23-076

RESOLUTION DIRECTING WORK TO HAZEN AND SAWYER FOR THE FEASIBILITY STUDY AND BASIS OF DESIGN SERVICES LTCP HOBOKEN GRAND STREET INTERCEPTOR AND PUMP STATION PROJECT

MOTIONED BY: Marotta
SECONDED BY: Friedrich

WHEREAS, the North Hudson Sewerage Authority (hereinafter "Authority") is a public body, duly formed under the Sewerage Authorities law, constituting Chapter 138 of the Laws of New Jersey of 1946, as amended (Chapter 14A of Title 40 of the New Jersey Statutes Annotated) and possesses the powers set forth therein; and

WHEREAS, Hazen and Sawyer has been selected under resolution 22-127 to provide engineering services for various capital projects required throughout its service area that must be performed in order to maximize the performance of its waste water treatment facility, the capacity of its combined sewer system and/or to comply with its New Jersey Pollution Discharge Elimination System (NJPDES) permit; and

WHEREAS, Hazen and Sawyer has submitted a proposal (Exhibit "A") to provide Engineering Services for the Feasibility Study and basis of design services LTCP Hoboken Grand Street Interceptor and Pump Station Project; and

WHEREAS, the Facilities Review Board has considered this request and proposal and recommends the approval of the full Board.

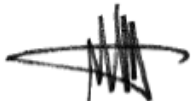
NOW THEREFORE, BE IT RESOLVED that the Authority, as recommended by the Facilities Review Board, directs Hazen and Sawyer to provide professional engineering services Feasibility Study and basis of design services LTCP Hoboken Grand Street Interceptor and Pump Station project not to exceed $849,894.00.

DATED: JUNE15, 2023

RECORD OF COMMISSIONERS' VOTE

	YES	NO	ABSENT
Commissioner Kappock	x		
Commissioner Marotta	x		
Commissioner Gardiner	x		
Commissioner Friedrich	x		
Commissioner Guzman	x		
Commissioner Velazquez	x		
Commissioner Barrera			x
Commissioner Zucconi	x		
Commissioner Assadourian	x		

THIS IS TO CERTIFY THAT THIS RESOLUTION WAS DULY ADOPTED BY THE NORTH HUDSON BOARD OF COMMISSIONERS ON JUNE 15, 2023.



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SECRETARY

Hazen

NORTH SEWERAGE AUTHORITY HUDSON

Letter Proposal for

FEASIBILITY STUDY AND BASIS OF DESIGN SERVICES

LTCP Hoboken Grand Street Interceptor and Pump Station Project

June 6, 2023

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Hazen and Sawyer
99 Wood Avenue South, 8th Floor
Iselin, NJ 08830 • 732.491.2810

June 6, 2023

Mr. Frederic Pocci
The North Hudson Sewerage Authority
1600 Adams Street
Hoboken, NJ 07030

Re: Proposal for Feasibility Study and Basis of Design Services
LTCP Hoboken Grand Street Interceptor and Pump Station Project

Dear Mr. Pocci:

Hazen and Sawyer (Hazen) is pleased to submit our proposal to The North Hudson Sewerage Authority (NHSA) to provide engineering services for the feasible and conceptual design associated with the proposed interceptor and downstream pumping station on Grand Street in Hoboken, New Jersey. The proposal addresses the subsurface and hydraulic investigation necessary to understand the challenges that the project may face during construction, while fulfilling the major project tasks as outlined in the Request for Proposal (RFP).

Our team will be led by myself serving as Project Manager, supported by our seasoned professional expert Hazen staff, some of which NHSA has come to know well. We have assembled a highly qualified team of senior microtunneling/pipeline and pumping station experts, with large diameter tunneling and large capacity pumping station experience. Our extensive two-dimensional (2D) LTCP hydraulic modeling experience will be utilized to help determine the above street effects of the proposed interceptor and pumping station at various storm intensities. The Hazen team will reason through risks to deliver sound solutions that will facilitate development and implementation of a resilient design that provides long-lasting benefits to NHSA and the community it serves. Together, we will strive to execute this project in a collaborative, timely, and cost-effective manner.

Geotechnical and Environmental labor costs associated with engineering inspection and analysis are based upon the prescribed 35 boring locations, as specified in the RFP for geotechnical and environmental sampling, testing and analyses. Based upon our review of available subsurface and environmental data, as well as our past experience in the project area, an alternate geotechnical and environmental program consisting of 25 test borings may be considered to reduce costs. It is our opinion that 25 test borings would be sufficient to evaluate the feasibility and cost of this project. **As required in the RFP, we note that costs for engineering inspection and analysis required during the geotechnical and environmental investigation phase of the project have been included in the cost presented for Task 2, and separate to the allowance for geotechnical and environmental testing per Addendum No. 1.**

We are confident that our defined approach, detailed work plan, and project schedule will result in a complete and conservative engineering basis for a feasibility and conceptual design, serving NHSA's mission, and achieving your goals with respect to: **redundancy, resiliency, community benefits, long- and short-term community impacts, implementation schedule, and operational efficiency.** We are

also committed to providing quality engineering services, and hope that we can put our resources and experience to work for you on this important project.

Hazen looks forward to a continued partnership with NHSA, and we thank you for your consideration in this solicitation. Please do not hesitate to contact me at wgettings@hazenandsawyer.com or (732) 439-6362 should you require any additional information.

Very truly yours,

William S. Gettings, PE, MBA, BCEE, Assoc. DBIA
Associate Vice President
New Jersey Operations Manager

(cc: Donald Conger, PE, NHSA and Belissa Vega, NHSA)

Executive Summary

The existing conditions for the subsurface portion of the project will be critical in the understanding of the feasibility of construction for this project.

The identification of hard versus soft substrate will determine the depth of tunneling and extent of structural support needed for the interceptor as well as the pumping station foundation. Potential utility conflicts may cause relocation to be necessary which can be costly. Possible ground water and soil contamination estimation is necessary to accurately quantify potential additional costs. Finally, construction in an urban setting such as in Hoboken will require a well thought out MOPO plan to minimize disruption to the residence during challenging construction.

	BENEFITS	CHALLENGES
Shallow Interceptor	• Less excavation • Shallow PS	• Greatest pile support • Greatest utility conflict
Mid-depth Interceptor	• Less utility conflict • Less support needed • Greater storage capacity	• More excavation • Deeper PS
Deep Interceptor	• Less utility conflict • Least support • Greatest storage capacity	• Greatest excavation • Deepest PS

HAZEN TEAM APPROACH

Proven Leadership

The Hazen team key staff has decades of direct relevant project experience to bring to bear on this assignment.

Proactive Risk Management

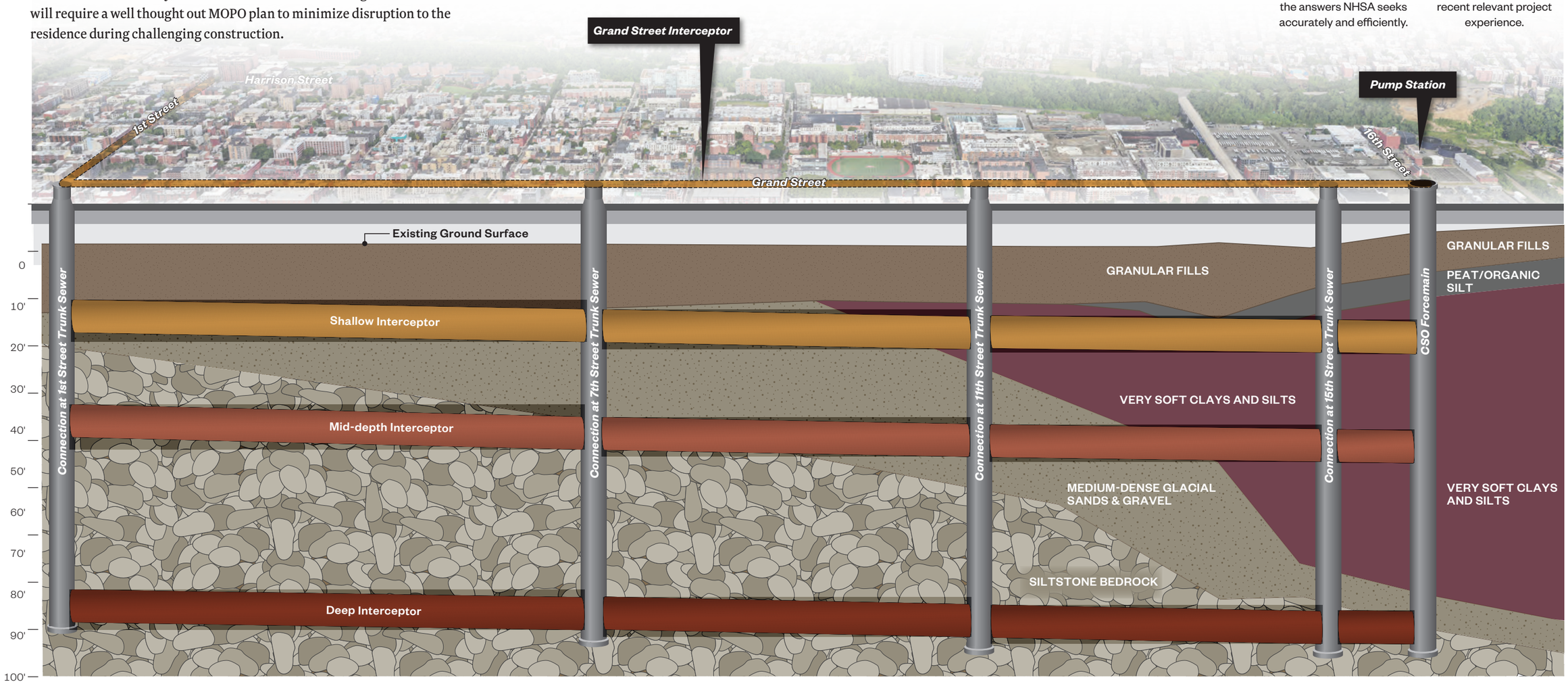
We will identify, quantify, and weigh the risks of each vertical interceptor alignment to land on the best solution for NHSA.

Efficient Delivery

We understand the community needs and time constraints associated with the implementation of the LTCP and will delivery the answers NHSA seeks accurately and efficiently.

Fresh Perspective

Hazen can provide the Authority with alternative design concepts and construction methods that are based upon actual recent relevant project experience.



Project Understanding & Technical Approach

The Hazen team is intimately familiar with NHSA's existing collection system and wastewater treatment infrastructure, as well as the geology and hydrology of Hoboken, and will use this knowledge coupled with our extensive, directly relevant experience to sort out and find solutions to the challenges with the proposed interceptor alignment and pumping station.

Project Understanding

The primary objective of this project scope that NHSA is seeking is to produce a Feasibility Study and Basis of Design Report for the Long Term Control Plan (LTCP) Hoboken Grand Street Interceptor and Pumping Station Project, involving the installation of a new interceptor sewer below Grand Street from 1st Street to 16th Street in Hoboken, New Jersey. The proposed connection points to the existing trunk sewers are at 1st Street, 3rd Street, 7th Street, 11th Street, and 15th Street. We understand that this proposed interceptor is intended to align with Grand Street's existing combined sewer infrastructure. It will collect combined sewage along the proposed alignment and will transport the flow to a proposed screening facility and pumping station at the Adams Street Wastewater Treatment Plant (WWTP). The pumping station will be approximately 268 mgd, including screening, pumps, an electrical room, and a generator. The pumping station will pump all flow into the plant influent or effluent outfall.

The proposed Grand Street Interceptor would replace upgrades proposed in the LTCP for Hoboken. It is intended to provide the same results as the projects currently in the LTCP to deliver additional flow to the plant for treatment with the added benefit of mitigating flooding throughout Hoboken.

The Hazen team understands the intent of the project, and in thinking about this project holistically, we look forward to the opportunity of working collaboratively with NHSA on arriving at a solution that maintains these vital assets in the short and long-term. We are capable of addressing all the risks and challenges associated with the tunnel, pumping station, and interceptor, and as outlined in the RFP, we can provide solutions to fulfill the following major project tasks:

- **Task 1 -** Information Gathering and Site Assessment
- **Task 2 -** Feasibility Study, including FEMA Building Resilient Infrastructure and Communities (BRIC) Application
- **Task 3 -** Basis of Design Report

OVERALL PROJECT APPROACH

1. Identification & Development (Mitigation Strategies)
Based on our project understanding and past experience, Hazen will assist NHSA in identifying engineering challenges and developing appropriate solutions to address them.

2. Management (Assignment Leads)
Hazen has assigned the appropriate task leads to manage the Pumping Station/ Interceptor Design, as well as the Tunneling Design aspects of this project.

3. Execution (Project Team)
Through the use of our technical expertise, the Hazen Team will develop and execute a well-thought out plan for this project.

4. Schedule & Cost Control
Based upon the schedule outlined in the RFP, Hazen's project scheduling, plant operations and design experts will help control costs through the use of detailed schedules.

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Technical Approach

Hazen will deploy our proven team of engineers and subcontractors for this assignment that have carefully reviewed the scope of work provided in the RFP, and developed a tailored technical approach that addresses all the proposed tasks while providing solid technical methodology based upon past relevant experience, to achieve NHSA's goals for the project.

Task 1 - Information Gathering and Location Assessment

The goal of Task 1 will be to understand the existing conditions for the proposed interceptor alignment and pumping station location to accurately develop a feasibility and conceptual design in subsequent tasks.

Kickoff Meeting/Risk Evaluation Workshop

A Kickoff Meeting will be held to review scope of work, schedule, safety requirements, communication/site access protocols, and conduct the initial Risk Evaluation Workshop.

At the Risk Evaluation Workshop, stakeholders from NHSA and the Hazen team will meet to discuss and prioritize various technical and non-technical issues likely to impact the project and their associated risk. These risk discussions will focus not only on cost and schedule impacts, but also on other factors important to the project, including redundancy, resiliency, community benefits, long and short-term community impacts, implementation schedule and operational efficiency. The workshop will establish design criteria for the project and would include a site visit to ensure all participants understand site constraints and likely public perception issues.

Review of Historic Documents

Hazen will obtain and review existing documentation provided by NHSA including the Long Term Control Plan, the Hoboken Trunk Sewer Analysis, soil borings, and record drawings for the Hoboken Sewers and Adams Street WWTP. The Hazen team will also draw upon their collective past experience in Hoboken to better understand the subsurface conditions along the proposed interceptor alignment.

Site Visit

A site visit along the proposed interceptor alignment and pumping station location will be made at the kickoff meeting. Hazen will document existing conditions and will take required field measurements. Photos will be included in the reports as needed with appropriate descriptions.

Proven Leadership

Our team is anchored by leadership that you know and trust. Project Manager Bill Gettings brings a hands-on proven leadership style and well-established relationships with NHSA's management and operations staff.

