedings*, Joint Annual Meeting of the American Water Works Association, Virginia Section and the Virginia Water Environment Association (WaterJAM 2007), Hampton VA, September 17-20, 2007.

Shelton, J.W., Harmer, M.T., **"Multiple Technologies - Maximum Flow Reduction: The Northcrest-Afton Sewer Rehabilitation Project,"** *Proceedings*, 25th Annual Conference and Exhibition of the International Society for Trenchless Technology (ISTT) (Mediterranean NO-DIG 2007), Rome, Italy, September 10-12, 2007.

Lennon, B.P., Hofer, D., Harold, E.M., Shelton, J.W., **"How New Castle County Applies Dynamic Hydraulic Modeling to Support Sanitary Sewer System Planning,"** presented at the CWEA/WWOA 2007, Joint Annual Conference of the Chesapeake Water Environment Association and the Water and Waste Operators Association of Maryland, Delaware and District of Columbia, Ocean City MD, August 28-31, 2007.

Shelton, J.W., **"Trenchless Rehab from the Engineer's Perspective,"** *Trenchless Technology*, p. 66, October 2006.

Batman, P.J., Shelton, J.W., **"Evaluating Sewer Rehabilitation Effectiveness: A Practical Methodology and Case Study,"** *Proceedings*, No-Dig 2005, Conference of the North American Society for Trenchless Technology (NASST), Orlando FL, April 24-27, 2005.

Shelton, J.W., Perez, R.G., **"From Physical Condition Assessment to Basis of Rehabilitation - Taking PACP to the Engineering Level,"** *Proceedings*, Annual Conference of the North American Society for Trenchless Technology (NO-DIG 2004), New Orleans LA, March 22-24, 2004.

Mahon, J.D., Shelton, J.W., **"Geographical Information Systems: How Can GIS Work for You?,"** presented at a Conference of the New Jersey Water Environment Assocation on Technology to Locate Underground Utilities, West Paterson NJ, January 27, 2004.

Shelton, J.W., Perez, R.G., **"To Line or To Grout....A Life-Cycle Cost Approach,"** *Proceedings*, Underground Infrastructure Advanced Technology Conference, Washington DC, December 8-9, 2003.

Shelton, J.W., Harmer, M., **"Sewer Rehab in the Suburbs...a Non-Urban Approach to Sewer Rehab Prioritization,"** *Proceedings*, Underground Infrastructure Advanced Technology Conference, Washington DC, December 8-9, 2003.

Wendell O. Khunjar, PhD, PE

Associate Vice President and
Director of Wastewater Innovation

Highlights

- Principal, Co-principal Investigator or Technical Advisor on **9** WE&RF projects since 2012.
- **18** peer reviewed publications on topics ranging from nutrient recovery to aerobic granular sludge.
- Project engineer or technical advisor on **38+** projects at Hazen and Sawyer.
- Developed novel deammonification process PArtial Nitrification Denitritation and Anaerobic ammonia oxidation (PANDA).

Select Projects

- WERF Towards a Renewable Future – Assessing Resource Recovery as a Viable Treatment Alternative (NTRY1R12), Alexandria, VA: Co-principal investigator of project that is providing industry wide guidance for the implementation of nutrient recovery as a viable treatment alternative for wastewater treatment plants performing nutrient removal.
- Metro Wastewater Reclamation District Denver CO, Facility Plan Update (2018): Process engineer involved in development of the 2018 Facility Plan, which is a District-wide planning document describing Robert W. Hite Treatment Facility (RWHTF), Northern Treatment Plant (NTP), transmission system, biosolids management and support facility improvements necessary to meet the planning and regulatory drivers for a 20-year planning period.
- Loudoun Water Broad Run Water Reclamation Facility Expansion Design, Ashburn VA: Lead process engineer involved expansion of BRWRF from 11 to 16.5 mgd. Tasks involves designing bioreactor basin and aeration system improvements as well as sidestream deammonification.
- Noman M. Cole Pollution Control Plant Primary and Secondary Facility Rehabilitation and Expansion, Lorton, VA: Lead process engineer involved in evaluation of expansion alternatives for the Noman M. Cole Pollution Control Plant. Evaluation included consideration of membrane aerated biofilm reactors, granular sludge, membrane bioreactors, inDENSE®, dynamic DO control strategies like ammonia based aeration control and AvN®, tertiary partial denitrification and anaerobic ammonia oxidation.

Academic Credentials

PhD	Virginia Polytechnic Institute and State University, 2009
MS	Virginia Polytechnic Institute and State University, 2006
BS	Howard University, 2004

Employment Record

2012 - Pres.	Hazen and Sawyer, P.C.
2015 – 2016	Columbia University, Department of Earth and Environmental Engineering – Adjunct Associate Research Scientist
2013	University of Maryland, College Park Department of Civil and Environmental Engineering - Lecturer
2010 - 2011	Columbia University, Department of Earth and Environmental Engineering – Post doctoral research associate
2009 - 2010	University of Michigan, Department of Civil and Environmental Engineering – Post doctoral research associate
2004 - 2009	Virginia Polytechnic Institute and State University, Graduate research assistant
2002 - 2004	Howard University, Department of Civil Engineering – Undergraduate research assistant

Professional Activities

Professional Engineer,

VA (0402054376), NY (100513-1)

Water Environment Federation

International Water Association

American Water Works Association

Hazen

- City of Durham NC, Sidestream Deammonification: Process engineer involved in startup of Anitamox™ sidestream deammonification process. Evaluation involved anammox and nitrifier specific activity testing in conjunction with nutrient profile sampling.

- Philadelphia Water Department Sidestream Deammonification, Philadelphia PA: Process engineer involved in preliminary design and pre-selection of sidestream deammonification technology for Southwest WPCP

- NYSERDA, Demonstration of a Novel Separate Centrate Deammonification Process Using Partial Nitrification-Denitratation-Anaerobic Ammonia Oxidation PON 2722, Albany, NY: Lead process engineer involved in the development and pilot scale demonstration of a Partial Nitrification-Denitratation-Anaerobic Ammonia Oxidation (PANDA) process at the 26th Ward WPCP.

Select Publications, Book Chapters, and Reports

- Sharp, R., Niemec, A., **Khunjar, W.O**., Galst, S., Deur, A. (2017). Development of a novel deammonification process for cost effective separate centrate and mainplant nitrogen removal. *International Journal of Sustainable Development and Planning*, 12 (1), 11 -21.

- **Khunjar, W.O**., Pace, G., S. Galst, R. Sharp and K. Chandran (2017). " **Separate Centrate Deammonification Using Partial Nitrification-Denitratation-Anammox**." Proceedings of the Water Environment Federation 2017 (3): 219-224.

- Mehta, C., **Khunjar, W.O**., Nguyen, V., Tait, S., Batstone*, D. (2014). Technologies to Recover Nutrients from Wastestreams: A Critical Review. *Critical Reviews in Environmental Science and Technology*, 10.1080/10643389.2013.866621.

- **Khunjar, W.O**, Pitt, P., Bott, C., Chandran, K.. (2014). Macro-nutrient Removal (Nitrogen), in *Activated Sludge - 100 Years and Counting*. IWA Publishing, ISBN: 9781780404936.

- **Khunjar, W.O**., Latimer, R., Jeyanayagam, S. (2013). Changing Perspectives: From Nutrient Removal to Nutrient Recovery, in *Enabling the Future: Advancing Resource Recovery from Biosolids.* WEF Publishing. Link

- Yi, P., **Khunjar, W. O**., Bilyk, K., Latimer, R., Pitt, P., Bott, C., O'Shaughnessy, M. Sensor calibration, maintenance, and validation. Lessons learned from operating advanced instrumentation to support nutrient removal. WE&T, August 2014.

- Pace, G., S. Galst, **W. Khunjar**, R. Sharp and K. Chandran (2017). "Demonstration of a Separate Centrate Deammonification (SCAD) Process at the 26th Ward Wastewater Treatment Plant." Proceedings of the Water Environment Federation 2017(3): 219-224.

- Bilyk, K., **W. Khunjar**, G. Pace, T. Worley-Morse, C. Cocker, S. Lobdell, R. Taylor, B. Gasper and P. Pitt (2017). "Lessons Learned about Deammonification from Design, Startup and Operation of an ANITA™ Mox System." Proceedings of the Water Environment Federation 2017(3): 253-263.

- Lynch, M., G. Pace, P. Saurer, P. Pitt, R. Latimer, C. Johnson, R. Sharp, J. Davenport and **W. O. Khunjar** (2015). "Development of A Novel Method For Tracking Anammox Specific Activity During Sidestream Deammonification." Proceedings of the Water Environment Federation 2015(16): 3423-3428.

  Khunjar, W. O., Mehta, S., Desmottes, C., Kaldate, A. Use of Free Ammonia and Dissolved Oxygen for Process Control of a Sidestream Deammonification Sequential Batch Reactor. 86th Annual Water Environment Federation Technical Exposition and Conference, October 2013, Chicago, IAL. Podium Presentation.

Richard A. Wagner, PE, D.WRE

Principal Water Resources Engineer

Mr. Wagner is a principal water resources engineer at CDM Smith and specializes in watershed and water quality studies. He has contributed to the development of Total Maximum Daily Load (TMDL) studies, stormwater master plans, nonpoint pollution management studies, water supply studies, wasteload allocation studies and water quality data assessments. He has applied numerous computer models in the simulation of hydrology, hydraulics and water quality impacts and has experience in applying statistical packages to water quality data. His experience includes modeling of conventional and toxic pollutants, assessing applicability of innovative permitting schemes to specific organic chemicals and heavy metals, comparing the theory and capabilities of a variety of water quality models, managing water quality databases, and development of manuals for Best Management Practice (BMP) implementation and TMDL model development. Mr. Wagner has provided technical support for flood insurance studies, dam inspections, dam break analyses, storm sewer analyses and hydrologic studies. His responsibilities have included collection and input of data, model calibration and analysis of results and construction cost analyses.

Technical Guidance and Review, Dallas-Fort Worth International Airport (DFWIA), 2018-2019. Mr. Wagner was technical reviewer for SWMM5 models of several watersheds at the DFWIA. He reviewed the airport "first-flush" stormwater treatment model developed by others, and documented necessary model refinements. The first-flush system is designed to capture runoff from select highly impervious areas of the airport for treatment before discharge to a wastewater treatment plant. He also determined how the stormwater capture associated with the first-flush system should be incorporated into the watersheds models (that did not explicitly simulate the first-flush system).

Experience Highlights

- Applications of numerous water quality models including SWMM5, HSPF, CORMIX, BATHTUB, WASP, CE-QUAL-W2 and QUAL2E to support watershed management studies and development of TMDLs throughout the United States.
- Lead or contributing author to stormwater Best Management Practice (BMP) manuals in Florida, South Carolina, Virginia and New Jersey
- Contributing author to the Florida TMDL Protocol and a draft WEF document on water quality modeling

Beaufort County (SC) Design Support, 2018-2019. Mr. Wagner was the lead technical resource and modeler in assessing the hydrologic, hydraulic and water quality benefits of two proposed regional stormwater Best Management Practices (BMPs) in Beaufort County. Beginning with ICPR models developed as part of the county's stormwater master plan (also developed by CDM Smith), he first updated hydrology and hydraulics as necessary to reflect current (pre-project) conditions and then modified the models to reflect the proposed regional ponds. ICPR results were presented to demonstrate no adverse impacts and potential benefits in peak flow and peak water elevations. A spreadsheet analysis was also conducted to document pre-project and post-project loads of total phosphorus, total nitrogen and fecal coliform bacteria, accounting for the expected load reductions in the proposed BMPs.

Education

MS – Civil Engineering, University of Cincinnati, 1983

BS – Civil Engineering, Marquette University, 1981

Registration

Professional Engineer: Virginia (1989) and Florida

Honors/Awards

Diplomate, Water Resources Engineer, American Academy of Water Resources Engineers, 2007

CDM Smith

Mary's Creek Wastewater Treatment Plant (WWTP) Study, Tarrant Regional Water District (TRWD), 2018-2019. Mr. Wagner was the lead technical resource and modeler in assessing the potential impacts of a proposed 10 million gallon per day (mgd) WWTP to downstream receiving waters. The analysis was conducted using an existing CE-QUAL-W2 model developed in previous CDM Smith project work with TRWD. The model results suggested that the discharge could result in higher algal growth in downstream Clear Fork Trinity River (which has a number of small impoundments) and West Fork of Trinity River below its confluence with the Clear Fork.

Technical Leader, Recharge & Evapotranspiration (ET) – Districtwide Surface Water Model Update, Southwest Florida Water Management District (SWFWMD), Florida, September 2017 – June 2019. The SWFWMD Surface Water Model (DSWM) is comprised of 12 HSPF models that cover the entire District and portions of St. Johns River Water Management District (SJRWMD). The DSWM was updated to extend the simulation period to include the years 2007 through 2015. HSPF inputs that were updated included those representing water budget terms including rainfall, potential evapotranspiration (PET), irrigation, diversions, well pumping, and springs. Training was provided to the District in HSPF model application to ensure transition of information and knowledge of the updated models including model file management and documentation of all tasks under the work order. After model extension, results were processed to compare modeled and observed streamflows, to calculate water budgets for each of the model subbasins, and to convert modeled groundwater recharge to a grid basis for a MODFLOW groundwater model. Mr. Wagner is serving as technical leader for this project.

