2018 National Capital Region Water Resources Symposium

Booklet of Abstracts
(Unedited)

Con-Current and Poster Sessions

American Water Resources Association
National Capital Section

University of the District of Columbia

April 6, 2018

CONTENTS

Con-Current Sessions

Session A. Special Session: Advances in Water Reuse Technology and Implementation

Nationwide perspective on trends in water reuse and implications for the Mid-Atlantic Region.

Justin Mattingly, Research Manager, Water Research Foundation, Alexandria, Virginia.
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Abstract

Due in large part to more common and severe drought events, communities are increasingly turning to water reuse to providing new sources of high quality water supplies. As treatment technologies have improved, advancements have been made in potable reuse to expand the number of potential uses for highly treated wastewater.

This presentation will provide a nationwide perspective on recent developments and trends in water reuse research with a focus on potable reuse. The potential for water reuse in the national capital region will be explored as a potential source of safe and sustainable water supplies, as well as well the co-benefits that water reuse can generate including a reduction in nutrient discharges, preservation of aquifers, and greater control over local water supplies. Lastly, the potential of water reuse to counter the effects of climate change will be discussed through mitigation of greenhouse gas emissions and adaptation to uncertain climatic conditions. Ultimately, this presentation will demonstrate how water reuse will become a necessary part of a community's water portfolio as a sustainable and climate resilient source.

Improving water reuse for a healthier Potomac Watershed.

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Abstract

The Potomac River serves as the primary drinking water source for more than 4 million people in the Washington Metropolitan Area (WMA) of Maryland, Washington DC and Virginia, and approximately 20% of the total streamflow to the ecologically sensitive Chesapeake Bay. Nutrients and endocrine disrupting compound (EDC) discharge into the watershed have been identified as potential issues which could negatively impact the health of the Potomac River watershed and the Bay.

This research project aims to elucidate the impact of best management practices on ecological and human health, using the Potomac Watershed as a test-bed for innovative approaches. By combining a suite of state-of-the-art techniques to actively identify

contaminant hot spots (EDCs, pesticides, and nutrients), assess the impact of those hot spots on human and ecological health endpoints, and quantify the impact of reuse and management solutions on these endpoints, this project aims to ultimately inform tools for decision makers to assign a priority order to managing contaminant sources and implementing water reuse and management practices on the basis of where funds and other resources can be best used, are most needed, and are most likely to achieve success.

HRSD's Vision for Advanced Water Treatment and Managed Aquifer Recharge in Eastern Virginia: Sustainable Water Initiative for Tomorrow (SWIFT)

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Abstract
Declining aquifer levels, land subsidence, and saltwater intrusion are occurring in the Potomac Aquifer System in Eastern Virginia. HRSD has developed an innovative program called the Sustainable Water Initiative for Tomorrow (SWIFT) that will address these challenges and provide additional benefits to the region, including nutrient credits for urban stormwater and other needs. SWIFT will add advanced water treatment (AWT) to seven of HRSD's existing treatment plants to produce more than 100 MGD of highly treated water that meets drinking water standards and is compatible with the receiving aquifer. SWIFT water will be pumped into the Potomac Aquifer System (PAS) as part of a groundwater augmentation program to counter the documented aquifer challenges. The SWIFT program enhances the sustainability of the region's long-term groundwater supply, and it also decreases the existing, permitted nutrient load currently entering the sensitive Chesapeake Bay, allowing the offset of MS4 urban stormwater nutrient management, for which several formal trading agreements with localities have already been executed. This program has been proposed as an integrated planning effort that was presented to USEPA in the form of a modification of the consent decree-mandated sanitary sewer overflow (SSO) Regional Wet Weather Management Plan (RWWMP).

At the initiation of the SWIFT program, a regional groundwater modeling study was completed to evaluate and demonstrate the benefit of pumping water into the PAS. Results of that work suggest significant improvement in hydrostatic pressures throughout eastern Virginia, and near complete elimination of groundwater extraction concerns, specifically aquifer dewatering in the locations of most intense pumping. There is also good circumstantial evidence that SWIFT could slow the rate of or perhaps reverse land subsidence which is a significant portion of the observed sea level rise in the Hampton Roads area.

Following successful pilot testing of two AWT approaches in 2016 and 2017, the next phase of the SWIFT program is construction and operation of a 1.0 MGD demonstration facility, the SWIFT Research Center, which will demonstrate at a meaningful scale that advanced treatment will produce water that meets primary drinking water standards and is compatible with the PAS. The intent of the facility is to provide at least 12 months of operational data to inform and optimize the design and construction of full-

scale facilities. The SWIFT Research Center is located at HRSD's Nansemond Treatment Plant and will be operational in February 2018.

This presentation will review the SWIFT program from concept development, including aquifer modeling and feasibility investigations, to AWT pilot testing, construction of a 1 MGD demonstration and research facility, incorporation of SWIFT as an integrated planning element in the SSO RWWMP, public outreach efforts, and finally to the plans for full-scale build-out.