Proactive Risk Management

Our team includes staff with prior NHSA experience, and therefore has a detailed understanding of the potential risks involved. As such, we have assigned staff familiar with NHSA's needs and facilities to identify and mitigate key risks before they become issues.

Efficient Delivery

Our team is structured to maximize opportunities for efficiency, from streamlined coordination to targeted design solutions. Our leadership will provide clear, straightforward solutions delivered on time.

Fresh Perspective

To deliver a truly exceptional design, our proposed team of specialists will help identify opportunities for innovation and improved operability with an eye towards addressing future regulations. As regulations are evolving rapidly, our approach will include capturing these considerations in the early stages of design.

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Task 2 - Feasibility Study

Based upon the review of existing documentation and information gathered during the site visit, Hazen will begin to analyze the feasibility of the construction of the proposed interceptor alignment and pumping station.

Potential site of the Grand Street Pumping Station at the Adam Street WWTP

Survey

The Hazen team will obtain existing survey information from NHSA. This survey information will include topographic as well as existing utility information for review/use for the project. The proposed interceptor alignment will be reviewed for accuracy, elevations and potential conflicts with a focus on the the intersections proposed for regulators or launching shafts.

Geotechnical and Structural Analysis

Subsurface Investigation

As part of the subsurface investigation, we will advance up to 35 test borings with truck mounted drilling equipment along the proposed tunneled sewer alignment. Based on existing site features and using GPS equipment, we anticipate that the proposed test boring locations will be located by Hazen's subcontractor, French & Parrello Associates (FPA). All fieldwork will be performed under full-time technical observation by a FPA representative.

Initial coordination of utility clearances will be performed by contacting New Jersey One-Call for mark-outs. In addition, the Hazen team will meet with representatives of the utility companies and the Owner for final clearance, if required. As an added measure, we will perform ground penetrating radar utility locating at each boring location to avoid below-grade obstructions. Traffic control, including potential block closures and closure and road opening permits, will be required to perform the test borings. FPA will obtain all the necessary permits and provide all required traffic control to complete the test borings.

The test borings for the proposed improvements are anticipated to be advanced to a depth of approximately 100 feet below the existing grade. Based upon our review of the regional geology and previous experience throughout Hoboken, bedrock may be present at depths as shallow as 20 feet below the existing grade near the southern half of the proposed tunnel alignment. If such shallow bedrock is encountered, the frequency of borings may be reduced in this area, given the anticipated consistency of the bedrock. The frequency of test borings should be maintained at the north end, given the inconsistent soil conditions, including very thick layers of compressible soil deposits and deep bedrock elevations.

Soil samples will be obtained from the test borings per ASTM Test Method D-1586, The Standard Penetration Test. Soil samples will be taken continuously to a depth of 12 feet and a maximum of 5-foot intervals afterward. If bedrock is encountered in the test borings, the borings be advanced into bedrock. Rock cores will be advanced utilizing a diamond-tipped, NX-sized core barrel. Subsequently, the soil samples will be classified in the field according to the Burmister Soil Classification System, and bedrock will be described in accordance with its geologic origin. Temporary wells will be installed to record groundwater depths during the subsurface investigation.

Laboratory Testing

Selected soil samples will be subjected to laboratory testing to assess their engineering characteristics and confirm visual classifications. The laboratory testing program may include the following testing:

- Test Procedure
- Grain Size Analyses ASTM D-422
- Atterberg Limits ASTM D-4318
- Unconfined Compressive Strength ASTM D-2166
- Corrosivity Testing ASTM G-51

Environmental risks will be evaluated and quantified to gain a thorough understanding of potential hazardous materials during construction

Environmental Investigation

FPA will perform an initial environmental assessment of the project corridor. The limited environmental assessment should include a review of the NJDEP GeoWeb Online Mapping Tool and available environmental databases to identify current and historic contaminated sites along the project coordinator. Additionally, soil and groundwater sampling should be performed at targeted locations along the project corridor based on the GeoWeb and database review results to determine the presence/absence of contamination in the project corridor. To evaluate the soil quality anticipated to be displaced by the project, we will perform an environmental soil evaluation and collect representative soil samples for laboratory analysis.

FPA will provide an environmental scientist to screen soils with a photo-ionization detector for volatile vapors and visually evaluate the soil for the presence of historic fill. Soil samples will be collected based on observations and/or PID screening. Submit soil samples to an NJDEP-certified laboratory for analysis. Laboratory analysis will include Extractable Petroleum Hydrocarbons (EPH), Target Analyte List (TAL)/Target Compound List (TCL) +30 (TAL/TCL+30), Toxicity Characteristics Leaching Procedure (TCLP) Metals, and Resource Conservation Recovery Act (RCRA) Characteristics. Concurrent with the soil sampling, we will evaluate groundwater to determine management and disposal options if dewatering is required to facilitate this project. Groundwater samples will be collected from temporary well points and purged with a peristaltic pump or bailer to reduce turbidity. Submit groundwater samples to an NJDEP certified laboratory for analysis. Laboratory analysis will include TALC/TCL+30.

Geotechnical Engineering Evaluation and Report Preparation

The results of the subsurface investigation program will be the basis for the feasibility evaluation and subsequent conceptual design. Based upon the results of the engineering evaluation, we will generate geotechnical recommendations addressing tunneled sewer installation. We will also discuss geotechnical aspects pertaining to the selection of appropriate foundation systems for structures and will provide design criteria for shallow foundations or deep foundations, as required. Should shallow foundation with ground improvement be a viable option, we will provide net allowable bearing pressures, minimum footing sizes, minimum embedment depth, and subgrade preparation requirements.

The report will address the need for ground improvement measures that may be required to allow footings and slabs to be constructed on shallow foundation. Additionally, we will provide estimates for total and differential settlement. We will recommend appropriate pile/drilled shaft foundation types for various vertical capacities

to offer an alternative to possible ground improvement. We will also provide lateral and uplift capacities should such be required. Our report will discuss the merits of each system and recommend the most technically appropriate and cost-effective deep foundation system for the project. The report will provide seismic design criteria for use in structural design, including seismic site class. We will assess the site based on encountered soil types and standard penetration testing values as part of our seismic analysis. We will include recommendations for subgrade preparation for structures.

Soil parameters, including lateral earth pressure coefficients, coefficient of base friction, and modulus of subgrade reaction for use in structural design, will be included in the project's design phase. Earthwork recommendations specifically required for this project will be made, including possible rock excavation, fill type, and compaction specifications. Groundwater considerations will be addressed, and recommendations for dewatering during construction made, if required. The results of the Geotechnical Engineering Evaluation will be presented in a written report. A summary of the results of the environmental soil and groundwater testing will also be presented in our report.

A complete understanding of required permits for construction will be established

Geotechnical and Environmental labor costs associated with engineering inspection and analysis are based upon the prescribed 35 boring locations, as specified in the RFP for geotechnical and environmental sampling, testing and analyses. Based upon our review of available subsurface and environmental data, as well as our past experience in the project area, an alternate geotechnical and environmental program consisting of 25 test borings may be considered to reduce costs. It is our opinion that 25 test borings would be sufficient to evaluate the feasibility and cost of this project.

Permitting

This task will include preparing permit applications as required for the proposed improvements. The key to the permitting process is to identify the long-lead and critical path approvals early and initiate these activities in the early stages of the project. To facilitate this process, the Hazen team will arrange a pre-application meeting with NJDEP to introduce the agencies to the project, define the required approvals and obtain agency guidance in consolidating and coordinating investigation and permit application submission efforts to shorten the overall regulatory review and approval process. Based on the NJ-GeoWeb screening, portions of the project are located within the area regulated by the NJDEP through the Waterfront Development Law (Waterfront Development Permit) and the Coastal Zone Management Rules. As such, it will require the following regulatory permits. We will perform a preliminary review of the requirements during the feasibility study and the results will be presented in a summary report.

1. **NJDEP Coastal Zone Management Rules (N.J.A.C. 7:7) Waterfront Development, Upland Individual Permit, and Tidelands Lease -** The project will require a Waterfront Development Individual Permit for the construction of the new interceptor and pumping station. Any portion of the project within the NJ Tidelands claims line will require a Tidelands Utility License. We will prepare all documents required by the Waterfront Development application checklist, including a Compliance Statement addressing Subchapter 9 Special Areas, Subchapter 14 General Location Rules, Subchapter 15 Use Rules, and Subchapter 16 Resource Rules.
2. **NJDEP Treatment Works Approval -** The project will require a Treatment Work Approval for the construction of the new pumping station and interceptor.
3. **Hudson-Essex-Passaic Soil Conservation District -** Since the project will result in more than 5,000 square-feet of land disturbance, it will require a Soil Erosion and Sediment Control Plan Certification from the Hudson-Essex-Passaic Soil Conservation District. The project may also require a 5G3-Construction Activities Stormwater General Permit.

Permit Summary Table

REGULATORY PERMIT	APPLICATION PREPARATION TIME	REGULATORY REVIEW PERIOD	ESTIMATED PERMIT APPLICATION FEE
NJDEP WFD IP in-water and uplands	12-weeks	6-months	Based upon acres of disturbance
NJDEP Treatment Works Approval	3-weeks	3-months	Based upon construction cost
Hudson-Essex-Passaic Soil Conservation District	1-week	4-weeks	Based upon area of disturbance

TASK NAME	CALENDAR DAYS TO COMPLETE APPLICATION	CALENDAR DAYS FOR REGULATORY APPROVAL
Hudson-Essex-Passaic Soil Conservation District	1-week	3-8 weeks
NJDEP Treatment Works Approval	4-weeks (see note 1 below)	120 days
NJDEP Waterfront Development	6-weeks (see note 2 below)	180 days
Tidelands License/Lease	1-week (see note 4 below)	No time limit, anticipate 90 days
NJDEP Dewatering Permit, And NJDEPS NJ0134511	Completed by contractor (see note 6 below)	

General note for all permits: application fees provided by NHSA.

Note 1: Building, installing, modifying, or operating any treatment works including, but not limited to, pumping station, or force main which will convey 8,000 gallons per day or more of flow to a treatment works will require a TWA permit. This application is normally submitted after final sign-off from NHSA and plans 100% complete.

Note 2: Since the project proposes work within 100 feet of the mean high-water line, it will require a waterfront development permit for all work waterward of the mean high-water line (outfall), and all work landward of the mean high-water line to a point 500' landward of the mean high-water line.

Note 3: Tidelands are all lands that are currently or formerly flowed by the mean high tide of a natural waterway. The State of New Jersey has claimed ownership of these lands, and any use of these lands including temporary and/or permanent construction will require a Tidelands Utility Lease. This application is filed concurrently with the WFD IP. NJDEP will not start the review until 30 days afterthe WFD-IP is issued. Project surveyor will provide all plans and legal descriptions.

Note 4: Temporary dewatering application, and NJPDES General Permit NJ0134511 Construction Dewatering Discharge to Surface Water is normally prepared by the Contractor, according to their means and methods, and signs a certification stating that the discharge complies with the applicable requirements.

Proposal Interceptor Alignment Layout

The interceptor will be designed to convey all expected flow ranges and maintain proper flushing velocities. We will design the interceptor to minimize potential surcharging at peak flow conditions and minimize settlement at low flow conditions. This will be achieved by selecting the proper interceptor size and slope for the flow ranges. The interceptor slopes will be kept at a minimum to meet these objectives as additional slope will result in greater depths and risks. In addition, a shallower interceptor is easier to access and maintain. We have experience designing manhole structures that provide additional accessibility to an interceptor and will work with the NHSA to make sure proper access is provided in the design.

Proper material selection is also critical to interceptor design due to the potential corrosive nature of the internal and external environment. We have extensive experience evaluating pipe materials and will work with NHSA to select the appropriate pipe material and/or linings and coatings to ensure the interceptor reaches its design life.

The interceptor pipe will be installed within the excavated tunnel. A variety of pipe materials can be considered, but fiberglass reinforced pipe (FRP) is commonly used because of its resistance to corrosion. The space between the tunnel support, either the casing pipe for a microtunnel or the initial ground support system for a tunnel, and the interceptor pipe is typically backfilled with low density cellular concrete (LDCC). **Such an installation will provide NHSA with a solid interceptor designed for long-term flood control.**

Microtunneling Design

Construction of the new inteceptor will be complex. Critically important to replacement of the existing interceptor is the selection of the alignment for the new interceptor. Factors influencing alignment selection include:

- Avoiding work in close proximity to the existing interceptor, in order to prevent damage during construction.
- Selecting the elevation of the new interceptor to ensure that the microtunnel is driven through ground conditions that the Microtunneling Boring Machine (MTBM) can control and that provide adequate support for the MTBM and the new interceptor.
- Selection of an interceptor pipe material that is resistant to corrosion.
- Staging construction in a manner that is acceptable to the community and NHSA, maximizing benefit while minimizing short- and long-term environmental, recreational, and community impacts.
- Ability to quickly move through the design and construction phases, recognizing the risks posed by the deteriorated condition of the existing interceptor and pumping station.
- Project constructibility and ability to attract bidders, while meeting budget and schedule requirements.

UNIQUE ASPECTS OF TUNNEL DESIGN

Tunnel excavation is a linear process. It begins at the launch shaft and ends at the retrieval shaft. The goal of all tunnel contractors is to complete the excavation as quickly as possible. Estimating the rate of excavation is critical to having a successful bid. Problems develop when the rate of advance expected by the contractor is not achieved. Unlike other types of construction, there is virtually no opportunity for the contractor to use his forces on other aspects of the project. The contractor cannot begin lining the tunnel or installing the carrier pipe within the tunnel until tunnel excavation is complete.

Hazen's team of tunnel engineers, Mike Robison, Josh Farmer and Wojciech Klecan, have decades of experience with design and construction of tunnels and microtunnels. We understand what can go wrong on tunnel projects and because of that knowledge, we perform geotechnical investigations, prepare designs, and write contract documents that address construction risks and maximize the likelihood of project success.

Hazen has extensive experience installing FRP on a variety of projects, and can leverage this experience for NHSA.

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Pumping Station

Hazen will deliver a cost-effective, realistically-phased and maintenance-friendly pumping station through the proper evaluation and selection of key pumping station design elements. While there are many decisions and factors that make a pumping station effective and maintenance friendly, of particular importance are facility layout for near- and long-term access, wet well design, appropriately planned electrical control components, pump protection and optimization of available space. Hazen's extensive pumping station experience will be brought to bear on this facility's evaluations and design, and most importantly will reflect the input and preferences of the Authority's engineering, operations and maintenance personnel.

The Hazen team has extensive large pumping station experience that can be utilized on this assignment to develop a feasible, robust and resilient solution

The Hydraulic Institute has several recommended wet well arrangements for solids bearing liquids that we will base our design around but for a pumping station this size, we will also look for innovative ways to achieve proper flow distribution and pump inlet conditions. Hazen has been able to accomplish this using our extensive experience in complex pumping station design in combination with CFD and physical modeling. The Two Rivers Water Reclamation Authority (TRWRA) Main Pumping Station incorporated this approach when we developed a sound wet well arrangement and worked with Clemson Engineering Hydraulics to develop a physical model that allowed us to make minor changes for better flow distribution and achieve a Hydraulic Institute compliant wet well.

