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Mitchell A. Buck, M.C.E., B.S., P.E.

Coastal Engineer

EXPERTISE

Broad base of experience in various phases of coastal management and design projects including field data acquisition and analysis, application of the results within numerical models, and the development of engineering designs and alternatives. Typical projects include elements of coastal structure design, beach nourishment, shoreline stabilization, sediment transport, inlet stability, water quality, tidal marsh restoration, environmental monitoring and dredging. Extensive experience utilizing software packages and programming languages (MATLAB, ArcGIS, etc.) to analyze, solve, and present engineering and scientific problems and their solutions. Data acquisition, engineering design, permitting, and construction oversight for dredging and both hard and soft coastal solutions such as rock revetments, coir envelopes, and beach nourishments including Green Infrastructure Projects. Terrestrial and bathymetric survey data acquisition using RTK GPS, total stations, and echosounders. Oceanographic data acquisition using tide gauges, flow meters, ADCPs, and CTDs. Implementing environmental monitoring programs for the collection of sediment, surface water, groundwater, and biological samples at Superfund and FUDS sites.

QUALIFICATION SUMMARY

- More than 12 years of diverse professional experience in the fields of coastal sciences and engineering, specializing in areas of numerical modeling, coastal structure design, project management, data acquisition, environmental monitoring, sediment transport, and littoral processes
- Engineering design and permitting of hard and soft solutions such as revetments, coir envelopes, and beach and dune nourishment; including those that qualify as Green Infrastructure Projects.
- Developing, leading, and managing environmental monitoring and survey data acquisition programs.
- Application of numerical models including STWAVE, XBEACH, RMA2, SBEACH, CORMIX, CSHORE, GENESIS, HEC-RAS, ACES, DYNLET, EXTRM2, CMS Wave, and CHAMP.
- Proficient with software including MATLAB, ESRI ArcGIS, SMS, and Microsoft Office products.
- Strong written and verbal communication skills

WORK EXPERIENCE

- 2007-Present Coastal Engineer, Woods Hole Group
- 2005-2007 Univ. of Delaware (Teaching and Research Assistant)

Education
2007– M.C.E.
Civil Engineering
University of Delaware

2005 – B.S.
Environmental Engineering
John Hopkins University

Licenses and Registrations
P.E., Professional Engineer, Massachusetts License #51147

Training
- OSHA HAZWOPER Site Supervisor
- The Complete Ground-water Sampling Field Course
- First Aid & CPR Certified
- SCUBA Certified

Publications & Presentations
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KEY PROJECTS

Green Infrastructure for Coastal Resilience on Barges Beach, Cuttyhunk, Town of Gosnold – Project Engineer
Cuttyhunk Island is a small, remote island located within the Town of Gosnold, approximately 12 miles off the southeastern coast of Massachusetts. Cuttyhunk Island is popular destination for island residents, commercial mariners, recreational boaters and tourists alike as Cuttyhunk Harbor is a scenic, pristine, natural harbor. Cuttyhunk channel connects Cuttyhunk Harbor to Buzzards Bay and is the life-line to the mainland as it provides the only means of access to and from Cuttyhunk Island for residents, tourists, supplies, and resources. A barrier spit delineates the southern margin of the channel, and this seaward (outside) facing shoreline is known as Barges Beach. Over the past twenty years, severe winter storms have caused significant overwashing of Barges Beach, causing the barrier to become extremely low and vulnerable and allowing sand, cobble, and rocks to frequently wash into Cuttyhunk Channel making navigation hazardous. Despite ongoing efforts by the Town and the USACE to stabilize the Barges Beach and protect the Federal Channel and Harbor of Safe Refuge, navigation is imminently threatened and the barrier beach is in a fragile condition. Woods Hole Group was contracted by the Town of Gosnold to implement the Green Infrastructure for Coastal Resilience on Barges Beach project that was funded through a MA Coastal Zone Management Green Infrastructure for Coastal Resilience Grant. Conducted a comprehensive coastal processes analysis utilizing the spectral wave model STWAVE Version 4.0 (Smith, Sherlock, and Resio, 2001), developed by the U.S. Army Corps of Engineers Waterways Experiment Station, and a process-based sediment transport model to determine local sediment transport trends in the presence of time-variable (in direction and height) waves. The data that was generated from the coastal processes analysis were used to design several green infrastructure design alternatives. The alternatives were evaluating using the model Storm-induced BEAch Change Model (SBEACH) to simulate cross-shore beach, berm, and dune erosion produced by storm waves and water levels and a preferred alternative was chosen based on the results. An engineering design for the preferred beach nourishment and dune restoration was drafted using a combination of sand, gravel and cobble in an effort to match the existing site conditions and improve resiliency while adhering to the Green Infrastructure guidelines. The Town of Gosnold intends to implement this nature based solution to improve the coastal resilience of the publicly accessible Barges Beach which will dramatically improve storm damage protection, wildlife habitat restoration, safe, reliable navigation, and recreation. The project is currently being reviewed by the regulatory agencies in MA.

