A clear, sunny day on Cannonsville Reservoir and Dam, Delaware County, NY. istockphoto.com, WoodyUpstate
A Comparison of Protozoan Matrix Recovery Using Acid and Heat Dissociation During Immunomagnetic Separation - Kerri Alderisio, Christian Pace, Alessandro Maestri, NYC Department of Environmental Conservation; Mark Bartlett, Stantec Consulting

Building upon Success: Long-Term Creation of Contiguous Wetland Complex - Barbara Barnes, HDR

Chlorine Dioxide Bench Testing on Croton and CAT-DEL waters - Dale Borcher, NYC Department of Environmental Conservation

The Ashokan Rail Trail: How data and information is used to guide management decisions - Tom Davdock, NYC Department of Environmental Conservation

Development and testing of a turbidity model for Cannonsville Reservoir - Rakesh Gelda, NYC Department of Environmental Conservation

Impacts from the Lead and Copper Rule Revisions on Compliance Levels - Flakë Gjonbalaj-Connors, Salome Freud, Carla Glaser, NYC Department of Environmental Conservation

Using Full-Scale Column Testing to Guide Granular Activated Carbon Filtration Media Selection - Blair Goodridge, NYC Department of Environmental Conservation

Large Decentralized Solutions, Passive Nutrient Reduction - Dennis F. Hallahan Infiltrator Water Technologies

NYC Stormwater Resiliency Plan: H&H Modeling - Erika Jozwiak, Alan Cohn, Melissa Enoch, NYC Department of Environmental Conservation

Department of Environmental Conservation Research Proposal Process - John Kaurich, Frank Beres, NYC Department of Environmental Protection

Carbon Storage in Freshwater Wetland Soils in the New York City Watershed - Laurie Machung, NYC Department of Environmental Conservation

Biological control of emerald ash borer in the New York City watershed - Collin Miller, New York City Department of Environmental Conservation

Managing Kensico Reservoir during Shoreline Stabilization Project - Antonino Modica, Crystal Ronci, NYC Department of Environmental Conservation

Uncertainty Analysis of SWAT-HS simulated streamflow for NYC West-of-Hudson Watersheds - Mahrokh Moknatian, Hunter College/CUNY Institute for Sustainable Cities; Rajith Mukundan, NYC Department of Environmental Conservation

Pitcher Filters: An evaluation of lead removal for NYC water - Dominic Moronta, Carla Claser, Flakë Gjonbalaj-Connors, Kathleen Czarnogorski, NYC Department of Environmental Conservation

Modeling Evaluation of Watershed Protection Programs in the Cannonsville Watershed - RAJITH MUKUNDAN, NYC Department of Environmental Conservation

Using Aerial Thermography to Find and Investigate Possible Illicit Discharges in Stormwater Management Systems - Ted Nitza, Walden Environmental Engineering; Scott Harrigan, Harkin Aerial

A Pilot Study of Polyaluminum Chloride at the Croton Filtration Plant - Nicholas Prokopowicz, NYC Department of Environmental Conservation

Data Wrangling: The Importance of Data Governance, Data Modernization, and Water Quality Index - Jason Railing, NYC Department of Environmental Conservation

Wrestling With Climate Uncertainty And Charting A Path To Resilient Water Infrastructure - Paul Robinson, Jacobs

Designing for Buffer Filtration along the Upper Rondout Creek: assessing existing hydrologic, soil, and ecological conditions to improve riparian buffer functionality - Haley Springer, Rondout Neversink Stream Program
Shared Services and Intermunicipal Agreements to Improve Water Quality - Thomas (Ted) Nitza, Jr., Walden Environmental Engineering, PLLC ................................................................. Session 4.6

A Comparison of Bench and Pilot Scale Study Results for Ex-Situ 1,4-Dioxane Treatment - Andrew Watson, HDR .......... Session 6.4

Engaging an Urban Population With Water Engineering Utilizing a Virtual GIS Platform in the Pandemic Era - Amelia Zaino, David Chuchua, Jonathon Turer, Stalin Espina, NYC H2O ............................................................................................................................... Session 4.5
INTRODUCTION and ACKNOWLEDGMENTS

Dear Conference Participants,

In 1997, the signatories to the historic New York City Watershed Agreement formed an enduring partnership to protect and enhance the City’s Watershed and the scores of communities living within it. Underlying this complex social and political undertaking has been an unprecedented technical initiative among scores of local, State and federal agencies with one common goal: to advance the science of watershed protection.

The NYC Watershed Science and Technical Conference was created as an annual opportunity to bring scientists, professionals, and other experts together with watershed stakeholders and the public, to technically inform, exchange ideas, and unveil new information regarding the protection of the nation’s largest unfiltered surface water supply.