Pump Selection

The number and type of pumps selected is also extremely to overall pumping station functionality and needs to be considered in conjunction with wet well arrangement. Hazen has significant experience in optimizing the number of pumps and type to provide proper pumping station performance while considering the downstream implications of the pumping station's operations. Hazen will review all possible pump types and arrangements that will meet the required hydraulic performance while minimizing the facility's size and provide acceptable flows into the treatment process.

Screening for Pump Protection

Pump protection is another vital component to a pumping system, particularly with large diameter sewers that are capable of conveying large material to the pumping station. Hazen has experience will all types of course mechanical screens and will apply this experience to select the proper screen and bar spacing that protects the pumps and the WWTP Headworks but does not produce an excessive amount of screenings to handle. In addition, we will use our significant screenings handling experience to convey and contain screenings for removal, while minimizing operations and maintenance and the need for extensive above grade facilities.

FEMA BRIC Applications

Hazen anticipates preparing required project and technical input inclusive of application while the NHSA Grant Management Company lead will be preparing the FEMAGo application. We anticipate the following general requirements being necessary from Hazen for submission of this application:

- A description of the tasks needed to accomplish the proposed activity as well as any required procurement.

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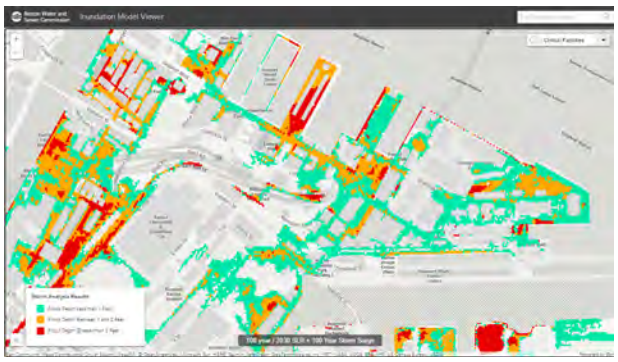
- A description of how the proposed activity aligns with the current mitigation plan.
- The outreach and engagement plan (if applicable) and an accounting of the time and effort it may take to incorporate public and stakeholder feedback.
- The goals of the project scoping/advance assistance activity and specific deliverables.
- The steps the NHSA will follow to complete the project scoping/advance assistance activity and proposed deliverables. The scope of work should identify a deliverable that includes required information to determine eligibility under FEMA Hazard Mitigation Grant Program (e.g., engineering, cost-effectiveness and environmental and historic preservation data, cost estimate, project schedule, design plan or specifications).
- A description of the deliverables, tasks, and schedule.
- Cost estimate – we will identify and incorporate expenditures incurred prior to submission as "pre-award" so those costs can be reimbursed if awarded.

This task will include Hazen Team support for the preparation, submission and coordination required to submit the FEMA BRIC application via the NHSA's Grant Management Company.

Hydraulic Modeling



Example 2D Street Flooding Hydraulic Model

Collaboration and coordination throughout the life of the project is key to successfully identifying the best solutions for this critical project. The Hazen Team thoroughly understands the hydraulic modeling requirements of the project. We will coordinate with the Authority staff on the existing and proposed conditions for modeling runs required to decide simulation scenarios, map potential street flooding, determine the size and type of regulators required, and to maximize potentials of H1 and H5 wet weather pumping stations. Hazen will use the updated model to determine if a connection to the Grand Street Interceptor is required at 15th Street with the new High Level Storm Sewer System installed in the H6 and H7 drainage areas. We will also use the updated hydraulic model to finalize the size and number of pumps that will be required at the Grand Street Pumping Station.

In addition, we understand that this project would achieve the target percent capture of CSO overflows while also addressing flooding issues throughout Hoboken. The existing model for the collection system is 1D model which only provides potential floodings at manholes. To accurately represent street flooding, an integrated 1D/2D model is required, which simulates flow movement above grade at street level. The integrated 1D/2D model will not only address the combined sewer surcharging and flooding, but also tidal conditions overtopping seawalls.

Feasibility Report and Cost Estimate

Hazen will draft a Feasibility Report to document the outcome of the Tasks 1 and 2 activities. A Class 4 construction cost estimate will be prepared to help determine the required funding for the project based upon the feasibility investigation. The construction cost estimate will use the process flow diagrams, proposed pumping station layout and mechanical equipment list, as well as other information developed in Task 2 to provide NHSA with the ability to determine the viability of the project. A review meeting will be held with NHSA to answer any questions and get comments for the final version of the report.

Task 3 - Basis of Design

Using the Feasibility Report as a basis, the Hazen Team will then begin to develop a concept for the design of the interceptor and pumping station. These concepts will be formalized in a Basis of Design Report to lay the groundwork for the detailed design phase and help further understand the anticipated construction costs.

Proposed Interceptor Alignment

The proposed interceptor alignment will be plotted with drop shafts and regulators located and profiles developed. A list of potential conflicts will be developed to highlight for potential relocation. The proposed regulators will be sized and type selected to maintain flow through the system while providing additional storage capacity to help alleviate flooding in Hoboken. An analysis will be performed to determine the size and type of pipe for the alignment.

Utility Conflicts

From experience on similar type projects, our design documents will include provisions for the contractor to perform test pits (i.e., type, number, designated locations, etc.). This will be defined as initial construction task to ascertain the exact location of utilities in potential conflict since utility as-built drawings accuracy is also unknown.

Maintenance of Plant Operations (MOPO)

The logistics of constructing a subsurface structure and pipeline in a densely populated urban setting can be challenging. Spatial restraints, traffic control, restricted working hours, and limited lay-down area make for difficult construction. To facilitate the construction of the new interceptor and pumping station, Hazen will draw upon our past experience and knowledge of current market conditions to develop an example MOPO plan and associated specification to help guide the Contractor in the development of their own MOPO plan for construction. Careful planning will help make the construction phase of the project go smoother, keep NHSA operations active, and reduce disruption to the local community in Hoboken.

Construction in an urban setting presents unique challenges that a well developed MOPO plan can help mitigate ahead of the first shovel hitting the ground

Grand Street Pumping Station

Hazen will design the pumping station wet well to minimize solids deposition within the wet well and provide proper pump operation in accordance with the Hydraulic Institute (HI) Section 9.8. We have experience designing all wet well arrangements recommended by HI, including self-cleaning trench style arrangement, confined inlet arrangement and the rectangular baffle wall arrangement. Hazen recommends evaluating all types following selection as some arrangements are more effective with certain pump types. We will also ensure our pumping station design minimizes cycling. We have achieved this in several locations by properly designing high and low flow pumps and confirming there are no gaps in the overall pumping envelope.

Our design will prevent surcharged conditions in the influent interceptors, even at peak flow conditions. The pumping station will also be equipped with other ancillary equipment as well as pump protection measures,

which will be evaluated further once the pumping station depth is finalized. Under normal conditions, variable speed drives will operate the pumps while maintaining a level in the wet well. We recommend including reduced voltage soft starters with the drives to run the pumping station in bypass mode using floats in the event the PLC is offline.

A backup generator above the FEMA flood hazard elevation will be included in the design that will be capable of operating the pumping station at firm capacity. Due to potential odors from the pumping station wet well and screening structure, we recommend vapor phase odor control, sized to treat between six to twelve air changes per hour. We will perform a cost evaluation of the different vapor phase treatment technologies based upon the current concentration of odorous compounds and provide recommendations. Liquid phase odor control will also be considered but it is not likely to be as effective for the pumping station due to the required reaction times but could be considered for odor abatement in the discharge force main.

BODR Report and Cost Estimate

Hazen will draft a Basis of Design Report to document the outcome of the Task 3 activities. A Class 3 construction cost estimate will be prepared to help determine the construction costs with a greater degree of accuracy. The construction cost estimate will use the conceptual design documents to help develop a project time line and take into account current materials and equipment lead-times. A review meeting will be held with NHSA to answer any questions and get comments for the final version of the report.

The Basis of Design Report will present the best solution for the Grand Street interceptor alignment and pumping station that provide necessary improvements to the collection system while helping mitigate flooding in Hoboken and fitting the goals of the Authority.

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Project Team

Our experienced, local management team is supported by experts in all areas of wastewater infrastructure projects, including pumping stations, CSO collection, conveyance and treatment, and microtunneling, to provide NHSA with the greatest value and a unique perspective on facility and infrastructure design and construction.

Hazen has assembled a team that brings the requisite depth of experience to solve the challenges posed by this project. Leveraging this national experience, which covers all aspects of the scope, will provide NHSA with the same successful outcomes. Throughout the remainder of this section we will detail specific elements of our Team's experience that we believe are critical to project success.

Open, proactive communication and transparency are a hallmark of our project management team. For NHSA, the proposed Project Manager and key staff assigned will be involved until project completion. Our ultimate goal is to provide NHSA with the best personnel and accurate current information for every project detail. Keeping our clients informed and in the know is key to our commitment to providing industry leading value.

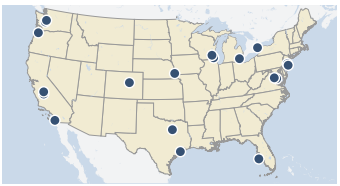
Key Personnel

As shown on our organizational chart on the following page and demonstrated throughout this proposal, **Hazen has assembled a highly capable engineering team prepared to deliver high-quality and responsive service to NHSA.**

Our assembled team structure reflects NHSA's needs:

- Having successfully delivered contracts of similar scope on time and within budget, our proposed Project Manager, Bill Gettings, has the experience and knowledge to effectively lead our proposed team to meet NHSA's goals for this assignment.
- Highly experienced technical leaders, specialized in the wastewater treatment process, and all aspects of the NHSA collection and treatment process.
- A deep bench of engineers and discipline leads who will be instrumental to the effective execution of the scope of work and tackle NHSA's engineering challenges.

Our Understanding of the Microtunnel Boring Machine (MTBM) Market Adds Value



MTBM Contractors List

Bradshaw	Eldersburg, MD
BRH Garver	Houston, TX
BT Construction	Henderson. CO
Coluccio	Seattle, WA
Cruz Contractors	Colts Neck, NJ
Earth Boring Co.	Ontario, Canada
Fowler	Dallas, Oregon
Huxted	Palmetto, FL
JayDee	Livonia, MI
JR Cruz	Aberdeen, NJ
Kiewit	Omaha, NE
Michels	Brownsville, WI
Nada Pacific	Caruthers, CA
Northeast Remsco	Farmingdale, NJ
Northwest Boring	Woodinville, WA
SECA Underground	Baltimore, MD
Southland	Roanoke, TX
Super Excavators	Menomonee Falls, WI
Vadnai Trenchless Services (Primoris)	Vista, CA
Walter C. Smith	Clovis, CA
Ward & Burke	Ontario, Canada

We have worked with a variety of contractors across the country on many tunneling projects. Our approach for specifying contractor services is **non-prescriptive to ensure that the best techniques and equipment are used for installation while factoring market conditions to obtain the best price possible.** The least risky method of installation, at the best price possible, will help ensure overall project success.

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Organization Chart

Grand Street Interceptor and Pumping Station Feasibility and Basis of Design

Subconsultants

▲ French & Parrello Associates (Wall Township, NJ)

Key staff

PROJECT MANAGER
William Gettings, PE, MBA, BCEE

Technical Advisors
Charles Wilson, PE *(Interceptor)*
David Nailor, PE *(Pump Station/Hydraulics)*

Tunneling Design

TUNNELING DESIGN LEAD
Michael Robison, PE

- **Tunneling Design**
  Joshua Farmer, PE
- **Tunneling Geotechnical/GBR**
  Wojciech Klecan, PE

Pumping Station/Interceptor Design

PROJECT SUPPORT DESIGN LEAD
Kevin Haney, PE, BCEE

- **Civil**
  Dan Sheeran, PE
- **Permitting Specialist**
  ▲Bahram Farzaneh, PE, PP
- **Geotechnical**
  ▲Rob Knotz, PE

PUMP STATION, FORCE MAIN, & INTERCEPTOR DESIGN LEAD
Brian Porter, PE

- **Hydraulic Capacity Review/CFD Modeling**
  Don Tian
- **Interceptor/Design**
  Nichole Johnson, PE
- **Odor Control Specialist**
  Richard Pope, PE BCEE

SUPPORT STAFF

Tunneling/Pipeline
Kimberly Hanson, PE

Architectural
Bill Russell, AIA, LEED AP

Landscape Architect
Liz Moskalenko

Structural
Christopher Phillips, PE

Mechanical
Nicholas Bowen

Electrical/I&C Lead
George Markou, PE

HVAC/Plumbing/Odor Control
Marc Giordano, PE

Safety
Jared Lewis, CSP

Cost Estimating
Rose Jesse, CPE, ENV S

Risk Integrated Project Scheduling
James Soroush

IBank/FEMA Bric Coordinator
Ruby Wells

Operations Specialist
John Fortin, PE

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Project Manager

William Gettings, PE, MBA, BCEE

As Project Manager, Mr. Gettings will leverage his experience in design and construction services, as well as his expertise in wastewater treatment facilities and pumping station reconstruction. Mr. Gettings has successfully managed numerous pumping station projects from facility planning through construction for public and private clients throughout New Jersey and New York. Projects have included planning, budgeting, design with resiliency features, technical evaluation, operations support, regulatory compliance, scheduling, and construction management. **His portfolio of work includes serving as Project Manager on multiple projects for NHSA involving similar scope of services as anticipated under this Contract, as well as the TRWRA's Pleasure Bay Project.** As NHSA's point-of-contact, Mr. Getttings will ensure that all project elements are executed on schedule and budget. His extensive project management experience and commitment to NHSA will facilitate open and proactive communication.

William Gettings, PE, MBA, BCEE, Assoc. DBIA

Areas of Expertise
Wastewater
Hydraulics
Pumping stations
CSO facilities
Collection system interceptors

Tunnel Design

Michael Robison, PE | Tunneling Design Lead

As Tunneling Design Lead, Mr. Robison will play a key role in the success of this project, bringing insight gained from delivering large, complex tunneling and underground projects for over four decades. He has a proven history of proactively managing risks by incorporating solutions during the design phase. He will draw on his extensive portfolio of work, which includes a recent project in which he is managing the design of a large CSO tunnel project in St. Louis that featured a 9-mile long tunnel with 34 intake structures and a cavern-style pump station. Mr. Robison also worked closely with Mr. Gettings on the TRWRA's Pleasure Bay project. **He has a breadth of experience in designing water and wastewater tunnels, specializing in the selection of shaft sites, tunnel alignments, and assisting with permits.** Having also served as resident construction manager and field engineer, he understands the challenges a project of this scale poses.

As one of the industry's top tunneling experts, Mr. Robison will leverage his insights from solving tunneling challenges for projects of similar scale.