New WHO Guidelines for Potable Reuse: Impact on Reuse Opportunities

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Abstract
Potable and other forms of wastewater reuse are truly sustainable concepts. Indirect (unplanned) wastewater reuse is routine; direct (planned) potable reuse is now viable as demonstrated by several successful projects with appropriate technologies. The key elements are multiple barrier treatment designs, real time monitoring for meeting performance expectations, and assuring reliability and safety. The WHO Guidelines provide pragmatic recommendations that should facilitate additional applications of reuse opportunities of all types. There are several successful technological approaches, so no single approach should be mandated. The acceptance decisions should be based upon water quality performance. The last barrier for potable reuse is public acceptance. The local public has supported reuse when they understood the need for additional water.

Session B. Stormwater and Flood Management

Flood modeling for major intersections known to flood near WMATA stations outside of the regulatory floodplain. Laurens van der Tak, PE, Technologist Management; Celeste R. Ostman, Water Engineer , JACOBS, Silver Springs, Maryland.
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The purpose of this study was to perform detailed two-dimensional (2D) surface hydraulic modeling for a range of storm events, reflecting existing rainfall occurrences and impacts from climate change in order to identify the level of risk via flooding depths near WMATA stations. When urban runoff overwhelms the catch basins and combined sewer system capacity, significant street flooding can occur. This can cause difficulties ranging from being a nuisance to serious damage to the surrounding architecture. The study looked to verify flooding depths at two known problem intersections in Washington DC near WMATA metro stations at the intersection of Connecticut Ave NW and Ordway St NW and the intersection of Rhode Island Ave NW and 7th Street NW. Both intersections have been known to flood and incidents have been reported in several media outlets.

Modeling was performed using CH2M's Flood Modeller Pro software, version 4.2. The flood management software has a wide range of applications including floodplain mapping, flood forecasting, hydrologic analysis, embankment/levee failure, dam breach analysis, and 1D and 2D floodplain modeling. This allows the user to model rivers, streams, floodplains, and urban areas at a chosen level of detail. The model for this project was a 2D hydraulic model for a densely urban area with detail down to 6ft grids. It incorporated the overland geometry, key locations, surface roughness, infiltration approximation, and direct rainfall application to determine water surface elevations, velocities, and direction of flow in areas of interest. Impacts from the direct rainfall application for the 50-year, 100-year, and 500-year, 24-hour storm events were examined. The 500-year, 24-hour rainfall event was also simulated with 2065 climate change impacts in order to evaluate a future worst case scenario. The depths ranged from 2.94 ft of flooding during the 50-year storm to 3.46 ft during the 500-year, 2065 projected rainfall at the intersection of Connecticut Ave NW and Ordway St NW. At the intersection of Rhode Island Ave NW and 7th Street NW the depths ranged from 2.25 ft of flooding during the 50-year storm to 3.14 ft during the 500-year, 2065 projected rainfall. Both intersections are not within either the 100-year or the 500-year regulatory floodplains. The Models were validated against three to four historical storm events, ranging in magnitude from high intensity cloudburst events to a multi-day high-volume rainfall event.

Site evaluation and design challenges of MS4/TMDL restoration projects in the urban environment of Baltimore City. John Shen, PhD, PE, Senior Water Resources Engineer; Michael Blose, MBE, PE, Director, Water Resources Engineering, Straughan Environmental, Inc., Columbia, Maryland.
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Abstract
This presentation covers the site evaluation and design approaches used for the MS4/TMDL restoration project recently completed by Straughan Environmental in the City of Baltimore. The goal of this project was to restore impervious areas in the urban communities, improving the water quality for its waterways as part of the larger Chesapeake Bay restoration efforts and building healthier, safer and cleaner communities. However, site selections and design of these stormwater management (SWM) best management practices (BMPs) are challenged by urban settings and aggressive project schedules. The site selection process involves considerations of various factors, including BMP design criteria, environmental features, land requirements, potential construction problems, sustainability considerations, life cycle cost analysis and non-monetary factors. The presentation will focus on the site selection and design challenges for SWM BMPs constructed within an urban environment. The project resulted in the design of 52 environmental site design (ESD) SWM BMPs treating approximately 12 acres of impervious acres. Additional topics will include: Maryland Department of Environment state revolving fund application requirements, stakeholders' requirements, environmental permitting requirements, site constraints, standard design details and specifications, existing utilities' needs for coordination and cooperation, and more.