This year’s 2021 NYC Watershed Science and Technical Conference continues to showcase the most current trends, technologies and scientific developments in the arena of watershed protection and management. With growing concerns of the Delta variant of Covid, the decision was made to make the conference virtual again this year.

It is more important than ever to advance all Science. The conference continues to punctuate the multiple longstanding themes that remain central to the business of caring for a watershed:

- Stormwater control,
- Wastewater treatment,
- Stream health,
- Emerging contaminants and microconstituents,
- Monitoring and modeling,
- Pathogens, nutrients, and turbidity,
- Recreational use, forestry, agriculture,
- and more.

The Conference Call for Abstracts was made to agencies and stakeholders in and beyond the New York City Watershed. The resulting responses were reviewed by the Watershed Technical Program Committee for technical merit and interdisciplinary utility, as well as temporal and substantive relevance. Those chosen by the Committee for presentation at this year’s Conference are included in this Compendium.

In addition to our esteemed presenters and all those who submitted their scientific endeavors, we wish to thank the many agencies, professional organizations, and individuals who contributed to the success of this conference. It is our hope that all who attend will be edified by the scientific data presented, and inspired by the dedication and hard work of those who, each day, advance our insight into the science of protecting the drinking water for 9 million New Yorkers.

Respectfully,

Lisa Melville
NYC Watershed Programs Coordinator
NYS Department of State

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For the Conference Organizers and Sponsors:
The Watershed Protection and Partnership Council
The New York Water Environment Association, Inc.
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The New York State Department of Health
The New York City Department of Environmental Protection
The Catskill Watershed Corporation
The Watershed Agricultural Council
The United States Geological SurveyThe New York State Environmental Facilities Corporation
A Comparison of Protozoan Matrix Recovery Using Acid and Heat Dissociation During Immunomagnetic Separation

Kerri Alderisio, Christian Pace, Alessandro Maestri, NYC Department of Environmental Protection; Mark Bartlett, Stantec Consulting

The New York City Department of Environmental Protection’s Bureau of Water Supply (DEP) has been collecting and analyzing water samples for the recovery of Giardia cysts and Cryptosporidium oocysts since 1992. During this nearly 30 year period, methods for collection and analysis have changed in order to improve recovery of these organisms, since initial methods were, at best, resulting in 20% recovery of spiked material. Along the way, the DEP Pathogen Laboratory has played an integral role in testing the different methodologies and providing valuable feedback to fellow researchers and regulators at the United States Environmental Protection Agency (US EPA). In 2015, DEP switched from Method 1623 to Method 1623.1, and also incorporated a change in immunofluorescent antibody stain. Even more recently, in 2017, DEP switched from acid to heat dissociation during the immunomagnetic separation step. While both improvements, these changes affected the recovery of Giardia and Cryptosporidium differently, as well as the water matrix they came from. This presentation will provide a brief review of the changes as they relate to historical methods, and describe how they impacted the recovery of these protozoan parasites from DEP reservoirs. Matrix spike data representing time periods when each method variation was used will be presented and compared to previous data.

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Building upon Success: Long-Term Creation of Contiguous Wetland Complex

Barbara Barnes, HDR

Stormwater Best Management Practices were implemented at three sites within the Kensico Reservoir to reduce pollutant loading and improve water quality in the Reservoir, to be in agreement with the 2007 Filtration Avoidance Determination. As a result of this work, mitigation was required by federal and state regulators to compensate for the impacts to wetland buffers, open water and submerged aquatic vegetation. HDR assisted NYCDEP with a site-selection and ultimately recommended off-site wetland creation at the former Armonk Bowling Alley.

When the bowling alley was constructed during the 1960s, Bear Gutter Creek, a NY Class A tributary of the reservoir, was re-routed and ditched to accommodate the building and its 3-acre parking lot. This mitigation design restored Bear Gutter Creek to its historic location by meandering the stream through created wetland and floodplain habitat on the site. In addition to providing sufficient acreage to compensate for impacts from the Kensico Reservoir projects, the bowling alley site is directly adjacent to wetlands previously created by DEP to mitigate impacts associated with construction of the Catskill-Delaware Ultraviolet Light Disinfection Facility. This is anticipated to cumulatively enhance function by creating a contiguous headwater complex.