Joshua Farmer, PE | Tunneling Design

Specializing in the design and construction of municipal conveyance projects, Mr. Farmer serves as Hazen's Conveyance/Tunneling and Boring Corporate Practice Group Lead. **He has facilitated the design and construction of several hundred thousand linear feet of gravity sewer and force mains, and is experienced in risk mitigation strategies for tunneling projects, including working with Mr. Gettings and Mr. Robison on the TRWRA's Pleasure Bay project.** His technical areas of focus include mechanized tunneling and boring installation methods, geotechnical evaluation, buried infrastructure design such as pump station

Mr. Farmer's expertise in tunneling and boring will serve as a valuable resource in mitigating risks during design.

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hydraulics, and analysis and recommendation of pipe materials and coatings for water and wastewater projects. He has also participated in and led high-profile projects, providing expertise to utilities as well as the public to address concerns about routing.

Wojciech Klecan, PE | Tunneling Geotechnical/GBR

Mr. Klecan is a recognized expert in tunneling and geotechnical engineering, with 42 years of experience on water, wastewater, and mass transit tunnel projects across the globe. He has coordinated the work of large multi-disciplinary teams, serving as the Design Manager and Technical Lead for the design of underground facilities, geotechnical investigations, tunnel system hydraulics, and preparation of contract documents. He has managed the underground designs of four sewer tunnels in St. Louis, ranging from a $20 million force main tunnel to a $500 million CSO tunnel. He has worked on the $5 billion Lesotho Highlands Water Project for a 14-mile long, 16-foot diameter tunnel. Later, **he was part of the Channel Tunnel Project, working as design team leader for the United Kingdom Undersea Crossover and Undersea Pumping Stations.** He was also a key member of Hazen's TRWRA Pleasure Bay project. His extensive work in the design of underground structures and in dealing with a variety of ground conditions will prove highly valuable to this project.

Mr. Klecan's experience on difficult tunneling and geotechnical projects will facilitate decision making and efficient project execution.

Pump Station / Interceptor Design

Kevin Haney, PE | Project Support Design Lead

Mr. Haney, a licensed New Jersey PE, has 38 years of experience successfully managing water and wastewater design and construction projects. He has supported projects during the construction period as the Owner's engineer, served as the Construction Manager on design-build construction projects, and worked as a field superintendent in charge of scheduling the various trades. He was also a key member of Hazen's TRWRA Pleasure Bay project. In each position, **he has ensured quality control, maintaining continuous work flow, commissioning, and on-site client relations.** He will leverage his significant field experience in facility operation to produce designs that minimize disruption of facilities during the construction period.

As a true "hands-on" engineer, Mr. Haney produces designs that meet client objectives, while keeping project on schedule and budget.

Brian Porter, PE | Pump Station/Interceptor Design Lead

Mr. Porter brings experience in all facets of large pump stations, including studies, design and/or construction administration roles. His career spans nearly 25 years with hands-on experience directly relevant to the pump station and force main design and construction scope items on this project. His extensive portfolio of over 20 pumping station projects with capacities up to 250 mgd includes: the Deer Creek Raw Water PS (250 mgd), Neuse River RRF Influent PS (150 mgd), Western Wake PS (60 mgd), West Cary PS (40 mgd), Rivanna PS (53 mgd), and Moores Creek PS (32 mgd). As Project Manager for the relocation and upgrade of the Rivanna Pump

With a proven track record of managing multi-discipline design and construction teams, Mr. Porter delivers projects with a collaborative "can do" work ethic.

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Station (RPS) from 25 mgd to 53 mgd, his management was instrumental to ensuring maintenance of operations throughout this $25 million project. He was also a key member of Hazen's TRWRA Pleasure Bay project. This allowed for trouble free tie-ins and streamlined force main construction through a 1,600 lf hard rock tunnel. **He is committed to delivering a pump station with the smallest possible footprint, lowest operating and capital cost, while also ensuring redundant and reliable operation.** Leveraging his comprehensive technical expertise and commitment to client satisfaction, he will ensure the design and construction of the pump station and force main goes smoothly for NHSA.

Nicole Johnson, PE | Interceptor Design

Ms. Johnson has dedicated her career to water and sewer conveyance projects. Her experience includes routing studies and design for water mains, force mains, and sewer interceptors as well as sewer system evaluation and rehabilitation. She has served as design team leader and project manager on over 435,000 lf of pipeline conveyance projects. With meticulous organization and attention to detail, her practical approach to project management and design results in efficient and cost-effective projects. **Her experience includes evaluation, design, permitting and construction administration on a wide range of conveyance projects from distribution main replacement in residential areas, to large diameter transmission main routing through high traffic commercial districts, as well as cross country force main design and large diameter sewer interceptor rehabilitation.** Her extensive portfolio of work includes transmission main projects that have required route development and evaluation, hydraulic modeling, limited subsurface utility engineering and geotechnical evaluation, and cost opinion. She was also part of the TRWRA's Pleasure Bay Project.

With similar interceptor and force main design and construction experience, Ms. Johnson will be instrumental in ensuring a reliable wastewater system for NHSA.

Availability of Key Personnel

Hazen has reviewed the RFP requirements and is committed to providing the necessary key personnel as well as other required resources to provide the services outlined herein. We guarantee the availability of our key personnel throughout the duration of the design and construction of this project, and that the participating key personnel in this submittal will not be changed unless approved by NHSA.

William Gettings, PE, MBA, BCEE
PROJECT MANAGER
20% available

Michael Robison, PE
TUNNELING
DESIGN LEAD
10% available

Kevin Haney, PE
PROJECT SUPPORT
DESIGN LEAD
30% available

Brian Porter, PE
PUMPING STATION/INTERCEPTOR
DESIGN LEAD
30% available

Joshua Farmer, PE
TUNNELING DESIGN
15% available

Wojciech Klecan, PE
TUNNELING GEOTECHNICAL/GBR
20% available

Nichole Johnson, PE
INTERCEPTOR DESIGN
40% available

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Experience & Qualifications

Hazen has long been at the forefront of wastewater collection and transmission, maintaining the industry's top expertise in hydraulics, tunneling, and pump station design and construction.

Firm Background

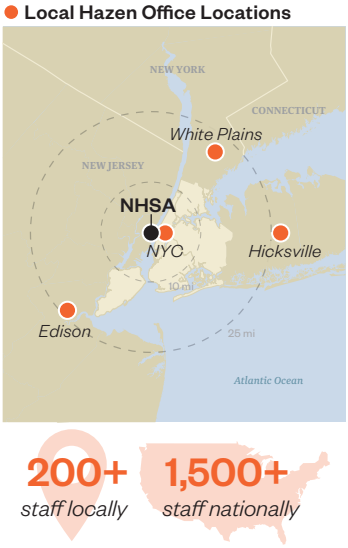
Hazen is a nationally-based, locally-focused environmental engineering firm dedicated to solving, simplifying, and delivering large complex wastewater projects in a collaborative manner. We provide a depth of technical experience and expertise that allows us to fully support our clients' needs through the planning, design, and construction of projects large and small. Hazen's culture promotes the stewardship of our client's most valuable resources - time and money, while also fostering innovation, streamlined delivery, and cost efficiency.

As a nationally recognized industry leader, Hazen operates at the forefront of technology and innovation, and will provide NHSA with a team of highly qualified industry leaders in pumping stations, tunneling, and geotechnical work, among others. These are seasoned engineers and engineering managers who have hands-on knowledge of the latest tools and technologies and are adept at helping select the most appropriate, cost-effective solutions to any challenge. We have assisted utilities across the country in microtunneling and pumping station design, using a portfolio of custom options to suit each client's particular needs. We utilize customized models during planning and design to maximize the return on investment from the solutions we recommend, and with advanced project management tools we can ensure delivery of finished facilities that satisfy client budget and schedule objectives. With extensive experience in delivering projects with similar challenges as well as decades of combined expertise, the Hazen team is qualified and committed to developing the most efficient, resilient, and cost-effective alternatives and solutions for this project.

Hazen is Structured for Success

This project requires an engineering firm who has a holistic understanding of all aspects of the project, from the geotechnical and structural challenges of the subgrade interceptor alignment along Grand Street to the hydraulics capabilities and requirements of the pumping station. This project — infrastructure hardening and maintaining the reliability of NHSA's wastewater system — is at the core of Hazen's business.

National Resources, Local Expertise



Hazen offers a wealth of local and national resources who have expertise in NHSA's project facets. We are committed to providing NHSA with the right resources who will ensure responsive service and successful project delivery.

Hazen has the experience and qualifications to evaluate all facets of this project, from resiliency, to redundancy, community impacts and benefits, as well as operational efficiencies, delivering a project that meets all of NHSA's goals.

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Effectively executing this work requires extensive resources, in-depth knowledge of the market conditions, proven technical expertise, and an **understanding of NHSA's needs and risk tolerance.** These characteristics are indicative of the Hazen team assembled for this contract, structured for success.

Hazen offers the right balance of specialized national resources and expertise, and familiarity with NHSA. As a valuable resource, we will be able to efficiently execute work, deploying staff with the skills to ensure the optimal outcome. As a firm with a sole focus on water, all of our technical staff are highly qualified, with expertise that is directly relevant to the project scope.

Our ability to reason through risks to deliver sound solutions will facilitate the development and implementation of a resilient design that provides long lasting benefits to NHSA and its customers. More importantly, our team understands the significance of this contract and is committed to ensuring that NHSA meets the needs of the community while protecting assets that are important to everyday life and environmental quality within Hoboken.

Subconsultants

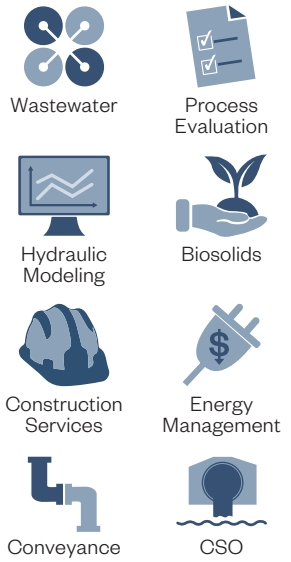
The complexity and critical nature of this project will require extensive and varied resources to ensure the best possible outcome for NHSA. As such, we have supplemented our team with our specialty subconsultant, **French & Parrello Associates (FPA), who has successfully worked with Hazen on numerous geotechnical projects in New Jersey,** including the TRWRA Pleasure Bay Crossing and Main Pump Station Replacement and PVSC Decant Facility Rehabilitation, among others. FPA will apply their extensive project experience, as well as their direct previous work collaboration with Hazen, to lead the geotechnical investigation/analysis and obtain the necessary permits for this project.

Spotlight Projects

In accordance with RFP requirements, we have selected three reference projects that highlight our experience with projects of similar scope, size, and complexity. These projects represent complex, large scale efforts and exemplify Hazen's ability to not only efficiently execute critical multifaceted projects, but to also manage risk at all levels. From design, construction, and program management, Hazen works efficiently with our clients, and when required, our team facilitates close collaboration with all stakeholders, including the community and regulatory agencies.

In the following pages we have included project sheets that provide details about our spotlight projects, team members and references.

Hazen's
Areas of Service



Wastewater Treatment Process
Pump Stations
Hydraulic Analysis
Microtunneling
Combined Sewer Overflow
Biosolids Management
PM/CM
Resiliency / Sustainability
Asset Management
Environmental Planning & Permitting

Hazen

We have partnered with a highly qualified subconsultant to supplement our Team and provide reliable coverage for the necessary scope items under this critical contract.

FPA FRENCH & PARRELLO ASSOCIATES

Geotechnical/Survey/ Environmental Permitting

French & Parrello Associates (FPA) has successfully collaborated with Hazen on a number of geotechnical and permitting projects in NJ. Similarly, FPA will provide NHSA with continued technical excellence and responsive service. FPA also offers the additional benefit of being locally based.

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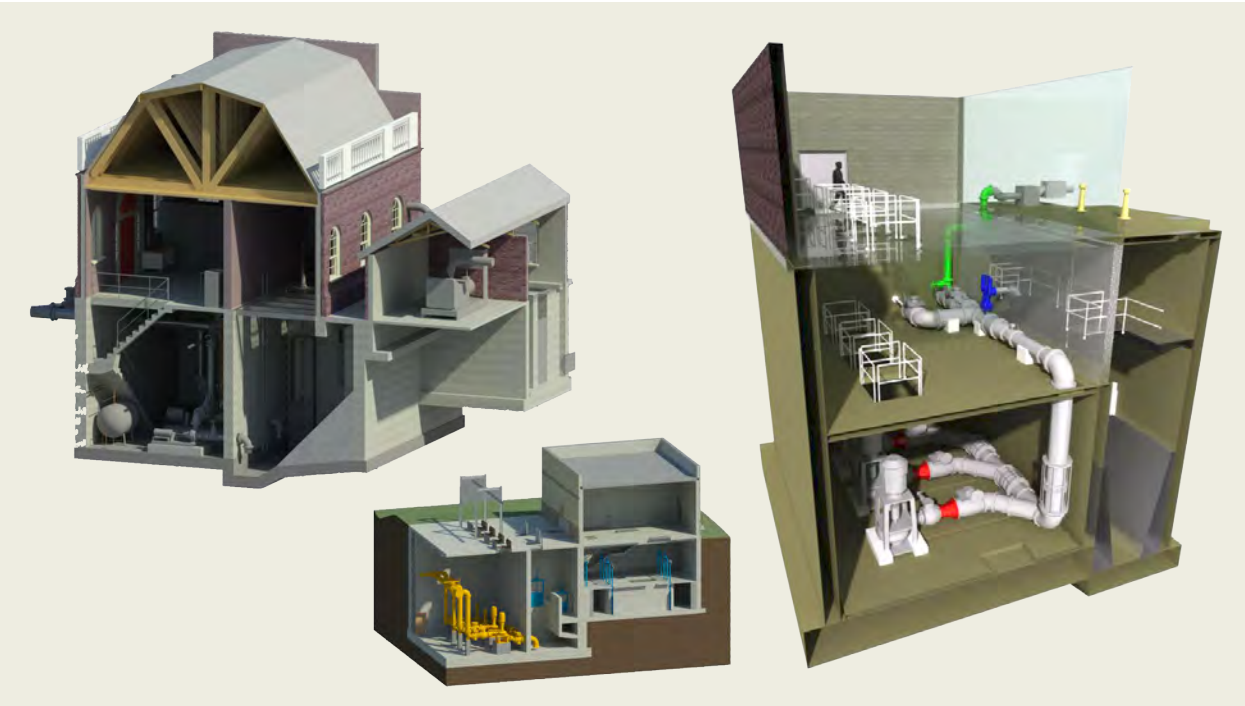
We Know How to Deliver Large Pump Stations

Hazen has successfully completed over 180 wastewater pump station projects ranging in size from .25 to over 400 mgd, and leveraged different technology, including BIM, to successfully deliver these projects. We have featured a selection of our large pump station experience along examples of some of the BIM models we have created.