Catchment-scale evaluation of stormwater green infrastructure using a flexible surface-subsurface interaction model.
Mohammad Almadani, King Abdul-Aziz University; Arash Massoudieh, Associate Professor, Civil Engineering Dept., The Catholic University of America, Washington, DC.
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Abstract
In urbanized watersheds, one or two inches of rainwater can result in significant amount of surface runoff. Stormwater green infrastructures (GI)s are being widely used to reduce volume and peak of surface runoff or its pollutant level through increasing infiltration, evaporation, filtration or just delayed release to the traditional sewer systems. To evaluate the cost-effectiveness of the GI practices, it is important to be able to predict their collective impacts at catchment scale while considering the processes occurring within individual GIs. In this presentation, we will show the application of a newly developed modeling system (GIFMod) to predict the long-term impacts of GIs on the hydrologic response of a highly urbanized watershed Sligo Creek, MD. In GIFMOD the watershed can be represented using a number of connected blocks representing sub-catchments, the unsaturated soils and groundwater beneath each sub-catchment and a network of streams. The soil columns underneath each catchment is discretized into several layers to more accurately capture infiltration and percolation processes. The overland and stream flow are modeled using diffusive wave model and the unsaturated flow in soil is modeled using Richards equation. Each individual GI is implemented into the model with high level of details and accurately considering the drainage area contributing into them. The pre-retrofit version of the model is

calibrated using observed hydrographs over a period of one year and the parameter values estimated is used to evaluate the post retrofit conditions of the catchment while considering multiple scenarios of GI implementation.

Assessing the effectiveness of urban gardens as green infrastructure in the Washington, DC area. Anna Spiller, M.S. in Agricultural Sciences and Resource Management in the Tropics and Subtropics, University of Bonn, Germany; Harrison Hyde, undergraduate student in Environmental Science; Keeli Howard, graduate student in Environmental Science; and
Karen Knee, Assistant Professor of Environmental Science, American University, Washington, DC.
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Abstract
Urban gardening or farming is growing in popularity, but scientific data on the ecosystem services it provides are lacking. This study aimed to improve understanding of community gardens' contribution to storm water management in the Washington, DC area and explore whether community gardens should be acknowledged as green infrastructure. We discuss the results of a pilot study focused on developing a method to capture surface runoff during simulated rainfall events. Through an analysis of the runoff quantity and quality of plant beds and co-located grassy areas, the pilot study provides insights into the amount of surface runoff generated and the concentrations of macronutrients and trace metals present in it. The effects of various factors on runoff are explored. The runoff coefficient for both surface types was relatively low (2% on average). Manganese and potassium were leached out of soils, with a significant difference between plant beds and grassy areas for potassium. Thus, the results indicate that community gardens may contribute to storm water management. We also discuss a more comprehensive study taking place in 2018, which looks at runoff quantity and quality over the course of an entire growing season and compares urban gardens to green roofs.

Session C. Water and Environment

Regulating environmental impacts of 'fracking' in the UK: lessons drawn from New York and California. Miriam R. Aczel, Centre for Environmental Policy, Imperial College London.
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Abstract
The United Kingdom is in preliminary stages of development of its shale gas resources, with the first test well dug in 2010, and the first commercial drilling in 2017. Hydraulic fracturing or *fracking* remains controversial. Data from the United States with its much longer history of natural gas development provides evidence of risk to environmental and public health from fracking processes, including depletion of water supply, ground and surface water contamination, effects on air quality from emissions, and change in 'quality of life' as communities become heavily industrialized with expansion of gas extraction operations. Sources of risk include potential migration of pollutants from fluids used in the extraction process, migration of toxic gases, liquids and solids that exist naturally underground, and impacts on water supply due to the high water volume used in shale gas exploitation. Studies have shown that there is potential for water contamination leading to environmental and public health effects at all stages of the development of the natural gas well site, from site preparation to decommissioning at the end of the well's functional life.[i]

The USA has significant experience with the use of fracking to extract natural gas. Therefore, that country's experience may provide useful analogues to the situation of the UK. This research examines two case studies in the U.S. in order to draw lessons useful in enhancing the regulatory structure in the UK.

[1] Christopher W. Moore, et al., 'Air Impacts of Increased Natural Gas Acquisition, Processing, and Use: A Critical Review', *Environmental Science & Technology*, (2014), accessed 2 Feb 2017, doi: 10.1021/es4053472

Chemical mass balance source apportionment of trace metals in road dust. Matthew Fiala and Hyun-Min Hwang, Dept. of Environmental and Interdisciplinary Sciences, Texas Southern University.
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Abstract
Operation of motor vehicles is a major source of environmental contaminants, especially in urban areas. Trace metals are released through abrasive wear between brake pads and rotors, tires and pavement surfaces, and are transported to receiving surface waters through highway stormwater. To investigate the contribution of source materials to trace metals in road dust, pavement (asphalt and concrete) and road dust

samples were collected from a highway (U.S. Route 59) in Houston, Texas. Upon arrival at the laboratory, road dusts were sieved to <63 µm. Bitumen and aggregates in asphalt pavement were separated using dichloromethane extraction. Total environmental-available trace metals were then quantified using ICP-MS. Concentrations for Pb, Cr, Ni, Cu and Zn were 95 ppm, 99 ppm, 160 ppm, 329 ppm, and 327 ppm, respectively, for concrete road dust and 40 ppm, 67 ppm, 120 ppm, 182 ppm, and 581 ppm, respectively, for asphalt road dust. A chemical mass balance model reveals that primary sources of Cu and Zn are identified as brake and tire wear, respectively. Highway pavement material is identified as a significant source of Ni, Cr, and Pb in road dust, while abraded wheel weights are the primary source of Pb.

