Water and Sediment Quality Abstracts

MODELING BACTERIAL LOADS IN A COASTAL WATERSHED

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The Double Bayou watershed is situated in the eastern portion of the Lower Galveston Bay. Double Bayou has two forks, the West and East Forks, which converge above the mouth of the Bayou on the eastern shoreline of Trinity Bay. Current water quality problems include reduced dissolved oxygen (DO) and elevated bacteria in the bayous. The Texas State Soil Water Conservation Board, Galveston Bay Estuary Program, United States Geological Survey, Shead Conservation Solutions and the Houston Advanced Research Center are all working together with the stakeholders to restore and maintain water quality through the development of a Watershed Protection Plan for Double Bayou.

The use of the Spatially Explicit Load Enrichment Calculation Tool (SELECT) model to estimate potential pollutant loadings from bacteria across the Double Bayou watershed will be discussed. SELECT was developed by the Department of Biological and Agricultural Engineering and the Spatial Science Laboratory at Texas A&M University. Modeling was performed to estimate bacterial loadings from various sources and to identify critical loading areas within the watershed. SELECT works within an ArcGIS environment and spatially characterizes the bacterial loads in the watershed - in this example, the distribution of livestock, wildlife, wastewater treatment plants, and septic systems and the contributions from each are quantified through source specific bacterial production rates. Rankings of each contribution source were assessed for the entire watershed. Modifications to SELECT, implemented with stakeholder input to achieve a more accurate model taking into account data availability and specific characteristics of the watershed, will be discussed. All model inputs as well as model results were discussed with stakeholders, and outputs were assessed for different kinds of Best Management Practice (BMP) implementation.

To maximize potential pollutant reduction and the efficiency of available funding, SELECT results will be transitioned to on-the-ground BMPs. For example, a riparian herbaceous buffer coupled with fencing and alternate water sources for livestock were suggested to control the bacterial contributions from both feral hog as well as livestock fecal waste. Other examples of management measures resulting from SELECT modeling will be discussed. SELECT provides insight to watershed stakeholders as they are selecting voluntary BMP strategies to include in the Double Bayou Watershed Protection Plan.

Abstract Information

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2. Oral presentation desired

3. Suggested Topic Area: Water and Sediment Quality

EMERGING WATER QUALITY HAZARDS IN URBANIZING TEXAS ESTUARIES

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In the rapidly urbanizing watersheds and estuaries of the Gulf of Mexico in Texas, instream flows are increasingly influenced and dominated by reclaimed water, which inherently contain diverse mixtures of inorganic, organic and biological contaminants. Though active pharmaceutical ingredients (APIs) and personal care products have received increasing attention in freshwater systems over the past decade, many research questions remain unanswered, and very few studies have focused on the occurrence, assessment, or management of pharmaceutical contaminants in marine systems or estuaries. Studies of APIs and other contaminants of emerging concern (CEC) in bays and estuaries of the Gulf of Mexico are even more limited. However, the rapidly urbanizing watersheds and estuaries of Texas represent a unique opportunity to understand influences of pronounced annual rainfall and urban gradients on emerging water quality challenges. We examined occurrence and bioaccumulation of wastewater tracers and selected CECs in tidally influenced segments of Buffalo Bayou, Dickenson Bayou, the Brazos River and the Guadalupe River over a two year period. Spatial and temporal fluctuations in pH within and among study sites altered the probability of encountering pharmaceutical water quality hazards to fish. We then compared predicted fish plasma concentrations of pharmaceuticals to measured plasma levels from various field collected fish species. The common pharmaceuticals diphenhydramine and diltiazem were observed in plasma of multiple species, and diltiazem exceeded human therapeutic doses in largemouth bass, catfish and mullet inhabiting these urban estuaries. Though the present study only examined a small number of target analytes, which represent a microcosm of the exposome of these fish, coastal systems are anticipate to be more strongly influenced by urbanization over the next fifty years when the state of Texas expects to double in population. Unfortunately, aquatic toxicology information for many of these emerging urban contaminants are not understood in fish, but such field observations strongly suggest that potential adverse outcomes should be examined.