Hazen's Large Wastewater Pump Station Experience

Project Name	Client	Capacity (mgd)	Pump Type
Newtown Creek - Brooklyn Queens PS	NYCDEP, NY	400	Vertical Non-Clog, Extended Shaft
Manhattan PS	NYCDEP, NY	400	Vertical Non-Clog, Extended Shaft
Bowery Bay Upgrade - Phase I	NYCDEP, NY	300	Vertical Non-Clog
Gowanus Canal PS	NYCDEP, NY	300	Submersible
Main St Pump Station	DC Water, DC	240	Vertical Non-Clog, Extended Shaft
Little Falls Pump Station	USACE, Baltimore, MD	225	Vertical Non-Clog
Walnut Creek PS	City of Raleigh, NC	200	Vertical Non-Clog
TRWRA Pleasure Bay Crossing and Main Pumping Station	Monmouth Beach, NJ	50	Submersible



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PROJECT SPOTLIGHT 1

TRWRA Pleasure Bay Tunnel Crossing and Main Pump Station Replacement

Two Rivers Water Reclamation Authority, Monmouth Beach, NJ

Hazen was selected by the TRWRA to design and perform construction management services for its Pleasure Bay Crossing and Main Pump Station Replacement project.

The Pleasure Bay Crossing and Main Pump Station Replacement is a large and critically important project for TRWRA, intended to replace two components: the 50-year old Pleasure Bay Interceptor (PBI) and the offsite 50-year old Main Pump Station (MPS), which convey flows to the TRWRA WWTP. Presently, both of these aging facilities are susceptible to failure, exhibiting internal corrosion, sagging, buildup of slime, and surcharging, all of which present risks to TRWRA's achievement of reliable wastewater service. There are additional risks should the pipeline or pump station fail, with ramifications that would be detrimental to the marine ecology of Pleasure Bay. TRWRA plans to increase the capacity of the MPS to 50-mgd to accommodate a growing community with increased wastewater flow in its service area.

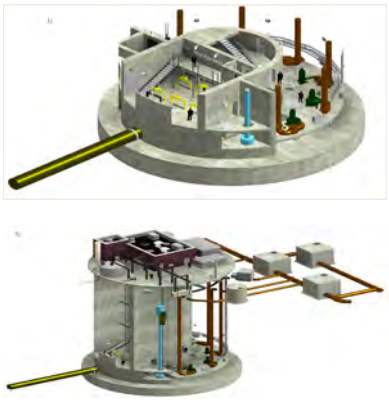
The new PBI will convey sewage flow beneath Pleasure Bay from a new intake and vortex drop structure located at Sommers Park in the Borough of Oceanport to a new MPS that will be constructed within the TRWRA WWTP fence line near the existing Sludge Dewatering Building. Construction improvements and MOPO will be managed by Hazen and is currently scheduled to be completed in 2026.

Project Highlights

- Open-Face Tunnel Boring Machine
- BIM 360 3D Design
- Subsurface Geotechnical Investigation

Construction Completion: 2026

Total Fee: $6 million



New Main Pump Station BIM 360 3D Design

Project Relevance

- Pumping Systems
- Tunneling and Conveyance
- Hydraulic Modeling and Analysis
- Maintenance of Plant Operations (MOPO)
- Full Service (Planning, Design and CM)
- Assisted TRWRA in obtaining $20M FEMA Hazard Mitigation Grant

Core Project Team

William Gettings, PE, MBA, BCEE, Assoc. DBIA
Project Manager

Kevin Haney, PE, BCEE
Process Mechanical

Reference

Michael Gianforte
Executive Director
Two Rivers Water Reclamation Authority
1 Highland Avenue
Monmouth Beach, NJ 07750
(732) 229-8578 ext. 16

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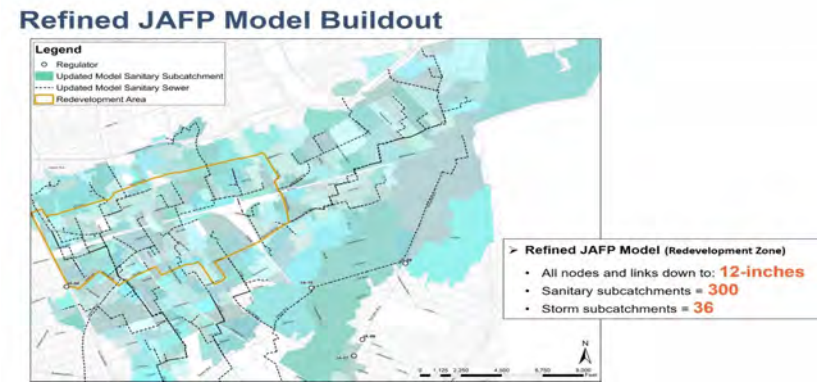
PROJECT SPOTLIGHT 2

Jamaica WRRF Drainage Area Facility Planning

New York City Department of Environmental Protection, Queens, NY



The Jamaica Redevelopment Zone, spanning over 1,770 acres in Southeast Queens, will create new business and residential districts that will increase sewage flows to the Jamaica Wastewater Resource Recovery Facility (WRRF). The Jamaica Redevelopment Zone is expected to generate 13 mgd of new sanitary flow under full buildout conditions. The area is currently served by three sanitary trunk sewers that convey flow to the Jamaica WRRF and are somewhat capacity limited; therefore, additional conveyance is needed to handle the new flows that the Jamaica Redevelopment Zone will generate.

The Jamaica WRRF Drainage Area Facility Planning study presented an opportunity to assess the current flow conditions in this area and to evaluate additional conveyance options to accommodate the increased sewage flows associated with the redevelopment. As part of the project, the Hazen team worked to evaluate strategic and synergistic drainage management solutions to Southeast Queens, in close coordination with the Jamaica Bay Long Term Control Plan (LTCP).

Hazen initiated this effort by performing an existing conditions assessment of the Jamaica Redevelopment Zone and adjacent areas, which consisted primarily of a review of available existing data. Concurrently, a hydraulic modeling effort was initiated, and existing data was integrated into the hydraulic model. The InfoWorks CS model developed for the Jamaica Bay LTCP served as the starting model; it was built out and refined to provide additional detail near the Jamaica Redevelopment Zone.

Upon review and integration of the existing data, flow metering was then performed within the existing sanitary sewer network to quantify the amount of flow currently being generated near the Jamaica Redevelopment

Project Relevance

- Facility Planning
- Drainage Analysis
- NYCDEP Coordination

Core Project Team

Don Tian
Hydraulic Modeling

Reference

Steve Elie-Pierre, PE
Accountable Manager
Bureau of Engineering Design and Construction
(718) 595-6070
selie-pierre@dep.nyc.gov

Matthew Osit, PE
Portfolio Manager
Bureau of Engineering Design and Construction
(718) 595-6077
mosit@dep.nyc.gov

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Zone, to gain insight into the conditions of the three existing trunk sewers serving the area, and to support calibration of the InfoWorks model. Sewer inspections were then performed at several locations adjacent to the Jamaica Area Redevelopment Zone and the sanitary sewer network accommodating flows from this area. The flow monitoring, sewer inspection, and hydraulic modeling tasks informed an understanding of the existing capacity limitations of the sewer network so that alternatives could be tailored to meet these needs.

Given the prior history of drainage concerns and sewer infrastructure limitations in this area of Southeast Queens, the provision of additional wastewater conveyance capacity has always been envisioned for this region. This project presented an opportunity to evaluate the needs of the redevelopment plan, along with the capacity limitations of the three main sanitary trunks serving the area, and to develop alternatives that could provide synergistic benefits to both. To verify the most cost-effective and expeditious approach, various metrics were factored into comparison of the conveyance alternatives, including, but not limited, to 100-year life cycles costs, constructability, and expediency.

Project Highlights

- LTCP
- Hydraulic Modeling
- Conveyance Alternative Evaluation

Construction Completion: 2018

Total Fee: $1.5 million

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PROJECT SPOTLIGHT 3

New Rivanna Pump Station and Interceptor Tunnel Project

Rivanna Water and Sewer Authority,
Charlottesville, VA

Hazen and Sawyer provided design and construction administration services for the new 53-mgd Rivanna Pump Station at the Moores Creek WWTP (to replace an old pump station) and a 60" interceptor extension, including a 1,700 LF deep rock tunnel.

The Tunnel was installed by Tunnel Boring Machine (TBM) and has an excavated diameter of 7'-5" supported by steel rings and lagging. The 60" ID fiberglass reinforced carrier pipe inside the tunnel will carry sewage flow from the vicinity of the old pump station to the WWTP.

The new Rivanna Pump Station and Interceptor Tunnel Project is located within a mixed residential/industrial historical area adjacent to the Rivanna River and the project included a challenging and comprehensive public participation effort led by Hazen and Sawyer and the Clay Christenson Group.

Innovative Solution to a Challenge - The contractor was concerned with completion requirements due to backfill restrictions in the contract for the 60' deep pump station.

Hazen's structural team worked with the geotechnical engineer and contractor to modify backfill requirements and allow the project to be completed on time.

Project Highlights

- Interceptor Tunneling
- Large Pumping Station
- Getechnical Investigation

Construction Completion: 2017

Total Fee: $24.1 million

Project Relevance

- Pumping Station
- Tunnel Installation
- Structural Analysis

Core Project Team

Brian Porter, PE
Project Manager

Christopher Phillips, PE
Structural

Reference

Jennifer Whitaker, PE
Chief Engineer
Rivanna Water and Sewer Authority
695 Moores Creek Lane
Charlottesville, VA 22902
(434) 977-2970 ext. 104

1010-809

Schedule

The Hazen Team will work closely with the Authority to develop a work plan that will use parallel paths to meet the prescribed schedule provided in the RFP. Our extensive local experience and resources will allow the rapid deployment and execution for the field work. This, in turn, will allow for the engineering evaluation and feasibility determination to be expedited and a conceptual design developed within the allotted timeframe.

Hazen has reviewed the proposed project schedule provided in the RFP. We will develop a work plan that can meet NHSA's anticipated timeline for the project barring delays associated with any unforeseen circumstances, including regulatory review times or drilling/boring operations. Field investigations are anticipated to be performed at approximately one (1) boring per day. The table below shows the anticipated project schedule.

		2023							2024	
TASK	DESCRIPTION	J	J	A	S	O	N	D	J	F
	Notice of Award	◆								
TASK 1	Information Gathering and Location Assessment		▬	▬						
TASK 2	Feasibility Study				▬	▬	▬			
TASK 2A	FEMA BRIC Grant Application						◆			
TASK 3	Basis of Design Report							▬	▬	▬

1010-809

Cost

Please note that costs for engineering inspection and analysis have been included in addition to the allowance for geotechnical and environmental testing per Addendum No. 1. Our monthly invoicing will be based upon time incurred and hourly loaded rates on a time and materials basis.

North Hudson Sewerage Authority
Feasibility Study and Basis of Design Services
Hoboken Grand Street Interceptor and Pump Station
June 6, 2023

	Employee		William Gettings	Charles Wilson	David Nailor	Michael Robison	Joshua Farmer	Wojceich Klecan	Kimberly Hansen	Kevin Haney	James Soroush	Jared Lewis	Rose Jesse	Sean Hooper	Ruby Wells	John Fortin	Brian Porter	Don Tian	Nichole Johnson	Phil Selesker	Richard Pope	Bill Russell	William Dunn	Dan Sheeran	Jon Rivas
	Position		Project Manager	Technical Advisor - Interceptor	Technical Advisor - Pump Station/ Hydraulics	Tunneling Design Lead	Tunneling Design	Tunneling Geotechnical/ GBR	Tunneling/ Pipeline	Project Support Design Lead	Risk Integrated Project Scheduling	Safety	Cost Estimating Lead	Cost Estimating	IBank/FEMA BRIC Coordinator	Operations Specialist	Pump Station, Force Main & Interceptor Design Lead	Hydraulic Capacity Review/CFD Modiling	Interceptor Design Lead	Interceptor Design	Odor Control Specialist	Architectural Lead	Architectural	Civil Lead	Civil Design
	Hourly Rate		$ 354.51	$ 262.95	$ 349.80	$ 390.66	$ 247.82	$ 392.92	$ 162.05	$ 245.46	$ 228.71	$ 283.72	$ 307.00	$ 171.24	$ 219.13	$ 304.68	$ 243.97	$ 217.42	$ 225.78	$ 151.50	$ 372.66	$ 249.82	$ 78.29	$ 230.84	$ 174.17
Task	**Description**	**Subtotal Hours**	**Hours & Costs**																						
1	***Information Gathering and Location Assessment***																								
	1.1 Kickoff Meeting	24	5	2	-	-	2	-	-	5	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-
	1.2 Evaluation and Analysis of Ex. Condtions	176	8	8	-	8	8	8	16	16	-	-	-	-	-	-	4	8	16	-	-	-	-	4	16
	1.3 Site Visit	100	8	-	-	-	-	-	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Hours	**300**	**21**	**10**	**-**	**8**	**10**	**8**	**16**	**45**	**-**	**-**	**-**	**-**	**-**	**-**	**6**	**8**	**18**	**-**	**-**	**-**	**-**	**4**	**44**
	Subtotal Costs		**$ 7,445**	**$ 2,630**	**$ -**	**$ 3,125**	**$ 2,478**	**$ 3,143**	**$ 2,593**	**$ 11,046**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,464**	**$ 1,739**	**$ 4,064**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 923**	**$ 7,663**
2	***Feasibility Study***																								
	2.1 Grand St. Interceptor and 1st. St Trunk Sewer	797	4	2	2	3	8	14	20	8	-	-	-	-	-	-	-	-	8	16	-	-	-	4	24
	2.1.1 Survey Mapping	*42*	*2*	-	-	*2*	*2*	*2*	*2*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*16*
	2.1.2 Layout of Interceptor Sewer	*94*	*1*	*1*	*1*	*1*	*4*	*8*	*16*	*8*	-	-	-	-	-	-	-	-	*8*	*16*	-	-	-	*4*	*8*
	2.1.3 Geotech and Structural Analysis	*661*	*1*	*1*	*1*	-	*2*	*4*	*2*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.2 Grand St. Pump Station	102	-	-	1	-	-	-	-	10	-	-	-	-	-	-	16	-	-	-	-	-	-	1	4
	2.2.1 Footprint and Layout	*25*	-	-	*1*	-	-	-	-	*4*	-	-	-	-	-	-	*4*	-	-	-	-	-	-	-	-
	2.2.2 Screening Facility	*24*	-	-	-	-	-	-	-	*2*	-	-	-	-	-	-	*4*	-	-	-	-	-	-	*1*	*4*
	2.2.3 Pumps	*27*	-	-	-	-	-	-	-	*2*	-	-	-	-	-	-	*4*	-	-	-	-	-	-	-	-
	2.2.4 P&ID	*26*	-	-	-	-	-	-	-	*2*	-	-	-	-	-	-	*4*	-	-	-	-	-	-	-	-
	2.3 FEMA BRIC Application	61	4	-	-	-	1	-	-	1	-	-	-	-	40	-	2	-	1	-	-	-	-	-	-
	2.4 Regulatory Permits	38	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.5 Hydraulic Modeling	114	-	1	1	-	-	-	-	2	-	-	-	-	-	-	4	106	-	-	-	-	-	-	-
	2.6 Cost Estimate	61	1	-	-	2	4	-	-	4	-	-	8	24	-	-	4	-	2	-	-	-	-	1	-
	2.7 Feasibility Report	105	8	2	-	2	2	2	4	4	-	-	-	-	-	2	8	-	4	-	1	-	-	2	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Hours	**1,278**	**19**	**5**	**4**	**7**	**15**	**16**	**24**	**31**	**-**	**-**	**8**	**24**	**40**	**2**	**34**	**106**	**15**	**16**	**1**	**-**	**-**	**8**	**28**
	Subtotal Costs		**$ 6,736**	**$ 1,315**	**$ 1,399**	**$ 2,735**	**$ 3,717**	**$ 6,287**	**$ 3,889**	**$ 7,609**	**$ -**	**$ -**	**$ 2,456**	**$ 4,110**	**$ 8,765**	**$ 609**	**$ 8,295**	**$ 23,046**	**$ 3,387**	**$ 2,424**	**$ 373**	**$ -**	**$ -**	**$ 1,847**	**$ 4,877**
3	***Basis of Design Report***																								
	3.1 Grand St. Interceptor and 1st St. Trunk Sewer	362	8	4	-	8	8	32	48	4	-	2	-	-	-	-	-	-	24	120	-	-	-	4	60
	3.2 Grand St. Pump Station	226	8	-	4	-	-	-		8	-	2	-	-	-	2	24	-	-	-	2	2	24	2	16
	3.3 Cost Estimate and Project Timeline	150	4	-	-	2	8	2	8	8	16	-	16	32	-	-	8	-	4	-	-	-	-	2	4
	3.4 Report Preparation	276	8	2	2	2	2	-		24	-	-	-	-	-	-	24	-	4	8	-	4	8	4	8
	3.5 Meetings	106	22	-	-	-	12	-		24	-	-	2	-	4	-	20	-	4	-	-	-	-	4	-
	Subtotal Hours	**1,120**	**50**	**6**	**6**	**12**	**30**	**34**	**56**	**68**	**16**	**4**	**18**	**32**	**4**	**2**	**76**	**-**	**36**	**128**	**2**	**6**	**32**	**16**	**88**
	Subtotal Costs		**$ 17,725**	**$ 1,578**	**$ 2,099**	**$ 4,688**	**$ 7,435**	**$ 13,359**	**$ 9,075**	**$ 16,692**	**$ 3,659**	**$ 1,135**	**$ 5,526**	**$ 5,480**	**$ 877**	**$ 609**	**$ 18,542**	**$ -**	**$ 8,128**	**$ 19,391**	**$ 745**	**$ 1,499**	**$ 2,505**	**$ 3,693**	**$ 15,327**
	Total Hours	**2,698**	**90**	**21**	**10**	**27**	**55**	**58**	**96**	**144**	**16**	**4**	**26**	**56**	**44**	**4**	**116**	**114**	**69**	**144**	**3**	**6**	**32**	**28**	**160**
	Total Costs		**$ 31,906**	**$ 5,522**	**$ 3,498**	**$ 10,548**	**$ 13,630**	**$ 22,789**	**$ 15,557**	**$ 35,347**	**$ 3,659**	**$ 1,135**	**$ 7,982**	**$ 9,590**	**$ 9,642**	**$ 1,219**	**$ 28,300**	**$ 24,785**	**$ 15,579**	**$ 21,815**	**$ 1,118**	**$ 1,499**	**$ 2,505**	**$ 6,463**	**$ 27,867**