Proof of management success in an agriculturally-impacted Delaware Estuary. Gulnihal Ozbay, Matthew Stone, Kristopher Roeske, Laurieann Phalen, and Karuna Chintapenta, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE.
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Abstract
Blackbird Creek is a waterway comprised of 36% agricultural land cover that empties into the Delaware Bay. Water quality and nutrient dynamics of the watershed were studied to understand how well this ecosystem sustains the impacts of human activity. Temperature, salinity, dissolved oxygen, pH, turbidity, and nutrient-derived variables (nitrate, nitrite, ammonia, orthophosphate, and alkalinity) were monitored. Samples were collected May through November 2012-2015 throughout the tidal portion of the creek. Results showed no spatial differences regardless of adjacent land use practice and, indeed, most parameters were within state and federal water quality regulations. Orthophosphate was elevated, though probably not due to agriculture, but rather to non-native marsh grass invasion and/or tidal scouring in the wetlands. Yearly changes were identified for alkalinity, turbidity, temperature, salinity, and dissolved oxygen, which can be attributed to variation in weather and climate patterns. Blackbird Creek can be designated as semi-pristine, with little evidence of human impact thanks to appropriate land management where use of forested riparian and marsh grass buffers intercept nutrients from entering the waterways from agricultural fields. Managers can use this as a model watershed example of how best to minimize human impacts on nutrient chemistry and, by extension, food web dynamics.

Developing a salt management strategy for Northern Virginia. Will Isenberg, Water Quality Assessment and TMDL Coordinator; Dave Evans, Nonpoint Source TMDL Coordinator, Virginia Department of Environmental Quality.
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Abstract

In January 2018, the Virginia Department of Environmental Quality (DEQ) will initiate the development of a Salt Management Strategy (SaMS). This SaMS represents an effort to proactively address an emerging water quality concern associated with chloride (salt) products used during winter storm events in the Northern Virginia Region while also implementing a chloride TMDL for the Accotink Creek watershed, located in Fairfax County, Virginia. Working collaboratively with a wide variety of stakeholders, including but not limited to water purveyors, public safety officials, property managers, salt applicators, universities, environmental organizations, and localities, the SaMS intends to (1) prepare a strategy capable of implementing the Accotink Creek TMDL and that is relevant to the Northern Virginia Region, and (2) foster collaboration among all stakeholder groups involved in winter maintenance activities to encourage long-term support for improved practices that protect public safety and lessen environmental, infrastructure, and public health effects. The final SaMS will be a stakeholder developed strategy that includes a suite of salt-related best management practices, an education and outreach campaign, and other recommendations for reducing salt loads. Once the strategy is developed, DEQ and the stakeholders will transition into the implementation phase of the SaMS to adaptively implement the recommendations.

Session D. Resilience and Sustainability

A novel online control monitoring shortcut nitrogen removal in wastewater treatment plant. T. Le[1,2], A. Massoudieh[1], C. Su[2], B. Peng[2,5] , A. Al-Omari[2], S. Murthy[2], B. Wett[3], C. Bott[4] and H. De Clippeleir[2]
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Abstract
Recently, a fast development on nutrient removal and recovery approaches has been ongoing and shortcut nitrogen removal has been proved to be the most energy-efficiency tech for nutrient removal due to its significant cost saving (40% aeration saving and 100% chemical usage saving) compared to conventional nitrification - denitrification. However, operating and maintaining good performance on shortcut-nitrogen process is complicated and labor-intensive work. This study proposes a novel overall online control for mainstream shortcut-nitrogen process at pilot scale. The control system consisted of (i) an ammonium versus NOx (nitrite + nitrate) control strategy to provide the optimal effluent conditions for the anoxic polishing step, (ii) a nitrate based COD dosing controller with the usage of acetate as external carbon to meet effluent limits, (iii) a wasting controller to balance different microorganism population within the mix liquor and (iv) a pH based alkalinity dosing. This system could allow for the treatment of the necessary ammonium residual of short-cut nitrogen removal systems and thus allow for achievement of the necessary discharge limits. Last but not least, an automation control is a useful tool for plant operators overseeing and controlling processes.

Incorporating climate resilience and mitigation planning into asset management for a water and wastewater utility.
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Abstract
This paper highlights a case study of how climate resilience planning is being integrated into an existing asset management system that quantified enterprise asset risk for the Washington Suburban Sanitary Commission in suburban Maryland outside Washington DC which comprises both riverine and coastal drinking water and wastewater infrastructure. This case study focuses on how climate

vulnerability assessments and probability of failure was linked with WSSC's existing asset management system risk management metrics for consequence of failure (COF) and business risk exposure (BRE) to prioritize climate adaptation efforts.