Hydrologic, Hydraulic and Water Quality Modeling, Black Creek Water Resource Development Project, St. Johns River Water Management District (SJRWMD), Florida, 2017-2019. Mr. Wagner is the modeling leader in developing an Environmental Protection Agency (EPA) Storm Water Management Model (SWMM5) hydrologic and hydraulic model and HSPF hydrologic and water quality model to support the Black Creek project. The project involves the diversion of flows from the South Fork of Black Creek to Alligator Creek and an associated chain of lakes (Lakes Brooklyn, Keystone and Geneva) to enhance recharge to the Upper Floridan aquifer. Mr. Wagner initially developed an HSPF model of the chain of lakes and associated tributary area, using measured flows and lakes stages to calibrate the tributary area inflows and lake seepage to the aquifer for the period of October 1997 through June 2016. The same model was then used to assess the impacts of the proposed Black Creek flow diversion on flows and lake stages. The HSPF models with and without the flow diversion were then refined to include simulation of water quality to evaluate the impacts of the proposed project. The HSPF model and a corresponding SWMM5 model were also used to evaluate potential impacts of extreme design storms. Hydrologic data were generated in HSPF by inserting extreme design storm events into the historical rainfall record, and the modeled hydrologic results were used as input to SWMM5, which routed the design storm flows and calculated anticipated peak stages in the lakes with and without the project. The peak stages were compared to FEMA 100-year base flood elevations to show that the project would not result in adverse flooding impacts.

Technical Guidance and Review, Great Lakes Water Authority (GLWA) Wastewater Master Plan – Water Quality Modeling, Detroit, MI, 2017 to 2019. Mr. Wagner has provided technical expertise in the combined use of models SWMM5 and HSPF in water quality simulations of the Rouge River watershed. He guided the use of an existing SWMM5

to simulate water quality in the watershed, and development of an HSPF model using the SWMM5 output as input and modeling water quality in the river. He provided guidance in converting the SWMM5 output into corresponding HSPF input as well as accounting for combined sewer overflow (CSO) and sanitary sewer overflow (SSO) discharges calculated using a different model. Mr. Wagner established appropriate HSPF instream water quality coefficient values as part of the water quality simulation of the Rouge River itself, evaluating the instream concentrations of parameters including dissolved oxygen (DO) and E. coli bacteria. The developed models will be used to evaluate the water quality benefits of alternative management strategies, and to evaluate the relative loading impacts of various sources (stormwater runoff, CSOs. SSOs).

Technical Leader, Arlington Office of Economic Development (OED) Stormwater Master Plan, City of Jacksonville, Florida (2018). Mr. Wagner provided technical guidance in the development of a conceptual stormwater plan for a redevelopment area in the city. The plan was designed to provide water quality treatment to the associated stormwater runoff, utilizing green infrastructure practices to the extent practicable. Mr. Wagner contributed to the identification of potential green infrastructure applications in the area, considering potential sizing of the infrastructure facilities and potential limitations such as seasonal high groundwater table elevations in some areas. The green infrastructure applications were supplemented by traditional wet detention pond treatment where required. The BMPTRAINS model was used to assess the water quality benefits of the conceptual green infrastructure applications.

Modeler, Lake Sylvan Minimum Flows and Levels, St. Johns River Water Management District (SJRWMD), Florida, 2017-2018. For the SJRWMD in Florida, Mr. Wagner developed an HSPF model of Lake Sylvan and its tributary area, for ultimate use by the SJRWMD in determining compliance with minimum flows and levels (MFL) requirements. Development of the HSPF model included the determination of tributary area contributing surface runoff and groundwater inflow, evaporation and direct rainfall at the lake surface, outflow through lake outlet structures and leakage from the lake to the underlying confined aquifer. Model simulations included a calibration period for which model hydrologic parameter values were adjusted based on comparison between modeled and observed lake stages, and a separate validation period using the calibrated hydrologic values.

Technical Lead and Modeler, Lakes Newnans/Orange/Lochloosa Minimum Flows and Levels, St. Johns River Water Management District (SJRWMD), Florida, 2017-2018. Mr. Wagner directed the modification of two existing HSPF models and the development of a SWMM5 hydraulic model as part of the evaluation of these three lakes. Refinement of the HSPF models included updates of the land cover in the tributary areas, re-calibration of hydrologic model inputs based on comparison of modeled and observed streamflow data and writing of output data that was then processed into a format that could be used by SWMM5 as input. The hydrologic inputs from HSPF were routed through the SWMM5 hydraulic network, and the lake stage results were compared to observed lake stages for a calibration period and separate validation period.

Modeler, Recycled Water Storage and Runoff Study, Sonoma Valley County Sanitation District (CA), 2017-2018. Mr. Wagner provided modeling expertise in the evaluation of the storage and irrigation use of disinfected tertiary recycled water. He developed an HSPF

model that represented an in-line reservoir and associated tributary area that was monitored as part of the study. The initial model development focused on current conditions such as tributary area, estimated irrigation demand from the reservoir, and recycled water pumping to the reservoir based on typical operations. The initial model results were compared to 2014-2016 estimated reservoir stages to validate the initial model inputs. The model was then applied for an extended period (2004-2016) to evaluate longer-term variability in reservoir stages and overflow frequency. The model application included the base condition (reuse water pumping to reservoir begins in April) as well as alternatives that initiated reuse water pumping to the reservoir starting in earlier months (January, February and March) to see the impacts on overflow frequency and volume with earlier start dates. HSPF was also enhanced to add water quality simulation to also evaluate changes in overflow loads to downstream receiving waters resulting from earlier start dates for pumping to the reservoir. Results suggested that the initiation of pumping as early as February did not result in substantial increases in overflow volumes or loads to downstream areas.

Water Quality Specialist, State Road (SR) 16 Wastewater Treatment Plant (WWTP) Water Quality Based Effluent Limitation (WQBEL) Evaluation, St. Johns County Utility Department, Florida, 2016 – 2017. Mr. Wagner developed the WQBEL study plan and conducted the WQBEL Level I analysis for the SR 16 WWTP. The WWTP has a current discharge permit that includes a 1.5 mgd slow-rate public access irrigation system, as well as a 0.50 mgd permitted discharge to three man-made treatment wetlands that ultimately discharge to Cowan Swamp. Mr. Wagner conducted analyses to determine the feasibility of direct discharge of the WWTP (at advanced wastewater treatment or AWT levels) to Cowan Swamp and abandoning discharge to the man-made wetlands. The initial WQBEL study plan included review of historical water quality data for the man-made wetlands and the downstream receiving water (Moultrie Creek), and discussion of the analysis and findings at a meeting with the Florida Department of Environmental Protection (FDEP). At the meeting, the FDEP suggested that a WQBEL Level 1 analysis would be appropriate and discussed the potential monitoring requirements, which would depend upon whether the discharge was permitted under the Florida APRICOT Act. Following the meeting, Mr. Wagner conducted additional water quality data analysis and evaluated potential monitoring sites. It was concluded it would be preferable to pursue direct discharge permitting as an APRICOT discharge, based on the limited historical discharge to the man-made wetlands and the potential difficulties in monitoring the Cowan Swamp wetland.

Technical Review, Cuyahoga River South Stormwater Master Plan Study, Northeast Ohio Regional Sewer District (NEORSD), 2016 to 2019. Mr. Wagner was responsible for review of multiple tasks associated with the master planning project. He reviewed and provided comments on Storm Water Management Model (SWMM5) hydrologic and hydraulic applications for several subwatersheds within the Cuyahoga River South watershed, to ensure that model results were reasonable and appropriate. He also reviewed and documented available hydraulic models for the main stem Cuyahoga River (primarily HEC-2 or HEC-RAS models) and identified main stem reaches with no available models. Mr. Wagner used output from those models to provide information on main stem problem areas that have been identified by the local jurisdictions and proposed potential solutions. He also prepared a white paper describing how the SWMM5 applications could

be refined to include simulation of water quality and contributed to the development of fact sheets for various management practices.

Technical Guidance and Review, James City Service Authority (VA) Salinity Modeling, 2016-2017. Mr. Wagner was the technical lead in the modeling of a proposed brine concentrate discharge to the Chickahominy River. The CORMIX model was used to evaluate potential brine discharge at two separate locations in the river, for various combinations of discharge flow rate, ambient velocity, and ambient vertical salinity profiles. Model results from a separate EFDC river model were used to develop the velocity and vertical salinity profiles. At each location, a mid-river and a shoreline discharge location was evaluated. The model findings indicated that the conceptual proposed discharge would not cause adverse impacts to the river.

Modeler, Hydrologic Modeling for the Jacksonville Harbor Corrective Action Plan, U.S. Army Corps of Engineers (USACE), Jacksonville (FL) District, 2016-2017. Mr. Wagner calibrated 10 HSPF watershed models that contribute flows to the Lower St. Johns River including the Jacksonville Harbor area. He used the Parameter Estimation (PEST) software to optimize the assignment of hydrologic parameter values based on comparison of modeled flows to measured gage flows in the watersheds. Timeseries of flows from the HSPF models to the Lower St. Johns River were provided to the USACE for their use as input to an EFDC model of the river. Sensitivity analyses were also conducted to evaluate the uncertainty of the HSPF model results.

Modeler and Technical Reviewer, Moving Lake Okeechobee Water South to Benefit the Everglades, South Florida Water Management District (SFWMD), 2016-2017. Mr. Wagner conducted and reviewed modeling using the HEC-RAS model to evaluate potential options for routing flows south through existing or modified conveyance pathways to the Everglades. Five different alternatives, which included various combinations of new or enhanced canals, gate structures and pump stations, were evaluated in the analysis. All of the alternatives were designed to convey an additional 300 cfs of flow to Storage Treatment Area (STA) 5/6.

Modeler, Letter of Map Revision (LOMR), City of Chattanooga (TN), 2016-2017. Mr. Wagner refined an existing HEC-RAS model as part of a LOMR for an unnamed tributary of the Tennessee River. A recent FEMA update had dramatically modified the base flood elevations (BFEs) on the unnamed tributary, which resulted in a proposed City structure being shown in the floodplain. Mr. Wagner reviewed the HEC-RAS model, and concluded that the peak flows used in the model did not account for substantial flow impoundment and attenuation behind an elevated railroad downstream of the proposed structure location. Mr. Wagner refined the HEC-HMS model, which was the source of the assigned HEC-RAS peak flows, to account for the attenuation behind the railroad. The peak flows from the refined HEC-HMS model were then used as input to the HEC-RAS model, and the results from the refined model showed that the proposed structure location would not be within the 100-year floodplain. The model modification and results were used to develop a LOMR application which documented the model correction and illustrated the proposed floodplain revision resulting from the model correction.

Modeler and Technical Lead, Silver River Enhancement Project, St. Johns River Water Management District (SJRWMD), 2016-2017. Mr. Wagner was the technical lead on this project, which focused on opportunities to capture and recharge stormwater in the Silver

Springs Forest Conservation Area (SSFCA) and reduce discharges of turbid water to the Silver River. In the first phase of the project, Mr. Wagner acquired an existing Interconnected Pond Routing (ICPR) model, pared down the model to include the SSFCA area and some adjacent area, and calibrated that model for several large historical storm events. The calibrated model was then used to evaluate potential structural controls including drop structures at channel crossings and low-level cascading weirs along channels conveying flow through the property. He developed a spreadsheet-based analysis to determine potential for recharge of surface water runoff captured by the potential structural controls. In the second phase of the project, Mr. Wagner directed and participated in the development and application of a parallel Storm Water Management Model, built using much of the data from the ICPR model. SWMM was applied for continuous simulation including evaluation of surface water and groundwater contributions to streamflows. The model was also expanded to include additional area north of the SSFCA. The continuous simulation was conducted to provide a more deterministic method of estimating harvested water potential.

Modeler, Cowpen Lake Minimum Flows and Levels, St. Johns River Water Management District (SJRWMD), Florida, 2016. For the SJRWMD in Florida, Mr. Wagner developed an HSPF model of Cowpen Lake and its tributary area, for use in determining compliance with minimum flows and levels (MFL) requirements. Development of the HSPF model included the determination of tributary area contributing surface runoff and groundwater inflow, evaporation and direct rainfall at the lake surface, outflow through lake outlet structures and leakage from the lake to the underlying confined aquifer. The initial model simulations included a calibration period for which model hydrologic parameter values were adjusted based on comparison between modeled and observed lake stages. The calibrated model was then applied to a long-term simulation period to assess compliance with MFL requirements.

Technical Review and Guidance, City of Virginia Beach (VA) Stormwater Management Master Planning Services, 2015 to 2018. Mr. Wagner has contributed to multiple tasks associated with the master planning services project. He reviewed and provided comments on Storm Water Management Model (SWMM5) hydrologic and hydraulic applications for several subwatersheds within the city, to ensure that model results were reasonable and appropriate. He was the primary author of a methodology document that outlined the proposed approach for refining the SWMM5 applications to add water quality simulations, including calculation of watershed pollutant load and the load reduction benefits of Best Management Practices (BMPs). Mr. Wagner then directed the application of the water quality modeling methodology to one of the watersheds in the city. He also developed a technical memorandum on the advantages and disadvantages of wet detention pond liner applications in the city to avoid impacts to adjacent groundwater.

Modeler, Decision Support Tool Development, City of Minot (ND), 2015-2017. Mr. Wagner conducted modeling using the HEC-RAS hydraulic model which provided data for the development of a decision support tool (DST) capable of evaluating alternative management practices. The DST was designed to evaluate alternative practices that could reduce flooding potential in the City of Minot which suffered extensive flooding from the June 2011 flood of record. Mr. Wagner used an existing HEC-RAS model to develop information such as stage-discharge relationships for the Souris River and its in-line impoundment Lake Darling that were used in the STELLA DST. The DST was used to

evaluate potential benefits of alternative management practices such as refinement of Lake Darling gate operations, refined operations at impoundments north of the Canadian border, and raising the Lake Darling spillway. Results predicted by STELLA (e.g., reduced peak stages for the June 2011 event and for extreme design storms) were then compared to results generated by Mr. Wagner based on explicit simulation in HEC-RAS.