Permitting of the 3.13-acre open water and wetland mitigation was challenging as aquatic submerged vegetation impacts were compensated for by wetland and open water creation. HDR conducted the functional assessment following the USACE Highway Methodology to provide and compensate for lost functions and values at the three impact sites and to guide the mitigation design. Additionally, the project team needed to ensure creation of the work on the Armonk site would not alter the hydrology of the previously constructed adjacent wetland mitigation area. Lessons from construction of the adjacent wetland site were incorporated into the design. The implementation of the design presented its own lessons related to soil management, construction of instream structures, post-construction monitoring and associated adaptive management needs.

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Chlorine Dioxide Bench Testing on Croton and CAT-DEL waters

Dale Borchert, NYC Department of Environmental Protection

Taste and Odor events on the New Croton System have been identified between 2018 and 2021. During these events, the compounds of Geosmin and 2-MIB have been observed within the system. Following a review of available treatment options to combat these compounds, Granular Activated Carbon was selected as the primary treatment train change, with chlorine dioxide selected as an additional alternative treatment to manage dissolved manganese in the system. Four separate bench tests programs were initiated to identify the impacts of chlorine dioxide application on both the Croton and CAT-DEL water systems. The results of these bench tests are described in this presentation. Primarily, the chlorine dioxide bench testing was found to be effective at substantially reducing dissolved manganese on Croton water at doses that would not generate chlorite concentrations above the MCL. In addition, chlorine dioxide application was also found to have a significant reduction in chlorine demand and TTHM and HAAS generation on CATDE water.

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The Ashokan Rail Trail: How data and information is used to guide management decisions

Tom Davidock, NYC Department of Environmental Protection

New York City Department of Environmental Protection (DEP) manages the largest unfiltered water supply in the country, delivering 1 billion gallons of clean water each day to more than 9.5 million New Yorkers. To protect its resources, DEP manages a robust land protection program and has opened more than 140,000 acres of its protected land and water for low-impact recreation. As the public’s enthusiasm for recreation within the City’s watersheds grows, DEP is tasked with finding the balance between recreation and source water protection. Through an Agreement with Ulster County in 2019, 11.5 miles of DEP’s Ashokan Reservoir were made accessible to the public as a world-class rail trail, attracting over 350,000 visitors since then. This presentation will provide an overview of the Ashokan Rail Trail and the management measures in place to protect drinking water. Utilizing near real-time usage tracking tools, DEP and its partners can identify use-patterns and apply this information to make informed decisions on operational activities, volunteer staffing, security, and other management tasks. This data has also been helpful in identifying trends in trail use, which was especially useful during the influx of visitors during the early phases of the Covid-19 pandemic. This presentation will briefly look at the history of the trail, identify key elements of trail management, and demonstrate how data, collaboration, and informed decision making can lead to the realization of a shared vision for both safe drinking water and recreational enjoyment.

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Development and testing of a turbidity model for Cannonsville Reservoir

Rakesh Gelda, NYC Department of Environmental Protection

Cannonsville Reservoir is one of New York City’s (NYC) 19 water supply reservoirs, located approximately 120 miles northwest of the city. The reservoir has gross storage of 96 billion gallons and supplies 134 million gallons per day on average (2000-2019), or about 12% of the average daily consumption, to NYC consumers. Of the total watershed, 78.5% is gauged at the mouths of West Branch Delaware River and Trout Creek, the two main tributaries of the reservoir. Outflow from the reservoir occurs via an aqueduct (Cannonsville Tunnel) that discharges into Rondout Reservoir, through release works located in the Dam,
and over the spillway. Water withdrawn from Rondout Reservoir enters an aqueduct for conveyance to a further downstream reservoir where it mixes with water from other parts of the system in Kensico Reservoir before disinfection and supply to NYC, without filtration.

An important water quality parameter of concern for the City’s water supply is turbidity. Inflow turbidity was < 15 NTU 75% of the time in all sources though occasionally it exceeded 100 NTU during extreme runoff events. Median diversion turbidity was 2.1 NTU. Mathematical models that predict transport and fate of turbidity-causing particles are desired for situations of high turbidity to guide reservoir operations.

Here we adopt a two-dimensional, multi-particle size-class, dynamic turbidity model for this reservoir based on the transport framework of CE‐QUAL‐W2. The same approach for developing, testing, and applying turbidity models for other NYC reservoirs had been successfully used in earlier turbidity modeling studies. Model testing is performed using data from 2011-2019. The model performed satisfactorily in simulating turbidity in the reservoir and in the withdrawal. The model may be integrated into NYC DEP’s Operations Support Tool (OST) in the future.