To continue to provide reliable service in a sustainable manner to WSSC's 460,000 customer accounts serving 1.8 million residents in Montgomery and Prince George's County Maryland for the next 50 years, this paper summarizes the third phase of a long-term planning project to address climate vulnerability and greenhouse gas emissions of all of WSSC's water and wastewater assets. These assets include 3 raw water reservoirs; 2 water filtration plants; 6 wastewater treatment plants; and network of nearly 5,600 miles of fresh water pipeline and over 5,400 miles of sewer pipeline, and associated pumping and storage facilities.

Evaluating the impacts of three intervention techniques to increase UDC student's knowledge and awareness on the university's water sustainability projects. K. Zendehdela[1], X. Hub[2], H. Trobmanc[2]. [1]Assistant Director of Center for Sustainable Development (CSDR); [2]Project Specialist, CSDR, CAUSES, UDC.
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Abstract

This study examines University of the District of Columbia (UDC) student's knowledge on UDC sustainability projects. Eight non-environmental-science majored, undergraduate classes (105 students in total) participated in this research. Six of the 8 classes were invited to involve in a level of sustainability educational intervention: signage (23 students), lecture (32 students), and in-person tour (21 students) of the UDC sustainability projects. Each intervention lasted for 20 minutes, which was followed by a survey. The two non- intervention classes (29 students) considered as our baseline.

Findings show that just 28% of our baseline group knew about the UDC sustainability projects. The interventions significantly increased the student's knowledge on the projects. In lecture intervention group, 58% of the students indicated good knowledge of the projects after going through a 20 minutes presentation. The Tour and Signage Intervention groups also indicated 48% and 27% awareness respectively after going through a 20 minutes presentation. Regression results show moving from signage intervention to tour and lecture intervention, on average, increases students' awareness by.76 sustainability knowledge score (highly significant). Interestingly, regression analysis also shows that the older and Hispanic students are more aware of sustainability challenges compare to younger and non-Hispanic students.

Session E. Remote Sensing, Modeling and GIS

Monitoring water and energy cycle from space. Abedeh Abdolghafoorian, Graduate Research Assistant and Leila Farhadi, Assistant Professor, Civil and Environmental Engineering Department, George Washington University, Washington, DC.
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Abstract
Accurate estimation of land surface water and energy fluxes as well as root zone soil moisture is crucial in various hydrological, climatological, and agricultural applications. "In situ" measurements of these fluxes are costly and cannot be readily scaled to large areas relevant to weather and climate studies.

Land surface models use quantitative methods to simulate these fluxes. Three key parameters of land surface models are: 1- neutral bulk heat transfer coefficient (C_{HN}), 2- soil evaporative fraction (EF_s), and 3- canopy evaporative fraction (EF_c). Optimizing model parameters mitigate model errors and improve model estimates.

In this work, parameters optimization is performed by assimilating land surface temperature and soil moisture observation (T_{obs} and θ_{obs}, respectively), which are readily available across a range of spatial scales from remote sensing, into models of heat and moisture diffusion via a variational data assimilation (VDA) approach. Uncertainty of retrieved parameters and fluxes are computed from the inverse of Hessian matrix of cost function obtained from the Lagrangian methodology.

The results of this research prove 1- the ability of VDA in using the information in T_{obs} and θ_{obs} to accurately partition available energy among the turbulent heat fluxes and provide reasonable estimates of root zone soil moisture, and 2- the feasibility of extending proposed approach to use remotely sensed land surface observations (that are widely available across a range of scale with low temporal resolution) in order to globally monitor water and energy cycle across a range of spatial and temporal scales.

RiverEye bathymetry retrievals (REBaR): A remote sensing approach to bathymetry and discharge estimation in rivers. Peter J. Rusello[1], Steven P. Anderson[1], and Edward D. Zaron, [1]Areté Associates, Arlington, Virginia, [2]Depart. of Civil and Environ. Eng. Portland State University, Portland, Oregon.
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Abstract
We describe an inversion technique for water depth estimation in riverine environments using surface velocity measurements. The depth inversion exploits the fundamental balance between the surface pressure gradient and the bottom drag force (proportional to velocity) in open channel flow.

$$gD\frac{\partial \eta}{\partial x} = -C_d u^2$$

Where g is gravity, $D = h + \eta$, with h the undisturbed water depth, and η the water surface elevation, C_d a bottom drag coefficient, and u is the streamwise velocity component. When, $h \gg \eta$, $D \approx h$ and the above equation can be solved for h:

$$h = \frac{-C_d u^2}{g\frac{\partial \eta}{\partial x}} = \gamma u^2$$

We implemented a numerical scheme to iteratively estimate local water depth using this second equation. Several assumptions, as well as the continuity equation, underlie the application of this inversion. We restrict ourselves to Uniform or Gradually Varied flow where $\frac{\partial}{\partial t} = 0$, water depth changes gradually or not at all along a reach, and pressure is hydrostatic (Chow, 1959).