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Presentation Type: Oral

Topical Area: Water and Sediment Quality

DIFFERENTIAL TROPHIC POSITION ACCUMULATION OF SELECT CONTAMINANTS OF EMERGING CONCERN IN BUFFALO BAYOU, TEXAS

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Though pharmaceuticals and other contaminants of emerging concern (CEC) occur in inland surface waters and accumulate in aquatic organisms, an understanding of bioaccumulation of many CECs and the associated risks to different trophic positions remain poorly understood in coastal systems. During the summer of 2012 and 2013, we examined the occurrence of CECs in different aquatic species collected downstream of a major municipal wastewater treatment plant (WWTP) in Houston, Texas, USA. This WWTP discharges ~200 million gallons of reclaimed wastewater daily to Buffalo Bayou, which is tidally influenced and flows to Galveston Bay. Isotope dilution LC/MSMS was used for the quantitation of target CECs in water and tissue samples; various target compounds were observed in multiple aquatic species (invertebrates, fish) during both years. IR/MS was employed to obtain stable isotope data.. The R package Stable Isotope Analysis in R (SIAR) was used to characterize functional feeding chains based on stable isotope signatures and help characterize the food web. Lastly trophic magnification factors (TMFs) were calculated by regressing trophic position and CEC concentrations to examine whether target CECs result in trophic magnification or trophic dilution in this urban coastal ecosystem. Our findings highlight the importance of characterizing bioaccumulation pathways of ionizable pharmaceuticals and other CECs by different aquatic organisms in urban-izing coastal ecosystems. Such considerations will be important during future ecological risk assessments of ionizable CECs, particularly in rapidly urbanizing coastal regions.

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Presentation Type: Poster

Topical Area: Water and Sediment Quality

DESIGNING FOR IMPACT: PROMOTING LOW IMPACT DEVELOPMENT IN THE HOUSTON-GALVESTON REGION

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Houston, Texas

As the Houston-Galveston region continues to grow and develop, opportunities exist to develop in an environmentally conscious manner. By implementing low impact development (LID) practices, the Houston-Galveston area can manage growth in a manner that reduces development impacts. LID techniques can promote the natural movement of water within an ecosystem improving storm water quality while benefiting the development community by reducing infrastructure costs, increasing developable property and increasing property values.

The Houston-Galveston Area Council (H-GAC) has been awarded a grant from the U.S. Environmental Protection Agency – Gulf of Mexico Program to address water quality, coastal ecosystems improvement, community resilience, and environmental education in the Gulf of Mexico region and its watersheds. The project, *Designing for Impact,* seeks to create policy recommendations and implementation tools that advance the use of LID techniques to mitigate negative impacts of development within the Houston-Galveston area. H-GAC will highlight obstacles to implementing LID practices and identify methods for successfully overcoming these challenges. This information will be collected and published in a regional guide to LID that will give an overview of the benefits of LID communicated through a visual and economical comparison of conventional and LID site plans. The guide will also include a “LID toolbox” containing a range of LID elements that are appropriate for the 13-county Houston-Galveston region.

A key component to the project aims to provide opportunities for collaboration among designers, policymakers, citizens, environmental organizations, and other stakeholders interested in land use and development issues. To achieve collaboration, H-GAC is hosting a design work session to bring together designers, planners, and engineers of the public and private sectors to work together to improve conventional site plans with LID techniques. Also, starting in 2016, H-GAC will host a series of workshops to share the regional guide to LID and educate the public on the benefits of using LID in our region.

1. Mary Martha Gaiennie, Regional Planner, Community and Environmental Planning Department, Houston Galveston Area Council, 3555 Timmons Lane, Houston, TX 77027, 713.993.2468, Fax: 713.993.4503, and marymartha.gaiennie@h-gac.com. Ms. Gaiennie would serve as a panelist/presenter.

Steven Johnston, Senior Environmental Planner, Community and Environmental Planning Department, Houston-Galveston Area Council, 3555 Timmons Lane, Houston, TX 77027, 832.681.2579, Fax: 713.993.4503 and steven.johnston@h-gac.com. Mr. Johnston would serve as panel moderator.

2. Format Recommendation: Panel. H-GAC recommends this subject as a panel and will work with the Galveston Bay Estuary Program to identify other panelists. H-GAC would serve as moderator and as a panelist/presenter. Suggested panelists include: Houston Land Water Sustainability Forum, Local Developer/Consultant, Texas Coastal Watershed Program, Harris County, and the City of League City.

3. Optional: Suggest panel would fit in a Water and Sediment Quality tract for topics such as, BMPs, LIDs, and stormwater management.

TWENTY YEARS OF SUCCESS: SUCCESS, FAILURES AND OPPORTUNITIES IN WATER QUALITY PLAN IMPLEMENTATION

Steven Johnston

Todd Running

Community & Environmental Planning Department
Houston-Galveston Area Council
Houston, Texas

The Region's water quality planning efforts beginning with the *Galveston Bay Plan* in 1995, have seen twenty years of successful execution. These successes have not come without identified failures and challenges which many times result in opportunities. Documenting success has proven difficult and linking that success to direct management decisions, even more challenging. Numerous adaptive management planning efforts, including TMDL Implementation plans and Watershed Protection Plans, are engaged in this endeavor. These projects continue to move forward despite limited budgets and the challenge of a rapidly developing landscape.