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Impacts from the Lead and Copper Rule Revisions on Compliance Levels
Flakë Gjonbalaj-Connors, Salome Freud, Carla Glaser, NYC Department of Environmental Protection

On January 15, 2021, Revisions to the Lead and Copper Rule (LCRR) were published in the Federal Register, and are slated to go into effect in 2024. The revisions include a change in the selection criteria for sampling, i.e. the original rule allowed for sampling at homes with lead service lines (LSLs) and homes with copper pipe joined by lead solder built between 1983-86, (the latter of which have lower lead levels), while the revisions require sampling only at homes with LSLs. Additionally, while the sample collected under the original rule is the first draw, the revisions require the sample collected to be the fifth liter of water from the tap still following 6 hours of stagnation.

In anticipation of the LCRR, New York City (NYC) Department of Environmental Protection (DEP) undertook a study to evaluate the effects of increasing the levels of PO4 in plumbing. The study is being conducted on City Island (CI) in the Bronx in New York City, which may receive water from either the Croton supply or the Catskill/Delaware supply depending on operational and distribution conditions. The water supply for CI is fed by two trunk mains, and the water running through the mains flows by a chemical booster station located in Pelham Bay Park. The booster station has been retrofitted to feed PO4. Because CI is isolated and covers a limited area of the NYC Distribution System, DEP is able to increase the PO4 in this controlled area while maintaining existing dosage levels for the rest of the City. The goal of the study is to understand the impact of the use of PO4 under various conditions including different water sources (Croton versus Cat/Del), water temperatures (warm versus cold) and doses (2 ppm versus 3 or 4 ppm) in DEP’s efforts to improve treatment processes; and to see if at-the-tap lead levels can be better controlled by increasing the PO4dose.

The study includes multiple components: Piloting an increased PO4 dose on CiProfile sampling of homes located on CI. Sampling of pipe loops (made from harvested LSLs from within the NYC distribution system) set up at the Bureau of Wastewater Treatment (BWT) pump station on CI and at the Distribution Laboratory in Flushing, NY (Lefrak) The study results are being used to evaluate the impact of the use of PO4 under various conditions, and its potential to reduce current lead levels as a means to further optimize DEP’s corrosion control program and potentially meet a lower lead Action Level in the future.

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Using Full-Scale Column Testing to Guide Granular Activated Carbon Filtration Media Selection
Blair Goodridge, NYC Department of Environmental Protection

The Croton Filtration Plant (CFP) can supply as much as 290 MGD of drinking water to New York City. The filtration media in the plant’s 48 filtration beds is a key regulator of this delivery capacity. In response to annually recurring taste and odor events that began in fall 2018, the filtration media was changed in spring/summer 2020 from anthracite to granular activated carbon (GAC), enabling the removal of around 50% of the culprit taste and odor compound, 2-methylisoborneol (MIB), that had been degrading drinking water quality prior to GAC installation. However, drinking water production capacity was reduced. To better understand how simultaneous drinking water quality and quantity goals can be maintained, a multi-disciplinary team from Water Treatment Operations constructed a filtration column test apparatus, consisting of four (4) 10’ length x 6” diameter columns. These filtration columns are being used to assess the hydraulic performance of different GAC types, with the goal of allowing CFP to maintain both high drinking water quality and quantity for New York City drinking water consumers.

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Large Decentralized Solutions, Passive Nutrient Reduction
Dennis F. Hallahan Infiltrator Water Technologies

Blodgett Landing, Newbury, NH case study. Approximately 9 years ago, the Blodgett Landing vacation community consisting of approximately 150 homes in Newbury, NH upgraded their community wastewater treatment system in response to a state regulatory requirement to reduce nitrate levels entering the groundwater. The 50,000 gallon per day design flow system was tasked with meeting a total nitrogen discharge level of 10 mg/L or less, as well as other stringent water quality requirements. A simplified design was proposed to achieve nitrification reduction, a modified sand filter, combined with a recirculation system for denitrification. Denitrification is accomplished by recirculating a portion of the treated wastewater back to the sludge layer within two large Imhoff tanks. The remainder of the treated effluent is conveyed to sand dispersal fields for native ground absorption and recharge to the local aquifer.

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NYC Stormwater Resiliency Plan: H&H Modeling,
Erika Jozwiak, Alan Cohn, Melissa Enoch, NYC Department of Environmental Protection

The New York City Panel on Climate Change (NPCC) has projected that New York City will become significantly wetter as global warming continues to worsen, with rainfall expected to increase by as much as 25 percent by the end of the century. This will place a growing strain on New York City’s drainage infrastructure, which includes a mix of traditional sewer systems, nature-based Bluebelts, and over 10,000 distributed green infrastructure assets that capture and absorb stormwater runoff and have the added benefit of reducing localized flooding. The NYC Stormwater Resiliency Plan outlines goals and initiatives for the City to implement over a period of 10 years, including new policies for resilient stormwater management, the integration of future-looking climate change projections into DEP’s long-term drainage planning, changes to the City’s flash flood emergency response procedure, and an increased focus on public communications related to rainfall-based flooding. These efforts will help New Yorkers prepare for flooding events, and help the City plan for emergency response and long-term management. This presentation will outline the Plan goals and novel modeling effort. 1.0 hours of PDH credit will be available.