Obtaining estimates of the bottom drag and the surface slope from remotely sensed data is difficult, leading to one of the fundamental problems with applying depth inversions, the need to have *a priori* knowledge of parameters best estimated with *in situ* or contact measurements. We develop techniques to estimate surface slope and bottom roughness using only remote sensing data, allowing determination of absolute water depth and volumetric discharge using remote sensing data. Comparisons to river gage data show good agreement between both absolute depth estimates and volumetric discharge values.

A flexible framework for modeling surface-subsurface hydraulic and water quality processes. Arash Massoudieh, Associate Professor, Civil Engineering Dept., The Catholic University of America, Washington, DC
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Abstract
In this presentation GIFMOD, a new flexible and user-friendly modeling tool for forward and inverse modeling of environmental processes in the surface, subsurface, and the vadose zone will be introduced. GIFMOD can be used to model flow, particle transport and reactive transport in systems composed of streams, ponds, soil, groundwater, catchments, and plants. Transport of multiple classes of particles undergoing settling, resuspension, filtration, and remobilization can also be modeled. The model also allows prediction of transport and reaction of user-defined water quality constituents in the system based on user-provided reaction networks and biokinetics rate expressions. Plants can be considered as individual blocks uptaking water and chemicals through their root system.

The modeling framework allows users to represent the system they intend to model with the desired level of complexity and only include the processes they deem essential in the processes. GIFMOD also has a built-in parameter estimation capability both for doing point estimates using a hybrid genetic algorithm and probabilistic parameter estimation using Markov chain Monte Carlo algorithm. The flexibility of the tool allows it to be applied to a wide range of systems ranging from stream networks, stream-catchment systems, surface water-groundwater interaction, batch and column experiments, best management practices, and groundwater flow and reactive transport among others. I will demonstrate the utility of GIFMOD to simulate flow and transport in a stream, bioretention, infiltration basin and permeable pavement GI systems.

ArcGIS online – how to make a story map (no coding). Jennifer McGee, Water Resources Engineer – Information Management
Amec Foster Wheeler (recently acquired by Wood), Chantilly, Virginia.
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Abstract
Maps are a fantastic tool for sharing project information to team members, stakeholders, the general public, etc. While paper maps (or PDF versions of those paper maps) are still useful, having dynamic maps that users can interact with provides a wealth of additional information.

ESRI's ArcGIS Online is a great platform for hosting and sharing geospatial data. With their Web App Templates it's easier than ever before to create your own application without writing any code and host it online for others to engage with. One of the most popular template styles is Story Maps. Maps, pictures, video, text and more are combined on a guided navigation to present content to users in a pre-set order, thus telling a story.

This presentation will provide an overview of the ArcGIS Online Web App Templates and work through demonstrations on the steps required for a couple of the most popular story map options. The goal is to show some really awesome examples already in the Gallery to ignite your imagination of what's possible and then go back to the basics and show how the fundamentals actually come together so that everyone can make their own story map!

Poster Session

A class in sustainability in housing: water as critical content

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Abstract

In winter 2015/2016, lead and water in Flint, Michigan was prominent in the media (Sanburn, 2016), and the Virginia Tech campus (Adams & Tuel, 2016). A cross-disciplinary course, *Housing: Energy and the Environment*, included lead and water as core content. Previously, energy was a major course focus, lead was a paint/renovation concern, and standards and treatment systems was the focus for water. The immediacy and controversy of Flint, Michigan's water crisis offered opportunities to rethink the relevance and importance of water issues in this course.

In the spring 2017 semester, water-related content encompassed 3+ weeks of the 15 week course semester. Content and learning activities were issue driven, with national and international concerns and multiple teaching methods. Topics included: water quality, conservation, rights, and privatization; gray water; storm water management; and watersheds.

In the 2018-2019 academic year, the course will be in the University's new general education core as a social science course. Water issues content will increase further, integrated into the overall course, as reflected in the new course title*: Environmental and Sustainability Issues in Housing.*

The poster presentation will highlight teaching and learning activities for water-related content of the newly revised course.

References

Adams, M. & Tuel, J. (2016, Spring). Fighting for Flint: A Virginia Tech team exposes lead poisoning. *Virginia Tech Magazine, 38* (3), pp. 40-50.

Sanburn, J. (2016, February 1). The Toxic Tap. *Time Magazine,* pp. 31-39.

Water contingency planning in Skaneateles, NY: Watershed resilience, planning, and management

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Abstract

Advancements in water contingency tools, strategies and policies have revolutionized drought management and water contingency planning. However, while the best management practices are available to communities, few watersheds have taken effective steps to

implement them in planning and management. This has left Northeast watersheds, such as the Skaneateles Lake watershed, ill-prepared to manage their water resources and vulnerable to water shortage events. The goal of this case study was to conduct a detailed cost-benefit analysis and create a comprehensive water contingency plan that could be applied across various watersheds. This strategy is based on a 5-tier drought monitoring system that requires specific actions and water conservation goals at each drought stage. The analysis of water and energy data from various utilities operating within the Skaneateles watershed was executed using both ArcGIS and Tableau. Juxtaposing conventional water saving technologies with EPA WaterSense and AWWA best management practices, policies and tools demonstrated a high rate of return, significant water and energy savings and increased resiliency.