Improving the Coastal Resilience of Popponesset Spit and Bay, Mashpee, MA – Project Engineer
Save Popponesset Bay received funds through the MA Coastal Zone Management Green Infrastructure for Coastal Resilience Grant Program, to improve the coastal resilience of the publicly accessible beach on Popponesset Spit, which suffers from a sand deficit, is eroding and experiences overtopping during even moderate storms. Woods Hole Group was contracted to evaluate and design a preferred alternative green infrastructure solution for restoration of the Spit, which is predominantly owned by Save Popponesset Bay but also by Mass Audubon. The scope of work includes improvement dredging that will allow for design alternatives for dune restoration and beach nourishment to improve coastal resiliency, while taking into consideration for local species of concern such as piping plovers. Woods Hole Group is conducting a comprehensive coastal processes analysis utilizing the spectral wave model STWAVE Version 4.0 (Smith, Sherlock, and Resio, 2001), developed by the U.S. Army Corps of Engineers Waterways Experiment Station, and a process-based sediment transport model to determine the local wave climate and sediment transport trends in the presence of time-variable (in direction and height) waves. The data that was generated from the coastal processes analysis were

KEY PROJECTS (CONTINUED)

used to design several green infrastructure design alternatives. The alternatives were evaluating using the model Storm-induced BEAch Change Model (SBEACH) to simulate cross-shore beach, berm, and dune erosion produced by storm waves and water levels and a preferred alternative was chosen based on the results. Preliminary analysis by Woods Hole Group indicates ~25,000 and 100,000 cubic yards of sand are required to restore the dunes and beach respectively and both upland sand and sand dredged from various navigation channels is being investigated as suitable material with Grant funding. Design considerations for improving the functionality of the main navigation channel in the Bay, including making it wider, deeper or longer, which could help maintain the navigation channel longer into the season, improve safety and reliability, and provide a sediment source for the beach nourishment, is being evaluated. Engineering design plans and specifications will be developed for the recommended beach nourishment, and dredging alternative, if applicable. The project will be advanced through the permitting stage.

Design and Construction of a Revetment with Nourishment, Chatham, MA – Engineer
Design, permitting, and construction of a rock revetment in Pleasant Bay, Chatham, MA. Historically these properties had a beach that fronted a coastal bank, however, in recent years the beach has largely disappeared eroding the coastal bank and threatening the homes behind it. The properties are situated across from the New Cut through the barrier beach that runs along the Chatham coastline and are subject to flooding and wave energy from the Atlantic Ocean as well as locally generated waves and upland flooding within Pleasant Bay. In addition, the navigational channel for Pleasant Bay is just off the beach and boat wakes also contribute to the erosion taking place. The revetment was designed to withstand diffracted storm wave energy and surge through the New Cut. The rock revetment spanned two adjacent properties and also included a bank/dune nourishment and planting along its length that also included an adjacent third property. Required negotiation of access to the beach through a town right away during peak season as well as neighboring properties.

Beach Profile Monitoring, Siasconset Beach, Nantucket, MA, Siasconset Beach Preservation Fund – Project Engineer
Lead a technical team to conduct quarterly beach profile surveys and annual bathymetry surveys as a part of require monitoring for over nine (9) years and continuing. Utilized RTK GPS Technology for both topographic and bathymetric surveys. Extended the topographic beach profiles seaward using a total station and a swimmer with a rod/prism. Analyzed data to compute beach volume and shoreline change as basis for evaluating success of shore protection measures. Prepared technical reports for wide range of stakeholders, including regulatory agencies and private landowners.

Rushy Marsh Restoration Evaluation, Osterville, MA –Engineer/Modeler
The Rushy Marsh Restoration Project involved the construction of a new inlet to restore tidal prism to an impaired tidal marsh; however, the new inlet completely shoaled within several months of construction. Our post-construction investigation evaluated the Rushy Marsh restoration project to understand the causes for poor performance and identify possible solutions for improvement. Existing data including previous reports, survey plans, and various data sets were compiled and reviewed. An analytical hydrodynamic model was developed using the compiled data to replicate the original hydrodynamic model results. This information was used to define and analyze the wave climate, tidal regime, and hydrodynamic characteristics for the Rushy Marsh System. A coastal processes analysis was conducted to calculate the longshore sediment transport rates

KEY PROJECTS (CONTINUED)

and perform an inlet stability assessment. The results indicated that the as-built inlet was unstable due to a small tidal prism relative to the scale of the annual longshore sediment transport rate. Alternate inlet/culvert configurations were investigated using the same data and methods, but it was determined that a stable inlet was not possible without substantial maintenance and additional engineering enhancements.