Erika Jozwiak
Program Manager
DEP Research Proposal Process

John Kaurich, Frank Beres, NYC Department of Environmental Protection

Most research institutions have some measure of governance to ensure quality, fairness, collaboration and a focus on the organization’s research priorities. NYCDEP is now no different in this regard and would like to share the research management framework recently implemented by the Bureau of Water Supply. Presenters will describe a structure that has created a research inventory, research agenda, a new governance structure, and a research process aimed to enhance on new research projects and encourage collaboration and transparency. Members of the Research Advisory Council will describe how the group formed in 2020 and what processes and initiatives have begun to enhance the efforts of DEP researchers and collaborators.

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Carbon Storage in Freshwater Wetland Soils in the New York City Watershed

Laurie Machung, NYC Department of Environmental Protection

Given their anoxic environment, wetland soils are significant carbon sinks and important for regulating atmospheric carbon levels. Much research on wetland carbon storage has focused on coastal saline systems, though they only account for a small proportion of wetlands relative to their inland freshwater counterparts. A recent analysis of data collected for the National Wetland Condition Assessment (NWCA) found carbon storage in freshwater wetland soils to be roughly 10 times that of tidal saline systems in the United States. As part of its reference wetland monitoring program, DEP has measured soil organic matter content in watershed wetlands using methods similar to the NWCA. These data, which were originally collected to guide ecological restoration projects and to study sources of dissolved organic carbon, were recently analyzed to evaluate carbon stocks in watershed wetlands. Organic carbon accumulation varied among wetland types, as sites with longer hydroperiods unsurprisingly showed higher accumulations. While more study is needed to extrapolate total carbon stored in watershed wetlands soils, this study demonstrates that freshwater wetlands are important carbon stocks, and that DEP’s Watershed Protection Programs provide ancillary benefits by preventing wetland loss and the associated transfer of carbon from soil to the atmosphere.

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Biological control of emerald ash borer in the New York City watershed

Collin Miller, NYC Department of Environmental Protection

White ash (Fraxinus americana) represents roughly 5-6% of the growing stock on NYC-owned forestland and is experiencing mortality or severe decline due to the emerald ash borer (Agrilus planipennis) or EAB – a non-native wood boring insect of Asian origin that is now prevalent in all but four counties in upstate New York. Salvage and pre-salvage through planned harvesting can usher in a new cohort in certain situations and promote growth of alternative species, but in the near term, predictions reveal that 99% ash mortality is imminent. Federal domestic quarantines regulating the handling of EAB host material have recently ceased, turning the focus and resources of the USDA APHIS Plant Protection Quarantine (PPQ) unit toward establishing biological control agents – namely Tetrastichus planipennisi, Spathius galinae and Oobius agrili (parasitoids that prey solely on EAB). In 2020, NYC DEP enlisted as a cooperator with hundreds of others across 372 counties in 30 states by surveying for suitable sites, conducting parasitoid releases and monitoring success over the next several...
years with the goal of developing a widely dispersed parasitoid population to come into equilibrium with EAB populations and save future generations of ash species.

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Uncertainty analysis is an important step in any hydrological modeling analysis for evaluating the strength of a calibrated model and the reliability of the simulations. In this study, we performed the uncertainty analysis on SWAT-HS streamflow simulations in West of Hudson (WOH) watersheds for the period of 2001 to 2018. The Bayesian Model Averaging (BMA) method, a widely used approach in hydrological studies, was selected as a tool due to its simplicity, ease of applicability, and ability to reduce the risk of overfitting. Uncertainty analysis was conducted on calibrated streamflow simulations utilizing BMA and the reliability of streamflow simulations was evaluated by quantifying the confidence interval (CI) characteristics. BMA analysis employed in this study comprised of developing six different ensemble models to additionally investigate the sensitivity of uncertainty to model configurations. The BMA models' configuration included employing different data transformation procedures and applying the models on various flow intervals of ensemble simulations. For each BMA model, ensemble simulations came from employing seven different objective functions in the calibration process when optimizing SWAT-HS model's parameters. CI characteristics were measured using two metrics of Containing Ratio (CR) and average Band-width Ratio (BR). CR is an indicator for the "goodness" of the uncertainty interval and BR is a measure of its precision. The uncertainty analysis results showed the similarity of CI characteristics for all BMA models across all watersheds. This analysis confirmed the goodness of CI by having average BR less than 1.0 and CR higher than 0.8, with an average of 0.9 and a maximum of 0.97, meaning that 80-97% of the observed streamflow values were captured by the uncertainty band. These results proved the high level of reliability of the streamflow simulations generated using SWAT-HS.