Hydrologic and Hydraulic Modeling, Glenrock Storm Water Master Plan, Norfolk, Virginia, 2015-2016. Mr. Wagner was the modeling task leader in developing an Environmental Protection Agency (EPA) Storm Water Management Model (SWMM5) hydrologic and hydraulic model of the Glenrock neighborhood in Norfolk, VA. The model development included the delineation of hydrologic catchments, evaluation of catchment hydrologic features (e.g., imperviousness, infiltration parameters), and definition of the hydraulic network, which included a combination of storm water pipes and ditches. The developed model was compared to problem areas identified by City residents and staff, to validate the model performance. The validated model was used to identify alternative management measures to control flooding.

Project Manager, Stormwater Modeling for Nova/Halifax Canal, City of Port Orange, Florida, 2015-2016. Mr. Wagner was the lead modeler in refining an existing Environmental Protection Agency (EPA) Storm Water Management Model (SWMM5) hydrologic and hydraulic model of the Nova/Halifax Canal system, which includes the Nova Canal and tributary canals including the 11th Street Canal, Reed Canal and Halifax Canal. The existing model was first refined to provide a better representation of a recent flood control project that was implemented by others. The refined model was then used to evaluate the potential benefits (and potential adverse impacts) of a flood control berm that was initially part of the flood control project plans but was not implemented. Model results suggested that the berm would provide minimal flood control benefit in the area of interest and would result in higher maximum water elevations outside the area protected by the berm. Therefore, implementation of a berm was not recommended. Mr. Wagner also developed a flood control alternative that would eliminate flooding in the area of interest, which included a large (125 cfs) pump station conveying water from the area to the Halifax River.

Modeler, Upper St. Johns River Basin Model Update, Florida, 2015. Mr. Wagner worked with staff of the St. Johns River Water Management District (SJRWMD) to update the Upper St. Johns River Basin (1,800-square-mile-tributary area) model. Specific updates to the HSPF model included the incorporation of additional years of meteorological data and observed flows and stages, review and refinement of model representation of hydraulic structure dimensions and operations, update of land cover data, and development of a template for developing the HSPF model input datasets. The updated model was ultimately used to evaluate Minimum Flows and Levels (MFL) in the basin.

Modeler, Minimum Flows and Levels, St. Johns River Water Management District (SJRWMD), Florida, 2015. For the SJRWMD in Florida, Mr. Wagner evaluated four lakes for compliance with minimum flows and levels (MFL) requirements. He applied the Hydrologic Simulation Program – Fortran (HSPF) computer model to simulate lake water budgets, considering runoff and baseflow inflows to the lake, evaporation and direct rainfall at the lake surface, outflow through lake outlet structures and leakage from the lake to the underlying confined aquifer. The simulations for each lake included a

calibration period with observed rainfall and lake stage data, and a long-term simulation that provided lake stage results for comparison to MFLs established by SJRWMD staff based on observed vegetation at the lake site. The comparison results were used to determine whether lake levels were sufficient to maintain the observed vegetation.

Modeler, Shop Road Extension Water Quality Analysis, Richland County, SC, 2015. Mr. Wagner developed a water quality model of a proposed industrial park site to demonstrate compliance with Section 401 of the Federal Clean Water Act. The water quality evaluation focused on the pre-development and post-development discharges of fecal coliform bacteria, considering that the site receiving waterbody (Reeder Point Branch) is classified as impaired for bacteria. The post-development evaluation included the benefits of anticipated Best Management Practices (BMPs) in accordance with local and State requirements. The evaluation was conducted using the EPA Stormwater Management Model (SWMM5) version 5.1. Results of the analysis indicated that wet detention treatment is expected to limit post-development bacteria loads to a lower level than pre-development loads, and the pond discharge is expected to meet the instream water quality standards for fecal coliform bacteria.

Modeler, Fellsmere Water Management Area (FWMA) Spillway and Approach Channel Evaluation, St. Johns River Water Management District (SJRWMD), 2014-2015. Mr. Wagner began this project with an existing SWMM5 representation of the proposed FWMA features including an "approach channel' conveying flow to the overflow spillway, and the spillway itself which discharges to the C-54 Canal. The initial model was first refined based on updated plans provided by the SJRWMD to include updated geometries and assigning appropriate roughness coefficients. The refined model was run for the Probable Maximum Precipitation (PMP) event to evaluate the peak FWMA water elevation, flow over spillway, and velocity over spillway. Alternative designs were also evaluated in an effort to establish a more cost-effective design. The alternatives included varied spillway lengths and a natural vegetated approach with vegetative control as an alternative to an excavated approach channel. Based on model results and discussion with SJRWMD staff, the desired alternative was a shorter spillway design with a natural vegetated channel.

Modeler and Technical Reviewer, ABC Ranch – Flaghole, Devils Garden and Starvation Slough Wetlands Reserve Program, Wetland Reserve Plan of Operations (WRPO) Studies, U.S. Army Corps of Engineers, Jacksonville District, Florida, 2014-2015. Mr. Wagner provided hydrologic modeling support to these projects, which were designed to evaluate alternatives for returning agricultural areas to historical, natural ecological conditions to the extent practicable. For these studies, he applied the HSPF hydrologic model to the WRPO site for selected design storms and for 30-year continuous simulation. In these studies, the HSPF design storm results were used as input to a SWMM5 hydraulic model that routed the storm flows and evaluated the potential for adverse offsite impacts resulting from the proposed WRPO and the continuous simulation results were compared for consistency with results from the NRCS SPAW (Soil, Plant, Atmosphere and Water) model, which was used to evaluate the long-term hydroperiod of several site areas and associated establishment of re-establishment of various communities (e.g., freshwater marsh and pond, wet prairie, cypress swamp, south Florida flatwoods). In the Devils Garden and Starvation Slough analyses, the HSPF continuous simulation results were also used as input to a continuous hydraulic simulation using

SWMM5. Mr. Wagner was the chief technical reviewer of the SWMM5 hydraulic models for all three sites.

Modeler, Green Infrastructure Analysis, Nashville, TN, 2014-2015. Mr. Wagner used a SWMM5 hydrologic and hydraulic model to determine the potential benefits of green infrastructure (GI) in reducing combined sewer overflow (CSO) discharges in Nashville. After running the base model for an "average" rainfall year and documenting the modeled overflow frequency and volumes at various locations, SWMM5 was modified so that runoff from impervious areas had an opportunity to infiltrate, as would occur in a GI facility such as a bioretention facility. Model results were evaluated for various percentages of treated impervious areas (10%, 35%, and 100%) and the results were compared by City sewershed to determine where GI implementation would be most effective.

Modeler, Cedar Bayou Watershed and Receiving Water Modeling, Texas, 2014-2015. Mr. Wagner developed a SWMM5 hydrologic, hydraulic and water quality model to support a Watershed Protection Plan (WPP) designed to remove Cedar Bayou from the 303(d) list for bacteria impairment. The model evaluated bacteria levels in the tidal receiving water based on non-tidal headwater inflows and bacteria loads (from a separate model), tidal tributary area inflows and bacteria loads calculated by SWMM5, time-varying downstream tidal water elevations, and a pumped cooling water diversion. Model results were evaluated for existing and future land use conditions to determine load reductions required to meet the water quality standards.

Modeler and Technical Reviewer, Watershed Master Plan, Columbus, Ohio, 2014-2015. Mr. Wagner refined a hydrologic watershed model developed by others using HSPF, to include water quality simulation of the watershed and associated receiving waters. The model included the pollution loads from surface runoff and baseflow in the watershed, as well as pollution loads from wastewater discharges. Several key impacts evaluated in the receiving waters included sedimentation and algae growth in the study area impoundments, which are water supply reservoirs. The model was developed to characterize existing pollution sources and associated receiving water impacts, to evaluate potential impacts of future development, and to assess the benefits of pollution load reductions in the watershed.

Technical Review and Modeler, Fellsmere Water Management Area Models, St. Johns River Water Management District (SJRWMD), Florida, 2014-2015. Mr. Wagner reviewed simulation models and reports developed by the SJRWMD, associated with the proposed Fellsmere Water Management Area (FWMA) in the Upper St. Johns River Basin project area. Models included (1) a long-term continuous simulation HSPF model which was used to evaluate operation of pump stations, gates and other structures to meet water quality treatment and flood control goals, (2) a SWMM5 hydraulic model (using HSPF hydrologic results) for evaluating design storms including the 100-year/24-hour, Spillway Design Flood (SDF) and Probable Maximum Precipitation (PMP) events and (3) SWMM5 hydraulic models (using HSPF hydrologic results) evaluating potential impacts of a breach of the FWMA berm for both "sunny day" and wet weather conditions. Models were reviewed for consistency regarding pump and structure operating rules, stage-storage relationships for major storage areas including the FWMA, numerical stability of the modeling results, appropriate representation of the hydraulic network and appropriate rainfall and hydrologic response. Mr. Wagner also conducted more detailed analysis of the

PMP event using SWMM5, to evaluate potential water elevation increases associated with alternative design characteristics of the emergency spillway and approach channel conveying flow to the spillway.

Technical Reviewer, Shine and Colonial Drainage Study, City of Orlando, Florida, 2014. This project involved the development of master plan to address multiple flooding areas for 647 acres located within the Lake Rowena Basin. The master plan's purpose was to develop conceptual improvements to resolve the historical flooding that occurs in the vicinity of Shine Avenue, Colonial Drive, Marks Street, and Oregon Street. We developed a stormwater model representation of the 647-acre tributary area, prepared an engineering report summarizing the findings of the master plan, and developed a geographic information system (GIS) database using ESRI Arc Hydro tools and the Geographic Watershed Information System (GWIS) originally developed by the Southwest Florida Water Management District.

Technical Reviewer, North Florida/Southeast Georgia (NFSEG) HSPF Initial Peer Review, St. Johns River Water Management District (SJRWMD), 2014. Mr. Wagner provided technical review of 6 of the 55 HSPF watershed models that were developed by SJRWMD and part of the NFSEG project. These watersheds were selected as being representative of the 55 watersheds. Mr. Wagner evaluated the models to determine whether key hydrologic parameter input values were within typical ranges, whether the overall hydrologic water budgets appeared reasonable, calibration was sufficient, and that model modifications through Special Actions were appropriate. Mr. Wagner developed a technical memorandum that documented the findings for each of the models and outlined potential issues and recommendations for resolution,

Technical Reviewer, Master Stormwater Management Plan Update, Osceola County, Florida, 2014. In response to water quality regulatory mandates issued by the FDEP, the County retained CDM Smith to update its Master Stormwater Management Plan. The update consisted of data compilation, development of a stormwater GIS geodatabase, water quality regulatory review and trend analyses, county-wide pollutant load analysis, development of conceptual retrofit alternatives, prioritization and ranking of basins and alternatives and development of conceptual cost estimates. Additionally, the plan update included delineation of best management practice (BMP) treatment areas for all unincorporated areas, regulatory framework review, water quality trend analysis of major water bodies within the County, identification of problem areas, Lake Tohopekaliga Nutrient Reduction Plan (NRP) support and activities, subbasin ranking and prioritization and identification of conceptual alternatives.

Modeler, Trail Ridge Landfill Stormwater Pond Berm Breach Analysis, City of Jacksonville, Florida, 2014. Mr. Wagner applied the HEC-RAS model to evaluate the potential impacts of a berm breach for a proposed stormwater pond on the landfill site. Based on the proposed berm and pond characteristics, Mr. Wagner established appropriate breach dimensions and time to breach for a sunny day and a wet weather breach scenario. He also used the HEC-GeoRAS software to develop the HEC-RAS hydraulic conveyance model downstream of the proposed berm. Both sunny day and wet weather scenarios were evaluated, using a previously developed hydrologic model to define the wet weather inflow to the pond. Model results (e.g., downstream flooding depths) were evaluated with

respect to existing and potential future urban development to assign a hazard classification to the proposed stormwater pond and berm.

Project Engineer, Toa Vaca Reservoir Water Level Prediction Tool, Puerto Rico Aqueduct and Sewer Authority (PRASA), Puerto Rico, 2014. Mr. Wagner developed a methodology to predict water levels in the Toa Vaca Reservoir based on historical gage flow data in the reservoir tributary area and planned water withdrawal rates. Projections were established for 7 days, 60 days and 90 days in the future. For the 7-day projection, Mr. Wagner analyzed historical gage data and determined a relationship between 7-day average future flows and the 30-day antecedent flows, establishing a "low" and "high" flow estimate that captured the historical 7-day future flow about 90 percent of the time. For the 60-day and 90-day projection, Mr. Wagner evaluated the long-term flow record to establish "low" and 'high" future flows looking forward from each day of the calendar year, again so that the actual historical 60-day and 90-day flows were within the range of predicted flows about 90 percent of the time. In all cases, the projected flows at the gage were adjusted (increased) to reflect the ratio of reservoir tributary area to gage tributary area as well as the average annual rainfall upstream and downstream of the gage. The adjusted projected gage flow was then compared to the projected water withdrawal to calculate the projected net increase or decrease in reservoir water volume (the reservoir water level is rarely high enough to discharge downstream) and associated increase or decrease in water level. The methodology was ultimately incorporated into an automated tool that obtains the latest gage data, projects a range of potential future reservoir water levels and provides graphs of the projection results.