North Hudson Sewerage Authority
Feasibility Study and Basis of Design Services
Hoboken Grand Street Interceptor and Pump Station
June 6, 2023

	Employee	Christopher Phillips	Amy Thurston	Nicholas Bowen	Sebastian JnoBaptiste	George Markou	Vin Tomarch	Marc Giordano	Chris Troisi	Michael Schilling	Robert Knotz	Bahram Farzaneh	David Rohmeyer	Tyler Martz	Nicholas Lane					Subcontracted Services	Other Direct Costs	Cost Totals
	Position	Structural Lead	Structural Design	Mechanical Design	Project Technician	Electrical & I&C Lead	Electrical Design	HVAC/ Plumbing Lead	CAD Coordination	Graphics	Geotechnical - FPA	Permitting Specialist - FPA	Project Engineer - FPA	Senior Project Manager - FPA	Environmental Engineer - FPA							
	Hourly Rate	$ 259.49	$ 249.82	$ 127.30	$ 107.01	$ 318.13	$ 307.54	$ 202.25	$ 116.77	$ 196.97	$ 215.00	$ 175.00	$ 150.00	$ 200.00	$ 120.00	$ -	$ -	$ -	$ -			
Task	Description																					
1	***Information Gathering and Location Assessment***																					
	1.1 Kickoff Meeting	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$ -	$ 100	$ 5,703
	1.2 Evaluation and Analysis of Ex. Condtions	-	8	-	16	-	8	-	-	-	4	-	8	4	8	-	-	-	-	$ -	$ -	$ 39,740
	1.3 Site Visit	-	-	-	32	-	8	-	-	-	-	-	-	-	-	-	-	-	-	$ -	$ 500	$ 19,988
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ -
	Subtotal Hours	**-**	**8**	**-**	**54**	**-**	**16**	**-**	**-**	**-**	**4**	**-**	**8**	**4**	**8**	**-**	**-**	**-**	**-**			
	Subtotal Costs	**$ -**	**$ 1,999**	**$ -**	**$ 5,778**	**$ -**	**$ 4,921**	**$ -**	**$ -**	**$ -**	**$ 860**	**$ -**	**$ 1,200**	**$ 800**	**$ 960**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 600**	**$ 65,431**
2	***Feasibility Study***																					
	2.1 Grand St. Interceptor and 1st. St Trunk Sewer	2	8	-	16	-	-	-	8	-	50	-	360	40	200	-	-	-	-	$ -	$ 400	$ 128,151
	2.1.1 Survey Mapping	-	-	-	*16*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*$ -*	*$ 400*	*$ 7,995*
	2.1.2 Layout of Interceptor Sewer	*2*	*8*	-	-	-	-	-	*8*	-	-	-	-	-	-	-	-	-	-	*$ -*	*$ -*	*$ 20,048*
	2.1.3 Geotech and Structural Analysis	-	-	-	-	-	-	-	-	-	*50*	-	*360*	*40*	*200*	-	-	-	-	*$ -*	*$ -*	*$ 100,109*
	2.2 Grand St. Pump Station	1	4	32	16	1	8	-	8	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ 18,392
	2.2.1 Footprint and Layout	-	-	-	*8*	-	-	-	*8*	-	-	-	-	-	-	-	-	-	-	*$ -*	*$ -*	*$ 4,098*
	2.2.2 Screening Facility	*1*	*4*	-	*8*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*$ -*	*$ -*	*$ 4,509*
	2.2.3 Pumps	-	-	*16*	-	*1*	*4*	-	-	-	-	-	-	-	-	-	-	-	-	*$ -*	*$ -*	*$ 5,052*
	2.2.4 P&ID	-	-	*16*	-	-	*4*	-	-	-	-	-	-	-	-	-	-	-	-	*$ -*	*$ -*	*$ 4,734*
	2.3 FEMA BRIC Application	-	-	-	8	-	-	-	4	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ 12,714
	2.4 Regulatory Permits	-	-	-	-	-	-	-	4	-	-	30	-	-	-	-	-	-	-	$ -	$ -	$ 6,917
	2.5 Hydraulic Modeling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ 25,126
	2.6 Cost Estimate	-	1	4	4	-	2	-	-	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ 13,135
	2.7 Feasibility Report	1	2	4	32	1	-	-	8	16	-	-	-	-	-	-	-	-	-	$ -	$ 400	$ 20,850
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ -
	Subtotal Hours	**4**	**15**	**40**	**76**	**2**	**10**	**-**	**32**	**16**	**50**	**30**	**360**	**40**	**200**	**-**	**-**	**-**	**-**			
	Subtotal Costs	**$ 1,038**	**$ 3,747**	**$ 5,092**	**$ 8,133**	**$ 636**	**$ 3,075**	**$ -**	**$ 3,737**	**$ 3,152**	**$ 10,750**	**$ 5,250**	**$ 54,000**	**$ 8,000**	**$ 24,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 800**	**$ 225,285**
3	***Basis of Design Report***																					
	3.1 Grand St. Interceptor and 1st St. Trunk Sewer	2	30	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ 74,816
	3.2 Grand St. Pump Station	2	24	24	24	2	32	8	16	-	-		-	-	-	-	-	-	-	$ -	$ -	$ 45,705
	3.3 Cost Estimate and Project Timeline	-	-	-	24	-	8	4	-	-	-	-	-	-	-	-	-	-	-	$ -	$ -	$ 32,130
	3.4 Report Preparation	4	12	24	48	2	12	4	24	40	4	-	-	2	-	-	-	-	-	$ -	$ 500	$ 52,946
	3.5 Meetings	-	-	-	-	-	4	-	-	-	6	4	-	-	-	-	-	-	-	$ -	$ 500	$ 28,581
	Subtotal Hours	**8**	**66**	**48**	**96**	**4**	**56**	**16**	**48**	**40**	**10**	**4**	**-**	**2**	**-**	**-**	**-**	**-**	**-**			
	Subtotal Costs	**$ 2,076**	**$ 16,488**	**$ 6,110**	**$ 10,273**	**$ 1,273**	**$ 17,222**	**$ 3,236**	**$ 5,605**	**$ 7,879**	**$ 2,150**	**$ 700**	**$ -**	**$ 400**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,000**	**$ 234,178**
	Total Hours	**12**	**89**	**88**	**226**	**6**	**82**	**16**	**80**	**56**	**64**	**34**	**368**	**46**	**208**	**-**	**-**	**-**	**-**			
	Total Costs	**$ 3,114**	**$ 22,234**	**$ 11,202**	**$ 24,184**	**$ 1,909**	**$ 25,218**	**$ 3,236**	**$ 9,342**	**$ 11,030**	**$ 13,760**	**$ 5,950**	**$ 55,200**	**$ 9,200**	**$ 24,960**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,400**	**$ 524,894**

Subtotal	$ 524,894
Geo/Enviro Borings & Testing Allowance	$ 325,000
Total Proposed Cost	**$ 849,894**

Appendix A: Resumes

William Gettings, PE, MBA, BCEE

Associate Vice President

Mr. Gettings has 33 years of experience managing a number of large conveyance, pumping station, and plant projects from facility planning through construction for both public and private clients. As a resident of Monmouth County, he has a vested interests in the success of this project.

Education

MBA, Montclair State University, 2004

BS, University of Rhode Island, Civil Engineering, 1991

Certification/License

Professional Engineer: NJ, NY, VA

Board Certified Environmental Engineer

Areas of Expertise

- Wastewater conveyance, treatment, and discharge
- MOPO/construction
- Drinking water supply, treatment, and distribution

Experience

- 33 total years
- 14 years with Hazen

Professional Activities

New Jersey Association of Environmental Authorities

- Board Member
- Education and Conference Committee Chair

Water Environment Federation

American Water Works Association

Presentations

Taking a Deep Dive: Assessing A Critical Ocean Outfall Using High-Tech Underwater Inspection Tools, WEFTEC, New Orleans, LA,

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ

Project Manager. Responsible for the design and construction services of a new 54-inch FRP interceptor that will be installed in a 8-foot diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay to avoid existing soft marine soils below the Pleasure Bay. As part of the design, a new 30-inch FRP Monmouth Beach Interceptor with a length of 950 feet will be rerouted from the existing offsite Main Pump Station (MPS) to the new onsite 50-mgd MPS located on the property of the Authority's WWTP. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout, designed to minimize pump station cycling and surges into the WWTP; and will utilize a high flow/low flow dry pit submersible pump arrangement, consisting of two low flow pumps and four high flow pumps. The new station's layout meets Hydraulic Institute standards as confirmed by a physical hydraulic model. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. As part of the MPS improvements, a new 36-inch DIP force main with a length of 700 feet will convey flows from the new on-site MPS on to the existing on-site Headworks/Blower Building for this NJ I-Bank funded project. The design phase is currently complete and the construction phase has commenced.

Return Activated Sludge (RAS) Piping Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ

Project Manager. Managed preparation of a RAS temporary bypass plan, which cost effectively utilized one of the TRWRA's existing pumps and installation of temporary HDPE piping to isolate the existing ductile iron RAS lines, and coordinated with the TRWRA's emergency services contractor to complete the installation of the bypass system that is now in service providing redundancy to facilitate additional inspection. Hazen also prepared plans for the replacement of the existing 10", 12" 20" and

Hazen

October 2018

Outfalls-Preserving Performance of This Critical Asset, NJWEA Technical Transfer Seminar, Eatontown, NJ, September 2011.

Renewable Energy Opportunities in the Public Sector, Columbia Business School, November 2011.

Importance of Outfall Inspection, NJWEA Technical Transfer Seminar, Eatontown, NJ, September 2011.

24" above-ground and underground RAS piping along with respective engineer's construction cost estimates for temporary and permanent plans.

Evaluation of Outfall Rehabilitation Alternatives, Township of Ocean Sewerage Authority, Oakhurst, NJ

Project Manager. Responsible for the rehabilitation study of TOSA's 36-inch diameter ocean outfall, which consisted of a 4,000-foot long land-based section and a 2,000-foot long section from a drop manhole on the shore, extending into the ocean. The onshore portion was thought to be constructed of PCCP, and the offshore portion was made of steel. The outfall pipeline was originally constructed between 1966 and 1968. TOSA retained Hazen to help assess the physical condition of each section, confirm the materials of construction, and identify the most appropriate repair and/or replacement methods. Hazen teamed with Pure Technologies and utilized PipeDiverTM, a state-of-the-art electromagnetic underwater inspection tool that enabled TOSA to identify the types and extent of deterioration and their locations in the outfall, determine the most cost-effective repairs, and thus minimize the duration of outfall downtime for rehabilitation. While TOSA had originally anticipated replacing the entire outfall piping, the inspection results indicated that only a small portion (16 feet) of the onshore section required rehabilitation/replacement, and only the last 784 feet of offshore piping and 328 feet of outfall diffuser pipe required replacement. These findings yielded TOSA a savings of $30 million in capital outlay as well as a significant reduction in outfall outage time and public disruption.