Dominic Moronta, Carla Claser, Flake Gjonbalaj-Connors, Kathleen Czarnogorski, NYC Department of Environmental Protection

In preparation for EPA’s Lead and Copper Rule Revisions (LCRR), New York City (NYC) Department of Environmental Protection (DEP) undertook a study to evaluate the effectiveness of different brands of pitcher filters at removing lead from NYC tap water. In 2015, the Environmental Protection Agency (EPA) was formulating proposed changes to the Lead and Copper Rule (LCR), and national studies indicated an increased risk of lead exposure when lead service lines (LSL) were disturbed. In response to this, DEP began evaluating pitcher filters for the removal of lead. By 2019, new local laws and initiatives were being rolled out in NYC, and the LCR Revisions (LCRR) were finally proposed. All this legislation aimed to minimize lead exposure from tap water, and promote the use of pitcher filters in specific scenarios (e.g., after disturbance of a LSL which increases the potential for lead release and thus the potential for exposure).

Some pitcher filters are certified for the removal of lead by NSF international and/or the Water Quality Association (WQA) using the NSF/ American National Standards Institute (ANSI) standard 53. In the DEP study, the standard’s laboratory designed water was replaced with NYC tap water spiked with Pb(NO3)2 to provide real-world conditions for evaluating the removal of lead from spiked samples. The study evaluated the effectiveness of a select number of pitcher filters at removing lead from the solutions created with NYC tap water to see if they could meet the 2019 NSF/ANSI 53 standard level of less than 10 ppb lead, which translates to 93% lead removal if influent lead is at a concentration of 150 ppb. DEP tested four (4) pitcher filters that are NSF/ American National Standards Institute (ANSI) 53 certified for lead reduction, and three (3) without NSF/ANSI 53 certification. The filters were tested using two (2) different influent solutions, one prepared with NYC tap water collected from a lead-free tap, and one from a lead pipe loop. Both types of influent solutions were spiked using Pb(NO3)2 to achieve three different concentrations of lead, 50 ppb, 100 ppb, and 150 ppb. Additionally, analyses of other metals, such as manganese, iron, zinc, etc., were performed to determine removal or release by the filter, and assess the impact of competing ions. This was done by comparing the lead concentrations

Pitcher Filters: An evaluation of lead removal for NYC water

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of the filtered effluent to the prepared influent solutions. In almost all cases the tested filters did not effectively remove lead from spiked NYC water or meet the certification standard, with the exception of one that performed better than others. It was also found that the solutions created from the lead pipe loop contained a higher concentrations of zinc and an overall higher concentration of metals which resulted in lower lead reduction rates. Furthermore, manganese was actually released from one pitcher filter (I.E. manganese levels increased after filtration). The findings have been published and form the foundation for selecting pitcher filters that are effective at removing lead from NYC tap water after the risk of lead exposure is increased by the disturbance of lead service lines.

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Modeling Evaluation of Watershed Protection Programs in the Cannonsville Watershed

Rajith Mukundan, NYC Department of Environmental Protection

Watershed models are used to evaluate the effects of best management practices (BMPs) implemented by watershed management programs. DEP uses watershed models to evaluate the impact of watershed protection programs, and climate change on streamflow and water quality in their water supply watersheds. As part of a 5-yr Filtration Avoidance Determination (FAD) Summary and Assessment report DEP used the SWAT-HS watershed model to evaluate watershed management including agricultural activity that occurred in Cannonsville watershed from early 1990s through 2019. Model simulations were compared with nutrient data for the Cannonsville watershed to test the validity of model predictions. Major watershed management programs that were evaluated include Watershed Agricultural Program (and associated BMPs), Septic Remediation and Replacement Program, and Waste Water Treatment Plant (WWTP) Upgrade Program. The calibrated model estimated the current sources of stream nutrient loads, assessed loading reductions from point and nonpoint sources achieved over the past 30 years (1990-2019), and simulated scenarios on the impact of various watershed management practices. This presentation summarizes results of these watershed-modeling analyses.