Water Quality Modeling Task Leader, Water Quality and Hydraulics Study, Monongahela, Allegheny and Ohio Rivers, West Virginia & Pennsylvania, 2013-2014. Mr. Wagner has provided modeling and technical review expertise for an analysis evaluating the potential water quality impacts of proposed hydropower facilities at several existing lock and dam structures on the three rivers. He was responsible for the setup of the river models using the USACE model CE-QUAL-W2. Initially Mr. Wagner defined the river segmentation, segment physical characteristics, dam structures (gated spillways and fixed crest spillways) and spillway discharge characteristics. Inflows to the model were evaluated for the period of March through May 2013, based on available USGS flow gage data and the model was calibrated so that modeled stage and flow data at the dam structures were consistent with measured data. After the initial setup and evaluation for flows and stages, Mr. Wagner added water quality simulation, focusing on the simulation of dissolved oxygen (DO), nutrients and phytoplankton in the rivers. Subsequent to that initial setup and simulation, Mr. Wagner has provided technical oversight as the modeling has been extended and the model has been refined based on comparison between modeled water quality and measured water quality from the sampling program implemented specifically for this study. The model was applied to existing conditions and also to the proposed conditions, which include the diversion of streamflow for hydropower generation. He developed the methodology used in the model to divert the appropriate amount of streamflow constrained by factors including the minimum dam bypass flow, lock leakage flow, minimum turbine flow and maximum turbine flow. Model results (particularly DO concentrations downstream of the proposed hydropower locations) for pre-project and post-project conditions have been compared to show any changes to the concentrations in the river.

Technical Review, Fort Worth Central City/Panther Island Project Study, Tarrant Regional Water District (TRWD), Texas, 2013-2014. Mr. Wagner provided technical review expertise for modeling studies evaluating water quality in the Trinity River under existing and proposed conditions (which include a new bypass canal and associated water control structures and operating schedules). He reviewed and provided comments on watershed modeling using the EPA Stormwater Management Model (SWMM5), which provided local flow and loading to a CE-QUAL-W2 model of the river. Mr. Wagner also conducted technical review of the CE-QUAL-W2 modeling of the river, which was driven by headwater gage flows and constituent loads as well as flows and loads from SWMM5 and included a number of in-line impoundments. He provided comments and suggested refinements for the model. He also participated in meetings with TRWD and affected stakeholders to present model development and model results and to conduct training with TRWD on the application of the CE-QUAL-W2 model.

Water Quality Specialist, Regional Wastewater Treatment Plants Surface Water Discharge Mixing Zone Analyses, JEA, Jacksonville, Florida, 2013-2018. Mr. Wagner determined the appropriate mixing zone size and dimensions for effluent discharges of metals from the District II (copper and cyanide), Arlington East (copper), and Southwest (copper and cyanide) wastewater treatment plants to the Lower St. Johns River. He developed a CORMIX model for each of the discharges to determine the dilution of the discharge in the river. Mr. Wagner used available data to develop appropriate model input for effluent characteristics, receiving water characteristics and outfall characteristics. Available historical copper and cyanide concentrations for effluent and river were also evaluated to determine the required level of dilution in the river to satisfy the instream water quality standard requirements. The required level of dilution was compared to the model results to establish the dimensions of a mixing zone for the effluent, verifying that the recommended mixing zone size was less than the maximum area allowed by regulations. The initial work for all three plants was conducted in 2013. Additional analyses of the Arlington East facility were conducted in 2016 (to reflect removal of 50-foot section of outfall pipe that has broken off) and 2018 (to evaluate required mixing using more recent ambient and effluent copper concentrations).

Water Quality Specialist, Evaluation of Copper and Cyanide Mixing Zones in the St. Johns River, Jacksonville, Florida, 2013. Mr. Wagner determined the appropriate mixing zone size and dimensions for discharges of copper and cyanide from an outfall discharging combined effluent from the City of Atlantic Beach, City of Neptune Beach and City of Jacksonville Beach wastewater plants to the Lower St. Johns River. He developed a CORMIX model for the discharge to determine the dilution of the discharge in the river. Mr. Wagner used available data to develop appropriate model input for effluent characteristics, receiving water characteristics and outfall characteristics. Available historical copper and cyanide concentrations for effluent and river were also evaluated to determine the required level of dilution in the river to satisfy the instream water quality standard requirements. The required level of dilution was compared to the model results to establish the dimensions of a mixing zone for the effluent, verifying that the recommended mixing zone size was less than the maximum area allowed by regulations.

Water Quality Specialist, River Road WWTP Permitting, Wichita Falls, Texas, 2013. Mr. Wagner provided modeling and technical review expertise for several analyses evaluating the potential impacts of a proposed WWTP discharge to Lake Arrowhead, a

drinking water reservoir that has suffered from low water levels due to an extended drought period. He developed a CORMIX model of the proposed outfall, using the model to evaluate an appropriate diffuser design to provide sufficient mixing near the outfall, within the allowable mixing zone dimensions for protection of human health. Mr. Wagner provided technical review of several other water quality models evaluating the same proposed discharge. These included a spreadsheet-based model to evaluate potential impacts of discharge carbonaceous and nitrogenous biochemical oxygen demand (CBOD and NBOD) on lake dissolved oxygen (DO), a spreadsheet-based model evaluating long-term levels of total dissolved solids (TDS) in Lake Arrowhead considering monthly water budget (inflow, evaporation/precipitation, outflow, water withdrawal) and TDS mass budget, and an EPA model WASP evaluation of potential impacts on nutrient concentrations and growth of phytoplankton in the lake. These modeling results formed the basis for the permitting of the proposed discharge.

Water Quality Specialist, Citywide Water Quality Analysis, Monroe, North Carolina, 2012-2013. Mr. Wagner was responsible for the review of historical water quality data and the development of water quality models to evaluate watershed flows and pollution loads as well as in-lake water quality for three lakes in the study area. The historical data review documented the available water quality data and verified that the data were consistent with the impairment designations for several waterbodies in the study area. These impairments included total copper, pH, dissolved oxygen and chlorophyll-a. The Watershed Management Model (WMM) was used to evaluate average annual flows and pollution loads from the watershed for parameters including nitrogen, phosphorus and copper. The results from WMM were used as input to the model BATHTUB, which was used to evaluate in-lake concentrations of copper, nitrogen, phosphorus and chlorophyll-a. Model results for existing conditions were compared to the historical lake water quality data and the model results were refined as necessary to provide good agreement between the modeled and measured lake concentrations. The models were then applied under future land use conditions to determine potential water quality changes in the lakes. When the modeling is completed, a final report was prepared documenting the data review and model development, presenting the modeling results, discussing the analysis and model limitations and recommending future modeling or monitoring efforts to better define water quality conditions and evaluate potential alternative management strategies.

Modeler, Lambert's North Ash Placement Area, Australia, 2012-2013. Mr. Wagner used the hydrologic and hydraulic model SWMM5 to evaluate alternatives for surface water management for the Lambert's North site, which will serve as a placement area for coal ash. SWMM5 was used to determine the appropriate size for a diversion channel keeping upstream watershed flows from entering the site and for sizing separate stormwater control ponds for runoff from active ash placement areas and undisturbed or rehabilitated areas of the site. Design storm simulations and continuous simulation based on a 50-year rainfall record were considered in sizing the ash runoff pond and the sediment pond (serving undisturbed or rehabilitated area). The ash runoff pond was sized so that there would be no pond discharge, even for a 100-year design storm. The sediment pond was sized to capture 90 percent of the tributary area runoff and also considered stormwater harvesting of the sediment pond water for rehabilitation and dust suppression.

Project Engineer, Stormwater Master Plan, Update and Implementation, Atlantic Beach, Florida, 2012. Mr. Wagner conducted an evaluation of onsite and offsite runoff volume control for a test area in the City of Atlantic Beach. Within the test area of 18 acres, Mr. Wagner identified the level of onsite runoff volume control required for each test area parcel and then evaluated the feasibility of various onsite runoff control features including bioretention (rain garden), infiltration trench, swale and underground storage. The feasibility of an offsite underground storage runoff control feature to handle excess runoff from the entire test site was also evaluated. Typical ranges of implementation costs were developed for each alternative control feature, revealing that swales appeared to be the most cost-effective control.

Technical Reviewer, Lake Worth Stormwater Master Plan, Lake Worth, Florida, 2012. Mr. Wagner served as a technical reviewer for the water quality analysis using CDM Smith's Watershed management Model (WMM). He reviewed the WMM application to validate model input including imperviousness and surface runoff water quality concentrations for various land use categories and pollutant removal efficiencies for potential Best Management Practices (BMPs). Mr. Wagner also reviewed the model output summaries that were prepared for the project report.

Water Quality Specialist, Preliminary Low Impact Development Manual, City of Jacksonville, Florida, 2011-2013. Mr. Wagner was the chief author of the Low Impact Development (LID) manual chapters on bioretention and pervious pavement. One of the key elements of each chapter was the determination of the LID effectiveness in capturing and treating runoff. Mr. Wagner applied the LID modeling features of SWMM5 to evaluate bioretention and pervious pavement effectiveness, based on a long-term model simulation including over 60 years of historical rainfall data. The chapters also cover topics including design considerations and requirements, an example design problem, construction considerations and operations and maintenance considerations.

Technical Reviewer, Stormwater Management Plan, Nassau County, Florida, 2011-2012. Mr. Wagner provided technical oversight in the application of the HEC-HMS hydrologic model and HEC-RAS hydraulic model for watersheds in Nassau County. Review of the hydrologic modeling included the selection of appropriate hydrologic input parameters for model subbasins and routing parameters for modeled channels. Review of the hydraulic modeling included proper linkage between the HEC-HMS output hydrographs and HEC-RAS inflow locations, selection of appropriate hydraulic input parameters, proper representation of stream crossings (e.g., bridges, culverts) and troubleshooting model instabilities when HEC-RAS was run in unsteady mode.

Project Engineer, Daytona Beach International Airport (DBIA) Stormwater Master Plan, Volusia County, Florida, 2011. Mr. Wagner served as a technical reviewer for the DBIA Stormwater Master Plan modeling. He reviewed the baseline models for existing and future land use conditions to verify that the models reflected appropriate imperviousness levels for each condition and also accurately reflected the existing airport stormwater management system. Similar review was provided by Mr. Wagner for several alternative improvements to the existing stormwater management system. He also reviewed the stormwater master plan summary report.

Project Manager/Modeler, First and Whites Creek Water Quality Model, Knoxville, Tennessee, 2010-2013. Mr. Wagner was the project manager and lead modeler in the

development of a watershed water quality model. The effort was the basis for the development of models for other watersheds within the city. Efforts led by Mr. Wagner included the model selection, development of study methodology, expansion and refinement of an existing Storm Water Management Model (SWMM) watershed model, model calibration of existing conditions, evaluation of future conditions and alternative best management practice (BMP) alternatives and training of city staff in applying the selected model.

Technical Reviewer/Water Quality Modeler, Upper Blackstone River Watershed Model, Massachusetts and Rhode Island, 2010-2013. Mr. Wagner refined an existing Hydrologic Simulation Program – Fortran (HSPF) water quality model, based on comments from a Technical Advisory Committee (TAC). The model was refined to provide better simulation of dissolved oxygen (DO) concentrations and eutrophication impacts in the river. Additional work was performed to refine the simulation of suspended sediment in the river and to evaluate modification or removal of one of the dams along the river. The model has been further refined to more accurately simulate benthic algae (periphyton) and has been updated to simulate more recent years (2009-2011).

Technical Leader, Caloosahatchee Estuary (Florida) Basin Management Action Plan Support, Florida, 2010-2012. For the Florida Department of Environmental Protection (FDEP), Mr. Wagner provided technical guidance to the allocation of existing watershed nitrogen loads between jurisdictions in the Caloosahatchee Estuary basin. An existing model (HSPF) had previously been developed to evaluate watershed loads by subwatershed and the subwatershed boundaries did not coincide with jurisdictional boundaries. Mr. Wagner developed the methodology for using the HSPF model (modified to produce loadings based on land use and rainfall zone) and GIS coverages of land use and jurisdictional boundaries, to determine the total loading by jurisdiction and then reviewed the results to make sure that the overall load from this method matched the watershed modeling results originally generated by HSPF. Loads were also broken out between urban, agricultural and undeveloped sources, with allocations being made on the basis of the urban loads.

Technical Reviewer, Modification of Hydraulic Structure S-65E, South Florida Water Management District (SFWMD), Florida, 2010-2011. Mr. Wagner was the lead technical reviewer in the evaluation of alternative modification strategies for the S65-E hydraulic structure. Hydrological studies had indicated that the existing structure is not adequate to pass design storm flow rates and velocities in the Kissimmee River. The Adaptive Hydraulics (ADH) model was used to characterize existing velocity and shear stresses downstream of the structure and to predict downstream velocities and shear stresses for several structure modification alignments. Mr. Wagner reviewed the ADH model calibration and evaluation of alternatives and the draft and final reports documenting the modeling and recommended alternative.

Task Manager and Technical Reviewer, Lake Okeechobee Environmental Model (LOEM), U.S. Army Corps of Engineers (USACE) and South Florida Water Management District (SFWMD), Florida, 2010-2011. Mr. Wagner was the lead technical reviewer in the LOEM submerged aquatic vegetation (SAV) model enhancement and application. LOEM was enhanced by adding the simulation of SAV processes to the model and was tested to verify that the processes were properly represented. The model was then applied for a

ten-year period for calibration and validation, followed by the evaluation of alternative aquifer storage and recovery (ASR) management scenarios. Mr. Wagner managed the application of the Lake Okeechobee Operations Screening Model (LOOPS) to evaluate the water budget in the lake for the ten-year simulation period under existing conditions and for the alternative ASR scenarios. LOOPS used gaged historical inflows and operating rules for the lake to determine lake water elevation, evaporation, outflow at the S-77 and S-308 structures and daily ASR recharge or recovery volumes in the scenarios with ASR. This information was input to the LOEM simulations. Mr. Wagner reviewed the calibration, validation and alternative scenario results and the draft and final reports documenting the mode development and application.