H-GAC will define water quality successes, including improving trends in environmental parameters, within the context of the implementation planning. We will review the water quality planning process, stakeholder involvement, and plan execution over the past twenty years. Case studies will be used to highlight meaningful water quality improvements and associated management practices. H-GAC will discuss planning and evaluation tools used to document and communicate success as well as the difficulties. H-GAC's new Water Resources Information Map, analyses of Sanitary Sewer Overflow and Discharge Monitoring Report data, the Regional OSSF Information System and the Galveston Bay Foundation's *Galveston Bay Action Network* will be discussed

1. Todd Running, Water Resources Program Manager, Community and Environmental Planning Department, Houston Galveston Area Council, 3555 Timmons Lane, Houston, TX 77027, 713.993.4549, fax number and todd.running@h-gac.com. Panel Moderator.

Steven Johnston, Senior Environmental Planner, Community and Environmental Planning Department, Houston-Galveston Area Council, 3555 Timmons Lane, Houston, TX 77027, 832.681.2579, fax number and steven.johnston@h-gac.com. Panelist/Presenter.

2. Panel. H-GAC recommends this subject as a panel and will work with the Galveston Bay Estuary Program to identify other panelist. H-GAC would serve as moderator and as a panelist/presenter. Potential identified panelist include: GBEP, GBF, Texas Coastal Watershed Program, Plum Creek Watershed Protection Plan, and the Hickory Creek Watershed Protection Plan

3. Optional: Suggest panel would fit in a Water and Sediment Quality or Monitoring and Research tract.

MERCURY MONITORING IN TEXAS WATERS OF THE GULF OF MEXICO: A CONCURRENT STUDY WITH THE NATIONAL COASTAL CONDITION ASSESSMENT

Nicole Morris[1]

Dr. George Guillen[2]

University of Houston Clear Lake
School of Science and Computer Engineering[1]
Environmental Institute of Houston[2]
Houston, TX

Our study examined the prevalence of mercury in various species of finfish including Atlantic croaker (*Micropogonias undulatus*) in eight Texas bays along the Gulf of Mexico. The data collection and analysis aspect of the research was conducted as a concurrent study with the 2015 National Coastal Condition Assessment; an EPA-sponsored program that monitors the state of the United States coastal waters. The results gathered from this study were supplemented by historic mercury data on Atlantic croaker collected through other programs and independent researchers. These data were compared against local and federal mercury standards, including proposed and adopted aquatic animal health standards and screening values. Results of the study are contrasted with spatial and temporal trends in mercury loading in Galveston Bay. Results of this evaluation of 30 years of mercury monitoring in Atlantic Croaker provides essential data needed by federal, state, and local communities responsible for protection of natural resources and human health.

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Presentation Type: Oral (Poster acceptable if unable to accommodate)

Requested Panel Session: Monitoring and Research

A Geospatial Approach to Estimate *E. Coli* Loadings into Waterways

Thushara Ranatunga
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More than half of water bodies in Houston-Galveston region are contaminated by elevated levels of bacteria which increases possible health risks to people who use them for contact recreation activities (such as swimming, wading, diving, etc.) . The Houston-Galveston Area Council (H-GAC) with the help of local stakeholders has developed several Watershed Protection Plans in an effort to bring the impaired water bodies back into compliance with contact recreational standards. In order to manage the water quality and lower the bacteria loading into waterways, it is necessary to identify the potential sources and distribution of the bacteria loading.

H-GAC applied geospatial analytical techniques integrated with bacteria load estimating methods to identify the spatial distribution of *E. coli* loading from sources into nearby streams. The analytical technique is a modification of the existing Spatially Explicit Load Enrichment Calculation Tool (SELECT) modeling, which estimates the potential loadings of fecal bacteria from varying sources.

This presentation illustrates bacteria loads estimated from different sources such as failing septic systems, discharges from wastewater treatment facilities, waste from wildlife, livestock, pets, and storm water runoff from urban surfaces. The analysis was conducted based on land use/land cover classification of NOAA C-CAP dataset in a GIS environment. The USEPA recommended protocol for developing pathogen TMDLs was used in fecal indicator loading assessment. The resulting cartographic maps illustrate the bacteria loading from each source in their occupied land cover types. The presentation will discuss the additions of a buffer approach as an adaption to the original SELECT methodology to simulate general transmission potential, based on stakeholder feedback.