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Using Aerial Thermography to Find and Investigate Possible Illicit Discharges in Stormwater Management Systems

Thomas (Ted) Nitz, Walden Environmental Engineering; Scott Harrigan, Harkin Aerial

The presentation will focus on how Walden Environmental Engineering and Harkin Aerial have developed ways to use drones to improve water quality, map water infrastructure, and detect/locate issues in drinking water and stormwater utility infrastructure. Recent developments in drone thermal imaging have proven to be especially effective at identifying water quality issues. Walden and Harkin have undertaken multiple case studies which show, under proper conditions, that many illicit discharges (sources of potential pollution) produce a measurable change in temperature that can be seen with a thermal drone. Unmanned Aerial Vehicles (UAVs, also known as drones) can be a helpful tool for many companies, government agencies and other organizations. Use of small drones in the commercial space formally began almost 10 years ago, when the FAA Modernization and Reform Act of 2012 created a process known as a Section 333 Exemption. Using this exemption, businesses were able to petition the FAA to deploy drones for specific cases. While limited, Section 333 provided many organizations their first legal pathway to pilot drone programs, integrating high resolution cameras with the first generations of mass-produced small drone hardware to use in inspection, mapping, photography, and more. As of 2018, there were more than one million drones registered with the FAA, and
Shared Services and Intermunicipal Agreements to Improve Water Quality

Thomas (Ted) Nitza, Jr., Walden Environmental Engineering, PLLC

Fort Wayne and the Allen County Regional Water and Sewer District entered a long term agreement to cooperate on better water quality for the Great Lakes basin.

A Pilot Study of Polyaluminum Chloride at the Croton Filtration Plant

Nicholas Prokopowicz, NYC Department of Environmental Protection

A pilot study for the efficacy of polyaluminum chloride (PACL) as the primary coagulant during colder water temperatures (typically below 7 °C) was performed using one of the four trains at the Croton Filtration Plant. Maximizing turbidity and ultraviolet absorption (UVA) reduction, with a target of 0.250 NTU and 0.030 CM-1 respectively, needs to be achieved to optimize plant performance and production. Additionally, laboratory testing of coagulant doses on Croton water during cold weather identified a zeta potential range between -2 and 0 mv as optimal for turbidity and UV254 reduction. The primary coagulant at the Croton Filtration plant, aluminum sulfate (alum), loses the ability to reduce turbidity at the dose rates required to attain the -2 and 0 mv zeta potential without the addition of a cationic polymer (CPOL). This issued is exacerbated at colder temperatures, with jar testing showing the reduction of turbidity and ultraviolet absorption greatly diminished, with 0.569 NTU and 0.043 CM-1 at operational dosing. Jar testing with PACL has proven to optimize the zeta potential as well as reduce the clarified turbidity by 1.24 times, at 0.325 NTU. Pilot testing confirmed that PACL was capable of producing comparable ultraviolet absorption, and zeta potential as our current alum and CPOL dose, while improving turbidity removal through coagulation.

Data Wrangling: The Importance of Data Governance, Data Modernization, and Water Quality Index

Jason Railing, NYC Department of Environmental Protection

Advancements in technology are creating and increase in data volume, variety, and velocity. It is important for water utilities to be adaptive in this rapidly changing environment. Historically, finding the data an end user needs, otherwise known as data wrangling, can be a challenging process due to the sheer number of databases and applications utilized to house and display data. This presentation will highlight some of the work the Bureau of Water Supply (BWS) has undertaken to stay adaptive while ensuring data systems provide for the requirements of its users, including an improvement on the process of data wrangling. The highlights will include an overview of the BWS Data Governance Program, BWS Data Modernization Pilot, and the Water Quality Index.

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Wrestling With Climate Uncertainty And Charting A Path To Resilient Water Infrastructure
Paul Robinson, Jacobs

Climate change is frequently in the news, and everyone now has a definition of resilience, but what is the science telling us, and how do we practically prepare the water industry and our communities for the uncertain threats? Current water management and planning principles often do not address risk that changes over time, leaving society exposed to more risk than anticipated. The last National Climate Assessment (published in 2018) discussed the evolution of risks over time and how risks interweave and compound each other. Infrastructure asset management planning is intended to manage system risks, but often does not really consider how the external threats may change over time, or if we truly can bracket them within a range of possible scenarios to understand their impact. By combining methods, tools and datasets that are often frequently available already, it is possible to identify how compounding threats may affect infrastructure and also the consequences of those threats changing over time.

The presentation will touch on how organizations often already have many of the resources needed to prudently plan a route to more robust and resilient systems. This can also contribute to addressing the issues raised by increased public concern and regulatory, insurance and investment interests.