Closing the loop, the UDC community compost project as part of the UDC food hub concept

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Abstract

The aim of the UDC community compost project is to enable all UDC Food Hubs to move toward zero waste and turn the garden wastes to healthy compost. The UDC food hub concept consists of food production, preparation, distribution and waste and water recovery. The UDC food hubs are systematically located in residential urban neighborhoods of Washington D.C. (Wards 3, 5, 7, and 8) where food security, water management, waste reduction and recycling of resources are essential.
The community compost project, as the last component of food hub concept focuses on community training and engagement and aims to maximize the efficiency of using resources, recycle nutrients, minimize waste and close the nutrient loop in the urban food hubs. Since June 2017, the UDC community compost project prevented more than 2,000 pound of food and yard waste from being send to landfill and contribute to Methane emission. More than 50 community members went through 7 trainings in two UDC Food hub locations. The project enabled the community to learn about food and yard waste management techniques and opportunities. We also aim to measure the educational impact of the compost project on community's knowledge and behavior related to urban resilience and sustainability.

Assessment of catalytic wet peroxide oxidation for treating pharmaceuticals in water: A review.

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Abstract

It has been recognized that conventional wastewater treatment process cannot effectively remove pharmaceuticals or micro-pollutants of concern from the wastewaters. Micro-pollutants may accumulate in the environment and subsequently pose risk to aquatic and human endocrine system. The purpose of this synthesis paper is to explore the role of catalytic wet peroxide oxidation for treating pharmaceuticals or micro-pollutants in industrial wastewaters. The catalytic wet peroxide oxidation is an advanced water treatment technology that uses transitional elements to destroy micro-pollutants of concern while yielding no chemical byproducts with greater efficiencies. It is relatively environmentally and economically friendly and holds a lot of promise going forward in treating industrial wastewaters. Wet peroxide oxidation normally requires high temperature with an extended period of time. To overcome this challenge, the catalytic peroxide wet oxidation became the main research focus for the last two decades. Based on the results obtained from this study, providing an Iron/Aluminium catalyst can improve the efficiency of the wet peroxide wet oxidation reaction. The catalyst slows down the degradation of peroxide allowing for sustained oxidation of contaminants over a longer treatment period per volume of peroxide used. The limitation of this technology includes a magnetic separation technology must be applied to recover metals.

Evaluating effects of deficit irrigation strategies on the yield and nutritional values of ethnic crops

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Abstract

Agriculture is one of the largest consumers of water in most countries, yet the global food production is expected to double by 2050. For example, agriculture accounts for 80 percent of the Nation's consumptive water use in the USA where the western states may use more than 90 percent. To address this growing challenge, maximizing food production per unit of water has been the main focus of present irrigation researches. Thus, the objective of this study is to assess the effect of an automatically controlled deficit irrigation

system on the yield and nutritional values of ethnic crops. An innovative automated drip irrigation experiment was conducted in the hoop house at the UDC's Firebirds Farm in Beltsville, MD. Two plots of plant bed were divided into two replicates of four equal sections. In each section, one soil moisture sensor was installed and connected to a data logger. Two varieties of ethnic crops (Denya and Rochco hot peppers) were watered at four different irrigation volumes (0.13, 0.16, 0.24 and 0.36 gallon/hour). We analyzed the effect of irrigation volume on plant height, yield, chlorophyll index, and nutritional values. The result shows that between 0.16 gallon/hour resulted in the highest yield and chlorophyll index.

Trends of lead contamination in tap water

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Abstract

Childhood lead exposure is estimated to contribute to more than half million new cases of children with intellectual disabilities every year in the USA. Elevated lead in tap water accounts for 20% of children's blood lead level. Thus, the objective of this study was to assess the trend of lead contamination in tap water in comparison with the blood lead level in children USA. Even if there is no safe level of lead in the body, the recommended blood lead level is less than 5 micrograms per deciliter. In addition, the DC case study between 1999 and 2004 showed a strong relationship between elevated lead in tap water with higher blood lead level in school children. Therefore, the childhood lead toxicity prevention policies have successfully managed to lower the prevalence of blood level lead ≥10ug/dl from 90 percent to almost zero percent in 1980 through 2008, respectively. The main reason for this big reduction was by eliminating multiple sources of lead in the children's environment, including bans on residential lead paint in 1978 and lead in plumbing in 1986. Regardless, elevated lead in tap water continues to be a problem nationwide at school, libraries and old houses.