A LOCAL GOVERNMENT'S GUIDE TO REDUCING BACTERIA IN AREA WATERWAYS: TECHNIQUES THAT WORK

Todd Running
C&E Department
Houston-Galveston Area Council
Houston, Texas

Clean water is our most important natural resource. But, despite an abundance of water in the H-GAC region (16,000 miles of streams and shoreline), 80% of waterbodies in the area are impaired in one way or another.

Bacteria is the number one pollutant in the region, impairing more than half of the waterways. Ten years ago, the bacteria problem was getting so bad that many people thought it could never get better. However, many are improving.

So why is water quality getting better? Because individuals, organizations, communities, and local governments are targeting their efforts to specifically reduce bacteria. This panel will focus on five successful projects highlighted in H-GAC's Water Resource Guide for Local Governments, scheduled for release the winter of 2015.

Presenter One will speak about maintaining and improving sanitary sewer systems and reducing the number of overflows and illegal connections.

Presenter Two will discuss successful steps taken to ensure that wastewater treatment facilities do not release water with high bacteria levels into surface water.

Presenter Three will give an overview of existing programs for the maintenance or repair of on-site sewage facilities.

Presenter Four will highlight projects that managed stormwater while also improving water quality.

Presenter Five will discuss how to successfully increase public awareness about water quality.

H-GAC staff would moderate the panel discussion and facilitate a question and answer session immediately following the discussion. It is not anticipated that an H-GAC project would be featured as a presentation.

Attendees should leave the session with information on how to implement water quality best management practices in their respective communities.

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2. A panel is preferred. A poster display about the Water Resources Guide for Local Governments could work as an alternative.

3. The topical area most relevant to this abstract is Public Participation, though Nonpoint Sources of Pollution, Point Sources of Pollution, and Water & Sediment Quality are also applicable to some panel topics.

TIDAL INFLUENCES ON AQUATIC HAZARDS OF PHARMACEUTICALS, NUTRIENTS, AND PATHOGENS IN DICKINSON BAYOU, TEXAS

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In the rapidly urbanizing watersheds and estuaries of the Gulf of Mexico in Texas, instream flows are increasingly influenced and dominated by reclaimed water. Unfortunately, few studies have focused on the occurrence, assessment, or management of pharmaceutical contaminants in marine systems or estuaries. Studies of pharmaceuticals and other contaminants of emerging concern (CEC) in the Gulf of Mexico are even more limited. Dickenson Bayou, historically affected by low dissolved oxygen and pathogens, is also notorious for water quality impairment from improperly functioning onsite waste water systems. Dickinson Bayou also receives discharge from a wastewater treatment plant located just downstream of Hwy 3 in downtown Dickinson, Texas. Approximately 70% of all pharmaceuticals on the market are ionizable and subject to bioavailability alterations from pH. The primary objective of this study was to explore the spatial and temporal dynamics of contaminant exposure, including pharmaceuticals, nutrients, and human pathogens, as a function of tidal influence. Isotope dilution LC/MSMS was used for the quantitation of target CECs in surface and bottom water samples. Standard methods were similarly employed for nutrient and pathogen analyses. We also explored the spatial and temporal variability of pH with depth in Dickinson Bayou. We then employed a novel water quality hazard modeling approach, which predicts the internal dose of pharmaceuticals in fish expected to result from surface water exposure. We specifically observed pH variability and low and high tides to differentially influence water quality hazards of select pharmaceuticals along a longitudinal gradient of Dickenson Bayou. These results provide a diagnostic approach to evaluate emerging water quality challenges across gradients of rapidly urbanizing coastal bays and estuaries.

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Presentation Type: Poster

Topical Area: Water and Sediment Quality

EXAMINATION OF THE SPATIAL RELATIONSHIP BETWEEN DEVELOPMENT AND AQUATIC NUTRIENT LOADING IN THE GALVESTON BAY ESTUARY

Helen Walters
Research fellow: Center for Texas Beaches and Shores; Texas A&M University Galveston

Dr. Samuel Brody
Professor: Texas A&M University Galveston

Houston-Galveston is one of the fastest growing regions in the United States. With this rapid growth comes increased development and associated impervious surfaces. Increased impervious surface area is not only a development indicator, but also a known catalyst for ecosystem degradation. Given that the Galveston Bay Estuary (as defined by the National Estuary Program) contains an ecologically unique and diverse ecosystem, and that land use is directly correlated with water quality, understanding how this increase in impervious surface area affects water quality is crucial.