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Haley Springston, Rondout Neversink Stream Program

Riparian buffers have the ability to serve many different functions, that are vital to both the ecological health of the surrounding landscape and to the water quality of the surrounding waterways. In order to improve the effectiveness of a riparian planting, it is vital to clearly identify the desired outcomes of the planting before beginning the design process. This presentation summarizes the planting design methodology implemented along the Upper Rondout Creek. The Upper Rondout Creek planting design focused on optimizing filtration capability, supporting native ecosystems, and improving stream bank stability.

Before designing the Upper Rondout Creek planting, a thorough assessment was conducted of the site’s existing soil, hydrological and ecological conditions. Soil and hydrological conditions were assessed using the USDA NRCS Web Soil Survey and analyzed using a Custom Soil Resource Report. Ecological conditions were assessed through extensive botanical survey. Soil samples were analyzed to determine baseline chemical and biological properties of the existing soil. The data collected during site assessment was used to improve the design of the planting. Hydrologic and soil data were used to map the boundary between optimal subsurface and groundwater filtration zones across the site. Ecological data informed the selection of native species with compatible root depth which corresponded to the identified filtration zones.

The planting was installed in the fall of 2020. Ongoing monitoring is scheduled to assess the project’s growth rate.

This study presents useful design methodology, which may be of use to those seeking to improve the functionality of riparian buffer plantings.

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Designing for Buffer Filtration along the Upper Rondout Creek: assessing existing hydrologic, soil, and ecological conditions to improve riparian buffer functionality

A Comparison of Bench and Pilot Scale Study Results for Ex-Situ 1,4-Dioxane Treatment
Andrew Watson, HDR

1,4-Dioxane is a recalcitrant compound that is a probable human carcinogen and is part of the emerging contaminants class. 1,4-Dioxane's properties make it difficult to remove from water, and the use of conventional treatment methods – such as air stripping and carbon adsorption – are virtually ineffective. Historically, 1,4-dioxane was used as a stabilizer, often co-located with 1,1,1-trichloroethane [TCA] and other solvents. It is also found as a byproduct in personal care products (e.g. cosmetics, deodorants, soaps) and food packaging. Use of 1,4-dioxane has been largely phased out of most applications, but it is not banned. As analytical methods have improved and testing has become more frequent, low-level 1,4-dioxane concentrations have become increasingly detected at contaminated sites and in public drinking water supply systems throughout the United States. In July 2020, New York became the first state to adopt a state drinking water MCL of 1 µg/l.

This presentation will compare the results of bench and pilot scale studies that were performed in support of an ex-situ pump and treat system design at an EPA Superfund Site in New Jersey. Four different ex-situ remedial treatment technologies were evaluated for their efficacy at removing 1,4-dioxane to concentrations less than the New Jersey Groundwater Quality Standard (GWQS) of 0.4 µg/l. These technologies included chemical advanced oxidation processes (AOP) using Fenton's chemistry and alkaline activated sodium persulfate, photo chemical AOP using hydrogen peroxide and UV light, co-metabolic bioaugmentation, and adsorption using a regenerable resin. Lessons learned and potential design optimizations and applicability to the drinking water market will be shared.

Amelia Zaino, David Chuchuca, Jonathon Turer, Stalin Espina, NYC H2O

NYC H2O’s mission is to inspire and educate New Yorkers of all ages to learn about, enjoy and protect their city’s local water ecology. Since 2014, the organization has accomplished this by taking New York City students on field trips to water infrastructure sites and coastal wetlands all over the city, as well as to the Ashokan Reservoir in the Catskill/Delaware Watershed. After a successful seven years of student engagement, the onset of the COVID-19 Pandemic forced NYCH2O to pause its in-person learning activities.

This presentation explores how NYCH2O utilized ArcGIS StoryMaps, an online multimedia platform with geospatial capabilities to transform their learning model from in-person field trips to virtual learning. The StoryMaps incorporate digitized historic maps, photographs, videos, and social narratives to tell the story of water-related infrastructure. Students now have access to virtual tools which help them understand complicated systems such as wastewater treatment, as well as providing a closer look at water infrastructure sites near their neighborhoods. Featured infrastructure includes the Ridgewood Reservoir in Queens, and stormwater and sewage systems. In addition, the use of student and teacher feedback and training will be discussed. Future plans under development including additional video and 3D modeling COVID-19 provided an impetus for NYC H2O to supplement its successful in-person field trip program and develop an online curriculum that serves to improve its educational reach. Students now have the opportunity to interact, in a robust way, with NYCH2O materials no matter the time or season.

Engaging an Urban Population With Water Engineering Utilizing a Virtual GIS Platform in the Pandemic Era

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