Project Manager and Modeler, Levitt Stormwater Park, Rockledge, Florida, 2010. Mr. Wagner, as part of the Stormwater Management Program for the City of Rockledge, was the project manager and modeler for the evaluation of the Levitt Stormwater Park. The Stormwater Management Model (SWMM Version 4) was used to evaluate potential modifications to reduce high water levels in the stormwater park pond during extreme storm events. The modeling demonstrated that the City could remove two weirs affecting levels in the pond, in order to reduce high water levels in the pond, without causing adverse impacts downstream of the pond. Mr. Wagner addressed St. Johns River Water Management District (SJRWMD) comments in order to secure the permit for removing the weirs. He also provided technical review of monitoring studies of the Levitt Stormwater Park pond and the Barton Park regional wet detention pond. He reviewed the calculations and the reporting of the monitoring results with respect to inflow and outflow quantities, pollutant concentrations and pollutant loads, which were ultimately used to evaluate the pollutant removal efficiency of the ponds.

Water Quality Specialist, U.S. Army Corps of Engineers (USACE) Water Resources Engineering Support, Jacksonville District, Jacksonville, Florida, Ongoing. On the Southwest Florida Feasibility Study (SWFFS) watershed management model (WMM) task order, Mr. Wagner provided senior technical review for the development of hydrologic and water quality models of four basins to assess nutrient loads and evaluate various water management, water delivery and ecosystem restoration alternatives. He served as peer reviewer, providing statistical analysis of nutrient loading and historical flow data and valuable input regarding assumptions pertaining to pollutant removal efficiencies and how to appropriately evaluate the management measures under consideration. Mr. Wagner was also the lead instructor of the Jacksonville District WMM course in January 2009.

Water Quality Specialist, Northwest Wastewater Treatment Plant (NW WWTP) Total Maximum Daily Load (TMDL) Assistance, St. Johns County Utility Department, Florida, 2009-2011. Mr. Wagner provided technical assistance to demonstrate that intermittent discharges from the NW WWTP would not have an adverse impact to the immediate receiving water (Mill Creek) and downstream water body Sixmile Creek. He developed a spreadsheet model to show that the discharge would not reduce dissolved oxygen (DO) concentrations in Mill Creek and, in fact, would actually increase DO concentrations under some circumstances. The model also demonstrated that the travel time in the creek was so limited that there is little likelihood that the nutrients in the wastewater discharge will cause adverse growth of phytoplankton in the creek. He also coordinated with the U.S. Environmental Protection Agency (EPA) modelers who added

the potential discharge to an existing water quality model of Sixmile Creek and determined that the discharge would not have an adverse impact on Sixmile Creek.

Technical Reviewer/Hydrologic and Hydraulic Modeler, Nova Canal Flood Control Project, East Volusia Regional Water Authority, Florida, 2009-2010. For the East Volusia Regional Water Authority, Mr. Wagner was the lead modeler in developing an Environmental Protection Agency (EPA) Storm Water Management Model (SWMM5) hydrologic and hydraulic model of the Nova Canal system, which includes the Nova Canal and tributary canals including the 11th Street Canal, Reed Canal and Halifax Canal. The model was developed by combining several existing models developed in an earlier version of SWMM. Mr. Wagner used the model to evaluate potential benefits of pump stations and tide weir-gate structures at the downstream end of the 11th Street, Reed and Halifax Canals, in order to reduce flooding impacts during extreme design storm events. Mr. Wagner also provided technical review for other alternatives including storage and pump stations in other locations within the system.

Modeling Leader/Water Quality Modeler, Hudson River, New York, 2009-2010. Mr. Wagner was involved in the development of water quality models for the Hudson River. The models were designed to assess the water quality impacts of nonpoint source pollution, wastewater discharges and combined sewer overflows (CSOs) on fecal coliform bacteria and dissolved oxygen (DO) in the river, under existing conditions and under alternative wastewater and CSO management strategies. Mr. Wagner oversaw the development of the bacteria model [Environmental Protection Agency (EPA) Storm Water Management Model (SWMM5)] and developed the DO model [Water Quality Analysis Simulation Program (WASP)]. He developed the methodology for comparing continuous model output to water quality standards in order to assess compliance for existing and alternative conditions.

Modeler, Carters Lake Dam Failure Analyses and Inundation Mapping Support, U.S. Army Corps of Engineers (USACE), Mobile District, 2009-2010. Mr. Wagner developed a HEC-RAS model to evaluate the impacts of a dam break for Carters Lake Dam in Georgia. The analyses included evaluation of the failure of the main dam, a downstream reregulation dam and several saddle dikes along the main dam. The evaluations were conducted for both a sunny day analysis and a spillway design flood (SDF) analysis. Products included inundation maps and tables indicating peak stages, peak flows and times to peak at locations downstream of the dam. The USACE will use this information to update the Emergency Action Plan (EAP) for the dam.

Technical Reviewer/Water Quality Modeler, Dickinson Bayou Bacteria Total Maximum Daily Load (TMDL) Modeling, Texas, 2009. Mr. Wagner provided technical oversight in the development of a spreadsheet tidal prism model of the Dickinson Bayou. The model was designed to accept time series data of flow and bacteria from a Hydrologic Simulation Program – Fortran (HSPF) watershed model. Calculations in the tidal prism model determined the hydrodynamics of the system (e.g., receiving water segment volumes and flows between segments) and bacteria concentrations based on advection and first-order decay. Model hydrodynamics were validated based on comparison of model results and observed salinity values and first-order decay rates were adjusted to calibrate measured bacteria concentrations to observed concentrations.

Water Quality Specialist, Eagle's Pointe Water Quality Data Analysis, Beaufort County, South Carolina, 2009. Mr. Wagner evaluated water quality data collected by the Eagle's Pointe development. The data were collected for a ten-year period to determine if the wet detention ponds implemented by the development were providing adequate water quality protection. The analysis indicated that downstream concentrations of various water quality constituents and downstream biological indicators, were not significantly different than concentrations and biological indicators upstream of the development. Therefore, it was recommended that the existing monitoring program need not be continued. The analysis did show elevated copper concentrations, which may be a function of pond maintenance practices to control algae levels in the ponds. Further monitoring of copper was recommended.

Senior Technical Review, Blind River Diversion Project Feasibility Report, Mississippi River, Louisiana, 2008-2009. CDM Smith was the prime consultant supporting development of a feasibility study for the Blind River Freshwater Diversion Project in St. James Parish, Louisiana, under contract with the Louisiana Department of Natural Resources and Office of Coastal Protection and Restoration Authority. Mr. Wagner provided senior technical review of the hydrologic, hydraulic and water quality modeling conducted during the study. The hydrologic and hydraulic modeling included the evaluation of design storm and continuous flows using HEC-HMS and the evaluation of flow distribution and flood control benefits using HEC-RAS. EFDC was applied to evaluate water depths, velocities and sediment accumulation in the wetland areas under existing conditions and various management alternatives. Mr. Wagner provided review and input to the methodology applied for all models and commented on the technical validity of the model results.

Technical Reviewer/Water Quality Modeler, Tributaries Total Maximum Daily Load (TMDL) Modeling Study, Indian River Lagoon, Florida, 2008-2009. For the Florida Department of Environmental Protection (FDEP), Mr. Wagner was involved in the development, calibration and validation of Hydrologic Simulation Program – Fortran (HSPF) hydrologic and water quality models for two tributaries to the Indian River Lagoon and technical review of data collection and HSPF modeling for other tributaries to the lagoon. A total of 15 impaired waterbodies [in most cases impaired for dissolved oxygen DO)] were evaluated with the HSPF models for current water quality conditions. The calibrated and validated HSPF models will be used to develop TMDL allocations for the study area.

Water Quality Task Manager and Master Plan Technical Reviewer, Master Stormwater Management Plan (MSMP) Update, Jacksonville, Florida, 2007-2012. Mr. Wagner led the effort to evaluate pollution loads and water quality issues for the master plan. He directed the development of model input data and evaluated model output, which was generated using the water quality model Watershed Management Model (WMM). Modeling results were used to identify "hot spots" (areas of high pollution loads) and to prioritize areas for implementation of retrofit best management practices (BMPs). Mr. Wagner also assessed watershed PLSM and receiving water CE-QUAL-ICM models used in the development of the Total Maximum Daily Load (TMDL) allocations for the Lower St. Johns River, which flows through the city. He has also provided guidance and review in the hydrologic and hydraulic modeling of extreme storm events using the Environmental Protection Agency (EPA) Stormwater Management Model (SWMM5). Mr.

Wagner reviewed developed models for technical soundness and helped to develop methodologies for modeling bridges in SWMM5, accounting for existing stormwater peak-shaving detention ponds and using SWMM5 to conduct floodway analyses (the SWMM5 model results were used to support FEMA flood map revisions).

Project Manager/Technical Reviewer, Total Maximum Daily Load (TMDL) Modeling Study, Caloosahatchee River Watershed, Florida, 2007-2010. For the Florida Department of Environmental Protection (FDEP), Mr. Wagner provides technical oversight in the development and calibration of the Watershed Management Model (WMM) for the Caloosahatchee River Watershed. Mr. Wagner also reviewed subcontractor modeling of the watershed and receiving waters using the Hydrologic Simulation Program – Fortran (HSPF), WASP and EFDC models. These models were used to evaluate current water quality conditions, as well as several different alternatives which included across-the-board pollutant load reductions, various levels of best management practice (BMP) implementation and elimination of Lake Okeechobee discharges to the Caloosahatchee River. Water quality concerns in the tidal river include low dissolved oxygen (DO) and light penetration as it affects seagrass in the tidal river. The calibrated and validated HSPF and EFDC models will be used to develop TMDL allocations for the study area.

Technical Leader, Development of Watershed Loads, Lake Okeechobee Fast-Track (LOFT) Project Basis of Design Report (BODR), South Florida Water Management District (SFWMD), 2007-2009. Mr. Wagner was the technical leader in the development of nutrient loadings from areas north of Lake Okeechobee using the Watershed Assessment Model (WAM). He reviewed model input (meteorological data, watershed hydrologic characteristics and watershed land-based nutrient loading rates) and model output (comparison of model results to measured water quality and flow data). The results from WAM served as input to another model (STELLA) that evaluated the potential nutrient reduction benefits of the proposed Taylor Creek Reservoir and Lakeside Ranch Storage Treatment Area (STA).

Project Manager, Total Maximum Daily Load (TMDL) Modeling Study, Stevenson Creek, Florida, 2007-2009. For the Florida Department of Environmental Protection (FDEP), Mr. Wagner managed the development of Hydrologic Simulation Program – Fortran (HSPF) hydrologic and water quality models for the Stevenson Creek watershed and an EFDC model of the tidal portion of the creek. The models were developed to evaluate current conditions which are characterized by impairments for dissolved oxygen (DO) and nutrients (chlorophyll-a).

Project Manager/Water Quality Modeler, Total Maximum Daily Load (TMDL) Modeling Study, Perdido Bay, Florida, 2007-2009. For the Florida Department of Environmental Protection (FDEP), Mr. Wagner was involved in the development of Hydrologic Simulation Program – Fortran (HSPF) hydrologic and water quality models for the Perdido River and Perdido Bay watersheds and an EFDC model of Perdido Bay. The HSPF models incorporated an area of 1,150 square miles. Mr. Wagner managed the development of the HSPF hydrologic and water quality models for the Perdido River watershed (performed by subconsultant Dynamic Solutions Inc.) and the Perdido Bay watershed (performed by CDM Smith). He also was the chief hydrologic and water quality modeler for the Perdido Bay watershed modeling. Mr. Wagner managed the development

of the Bay EFDC model by the subconsultant. The calibrated and validated HSPF and EFDC models will be used to develop TMDL allocations for the study area.

Technical Reviewer/Water Quality Modeler, Upper Kissimmee River Basin, Florida, Total Maximum Daily Load (TMDL) Modeling Study, 2007-2008. For the Florida Department of Environmental Protection (FDEP), Mr. Wagner was involved in the development of the Hydrologic Simulation Program – Fortran (HSPF) hydrologic and water quality models for the Upper Kissimmee River Basin. The models incorporated an area of 2,200 square miles. Mr. Wagner provided technical oversight on the development of the HSPF hydrologic models of the area and was the chief developer of the HSPF water quality models. A total of 24 impaired waterbodies were evaluated with the HSPF models for current water quality conditions, as well as water quality under "natural background" (i.e., totally undeveloped) and "maximum wastewater point source discharge" conditions. Generally the waterbodies were impaired for nutrients, although several were also impaired for dissolved oxygen (DO). The calibrated and validated HSPF models will be used to develop TMDL allocations for the study area.

Technical Leader, North Shore Lake Apopka Hydrologic Restoration Study, Apopka, Florida, 2006-2007. Mr. Wagner was the technical leader in a study that evaluated alternative measures for the restoration of the north shore of Lake Apopka. In the past, the area was separated from the lake by berms and used for agriculture. This area has been purchased by the St. Johns River Water Management District (SJRWMD), with the idea that the area may be reconnected with the lake and/or converted to wetland or reservoir areas that could reduce nutrient pollution loads downstream of the Lake Apopka area and potentially provide water for other uses (e.g., irrigation). Mr. Wagner oversaw the evaluation of a number of alternative restoration scenarios using the hydrologic model Hydrologic Simulation Program – Fortran (HSPF). He provided technical guidance in the use of HSPF "special actions" to route flows from Lake Apopka to the north shore, subject to constraints such as depth and duration of wetland flooding.

Project Engineer, C-1 Canal Diversion Study, St. Johns River Water Management District (SJRWMD), Florida, 2006-2007. For the SJRWMD, Mr. Wagner updated an HSPF hydrologic model of the C-1 Canal tributary area and conveyance system that was developed by District staff, based on comments from an independent review of the model. Mr. Wagner then used the model to evaluate alternative designs for diverting freshwater flow from the C-1 Canal conveyance system westward for ultimate discharge to the Upper St. Johns River. Under current conditions, the canal conveyance system carries freshwater flow eastward to the Indian River Lagoon estuary and excessive freshwater flows to the estuary are considered undesirable.