Silver Sands, Milford, CT –Engineer/Modeler
Performed a coastal engineering assessment of Great Creek outlet (flow control structure/tide gate) at Silver Sands State Park in Milford, Connecticut that included coastal processes assessment, water level data collection, wave transformation modeling, and sediment transport modeling. Lead the field effort in deploying tides gauges in the creek and Long Island Sound to characterize water levels over a full lunar cycle. Developed a wave simulation model using STWAVE to generate a local wave climate to assess the erosive conditions of the beach. Wave model input was based on historical wind and wave data, tide data from instruments, and bathymetric data from published data sources. Wave simulation was used to development sediment transport conditions for the beach and perform an inlet stability analysis to assess the feasibility of proposed alternatives for the outlet structure.

Bucks Harbor Former Air Force Radar Tracking Station and Former Ground/Air/Transmitter/Receiver Site, Machiasport, Maine – Project Manager
The site is a former Air Force Radar Tracking Station and Ground/Air/Transmitter/Receiver that has Volatile Organic Compounds (VOCs) contamination in the groundwater and is listed as a Formerly Used Defense Site (FUDS). The Woods Hole Group monitored for Volatile Organic Compounds (VOCs) contamination in both monitoring and drinking water wells for the U.S. Army Corp of Engineers (USACE) between 2010 and 2014. In 2012, the USACE optimized the monitoring program based on Woods Hole Group recommendations and analysis. In addition, in 2013 the Woods Hole Group oversaw the installation of Water FLUTe Systems in several wells for allowing for discrete sampling from specific zones and isolating fractures in the borehole. Drafted the Sampling and Analysis Plan (SAP) and Health and Safety Plan (HASP) documents. Lead the field team in tasks including monitoring well sampling, pore water sampling, and residential water sampling. Analyzed data and wrote reports and notifications letters for landowners. Laboratory VOC results were built into the historical USACE database using ADR software.

Glenburn Former Ground to Air Transmitter Site, Glenburn, Maine – Project Manager
The site is a former Air Force Ground to Air Transmitter site that has Volatile Organic Compounds (VOCs) contamination in the groundwater and is listed as a Formerly Used Defense Site (FUDS). The Woods Hole Group monitored for Volatile Organic Compounds (VOCs) contamination in both monitoring and drinking water wells for the U.S. Army Corp of Engineers (USACE) from 2010 to 2014. Drafted the Sampling and Analysis Plan (SAP) and the Health and Safety Plan (HASP) documents for the biannual groundwater and residential water-monitoring program in conjunction with U.S. Army Corps of Engineers. Lead the field team in tasks including monitoring well sampling, pore water sampling, and residential water sampling. In addition, electronic water level loggers deployed in wells were maintained and the data downloaded. Analyzed data and wrote reports and notifications letters for landowners. Laboratory VOC results were built into the historical USACE database using ADR software.

KEY PROJECTS (CONTINUED)

New Bedford Harbor OU3 Sampling Program, New Bedford, Massachusetts – Field Engineer
Implemented a sample collection program on behalf of the U.S. Army Corps of Engineers for the New Bedford Superfund Site. The monitoring program included extensive benthic sampling where benthic grab samples were prepared, sampled, and sent to the lab for benthic biological organism identification. Sediment grab and core samples were collected for the characterization of grain size, Total Organic Carbon (TOC), and the primary chemical contaminant polychlorinated biphenyls (PCBs). Recorded in-situ water quality parameters including temperature, pH, ORP, salinity, dissolved Oxygen, and turbidity using YSI 600 series Sondes. Collected water samples from storm sewer outfalls following a storm event to assess the outfalls as a contaminant pathway.