Galveston Bay Estuary is an ecologically diverse area in southern Texas. Non-point source pollution, developing from impervious surface runoff, has detrimental impacts on the aquatic environment within the Estuary. This study examines the degree to which specific development patterns impact aquatic nutrient loading, within rivers in the Galveston Bay Estuary. The focus will be on several development metrics, such as patch size, density, and proximity to a river or stream. Subwatersheds (roughly a hydrologic unit of 12 as defined by the National Hydrography Program) will be delineated and used as the unit of analysis in this study.

Spatially evaluating developmental patterns on a watershed level is a relatively new approach. In previous literature, much of the impact of development analysis is evaluated within jurisdictional boundaries. Instead of taking human-defined boundaries, this study examines the area at a hydraulically-driven scale, the subwatershed level. In addition to utilizing an ecosystem approach, there has been minimal research conducted on the relationship between aquatic nutrient loading and development metrics in Texas. The Texas Coast, and particularly Galveston Bay, is important economically due to its fisheries and petrochemical industry, as well as for its leisure and tourism industry. In addition, there are many unique ecological habitats contained within the Bay system. It is important to understand how human development affects this ecologically diverse and productive region.

The implications and broader impacts of this study are numerous. Understanding how close development patches can be to rivers before there are substantial detrimental effects on the aquatic environment is critically important. Once the size of the buffer zone is understood, policy makers can better plan development while remaining conscious of its impact on water quality. This will in turn help stakeholders and planners keep the rivers of Galveston Bay more pristine.

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Oral presentation is desired but a poster presentation will be accepted if oral presentation submittal is not selected.

Topical Areas: nonpoint source of pollution and water and sediment quality

STREAMBANK STABILIZATION, RIPARIAN STEWARDSHIP, AND SEDIMENT LOAD REDUCTION IN HARRIS COUNTY WATERSHEDS

Carolyn White, Harris County Flood Control District, Houston, Texas

The Harris County Flood Control District ("FCD" or "District") mission to provide flood damage reduction projects that work, with appropriate regard for community and natural values is inherently complex. Layering on the District's requirement to enhance stormwater quality, as dictated by its Municipal Separate Storm Sewer System ("MS4") discharge permit, the balance of flood damage reduction goals with environmental considerations is increasingly important. Channel roughness and conveyance capacity is balanced with streambank stabilization provided by riparian habitat. In addition, right-of-way is often a limiting factor in achieving stable channel geometry and allowing for proper interception of stormwater flows prior to reaching the receiving waters and Galveston Bay.

This paper presents the results of the HCFCD's watershed planning efforts that include fluvial geomorphic assessments and determination of streambank erosion rates. Results of sediment and pollutants load studies in urban streams demonstrate the need to stabilize local streambanks and provide stable channels.

Design initiatives to incorporate principles of fluvial geomorphology or natural stable channel design are presented within the context of the Houston area urban drainage system. Regional curves that provide channel dimension relationships for geomorphically stable channels have been developed by the District to guide local stream design. Other resources and design manuals available to guide local development of natural channels will be provided and their application discussed.

CHARACTERIZATION OF AMBIENT WATER QUALITY AND INFLUENCING CHARATERISTICS IN NATURAL AND CREATED WETLANDS OF THE TEXAS COAST

Natasha Zarnstorff, School of Science and Computer Engineering, University of Houston-Clear Lake, Houston, TX

George Guillen, Environmental Institute of Houston, University of Houston-Clear Lake, Houston, TX

Environmental agencies, limnologists and oceanographers have long recognized the fundamental difference in ambient water quality between open water systems and wetlands and the need to develop specific protective water quality standards for each type of system. Saltwater wetlands provide a variety of ecosystem services, but little research has been published on water quality of these marshes. In addition to the paucity of information that exists on saltmarsh water quality, there has been no critical studies looking at the differences in water quality between created and natural coastal marshes. This information is critically needed for developing criteria and evaluating the success of created saltmarsh wetlands.

The results of our study document the range of water quality conditions and modifying factors of coastal wetlands in Texas. During our study we measured surface water quality of an open water site, a natural marsh, and a created marsh within three bays of the Galveston Bay system. Surface water quality was measured every other month with a YSI sonde and collection of grab samples. Deployable water quality monitoring devices were also used to document dissolved oxygen, temperature, and conductivity for three days prior to water sample collection. Vegetation densities and species composition was determined for each marsh using random points and vegetation quadrates. Soil nutrients and grain size was also determined at the random points were vegetation data was collected. Seining was conducted to collect nekton from each marsh. Water quality trends and comparisons are presented for natural and created saltmarshes. Other marsh characteristics were identified and compared with water quality data to identify factors influencing biological and water quality characteristics of these wetlands.

10th State of the Bay Symposium 2016, Abstract Submittal

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Category: Habitat Protection, or Water and Sediment Quality

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