Project Manager/Water Quality Modeler, Total Maximum Daily Load (TMDL) Modeling Study, Wekiva Lakes, Florida, 2006-2007. For the Florida Department of Environmental Protection (FDEP), Mr. Wagner was involved in the development of watershed loading and lake receiving water quality models associated with five lakes in the Wekiva River watershed. He applied the Watershed Management Model (WMM) to calculate watershed loads to the lakes and he applied the BATHTUB model to evaluate in-lake concentrations of total nitrogen, total phosphorus and chlorophyll-a, which in turn were used to calculate the average Trophic State Index (TSI) for the lakes. He calibrated the watershed and lake water quality models to existing land use conditions and then

modified the calibrated models to evaluate "natural background" (i.e., totally undeveloped) conditions. The models will eventually be used by the FDEP to develop TMDL allocations for the study area.

Project Engineer, Total Maximum Daily Load (TMDL) Model Selection Memorandum, Kissimmee River Basin, Florida, 2006. Mr. Wagner was the lead engineer for CDM Smith in the evaluation of existing watershed and water quality models and development of recommendations for the TMDL modeling in the Kissimmee River Basin. The model recommendations considered the administrative deadlines for TMDL development, availability of data and the capabilities of previously-developed models for the study area.

Technical Leader, Nutrient Assessment Study, Estero Bay and Caloosahatchee River, Florida, 2006-2007. Mr. Wagner was the technical leader in a study that evaluated existing and future pollution loads in the study area and load reduction benefits of alternative management measures. The analysis was done using CDM Smith's Watershed Management Model (WMM). He provided guidance in model development for existing conditions of land use, wastewater discharges, failing septic tanks and best management practices (BMPs). He compared the average annual pollution load results from WMM to available flow and water quality concentration data to show that the pollution loads calculated by WMM were reasonable. Mr. Wagner also guided the model development and reviewed results for the future buildout conditions to evaluate the potential increase in pollution loads associated with development and buildout condition with alternative management measures to assess the load reduction benefits. These measures included high-efficiency onsite BMPs, retrofit BMPs, low impact development and regional water quality treatment by the proposed C-43 reservoir. Mr. Wagner reviewed proposed C-43 reservoir operations to calculate the potential load reduction achieved by the reservoir.

Project Manager/Water Quality Modeler, Watershed Studies, Richland County, South Carolina, 2005-2008. Mr. Wagner was the lead modeler involved in the development of HSPF hydrologic and water quality models for the Gills Creek and Crane Creek watersheds in Richland County (near Columbia). He was responsible for the calibration of the hydrologic and water quality models, focusing on the models' capability of accurately simulating water quality concentrations for areas that were considered impaired, based on comparison of available monitoring data and receiving water quality standards. The models are expected to be used to evaluate alternative load reductions required to attain water quality standards.

Project Engineer, Sandalwood Canal, Jacksonville, Florida, 2005-2008. For the Sandalwood Canal analysis, Mr. Wagner used the Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) model to run a continuous simulation model that estimated the quantity of flow (percent capture) that would be diverted from the canal to an existing borrow pit and diverted from the canal to a proposed regional pond in a proposed new development. He provided technical review of calculations that quantified the nonpoint pollution load reductions that would be achieved by the diversions to the borrow pit and new proposed pond. The load reductions were compared to load increases that will result from road widening projects to demonstrate that the retrofit project load reduction is greater in magnitude than the road widening project load increases. The continuous simulation model was also applied by Mr. Wagner to determine how the percent capture was affected by alternative outflow rates from the borrow pit

(conceptual design involves pumping of outflow to an adjoining wetland). One unique feature of the new proposed pond is the use of an amil gate as part of the diversion to limit how much water can be diverted from the canal to the proposed pond under extreme design storm events. Mr. Wagner applied SWMM to determine the appropriate operations of the amil gate. He also used the model to demonstrate that peak water elevations for extreme design storm events would not increase as a result of the proposed diversion and retrofit projects. In fact, results for the average annual storm suggest that the diversion projects will reduce peak velocities downstream and thereby reduce the potential for erosion of the canal.

Project Engineer, 103rd Street Pond, Jacksonville, Florida, 2005-2006. For the 103rd Street Pond analysis, Mr. Wagner used the Environmental Protection Agency (EPA) SWMM model to run a continuous simulation model that estimated the quantity of flow (percent capture) that would be diverted from a local creek to two interconnected wet detention ponds for water quality treatment and the mean residence time in the ponds (which influences the pollutant removal effectiveness of the ponds). Mr. Wagner provided technical review for the calculation of nonpoint pollution load reductions that would be achieved by the diversion and retrofit pond project. He also used the SWMM results to demonstrate that peak water elevations for extreme design storm events would not increase as a result of the proposed diversion and retrofit project.

Project Manager/Water Quality Modeler, Hampton Lake Study, Beaufort County, South Carolina, 2005-2006. Mr. Wagner was the lead modeler involved in the development of HSPF hydrologic and water quality models for a proposed development area in Beaufort County. He set up and applied the models for a long-term continuous and used the model results to assess projected loads from the development, expected water quality concentrations within the lake and reduction in downstream pollution loads resulting from stormwater treatment within the lake. Mr. Wagner used the model results to make recommendations regarding water quality monitoring, necessity of fountains/aerators and maintenance practices.

Project Engineer, Total Maximum Daily Load (TMDL) Model Development, Hillsborough River, Florida, 2005-2006. Mr. Wagner was the lead engineer for CDM Smith in the development of a receiving water model for the Hillsborough River using the Environmental Agency Protection model WASP. CDM Smith coordinated with Soil and Water Engineering Technology (SWET), who developed nonpoint load and hydraulics input data files for WASP using the Watershed Analysis Model (WAM). He was responsible for the setup, calibration and validation of the WASP model and development of nonparametric statistics and graphics to support the calibration and validation process. He also reviewed the input files generated by WAM and worked with SWET to refine these input files as appropriate.

Project Engineer, Upper St. Johns River Basin Model, Florida, 2003-2006. Mr. Wagner was the lead engineer in the development of a watershed model for the Upper St. Johns River Basin (1,800-square-mile-tributary area). He led a team of modelers in developing the HSPF model of the basin. He performed modeling and provided technical guidance to other modelers in the development of the hydrologic and hydraulic model, which was calibrated by Mr. Wagner and others through comparison of modeled and measured streamflow at eight UGSG stations in the study area for a four-year simulation period. He

was the chief water quality modeler, developing a model that focused on total suspended solids (TSS), nitrogen, phosphorus and phytoplankton (chlorophyll-a). He calibrated the model by comparing measured concentrations to modeled concentrations on the days corresponding to the sampling dates. Nonparametric statistics were calculated by Mr. Wagner to test whether the means and distributions of the measured and modeled concentrations were significantly different. In addition, measured flows and concentrations were used by Mr. Wagner to estimate annual loads, which he then compared to the modeled annual loads. He also provided technical review for a separate application of the USJRB model, which was used to evaluate the potential water supply that could be provided by diversion from the river to the Taylor Creek reservoir.

Project Engineer, Total Maximum Daily Load (TMDL) Protocol for Florida, 2003-2005. As part of the protocol development team, Mr. Wagner contributed to the sections related to watershed and receiving water data analysis, model selection, model calibration and validation and model application. Specific topics addressed included model setup and data input, model output, model calibration and validation techniques and evaluation methods, sensitivity analysis and uncertainty analysis.

Project Manager, Beaufort County Stormwater Master Plan, Beaufort County, South Carolina, 2002-2006. Mr. Wagner led a team that developed a stormwater master plan for Beaufort County. The project included a number of elements, including hydrologic/hydraulic modeling of the county's primary drainage system, watershed and tidal river water quality modeling, infrastructure inventory of the primary drainage system and plan development. Mr. Wagner provided technical oversight and review of the application of the ICPR model for the hydrologic/hydraulic modeling, which evaluated the capacity of the existing drainage system and identified problem areas. He also guided and reviewed the evaluation of alternative solutions for the problem areas using the ICPR model. He provided technical guidance in the development of CDM Smith's Watershed Management Model (WMM) and reviewed model calculations of annual pollution loads from county watersheds under existing and future land use conditions and the evaluation of alternative management measures to reduce impacts of existing and future development. Mr. Wagner developed WASP computer models of the tidal rivers in Beaufort County and calibrated the models to existing conditions based on measured fecal coliform bacteria in the rivers and the bacteria loads calculated by WMM. The WASP models were also applied by Mr. Wagner for future conditions to evaluate potential impacts of future development.

Project Engineer, Fairfax County Water Authority, Virginia, 2002-2003. Mr. Wagner was the project engineer for two task orders. Under one task order, Mr. Wagner used available information to estimate travel times for the Potomac River main stem to the county's drinking water withdrawal location and travel times from upstream tributaries to the withdrawal location. Various sources, such as the reach file associated with the [Environmental Protection Agency (EPA)] BASINS program, Federal Emergency Management Agency (FEMA) floodplain modeling studies and local studies, were used as the basis for the travel time estimates by Mr. Wagner. The travel time results and other information were used by Mr. Wagner and others to define and prioritize watershed management zones upstream of the withdrawal site. Under the second task order, he refined an existing WASP water quality model of the Potomac River to evaluate the water quality in the river based on various discharges in the river at Chain Bridge, withdrawals

upstream of Chain Bridge and wastewater discharges (e.g., Blue Plains plant). Of particular interest were the salinity and the influence of wastewater discharges associated with the Potomac River at Occoquan Bay. Results of the analyses were used by others to evaluate the feasibility of a water withdrawal from the river at Occoquan Bay.

Project Engineer, Watershed Model Selection and Methodology Development, Fairfax County, Virginia, 2002-2003. Mr. Wagner was responsible for model selection and methodology development for watershed master planning in Fairfax County. A number of computer models were evaluated based on criteria such as technical capabilities, ease of use, availability of user support and anticipated future model support and development. He selected a set of models for use by CDM Smith and other consultants that were used for hydrology/hydraulics and water quality analyses. The development of the model methodology included selecting typical model parameter values, as well as describing techniques to develop model input parameters using available GIS coverages.

Project Engineer, Cedar River Water Quality Analysis, St. Johns River Water Management District, Florida, 2002. For the Cedar River analysis, Mr. Wagner refined an existing model of the river watershed [Environmental Protection Agency (EPA) (SWMM)] so that continuous hydrologic, hydraulic and water quality simulations could be conducted. He calibrated the hydrology by comparing continuous model streamflow results to flows measured at a U.S. Geological Survey (USGS) station in the watershed. The continuous water quality simulations conducted by Mr. Wagner focused on constituents, including TSS, lead, zinc, copper, cadmium, chemical oxygen demand (COD) and polychlorinated biphenyls (PCB). He calibrated water quality model coefficients based on comparison of modeled concentrations to instream measured concentrations [total suspended solids (TSS), lead, zinc and copper], or based on evaluation of literature values and measured instream sediment concentrations (cadmium, COD, PCBs). He applied the calibrated model to calculate watershed loads for an "average" year and he estimated the load reduction that could be achieved by implementing a regional pond to treat stormwater from part of the watershed.

Project Engineer, Regional Stormwater Treatment Systems, Tri-County Agricultural Area, Florida, 2001-2002. For the St. Johns River Water Management District (SJRWMD), Mr. Wagner used local flow and water quality data to estimate average and seasonal flows and loads of nitrogen and phosphorus at the location of two proposed regional stormwater treatment facilities. This information was used as input to an empirical model that estimated the reductions in phosphorus and nitrogen loads that would be achieved by the proposed regional facilities. For one of the facility locations, Mr. Wagner estimated the removal efficiencies of various forms of nitrogen and phosphorus (organic phosphorus, dissolved phosphorus, organic nitrogen, ammonia nitrogen and nitrite + nitrate nitrogen). For a wet detention pond, the method was based on calibration of the Environmental Protection Agency (EPA) model WASP to several wet detention ponds and use of the calibrated parameters to estimate the fate of various nitrogen and phosphorus forms in the proposed facility. For a wetland facility, he refined regression equations developed in a previous project to estimate the fate of the various forms of nitrogen and phosphorus. Mr. Wagner provided technical oversight to additional work in 2008 that evaluated nutrient loads at various locations in the TCAA, evaluated potential load reduction from retrofit regional best management practice (BMP) facilities and used these findings to prioritize the implementation of regional BMPs.

Project Engineer, Hydrologic Analysis, St. Johns River Water Management District, Florida, 2001-2002. Mr. Wagner developed a detailed hydrology model for the Pellicer Creek watershed in Florida. The HSPF computer model was used to calculate time series of surface runoff, interflow and groundwater flow to the stream network in the watershed. Measured rainfall data and streamflow data were used to calibrate the key hydrologic parameters in the model. It is anticipated that water quality characteristics will be added to the model to assess nonpoint source loads from the watershed to the Intercoastal Waterway.

Project Engineer, Stormwater Plan, Atlanta, Georgia, 2001. Mr. Wagner performed a stormwater analysis for a proposed runway addition at Hartsfield Airport in Atlanta. Hydrologic and hydraulic evaluations for design storm events were conducted using the Interconnected Pond Routing model (ICPR). The results of the modeling were used to ensure that the proposed plan (enclosing an existing creek with box culverts under the runway) was adequate for handling extreme storm events. The ICPR model results were also used to develop a Conditional Letter of Map Revision (CLOMR) that delineated the floodway and floodplain under the proposed plan.

Project Engineer, Water Resources/Water Supply, Newport News, Virginia, 2001. Mr. Wagner conducted a re-evaluation of critical drought conditions and safe yield for the City of Newport News water supply. He developed a set of monthly linear regression models to predict monthly streamflows in the Chickahominy River (a key element of the city's water supply) based on a composite monthly rainfall record for the watershed. Mr. Wagner tested the models to evaluate their predictive capability against measured monthly streamflows for the period that both rainfall and streamflow records were available (1942-1999) and then applied the models to calculate synthetic monthly streamflows as far back as 1838. The 161-year streamflow record (1838-1999) was used by Mr. Wagner to re-evaluate the safe yield, using the safe yield model developed previously by CDM Smith. The previous modeling of safe yield had been based on monthly streamflow going back only to 1926. Mr. Wagner's analysis of the results concluded that the 57-mgd safe yield reported by previous studies is actually associated with a 22-year drought event, rather than a 75-year return period as assumed by previous studies.