Wastewater Pumping Station Reconstruction, NYCDEP, NY

Project Manager. Managed an engineering services contract for the reconstruction of three wastewater pumping stations. Managed the design team, including architectural, structural, mechanical, electrical, HVAC, instrumentation, and geotechnical engineers. Project reconstruction tasks included environmental review, facility planning, pre-final design services, and construction services for these stations that ranged in size from 1.0 mgd to 35 mgd.

Vine Ave Interceptor, New Jersey American Water, Lakewood, NJ

Project Manager. Responsible for the planning, design, permitting, bidding and construction management services for over 7,400 feet of 18- and 24-inch sewer mains that discharged into the Ocean County Utilities Authority wastewater collection system.

Michael Robison, PE

Associate Vice President

Mr. Robison brings 44 years of tunneling and underground construction experience. His projects have included design and construction management of over 58 miles of tunnels with a combined constructed value of over $1 billion.

Education

MSCE, University of Colorado at Boulder, 1985

BSCE, North Carolina State University, 1978

Certification/License

Professional Engineer: GA, KY, SC, CA, CO, MO

Areas of Expertise

- Design and construction of sewer tunnels
- Construction management and inspection of tunnels
- Siting of underground construction projects including construction shafts and intake facilities
- Constructibility analysis related to sewer and water tunnels
- Risk analysis and management related to underground construction

Experience

- 44 total years
- 5 years with Hazen

Professional Activities

American Society of Civil Engineers

Underground Construction Association of the Society for Mining, Metallurgy and Exploration

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ

Tunneling Design and Construction Lead. Responsible for the design and construction services of a new 54-inch FRP interceptor that will be installed in a 10-foot maximum diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay to avoid existing soft marine soils below the Pleasure Bay. As part of the design, a new 30-inch FRP Monmouth Beach Interceptor with a length of 950 feet will be rerouted from the existing offsite Main Pump Station (MPS) to the new onsite 50-mgd MPS located on the property of the Authority's WWTP. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout, designed to minimize pump station cycling and surges into the WWTP; and will utilize a high flow/low flow dry pit submersible pump arrangement, consisting of two low flow pumps and four high flow pumps. The new station's layout meets Hydraulic Institute standards as confirmed by a physical hydraulic model. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. As part of the MPS improvements, a new 36-inch DIP force main with a length of 700 feet will convey flows from the new on-site MPS on to the existing on-site Headworks/Blower Building for this NJ I-Bank funded project. The design phase is currently complete, permitting applications submitted, and project is entering the NJ DCA approved contractor pre-qualification phase given complexity and magnitude.

South Cobb Tunnel and Pumping Station, Cobb County Water System , GA

Construction Engineer. Provided field engineering services during construction, including technical review of contractor's submittals and construction procedures, for a 29,000-foot-long, 27-foot-diameter tunnel excavated using hard rock tunnel boring machine (TBM); 3,200-foot-long drill/blast connecting tunnel; 120-foot-diameter wet pit/dry pit pump station; and five intake structures. The tunnel included two shafts, five chambers/connecting tunnels, and six intakes.

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West Area CSO Tunnel and Pumping Station, City of Atlanta's Department of Watershed Management, GA
Resident Construction Manager responsible for construction inspection, change order negotiation, processing monthly pay requests, schedule analysis, submittal review and permit compliance for a 45,760-foot-long, 24-foot-diameter tunnel with diversion structures located at three CSO facilities. The hard rock tunnel included 3,730 feet of drill/blast, five shafts, five chambers/connecting tunnels, and three intakes.

Nancy Creek Tunnel, City of Atlanta's Department of Watershed Management, Atlanta, GA
Resident Construction Manager and Tunnel Engineer. As Tunnel Engineer during the design phase, responsible for siting of facilities, oversight of the subsurface investigation, development of geotechnical baseline report, and technical specifications. As Resident Construction Manager, responsible for construction inspection, change order negotiation, processing monthly pay requests, schedule analysis, submittal review and permit compliance for two 16-foot-diameter tunnels totaling 43,700-foot-long, excavated using two 18-foot-diameter hard-rock TBMs. The tunnel included 3,410 feet of drill/blast, three shafts, eight deaeration chambers/connecting tunnels, and eight intakes.

Gowanus Tunnel Evaluation, NYCDEP, New York, NY
Technical Advisor. Provided review of tunneling alternatives for minimum of 12 MG of total CSO storage along with various flood reduction and resiliency benefits. Review included six different tunnel alignments and diameters. Design items included hydraulic design, air handling, odor control, screening, grit removal and dewatering pump station. Construction items included tunnels, construction shafts, drop shafts, diversion and intake structures, and diversion sewers using microtunneling methods.

CMOM Phase II Sewer Rehabilitation and Repair Project, City of Manchester Environmental Protection Division, NH
Tunnel Engineer. Responsible for preparing technical specifications and reviewing cost proposals and submittals for 220 ft long, 16-inch diameter sewer installed in 48-inch diameter casing constructed by tunneling using pipe jacking with shield method.

North Clarksville Water Treatment Plant Pump Station and Intake, Clarksville Gas and Water, TN
Technical Advisor. Responsible for review of geotechnical investigation for deep pump station and river intake and design of support of excavation and tunneling aspects. Pump station excavation will be 46 ft x 96 ft x 70 ft deep in limestone bedrock. The tunnel will be 60-inch diameter excavated by microtunnel boring machine from the pump station to an intake structure in the Cumberland River.

Joshua Farmer, PE

Senior Associate

Mr. Farmer serves as Hazen's Tunneling and Boring Corporate Practice Leader, providing both traditional open-cut and trenchless pipeline expertise. He specializes in the design and construction of water/wastewater conveyance projects for municipal facilities.

Education

BSCE, North Carolina State University, 2003

Certification/License

Professional Engineer: NC, SC

Areas of Expertise

- Trenchless design
  - TBM tunneling
  - Microtunneling
  - Bore and jack/guided boring,
  - Pipe ramming
  - Pipe jacking with shield
  - Horizontal directional drilling
- Collections and distribution conveyance system design – gravity sewer, force mains, and water mains
- Water and wastewater pump station design
- Project management and construction administration
- State and municipal environmental permitting

Experience

- 20 total years
- 20 years with Hazen

Professional Activities

American Water Works Association

Water Environment Federation

South Carolina Water Environment Association

North American Society of Trenchless Technologies

Center for Underground Research

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ

Tunneling Design. Responsible for the design and construction services of a new 54-inch FRP interceptor that will be installed in a 10-foot maximum diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay to avoid existing soft marine soils below the Pleasure Bay. As part of the design, a new 30-inch FRP Monmouth Beach Interceptor with a length of 950 feet will be rerouted from the existing offsite Main Pump Station (MPS) to the new onsite 50-mgd MPS located on the property of the Authority's WWTP. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout, designed to minimize pump station cycling and surges into the WWTP; and will utilize a high flow/low flow dry pit submersible pump arrangement, consisting of two low flow pumps and four high flow pumps. The new station's layout meets Hydraulic Institute standards as confirmed by a physical hydraulic model. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. As part of the MPS improvements, a new 36-inch DIP force main with a length of 700 feet will convey flows from the new on-site MPS on to the existing on-site Headworks/Blower Building for this NJ I-Bank funded project. The design phase is currently complete, permitting applications submitted, and project is entering the NJ DCA approved contractor pre-qualification phase given complexity and magnitude.

Rivanna Pump Station Replacement and Tunnel Project, Rivanna Water and Sewer Authority, Charlottesville, VA

Project Engineer for site and tunnel evaluation in the study phase. Scope included replacement and relocation of the existing 25-mgd pump station with a new 53-mgd pump station located at the Moore's Creek Wastewater Treatment Facility. This was accomplished by constructing a 96-inch rock and soft earth tunnel by TBM and chemical ground modification. 60-inch reinforced fiberglass gravity Sewer was installed inside the liner plate tunnel and grouted in place. Provided an evaluation of site

Hazen

and Education (CURE), The University of Texas at Arlington, 2008

- Trenchless Technology New Construction Best Practices, certification

Louisiana State University

- Horizontal Directional Drilling Design and Construction Best Practices, certification, 2010

Technical Publications/ Presentations

NC AWWA Conference – One Pipe Does Not Fit All, 2012.

New Jersey United Water - Introduction to Trenchless Construction Methods, 2013.

SCEC Conference - One Pipe Does Not Fit All and Microtunneling Large Diameter Gravity Sewer may be the Best Option for You, 2013.

HRSD, Virginia Beach, VA - Introduction to Trenchless Construction Methods, 2013.

New Jersey American Water – Trenchless Installation Methods Design Guidance and Risk Mitigation, 2013.

locations, tunnel installation methods, tunnel hydraulics, transportation design, and permitting.

Government Cut Utility Relocation, Miami-Dade County Water and Sewer Department, FL

Tunnel Engineer, Technical Advisor, and QA/QC. Assisted with pipe material selection, grout port design, other design coordination related to the 60-inch force main being installed by 2 two-pass 74-inch micro-tunnels, 1,100 lf and 700 lf to an in-water retrieval shaft. The retrieval shaft and two launch shafts were designed by Hazen with four built-in unique water tightness features – an external grout column, a secant pile shaft structure, a grouted annulus and a steel can liner, all working together to form a 100-foot deep water tight structure. The water main replacement was installed by 30-inch 128-foot deep, 1600 lf HDPE Horizontal Directional Drill under the shipping lane in karst rock. Performed QA/QC on multiple work packages concentrating on trenchless installation and on-island, open-cut construction of 60" PCCP, and complex tie-ins to existing pipelines.

Western Wake Regional Wastewater Treatment Plant Conveyance Facilities, Western Wake Partners, Cary, NC

Project Engineer for the 15,000 lf 36-inch and 24-inch West Cary Force Main, 11,000 lf 54-inch West Reedy Branch Gravity Interceptor, 6,000 lf 42-inch Beaver Creek Gravity Sewer, 20,000 lf 42-inch and 36-inch Beaver Creek Force Main, 63,000 lf 60-inch Effluent Force Main, City of Apex Site Plan and Stormwater Permitting, and NC ESC Permit. Also included West Cary PS and Beaver Creek PS site planning and selection, grading, roadway, permitting, and stormwater quality and quantity design.

Crabtree Interceptor Improvements Phase I, City of Raleigh, NC

Project Engineer/Tunnel Engineer. The project included over 30,000 lf of reinforced fiberglass 72-inch gravity interceptor in deep, wet conditions with three 78-inch tunnels in a variety of in-situ conditions including alluvial, weight of hammer (WOH) soils and 25,000+ psi rock utilizing slurry microtunnel boring machine.

Gilboa Low Level Outlet, NYCDEP, New York, NY

Project Engineer. This project involved designing the low-level outlet (LLO) tunnel for the Gilboa Dam located in the Catskills area of New York. The dam was originally constructed in the 1920s and provides 15% of the water supply for the City of New York. With the new LLO tunnel, the reservoir pool will be able to be lowered to allow for dam-safety emergencies, maintenance or construction. At 111-inch diameter, the 2,200 lf Gilboa Dam LLO Tunnel, will be the largest diameter tunnel by microtunnel boring machine (MTBM) ever constructed in North America. Construction of the intake and final retrieval of the specially designed MTBM will be by the diver at greater than 150 feet below the water surface.

Wojciech Klecan, PE

Associate Vice President

Mr. Klecan has nearly 44 years of experience in the tunneling industry that includes extensive work in design of underground structures in a variety of ground conditions on projects involving water, wastewater, and transportation tunnels. He has managed many large, multi-disciplinary teams.

Education

MSc., Engineering Rock Mechanics, Imperial College, London, 1981

BSc. (Hons.), Engineering Geology and Geotechnics, Portsmouth Polytechnic (UK), 1980

Certification/License

Professional Engineer: FL, GA, KY, MI, MO

Chartered Engineer (United Kingdom)

Areas of Expertise

- Geotechnical investigations for underground facilities
- Dropshafts and intake structures for wastewater tunnels
- Risk analysis and mitigation related to underground design and construction

Experience

- 44 total years
- 5 years with Hazen

Professional Activities

American Society of Civil Engineers

Institution of Civil Engineers, United Kingdom

Geological Society, United Kingdom

- Fellow

British Tunneling Society

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority (TRWRA), Monmouth Beach, NJ

Geotechnical Engineer. Developed the Geotechnical site investigation program, prepared the Geotechnical Baseline Report and specifications for tunneling, and designed the tunnel and dropshaft.

Neuse River East Parallel Interceptor, City of Raleigh Public Utilities Department, NC

Tunnel Engineer. Responsible for designing a 100 mgd drop structure and Technical Advisor for two, 120-foot long, about 11-foot diameter, shallow tunnels under road embankments. Project is currently in design.

Occoquan River Crossing Transmission Main, Fairfax Water, VA

Tunnel Designer. Responsible for design of a 500-foot long, 84-inch diameter water tunnel in hard rock under the River Occoquan.

FDR Drive Trenchless Crossing - East Side Coastal Resiliency Project, New York City Department of Design and Construction (NYCDDC), New York, NY

Tunnel Engineer. Responsible for design of a 100-foot long, 60-inch microtunnel under FDR Drive for conveying wastewater. The tunnel will be excavated in very soft soils below the water-table.

Experience Prior to Hazen

Government Cut Microtunnel, Miami-Dade Water and Sewer Department (WASD), FL

Design and Geotechnical Engineer. Responsible for designing this 5-foot diameter, 1,700-foot long microtunnel to convey wastewater from South Beach to Fisher Island under the Government Cut shipping channel and managing the geotechnical investigations. Challenging conditions included water-bearing, highly porous and permeable limestones and sandstones with numerous voids, an extremely environmentally sensitive area and crossing under the Government Cut shipping channel leading

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to the Port of Miami. The original design was completed in 1997 and estimated would cost $17 million to construct. WASD subsequently re-bid the tunnel as design-build project with Hazen as the designer.

Riverbank Filtration Tunnel and Pump Station, Louisville Water Company, KY

Tunnel Design Manager. Responsible for managing the tunnel design on this $35 million, 7,800-foot long, 10-foot finished diameter water tunnel. The project includes four concrete caisson collector wells located next to the Ohio River, about 100-foot deep that extract filtered water from the sand/gravel aquifer above the tunnel and then convey it to a new 65-mgd pump station. The tunnel was excavated through potentially gassy shales and limestones and lined with cast-in-place concrete. The single construction shaft on this project also serves as the pump station and consists of a 40-foot diameter concrete diaphragm wall that extends through about 120-feet of saturated alluvium and socketed into the bedrock. The pump station building sits directly on the diaphragm wall. Won the American Society of Civil Engineers 2011 Outstanding Civil Engineering Achievement Award.

Nancy Creek Tunnel, City of Atlanta, GA

Design Manager. Responsible for designing this 16-foot finished diameter, 8-mile long, wastewater storage and conveyance rock tunnel. The project consists of a concrete lined tunnel with eight intake structures and three construction shafts. This $138 million Consent Decree project was completed in 2006 and named the “Public Works Project of the Year”, by the American Public Works.