Monitoring water quality variables in aquaponics systems

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Abstract

Aquaponics is an innovative system that addresses the issues of sustainable urban fresh food access and water use efficiency. To operate at the commercial level, the system needs to be frequently monitored and managed. Aquaponics system is a closed loop

system that integrates both aquaculture and hydroponics. Hence, the integrated system does not need a large space. The aquaculture system allows for the production of high protein sources, whereas the hydroponic system produces nutrient-rich vegetables. Furthermore, the management of nutrient dynamics poses a challenge for optimizing productivity. Thus, the objective of this study was to assess the nutrient dynamics of the Aquaponics system at two UDC's food hub locations: Bertie Backus and Van Ness Campuses in the District of Columbia. In this study, we performed a weekly water quality monitoring study in the fish tank and hydroponic. Selected water quality variables included water temperature, dissolved oxygen, conductivity, total dissolved solids, nitrate, ammonia, orthophosphate, pH and macro trace metals. The results showed that the Aquaponics systems at both locations were in the recommended ranges in trace metals, pH and conductivity. Nevertheless, temperature, orthophosphate, ammonia, and nitrate were not in the recommended range for most of the time.

Real-time flood forecasting for the National Capital Region: Integrating storm surge, tides and river flows

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Abstract

Coastal flooding is becoming a major threat to increased population in the coastal areas. To protect coastal communities from tropical storms & hurricane damages, early warning systems are under development. The National Capital Region location at the junction of the Potomac and Anacostia Rivers, combined with broad floodplains, and relatively flat elevations, makes it highly vulnerable to periodic flooding. This study presents a multi-model, automated, flood forecast system developed for predicting flood levels in the tidal Potomac River Estuary in the metropolitan Washington DC area using the guideline from the ADCIRC Surge Guidance System (ASGS). Integrated system incorporates storm surge, tides and river inflows to better predict the total water in the Potomac River. This system takes in the Weather Forecast from North American Mesoscale Model (NAM) every six (6) hours and forces the water within the model domain. Automated python and bash scripts prepare the model inputs and simulation is submitted for parallel computation to our local 32 core Linux machine (Poseidon). The Forecast model takes about 3 hours to finish all the pre and post processing, and final forecasted products compared with the official forecasts from National Weather Service (NWS) are published at https://masonfloodhazardsresearchlab.github.io/index.html every six (6) hours on daily basis.

Bi-directional waterway reveals nutrient runoff from cropland

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Abstract

Blackbird Creek is a waterway that empties into the Delaware Bay. The lower 13 miles of the creek has been shown to have appreciable salinity measurements, suggesting that this portion is influenced by tidal fluctuations. Fourteen sampling stations were established within this lateral range in order to examine the nutrient dynamics of the creek at various time stamps. Concentrations of dissolved nitrate (NO_3), nitrite (NO_2), ammonia (NH_3), orthophosphate (PO_4), alkalinity (Alk), and turbidity (Tbd) were measured at each station over the course of the field season. Average concentrations were generally low for the nitrogen species: NH_4 = 0.11 mg/L, NO_3 = 0.30 mg/L, NO_2 = 0.02 mg/L. Average alkalinity (92 mg/L $CaCO_3$) and turbidity (71 FTU) concentrations were appropriate given the nature of the marsh environment. The average PO4 concentration, however, was elevated (=0.44 mg/L). The EPA recommends values under 0.1 mg/L for this type of waterway. When considered separately, nutrient concentrations on outgoing tides were elevated relative to nutrient concentrations on incoming tides. Overall, the highest concentrations for all parameters occurred at low tide before the shift to the next incoming tide. This suggests that there are greater nutrient concentrations upstream than downstream. Given that land use in the Blackbird Creek watershed is primarily agricultural, it is likely that upstream pore water input from cropland is influencing the nutrient dynamics of the waterway. This information is key to understanding the efficiency of the riparian buffer system that has been established in the watershed and to allow for opportunities for improvement to mitigate nutrient runoff from agricultural fields.

Studies on Water Quality of Appomattox River at Selected Locations in Southside Virginia

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Abstract

The Appomattox River, a tributary of the James River, stretches from Lake Chesdin to Hopewell Point and ultimately joins with Chesapeake Bay. It provides drinking water to Dinwiddie, Petersburg, and Colonial Heights and is home to many species of fish. The purpose of this project is to monitor the quality of water at selected sites of Appomattox River. Specifically, water quality parameters (e.g. nutrients, turbidity, and dissolved oxygen) and the pathogenic strains of *Escherichia coli* (*E. coli*) were monitored starting from the Randolph Farm of Virginia State University and further along the sites in the Appomattox River to determine the safety of water

for the aquatic organisms and human health. GPS points were taken at water quality and bacterial monitoring sites. Data were entered on ArcMap to display the study results on the map to better visualize the outcome and compare among study sites. Our results showed that turbidity, dissolved oxygen, and nutrients varied among the sites along the Appomattox Rive. *E. coli* was present in higher levels in Appomattox River flowing through the Randolph Farm. We are pursuing this contamination by conducting microbiological assays (petri dish) to find out if any pathogenic strains are present in our study samples.