Project Engineer, Minimum Flows and Levels, St. Johns River Water Management District (SJRWMD), Florida, 2000-2007. For the SJRWMD in Florida, Mr. Wagner has conducted several lake analyses to evaluate the compliance with minimum flows and levels (MFL) requirements. Initially, he performed modeling using the Stormwater Management Model (SWMM) and HSPF models as part of an overall evaluation of model capabilities as applied to two lakes (Indian Lake and Lake Nicotoon). After the District selected HSPF as the desired modeling tool, he (and others) applied the Hydrologic Simulation Program – Fortran (HSPF) computer model to numerous lakes. Each analysis evaluated a long-term simulation of lake levels, considering runoff and baseflow inflows to the lake, evaporation and direct rainfall at the lake surface, outflow through lake outlet structures and leakage from the lake to the underlying confined aquifer. The modeling results were compared to MFLs established by SJRWMD staff based on observed vegetation at the lake site to determine whether lake levels were sufficient to maintain the observed vegetation.

Project Engineer, Combined Sewer Overflow (CSO) Water Quality Analysis, Indianapolis, Indiana, 1999-2003. Mr. Wagner served as project engineer for a CSO

water quality analysis for the White River and Fall Creek in the Indianapolis area. He coordinated the development of a linkage between the EXTRAN module of the Environmental Protection Agency (EPA) Stormwater Management Model (SWMM) and the EPA receiving water model WASP. The linkage enabled CDM Smith to evaluate the instream water quality impacts, such as low dissolved oxygen (DO) concentrations, from actual or design storm events in the White River watershed. He set up the WASP model of the river to accept watershed flows and loads from CSOs as well as areas without combined sewers. He also used watershed and CSO models developed previously by others to evaluate flows and loads to the river for two actual storm events. He then calibrated the WASP river water quality model based on comparison of modeled and measured flows and DO concentrations during those two actual storm events. The calibrated model was then applied by Mr. Wagner to evaluate the benefits of alternative control strategies, such as detention basins and primary settling and alternative sizing criteria for structural controls. He also expanded the watershed and river models further downstream of the City of Indianapolis to evaluate the extent of elevated coliform bacteria concentrations downstream of the city flowing CSO discharge events.

Project Engineer, Big Creek Watershed Water Quality Management Plan, Fulton County, Georgia, 1999-2001. Mr. Wagner developed a water quality model of the Big Creek watershed using the Environmental Protection Agency (EPA) model BASINS. The model was used to assess the instream loads of sediment, nutrients, bacteria, metals and other pollutants from point sources and nonpoint sources. Loads were assessed for existing and future land use conditions, with and without alternative management controls. The results were used to recommend a management plan designed to protect water quality in the watershed and downstream of the watershed and to protect stream integrity and fish habitats.

Project Engineer, Bacteria Water Quality Modeling Studies, South Carolina, 1999-2000. Mr. Wagner has conducted several water quality studies to assess bacteria impacts from developed areas in South Carolina. He reviewed a bacteria model developed by another consultant to estimate bacteria removal efficiency from wet detention pond BMPs. The model, as revised based on Mr. Wagner's comments, was accepted by the South Carolina Department of Health and Environmental Control (DHEC). He also conducted a study to define the impacts of existing and future development on bacteria concentrations in the May River. In another study, Mr. Wagner estimated average annual pre-development and post-development bacteria loads for a proposed development site and evaluated the reduction in bacteria load achieved by the proposed stormwater BMP plan for the site.

Project Engineer, Water Quality Analysis, Blackstone River, Massachusetts, 1999. Mr. Wagner used the EPA receiving water quality model WASP to evaluate conditions in the Blackstone River. A previous study had used the Environmental Protection Agency (EPA) model QUAL2E to develop a representation of the river and to determine appropriate wasteload allocation limits for point source discharges to the river. CDM Smith identified a number of deficiencies in the initial QUAL2E model, such as unreasonable values for water quality process rates. He used the WASP model to develop a more reasonable representation of the river system and to evaluate whether the management decisions recommended as part of the initial QUAL2E modeling were justified.

Project Engineer, Sewer System Analyses, Allegheny County, Pennsylvania, 1998-1999. Mr. Wagner applied a model of the combined sewer and sanitary sewer network for the Allegheny County Sanitary Authority (ALCOSAN). The Environmental Protection Agency (EPA) Stormwater Management Model (SWMM) was used to evaluate the system, particularly the impact of existing pipe sedimentation on flow depths and potential for system overflows. Results were used to evaluate whether or not ALCOSAN should initiate sediment removal procedures.

Project Engineer, Water Quality Analysis, Waynesboro, Virginia, 1998-1999. Mr. Wagner applied an existing state wasteload allocation model to evaluate discharge alternatives from the Waynesboro wastewater treatment plant. The impact of the discharge on South River dissolved oxygen (DO) concentrations under low flow conditions was evaluated by Mr. Wagner for the existing discharge and for alternative future discharges, including additional discharge at the existing location and a new downstream discharge location. He applied the model to evaluate the plant discharge under wet weather conditions. Model results were used by Mr. Wagner to support the concept of a wet weather treatment facility that would handle wet weather inflows due to excessive infiltration/inflow (I/I) in the collection system, without causing adverse DO impacts in the South River.

Project Engineer, Stormwater Management Plan, Johnson County, Kansas, 1998-1999. Mr. Wagner was responsible for developing the Hydraulic Engineering Center (HEC)-1 model hydrology for the Blue River Watershed in Johnson County. He coordinated closely with GIS staff to automate processes, such as subwatershed delineation, development of subwatershed flow paths and development of subwatershed curve numbers based on land use distribution. Mr. Wagner also developed an interface between the HEC-1 model and the hydraulics model (HEC-RAS) to provide consistency between the stream routing calculations in the HEC-1 model and the stream routing data developed in HEC-RAS.

Project Engineer, Sewer System Analyses, Haverhill, Massachusetts, 1998. Mr. Wagner developed a model of the combined sewer and sanitary sewer network for Haverhill. The Environmental Protection Agency (EPA) Stormwater Management Model (SWMM) was used to evaluate the system, calibrating the hydrologic and hydraulic components of the model against measured storm event water depths and then applying the model to determine long-term overflow frequencies and volumes.

Project Engineer, Stormwater Plan, Orlando, Florida, 1998. Mr. Wagner evaluated a site plan for Universal Studios using the Interconnected Pond Routing Model (ICPR) model. He used model results to determine whether the site plan incorporated sufficient stormwater storage area to control peak flows without causing excessive increases in water depth, which could cause flooding or other adverse impacts on the site.

Project Engineer, Water Quality Analysis, Milwaukee, Wisconsin, 1997-1998. Mr. Wagner used the Environmental Protection Agency (EPA) receiving water model QUAL2E to evaluate the impacts of glycol discharges from airplane de-icing on dissolved oxygen (DO) levels in the Kinnickkinnic River in Milwaukee, Wisconsin. Local monitoring data were used to determine the oxygen demand associated with glycol and typical decay rates, which were applied in the model under design conditions (e.g., temperature,

streamflow), associated with de-icing events, to determine instream DO concentrations downstream of the airport.

Project Engineer, Beaufort County Planned Urban Development (PUD) Plan Reviews and Best Management Practices (BMP) Manual Development, Beaufort County, South Carolina, 1996-1998. Mr. Wagner reviewed several PUD stormwater plans for Beaufort County and provided comments to the County regarding the adequacy of the proposed stormwater BMPs for water quality protection. These included the Indian Hills/Eagle's Pointe, Laurel Hill, Habersham and Bull Point PUDs. This led to the development of a stormwater BMP manual for the county in 1998. Mr. Wagner used local and regional data to develop appropriate water quality goals for new development, to identify appropriate BMP types based on local conditions and development intensity and to determine appropriate design and sizing criteria for the BMPs. The heart of the manual is a worksheet that can be used by engineers and plan reviewers to verify that the proposed stormwater BMPs adequately treat stormwater from the development. The manual also discusses policies and programs to reduce pollution from existing development (e.g., used motor oil recycling) and stormwater master planning. Mr. Wagner prepared an updated BMP Manual in 2003 and updated the Manual again in 2008, to reflect changes to stormwater regulations and receiving water classifications and incorporation of more recent trends in stormwater treatment (e.g., Low Impact Development or LID). The manual was further refined in 2010 and 2011, including new requirements for runoff volume control through the use of LID and a re-organization of the manual to more effectively organize the material from the original manual and subsequent updates.

Project Engineer, Sanitary Sewer Overflow Study, Bridgewater, New Jersey, 1996-1999. For the Somerset Raritan Valley Sewerage Authority (SRVSA) sanitary sewer interceptor project in New Jersey, Mr. Wagner served as project engineer evaluating the hydraulic capacity. He applied the EXTRAN module of the Environmental Protection Agency (EPA) model SWMM to calculate the interceptor capacity and to identify "bottlenecks" in the system. The EXTRAN model was applied by Mr. Wagner to evaluate the impacts of infiltration/inflow (I/I), such as location and quantity of capacity exceedance, for several historical storm events. The EXTRAN model and event results were used by Mr. Wagner to develop an enhanced STORM model of the system. The STORM model was applied by Mr. Wagner to evaluate capacity exceedances over a 45-year rainfall period and to evaluate alternative management measures to reduce the exceedances (e.g., storage and relief sewer).

Project Engineer, Combined Sewer Overflow (CSO) and Sanitary Sewer Overflow (SSO) Projects, Various Locations, 1995-2000. Mr. Wagner has participated in CSO and SSO studies for the City of Philadelphia, Pennsylvania; the City of Perth Amboy, the Somerset Raritan Valley Sewerage Authority (SRVSA) and the Rahway Valley Sewerage Authority (RVSA), New Jersey; the City of Atlanta, Georgia; the Allegheny County Sanitary Authority (ALCOSAN), Pennsylvania; the City of Haverhill, Massachusetts; and Henrico County, Virginia. Models—including SWMM and an enhanced version of Environmental Protection Agency's (EPA) STORM model—were used to assess the capacity of the sewer systems, to determine overflow frequencies and volumes and to evaluate alternatives for reducing overflows (e.g., storage and relief sewers).

Project Engineer, Water Quality Management Plan, Baltimore County, Maryland, 1995-1997. Mr. Wagner was project engineer for the development of a watershed water quality management plan for the Back River watershed in Baltimore County. He developed and calibrated Environmental Protection Agency's (EPA) Stormwater Management Model (SWMM) model for purposes of evaluating surface runoff loadings under existing and future land-use conditions, determining existing and future erosion potential and projecting the extent to which alternative watershed management measures [e.g., regional detention basins and best management practices (BMP) retrofits] would reduce future pollution loadings and stream-bank erosion. The modeling results he produced were combined with field assessment of the streams in the watershed to develop a plan that balanced stream restoration and stormwater management considerations.

Project Engineer, Rouge River Watershed Water Quality Model, Detroit, Michigan, 1994-1999. As project engineer, Mr. Wagner contributed to several facets of the Rouge River national wet-weather demonstration program for the Rouge River watershed in Detroit. His primary responsibility was the preliminary development of a receiving water and watershed water quality model [Environmental Protection Agency's (EPA) WASP model] for the Rouge River and the three main tributaries. WASP input—such as nonpoint source loads, combined sewer overflow loads and hydraulic routing data—was developed using EPA Stormwater Management Model (SWMM). The SWMM and WASP models were calibrated to stormwater runoff data, continuous in-stream dissolved oxygen data and storm event in-stream nutrient and oxygen demand data collected by the Rouge River program office. In addition, he participated in water quality data analyses, in pilot structural BMP site selection and assessment and preparing estimates of watershed loads from septic tanks, illicit discharges and stream-bank erosion. The SWMM and WASP models were also used to assess the receiving water impacts of alternative management practices such as sewer separation projects and combined sewer overflow (CSO) detention basins.

Project Engineer, Surface Water Supply Alternatives, Manatee County, Florida, 1994-1995. Mr. Wagner served as the project engineer for the evaluation of surface water supply alternatives for Manatee County. The microcomputer model developed by CDM Smith – based upon the U.S. Army Corps of Engineers (USACE) Hydraulic Engineering Center (HEC)-3 and HEC-5 models– was used to evaluate the safe yield of an existing reservoir and to evaluate future alternatives, including modification of the existing reservoir, construction of additional reservoirs, off-line storage and aquifer storage and retrieval. Capital and operation and maintenance costs were developed to determine the relative cost-effectiveness of each alternative.

Project Engineer, Water/Wastewater Study, Sarasota Bay, Florida, 1991-1993. As project engineer for a point source/nonpoint source assessment study of the Sarasota Bay National Estuary Program, Mr. Wagner used spreadsheet-based modeling tools to estimate existing and future pollution loadings to Sarasota Bay from sources such as surface runoff, base flow, wastewater treatment plants, septic tanks and rainfall on the bay surface. The model was also used to evaluate the effectiveness of alternative pollution management measures such as best management practices (BMP) and improvements in wastewater treatment. Study results were used to develop an overall strategy to protect the bay ecosystem.

Project Engineer, Basin Assessment, South Florida Water Management District, Florida, 1991. As project engineer for the Caloosahatchee River basin assessment in Florida, Mr. Wagner contributed to reviewing the existing land-based and stream models, selecting the appropriate models for the study area and developing a monitoring program designed to acquire data for model calibration and verification.