Field Data Collection, Engineering Design and Permitting for the Town of Edgartown's 10-year Comprehensive Dredging Permit, Edgartown, MA – Project Engineer
The Town of Edgartown has innovatively set the stage for the Federal Comprehensive Permit process for Coastal Municipalities within Massachusetts, with the acquisition of an interchangeable permit for dredging and beach nourishment at thirty-nine different sites within the Towns of Edgartown and Oak Bluffs. The Town invested the time and money, with the help of private contributions, to acquire a Town-wide Ten-year Comprehensive Permit from the Army Corps of Engineers as well as numerous State and Town agencies, for a blanket permit that allows compatible dredged material from any of the fourteen historic dredge sites to be placed on any one of the twenty five disposal sites within the Town, and several additional sites in Oak Bluffs. This flexibility provided by this multi-jurisdictional comprehensive Federal permit is unprecedented. As a part of this effort, I conducted bathymetric surveys using Real Time Kinetic (RTK) GPS technology at fourteen (14) different dredging locations from harbors to coastal ponds to Nantucket Sound. Conducted topographic surveys at twenty-five (25) beach nourishment locations. Deployed and surveyed tide gauges to reference the water levels (MHW, MLW, MTL, etc.) to a common datum (NAVD88). Worked with the CAD technician in the production of engineering drawings for each site, many of which incorporated special requirements for rare and endangered species habitat. Participated in the collection of fifty (50) vibracores and forty (40) grab samples within the various footprints and over 100 grain size samples at samples to characterize the depositional environments. A total volume of approximately 248,000 cubic yards of sediment will be hydraulically dredged from navigation projects within the two Towns over 10 years, with beneficial reuse of the dredged material at various beach nourishment locations.

Dredging support services for the Town of Falmouth, Falmouth, MA – Project Engineer
Woods Hole Group, Inc. was contracted by the Town of Falmouth to collect field data, perform the engineering design, and prepare the application for several sites covered under the Town of Falmouth Federal Comprehensive Permit for dredging and beach nourishment. Field data collection included the bathymetric surveying using RTK GPS technology and the collection of sediment core samples at Green Pond and Eel Pond in Falmouth. Subsequently conducted a topographic survey of Washburn Island for use as a disposal site. Helped in the production of engineering drawings for each site.

Bay View Pond Tidal Restoration Project, West Yarmouth, MA – Project Manager/Engineer
The Bay View Pond system includes a pond and tidal marsh that is subject to poor drainage and limited tidal exchange with Lewis Bay due to inlet shoaling and clogging of the culvert. Designed and implemented a field data collection program, and then utilized data with an analytical hydrodynamic model to evaluate the system

KEY PROJECTS (CONTINUED)

and potential alternatives for restoring the system. The field data collection program included the collection of topographic and bathymetric data in addition to the deployment of three tide gauges to define the tidal regime throughout the system. Used this data within an analytical hydrodynamic model to calculate the amount of tidal prism restoration for each alternative. Estimated sediment transport rates along the beach in order to perform inlet stability calculations. Evaluated alternatives based upon the amount of tidal prism restored to the pond and the stability of the inlet.

Stony Brook, Brewster, Massachusetts – Lead Engineer
Conducted a post-construction hydraulic study of the Stony Brook Marsh system intended to evaluate the effects of the culvert replacement to restore tidal flow to the salt marsh on the south side (upstream) of Route 6A. Lead the field effort in collecting elevation data using real-time kinematic (RTK) GPS surveying techniques and deploying six tides gauges at various locations in the marsh system to characterize water levels over a full lunar cycle. Processed and analyzed the collected data and compared with the pre-construction water level data collected in 2007. The results showed that the tidal dampening caused by the old culvert has been successfully mitigated as the tidal amplitude increased upstream of the culvert while the phase lag between the upstream and downstream locations was reduced.

Lake Wequaquet, Barnstable, Massachusetts - Engineer
Lake Wequaquet experiences seasonal eutrophic conditions due to excessive nutrient loadings to the lake. Lead the field effort to collect shallow groundwater samples along the shoreline using shallow piezometers to determine phosphorus and nitrogren loading from groundwater to the lake. Sampling was performed on a seasonal basis to determine seasonal variation in groundwater nutrient loading. Analyzed data to determine where and when excessive nutrient loading was occurring and compared against other sources such as rain and background levels. The results of the data collection effort were used to estimate the groundwater discharge of phosphorus to the lake, which would be used in the context of developing a management for the lake.

Restoration of Bride Brook Marsh System, East Lyme, Connecticut - Engineer
Assisted in a data collection program to assess potential restoration of a tidal salt marsh located in Rocky Neck State Park by improving an existing culvert controlling flow into the marsh. Tide data was collected via Seabird instruments deployed for a 30 day period to record conductivity, temperature, density and pressure to assess tidal conditions to assess the tidal conditions. Tide data was used to drive a hydrodynamic model DYNLET to understand the existing conditions within the tidal marsh and assess alternatives.