Project Engineer, Water Supply Options, Various Counties, 1990-1995. Mr. Wagner used microcomputer models to assess alternative water supply options for Manatee County, Florida and for the Asheville-Buncombe Water Authority, North Carolina. In both studies, the additional safe yield resulting from reservoir modifications and alternative sources were evaluated. Based upon the calculated safe yield increases and estimated costs, specific alternatives were recommended.

Project Engineer, Watershed Project, South Florida Water Management District, Florida, 1990-1993. In developing a phosphorus transport model for the Lake Okeechobee watershed, Mr. Wagner served as lead engineer. The project objective was to develop a distributed physically-based simulation model consisting of an existing land-based model, a transport model and an existing geographic information system (GIS) package. Mr. Wagner participated in reviewing the existing flow and water quality data, selecting an appropriate land-based model, developing the transport modeling framework, selecting an existing stream model (QUAL2E) to form the basis for the transport model, developing new transport model algorithms, testing the algorithms, validating the model for three pilot watersheds in the study area and preparing a training manual and training session for the client. One of the major features of the transport model is the ability to simulate phosphorus assimilation in wetlands that are part of the transport system. The new algorithms in the modified QUAL2E model enable the model to account for the splitting of flow between stream channels and wetlands, to flow between stream channels and wetlands and to calculate wetland assimilation based upon factors such as detention time, areal phosphorus loading and maximum assimilation rate. The model will ultimately be used to assess how changes in land use and land management will affect phosphorus loadings to Lake Okeechobee.

Project Engineer, Watershed Study, North Port, Florida, 1990-1993. Mr. Wagner served as project engineer for the Big Slough watershed study in Florida. A stormwater model of the watershed was developed using the Stormwater Management Model (SWMM) RUNOFF and EXTRAN models. The models were calibrated and verified using historical storm event data. Design storms were then evaluated for existing and future land use conditions to determine flooding problems. The models are now being applied to evaluate alternative management measures to reduce or eliminate flooding impacts. A spreadsheet-based model will also be applied to assess water quality impacts of future development and the alternative management measures.

Project Engineer, Various Stormwater Management Plans, Various Counties, 1989-2006. Mr. Wagner has been involved in the development of stormwater management plans for watersheds in Henrico County, Prince William County and the City of Newport News, Virginia; Baltimore County, Maryland; the City of Raleigh, North Carolina; Johnson County, Kansas; Fulton County, Georgia; Beaufort County, South Carolina; and Lake County, Manatee County, the City of North Port, the City of Hialeah and the City of Naples, Florida. Computer models—such as Hydraulic Engineering

Center (HEC)-1, HEC-2, Stormwater Management Model (SWMM) and Interconnected Pond Routing Model (ICPR)—were used to assess the adequacy of the existing hydraulic systems under existing and future land use conditions and to determine alternative measures to control erosion, road overtopping and building flooding in the watersheds. These studies emphasize the location of regional detention facilities for stormwater management.

Project Engineer, Detention Basins, Newport News, Virginia, 1989-1990. Mr. Wagner was responsible for the preliminary design of five detention basins and a diversion pipeline for the City of Newport News, in which microcomputer models were used to determine the required size and outlet configuration of each detention basin and the required size of the pipeline. The facilities were designed to protect the water quality of two drinking water reservoirs in the Newport News area.

Project Engineer, Regional BMPs, Newport News, Virginia, 1989. Mr. Wagner served as the project engineer for the preliminary design of regional BMP facilities for Newport News. He participated in the application of the Hydraulic Engineering Center (HEC)-1 model to design five detention basins and one diversion pipeline to protect the water quality of two drinking water reservoirs.

Project Engineer, Stormwater Management Master Plan, Prince William County, Virginia, 1989. Mr. Wagner served as project engineer for the development of a stormwater management master plan for the Broad Run watershed. He assisted with the application of Hydraulic Engineering Center (HEC)-1 and HEC-2 modeling to evaluate the existing drainage system under existing and future land use conditions in the 90-square-mile study area and to site regional facilities to alleviate flooding and erosion problems.

Project Engineer, Stormwater Services, 1989. As project engineer for the Federal Highway Administration (FHWA), Mr. Wagner helped develop guidelines to control nonpoint pollution in highway stormwater runoff. He analyzed water quality data for three grassed channels; three detention basins were monitored as part of the study. In addition, he assisted with preparing the guidelines regarding grassed channel and detention basin design.

Project Engineer, Stormwater Management Master Plan, Henrico County, Virginia, 1988-1989. Serving as project engineer for the development of a stormwater management master plan for Henrico County, Mr. Wagner assisted with the application of Stormwater Management Model (SWMM)-RUNOFF and SWMM-EXTRAN to evaluate the existing drainage system under existing and future land use conditions to determine solutions for predicted flooding problems and to estimate costs for the remedial measures.

Project Engineer, Various Stormwater Projects, Various Counties, 1985-1989. Mr. Wagner has investigated water quality impacts of stormwater runoff and alternative runoff controls. In many of the stormwater management plans, spreadsheet-based analyses were conducted to assess nonpoint pollution loading reductions that could be achieved by implementing regional detention facilities. Mr. Wagner contributed to the development of a best management practice (BMP) handbook for the Occoquan watershed, a national guidance document for controlling nonpoint pollution from highway stormwater runoff and a technical memorandum evaluating and recommending BMP demonstration project sites for the Rouge River national wet-weather demonstration

project. In addition, Mr. Wagner has used computer models—such as HSPF, SWMM, BASINS and WASP—to assess surface runoff pollution loadings and receiving water impacts in the Occoquan, Virginia, Rouge River, Michigan and Big Creek, Georgia watersheds.

Project Engineer, Water Quality Studies, Various Locations, 1983-1995. Mr. Wagner participated in a number of water quality studies. Specific projects included developing a computer model to simulate phosphorus transport and assimilation in stream channels and wetlands north of Lake Okeechobee, Florida; developing national guidance documents for estuarine wasteload allocation modeling and for control of nonpoint pollution from highway stormwater runoff; and applying a water quality model to estimate watershed nonpoint pollution loadings and to evaluate alternative control strategies for Sarasota Bay, Florida.

Publications

Wagner, R.A. "How to Include WWTP Backup Discharge into Receiving Water Bodies under Existing TMDLs." Presented at the Florida Water Environment Association Workshop on Wastewater Process Ephemeralization – Treating More with Less, February 2018.

Wagner, R.A. (with S. Nehrke). "Low Impact Development Coupled with Flood Mitigation." Presented at the American Public Works Association Florida Chapter Conference and Exposition, April 2016.

Wagner, R.A. "Evaluation of Water Quality Strategies in Knoxville." Presented at the Tennessee Stormwater Association Conference, November 2013.

Wagner, R.A. (with Z. Eichenwald, M. Gamache, M. Heineman, P. Keohan, J. Lefkowitz and R. Miner). "Lessons Learned Modeling LID Using SWMM LID Controls." International Low Impact Development Symposium, Saint Paul, Minnesota, August 2013.

Wagner, R.A. (with S. Nehrke). "Low Impact Development Coupled with Flood Mitigation." Presentation for the City of Jacksonville Environmental Symposium, August 2013.

Wagner, R.A. (with D. Ahern and R. Klink). "Integrating Stormwater Runoff Quantity and Quality Requirements." Proceedings paper and presentation for StormCon, August 2012 and published in Stormwater magazine January/February 2013.

Wagner, R.A. (with D. Ahern and R. Klink). "Integrating Stormwater Runoff Quantity and Quality Requirements in a Coastal County." Proceedings paper for the WEF Stormwater Symposium, July 2012.

Wagner, R.A. (with T. Pinson, C. Toupiol, L. Miller, N. Shinkre and P. Victor). "Success Story: how to include a wastewater treatment plant backup discharge into Total Maximum Daily Loads Documents." Florida Water Resources Journal, Volume 64, January 2012

Wagner, R.A. (with B. Cunningham). "Low-Impact Development: Principles, Manual and Case Study." Presentation for the City of Jacksonville Environmental Symposium, August 2011.

Wagner, R.A. (with T. Pinson, C. Toupiol, L. Miller, N. Shinkre and P. Victor). "Successful Story of how to include a wastewater treatment plant backup discharge into TMDL Documents." Presented at the FWRC Conference, Kissimmee, Florida, May 2, 2011.

Wagner, R.A. (with D. Ahern and R. Klink). "Developing On-Lot Stormwater Runoff Volume Controls." Proceedings paper and presentation for the South Carolina Environmental Conference (SCEC), April 2011.

Wagner, R.A. (with R.. Klink and D. Ahern). "Consideration of Low-Impact Development Benefits in Beaufort County, SC." Florida Watershed Journal, January 2011.

Wagner, R.A. (with T. Petersen, H. Rifai, R. Miranda). "Evaluation and Modeling of Bacteria Water Quality in an Urbanizing Stream." Selected for Platform Presentation and Paper at the World Water and Environmental Resources Congress, Providence, Rhode Island, 2010.

Wagner, R.A. "Calculation of LID Benefits in Meeting New Development Standards." Proceeding paper and poster presentation for the ASCE 2010 International Low Impact Development Conference, April 2010.

Wagner, R.A. "Consideration of Low Impact Development Benefits in Beaufort County." Proceeding paper and presentation for the South Carolina Environmental Conference, March 2010.

Wagner, R.A. (with S. Lu, M. Schmidt and L. Wiseman). "Impact of Groundwater Seepage Flow on DO TMDL Development." Presented at the WEFTEC 2009 Conference held in Orlando, Florida, October 13, 2009

Wagner, R.A. (with S. Lu, M. Schmidt and L. Rivera). "TMDL Model Development for the Upper Kissimmee and Lake Istokpoga Basins." Proceedings paper and presentation for the WEF TMDL Conference, August 2009.

Wagner, R.A. "Incorporation of Water Quality Uncertainties in Stormwater Master Planning." Proceedings paper and presentation for the AWRA Summer Specialty Conference on Adaptive Management, June-July 2009.

Wagner, R.A. "Evolution of the Beaufort County BMP Manual." Presented at the American Water Resources Association National Conference, New Orleans, Louisiana, November 2008.

Wagner, R.A. (with L. Wiseman, S. Lu, M. Schmidt, X. Gao and L. Rivera). "Impact of Groundwater Seepage Flow on the Development of TMDLs for the Upper Kissimmee River Watershed in Florida." Presented at the 2008 AWRA National Conference. New Orleans, Louisiana, November 20, 2008.

Wagner, R.A. "Water Quality Evaluations for a Proposed Lake." Poster presented at the American Water Resources Association National Conference, Albuquerque, New Mexico, November 2007.

Wagner, R.A. "Stormwater Master Planning for a Coastal County." Presented at the Georgia Association of Water Quality Professionals, Savannah, Georgia, July 18, 2007.

Wagner, R.A. "Protection of High-Quality Waters in Coastal South Carolina." Presented at the South Carolina Environmental Conference, Myrtle Beach, South Carolina, March 21, 2006.

Wagner, R.A. "Accounting for Uncertainty in the TMDL Process." Presented at the AWRA Florida Section Bi-Monthly Meeting, January 21, 2005.

Wagner, R.A. "Framework Model for the Upper St. Johns River." Presented at the AWRA 2004 Annual Water Resources Conference, Orlando, Florida, November 4, 2004.

Wagner, R.A. "Stormwater Master Planning for a Coastal Plain County." Presented at the Georgia Water & Pollution Control Association 2004 Annual Conference and Expo, August 3, 2004.

Wagner, R.A. "A Sustainable Water Resources Management Plan for a Big Creek." Proceedings of the Georgia Water Resources Conference, April 2003.

Wagner, R.A. (with M.F. Schmidt and M.G. Heyl). "A Method to Track and Identify Fecal Coliform Sources in Fulton County, Georgia." Presented at AWRA National Conference, 2003.

Wagner, R.A. "Bacteria Model for Wet Detention Ponds." Paper presented at the American Water Resources Association 2002 National Conference, November 2002.

Wagner, R.A. "May River Water Quality Model." Paper presented at the American Water Resources Association, 2002 National Conference, November 2002.

Wagner, R.A. and M.F. Schmidt. "Watershed Quantity and Quality Approaches for a Big Creek." Proceedings of the Water Environment Federation Watersheds 2002 Conference, February 2002.

Wagner, R.A., J.P. Hartigan and R.E. Harris. "Impacts of 19th Century Droughts on Water Supply Design Conditions." Proceedings of the American Water Works Association 2001 Annual Conference and Exhibition, June 2001.

Wagner, R.A. "An Introduction to Urban Stormwater." Article presented in Virginia Water Central, Virginia Water Resources Research Center, Blacksburg, Virginia, February 2000.

Wagner, R.A., J. Zhang and T.S. Tisdale. "A Basin Scale Phosphorus Transport Model for South Florida." Journal of the American Society of Agricultural Engineers, Vol. 12, No. 3, March 1996.

Wagner, R.A., T.S. Tisdale and J. Zhang. "A Framework for Phosphorus Transport Modeling in the Lake Okeechobee Watershed." Journal of the American Water Resources Association, Vol. 32, No. 1, February 1996.

Wagner, R.A., J.W. Adcock, M.A. Hanson, M.G. Heyl and T.G. Walker. "Overview of the Big Slough Watershed Master Plan." Presented at the Third Biennial Stormwater Research Conference, Tampa, Florida, October 7-8, 1993.

Wagner, R.A., M.G. Heyl. "Sarasota Bay: Protection of a National Resource." Water Science and Technology, Vol. 28, No. 3-5, pp. 91-99, September 1993.

Wagner, R.A. and L.A. Roesner. "Development of the Lake Okeechobee Phosphorus Transport Model." Proceedings of the 1993 Hydraulic Engineering Conference, American Society of Civil Engineers, Vol. 1, pp. 281-286, July 25-30, 1993.

Wagner, R.A. "Development of the Lake Okeechobee Watershed Phosphorous Transport Model." Paper presented at the Water Environment Federation Annual Conference, September 1992.