Sengekontacket Pond ENF/EIR, Town of Edgartown, Massachusetts – Engineer/Modeler
Developed a wave simulation model using STWAVE to generate a local wave climate to assess the erosive conditions of the beach at Sengekontacket for the town of Edgartown. Wave model input was based on historical wind data, tide data from instruments, and bathymetric data from published data sources. Wave simulation was used to development sediment transport conditions for the beach to understand the erosion taking place.

KEY PROJECTS (CONTINUED)

Dilution of Marafiq IWWTP Discharge to Red Sea, Al Farsh, Saudi Arabia – Engineer/Modeler
Assessed the feasibility of increasing the discharge volume and contaminant concentration for the Industrial Wastewater Treatment Plant (IWWTP) discharge into the Red Sea for the Power & Water Utility Company of Jubail & Yanbu (Marafiq). Concerns of negative water quality impacts. Data collected from previous studies were used to determine the necessary mixing zone sizes that would be required to meet the regulatory criteria. Implemented the plume model CORMIX to simulate plume characteristics both in a discharge canal and the surrounding waters.

Bayview Beach Coastal Processes & Outfall Design, Milford, Connecticut – Engineer/Modeler
Performed a coastal processes analysis and provided engineering design support for the Bayview Beach outfall system in Milford, Connecticut. The Bayview Beach community has ongoing issues with storm inundation and flooding from both storm surges and rainfall runoff. The existing storm drainage system consists of a series of gravity-fed culverts whose outfalls discharge into Long Island Sound and have tidal control in the form of duckbill tide gates. Currently, the system does not provide enough drainage for storm flooding events that leads to ponding that can last several days, and the culverts themselves are undersized and have reached the end of the design lifetime. Conducted a coastal processes analysis included evaluating local water levels, waves, winds, and bathymetric data sets to develop model input and design parameters. Wave transformation modeling was then conducted for Bayview Beach for both normal and storm scenarios while also evaluating sea level rise. The wave transformation model results were then used to conduct sediment transport modeling and cross-shore beach profile change (erosion/accretion) for Bayview Beach. The oceanographic parameters and model results were then used to develop design criteria for both the gravity fed outfall design and stormwater pump station including pipe diameter, length, and invert elevations as well as wave forcing. Also evaluated conducting a beach nourishment project in conjunction with the outfall design for future planning. Project is currently in the construction phase with completion by the end of 2019. As an add on to the project, evaluated alternatives for providing shoreline resiliency to Deerfield Avenue beach access with the Town deciding to construct a sand dune with coir envelope core that satisfies the Green Infrastructure framework.

Sheffield Brook, Old Lyme, Connecticut – Engineer/Modeler
Performed a coastal processes analysis and provided engineering design support for the Sheffield Brook outfall system in Old Lyme, Connecticut. The existing system at Sheffield Brook consisted of a shallow creek that provided storm drainage for a coastal neighborhood and flowed through an undersized culvert underneath the beach before discharging into an outfall Long Island Sound. Restoration efforts by Fuss & O'Neill for the Sheffield Brook system included excavating the channel to remove blockages and channelizing flow, stabilizing and vegetating the bank, and designing a new culvert underneath the beach to accommodate significant storm flows. Woods Hole Group was subcontracted to develop design alternatives and criteria for the outfall end of the culvert on the beach. Conducted a coastal processes analysis evaluating local water levels, waves, winds, and bathymetric data sets to develop model input and design parameters. The oceanographic parameters and model results were then used to develop design criteria and model input. Evaluated both cross shore and longshore sediment transport using both publicly available data sets and computer modeling techniques. Longshore rates calculated using accept engineering methods while cross-shore beach profile change (erosion/accretion) was evaluate for various storm scenarios using SBEACH. Conducted an alternatives analysis

KEY PROJECTS (CONTINUED)

evaluating different culvert configurations as well as creating an open channel. The client selected the open channel alternative, which required designing jetties to stabilize the new inlet and tie into the existing groin. An inlet stability analysis was also conducted. Provided construction oversight of the new inlet and open channel with completion of construction in 2017.

PUBLICATIONS & PRESENTATIONS

Buck, M., N.K. Kobayashi, A. Payo, and B.D. Johnson. "Berm and dune erosion during a storm." CACR-07-03, Center for Applied Coastal Research, University of Delaware, Newark, Delaware.

Buck, M., N.K. Kobayashi, A. Payo, and B.D. Johnson. 2008. "Berm and Dune Erosion." International Conference on Coastal Engineering 2008", Hamburg, Germany.