United Kingdom Undersea Crossover and Undersea Pumping Stations Channel Tunnel Project (Chunnel), UK

Design Team Leader. Responsible for completing the detailed design of the United Kingdom Undersea Crossover and Undersea Pumping Stations. The UK Undersea Crossover is 60-foot wide, 470-foot long undersea cavern and the largest NATM structure on the project. The work also included design modifications to the 24.9 foot-diameter pre-cast running tunnel segments each side of the Crossover. Further responsibilities included the detailed design of a 30-foot diameter, 350-foot deep ventilation shaft at Shakespeare Cliff, temporary crossover tunnels near the mid-point of the Channel Tunnel between the service and running tunnels. Completed each design task under a very tight schedule, and to the required quality, as construction progressed by working closely with the client managers (Transmanche-Link) and careful oversight and coordination of activities undertaken by sub-consultants and other design groups. This historic design/build project took six years to construct and officially opened in 1994.

Kevin Haney, PE

Associate

Mr. Haney has 38 years of experience performing design, specification, installation and startup of a wide range of commercial, industrial, water, wastewater and biosolids equipment, and facilities. He has managed and worked through complete projects, from concept through construction and commissioning.

Education

MS, Mechanical Engineering, Fairleigh Dickinson University, 1987

BS, Mechanical Engineering, Fairleigh Dickinson University, 1985

Certification/License

Professional Engineer: NJ

Areas of Expertise

- Wastewater infrastructure planning
- Design
- Construction project management

Experience

- 38 total years
- 7 years with Hazen

Professional Activities

Water Environment Federation

Technical Publications

Ponte, M.; Metcalfe, M.; Haney, K. D.; May 2014. Flood Proofing Mitigation Alternatives for Existing Treatment Plants. NJWEA 99th Annual Conference and Exhibition.

Haney, K. D. May 2014. Emergency Response to Flood-Damaged Water Pollution Control Facilities. NJWEA 99th Annual Conference and Exhibition.

Haney, K. D.; Zabrosky, M. C.; September 2013. A Primer on Emergency Generators. NJWEA Technology Transfer Seminar.

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority (TRWRA), Monmouth Beach, NJ

Lead support Engineer and *project controls coordinator* for the replacement of the Pleasure Bay Crossing and Main Pump Station. The Project involves construction of two new interceptor sewers (30" and 54" diameters respectively), along with a new 50-mgd pump station with a 36" force main extending to the Plants existing headworks facility. The new approximately 3,250-foot long, 54" diameter Pleasure Bay Interceptor will be installed by a 10-foot diameter tunnel boring machine and will cross under the Pleasure Bay portion of the Shrewsbury River at a depth of approximately 90-feet. The launch shaft will be at the Plant site and will also serve as the wet well for the Main Pump Station. The reception shaft will be located across the river in Oceanport, NJ. The project will also include demolition of the existing, off-site, main pump station, along with the construction of a new electrical building to serve the new 50 MGD main pump station, and miscellaneous site improvements. Coordinated with the NJDEP I-Bank on funding for the project. Responsibilities included gathering of all on-site information along with organization and distribution to all design disciplines, assisted the project manager with design coordination with all disciplines. Participated in all meetings with the Owner including intermediate design coordination meetings, and monthly progress meetings. Provided constructability reviews and oversaw the QAQC process for the intermediate and final work products. Coordinated with the Owner and prepared the Division 00 and Division 01 specifications for the project along with coordinating the specifications for all other disciplines. Prepared submittals to the NJDEP I-Bank and State Comptroller's office for "Authorization to Advertise". Assisted with the process to prequalify bidders in accordance with NJ Statutes, prepared addenda for the project, and reviewed bids received.

Hazen

Morehouse, C. S.; Samuel M. J.; Haney, K. D.; September 2011. OBMUA Sewer Division SCADA System for 35 Remote Pump Stations. NJWEA Technology Transfer Seminar.

Haney, K. D.; April 1997. A Penny Saved Is A Penny Earned, Making the Most Out Of Your Electricity Dollars. NJWEA Technology Transfer Seminar.

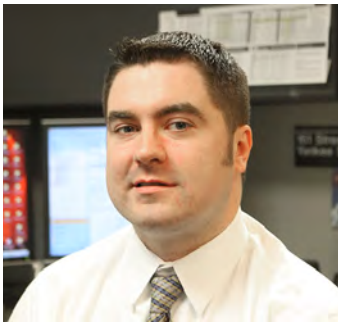
Return Activated Sludge (RAS) Piping Replacement, Two Rivers Water Reclamation Authority (TRWRA), Monmouth Beach, NJ
Provided initial inspection of existing, exposed, ductile iron, return activated sludge piping after several sections of piping had failed by what initially appeared to be some type of corrosion. Coordinated with the services of corrosion experts to provide an analysis of the failed pipe sections and prepared a report of findings where it was concluded that the RAS piping was failing due to erosion-corrosion. Prepared a RAS temporary bypass plan which utilized one of the Authority's existing pumps and installation of temporary HDPE piping to isolate the existing ductile iron RAS lines, and coordinated with the Authority's emergency services contractor to complete the installation of the bypass system. Prepared plans for the replacement of the existing 10", 12" 20" and 24" above-ground and underground RAS piping.

Sayreville Pump Station Repairs, Middlesex County Utilities Authority (MCUA), Sayreville, NJ
Provided engineering evaluation and design of $8.7 million repairs to MCUA's 300-mgd Sayreville Pump Station after it suffered damages as a result of Superstorm Sandy. Work included initial evaluation of electrical, pumping, and controls systems; assistance with preparation of baseline cost estimates; and technical assistance for evaluation, repair and/or replacement of flood damaged equipment.

Farrington Road Pump Station Upgrade, Old Bridge Municipal Utilities Authority (OBMUA), NJ
Project Manager for the upgrade of an existing force main bypass connection. The work included design and specification for piping upgrades and for the installation of a pre-cast concrete chamber over the bypass connection. Additional responsibilities included providing assistance during bidding, project oversight, shop drawing review, contractor and owner coordination during pump station bypass operations, pay estimate review, construction observation, and punchlist preparation.

Force Main Repairs, Township of Ocean Sewerage Authority (TOSA), Oakhurst, NJ
Provided construction oversight for replacement of approximately 300 linear feet each of 18" and 20" HDPE force main piping by directional drilling method. This work was performed to replace previous sections of directionally drilled piping that had been damaged by other work performed in the vicinity.

Force Main Phase 1 Improvements, OBMUA, NJ
Provided design and construction services for the Old Bride Municipal Utility Authority's Foxboro Pump Station force main replacement using a combination of directional drilling and open cut.



Daniel Sheeran, PE

Senior Associate

Mr. Sheeran is Hazen's Northeast Civil Discipline Leader with extensive experience in upgrading existing water/wastewater facility sites that are often heavily constrained.

Education

MS, Civil Engineering, Manhattan College, 2012

BS, Civil Engineering, Manhattan College, 2005

Certification/License

Professional Engineer: NY

Areas of Expertise

- Civil site planning and design
- Permitting and inter-agency coordination
- Design services during construction
- Civil shop drawing review

Experience

- 17 total years
- 14 years with Hazen

Professional Activities

New York Water Environment Association

American Water Works Association

CS-JA-BBS - Bergen Basin Sewer Reconstruction, NYCDEP, Queens, NY

Project Engineer and *DSDC Manager.* Oversaw and coordinated the design of the staging areas required for the microtunneling activities associated with the installation of twin 36" interceptor sewers underneath the Belt Parkway. Worked with NYCDEP BWSO for the relocation of a 12" water main to accommodate the installation of the sewer.

SANDRESM1 - East Side Coastal Resiliency, NYCDDC, Manhattan, NY

Civil Discipline QA/QC Reviewer. Oversaw and coordinated the civil site design for multiple project elements including parallel conveyance, storage conveyance, storage tank emergency pump station, and interceptor gates. Performed QA/QC reviews on all project elements including sanitary force main design for the pump station, parallel conveyance sewer pipelines and structures, and provided input for utility relocations and agency impacts to proposed infrastructure.

Connor Street Pump Station and Force Main, DEP, Bronx, NY

Civil Discipline Lead. Overseeing the development, Facility Planning, and 30% design associated with the replacement of approximately 4800 LF of an existing 24-inch sanitary force main. Reviewed design alternatives utilizing available GIS data and record drawings. Coordinated cost estimates for each alternative. Evaluated potential for trenchless crossing of the I-95 corridor. Assisted in the procurement of survey and geotechnical investigations.

Tarrytown Pump Station Rehabilitation and Force Main Replacement, Westchester County Department of Environmental Facilities, NY

Civil Design Engineer. Provided preliminary design for the rehab of the existing pump station site including the siting of new generator, administration building, and odor control system. Also evaluated the re-routing stormwater piping to accommodate new infrastructure. For 30-inch force main contract, assisted with procurement of site survey and test pits. During construction, helped with shop drawing reviews, RFIs, and coordination with the County for changes due to field conditions.

Hazen

Brian Porter, PE

Senior Associate

Mr. Porter specializes in water and wastewater treatment and conveyance systems. His experience includes planning, design, and construction of water and wastewater facilities and infrastructure.

Education

MSCE, Virginia Polytechnic Institute and State University, 2006

BSCE, Virginia Polytechnic Institute and State University, 2000

Certification/License

Professional Engineer: VA, NC

Areas of Expertise

- Pump station design
- Water and wastewater treatment design
- Surge analysis
- Collection and distribution modeling
- GIS mapping and geospatial analysis
- Stormwater analysis and modeling
- Water demand forecasting and supply planning

Experience

- 23 total years
- 17 years with Hazen

Professional Activities

American Water Works Association

Water Environment Federation

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ
Pump Station Design. Mr. Porter led the pump station design for the 50 mgd Main Pump Station at the Two Rivers Water Reclamation Authority, which will be fed by a new Pleasure Bay Interceptor Tunnel and Monmouth Beach Interceptor extension. The pump station will include high and low flow pumps with variable speed drives to minimize abrupt flow changes into the treatment plant. The project is currently under construction.

Western Wake Influent Conveyance Facilities, Town of Cary, NC
Project Engineer. Assisted in evaluations for this project. Responsibilities included site selection and preliminary hydraulic design for the new 60-mgd Beaver Creek Pump Station and preliminary hydraulic design for the upgrade of the West Cary Pump Station to-44 mgd. Assisted in the final design of the pump stations, including hydraulic and transient analysis, final site layout, permitting, equipment selection, and odor control design.

Rivanna Pump Station, RWSA, Charlottesville, VA
Project Engineer and Project Manager. Responsible for preliminary and final design of the 53-mgd pump station, including equipment selection, permitting, and routing of a 1,600 rock tunnel from the existing pump station location to the new pump station site. The pump station included high and low flow pumps, grinder and covered channels. Foul air from the headspace of the wet well and influent channels is treated by the existing odor control system at the treatment facility.

Moores Creek Pump Station Improvements, RWSA, Charlottesville, VA
Project Engineer. Responsible for final design of the 32-mgd pump station expansion, including equipment selection, permitting, and routing of a parallel 24-inch force main. Duties included hydraulic analysis and transient modeling for the pump station. Also assisted with construction administration of the project.

Hazen

Westside Pump Station, Greenville Utilities Commission, NC
Project Engineer for pump station, force main, and interceptor. Responsible for preliminary and final pump station design, including hydraulic and transient analysis. The pump station ancillary facilities included a coarse bar screen and two-stage chemical scrubber for odor control. Assisted in pipeline alignment alternatives for the 30,000-lf 24-inch force main and the 5,000-lf 21-inch interceptor. Also served as Project Manager for the construction administration phase of the project.

Winding Pine Pump Station, Town of Cary, NC
Project Manager responsible for the management of all phases of design and construction. Design responsibilities include hydraulic and transient evaluations, equipment selection and discipline coordination. The project is in the final stages of design and is expected to advertise for bid in May of 2019.

Lick Creek Regional Pump Station, City of Durham, NC
Project Engineer. Responsible for hydraulic design as well as design of the pump station and ancillary facilities, including a multiple stage chemical scrubber for vapor phase odor treatment.

Bradley Avenue Water Treatment Facility, Illinois American Water, Champaign, IL
Project Engineer for design of the new 15-mgd water treatment facility. Assisted with the hydraulic and transient design of the raw water conveyance system and the finished water pump station.

Neuse River Wastewater Treatment Plant (WWTP) Expansion, City of Raleigh, NC
Project Engineer for 150-mgd Influent Pump Station Phase and Primary Clarifier and BNR Improvement Phase for expansion of the WWTP to 75 mgd. Duties included mechanical design and transient analysis and discipline coordination. The BNR Improvement Phase included three biological odor control treatment systems to treat the head space of the influent pump stations and the primary clarifiers launders.

Experience Prior to Hazen

Sanitary Sewer Master Plan Update, Public Works Commission, Fayetteville, NC
Project Engineer. Responsible for evaluating the flow monitoring and rainfall data, creating and analyzing a hydraulic model for dry and wet weather conditions, and recommending capital improvement projects to eliminate system deficiencies.

Xiaodong Tian, PhD, PE, LEED AP

Associate

Dr. Tian has close to 30 years of experience in water and wastewater modeling. This includes hydrologic and hydraulic modeling, treatment hydraulics, and mixing zone dilution modeling for a wide range of projects.

Education

PhD, Civil and Environmental Engineering, Georgia Institute of Technology, GA, 2002

MS, Hydraulics and Fluid Dynamics, Tsinghua University, China, 1996

BS, Hydraulic Engineering Tsinghua University, China, 1993

Certification/License

Professional Engineer: MD

LEED Accredited Professional

Areas of Expertise

- Hydrologic and hydraulic modeling
- Stormwater management and CSO BMP
- Water/wastewater treatment plant hydraulics
- Outfall design and mixing zone modeling
- Computer programming for data analysis

Experience

- 29 total years
- 16 years with Hazen

Conceptual Design for Pevey Storage Facility, City of Lowell, MA
Hydraulic Engineer. The Marginal Interceptor owned by Lowell has experienced excessive surcharging during storm events. An existing model developed in PCSWMM was updated and recalibrated for the Marginal Interceptor tributary areas. A storage facility was proposed along the interceptor to reduce surcharging and overflows during rain events. An alternatives analysis was performed in support of developing conceptual design recommendations.

West Street Pump Station Interior Drainage/Coincident Frequency Analysis, City of Lowell , MA
Hydraulic Engineer. Lowell owns and maintains a flood damage reduction system composed of earthen and concrete levees as well as a flood pump station (West Street Pump Station). An existing model developed in PCSWMM was updated for an alternative analysis which considers rehabilitating West Street Pump Station as well as having a separate CSO treatment facility at Read Street. An interior drainage analysis and a coincident frequency analysis were performed in support of the recommended alternatives.

Sewer System Hydraulic Model Calibration, Miami-Dade Water and Sewer Department, FL
Hydraulic Engineer. Calibrated the world's largest hydraulic model of this type, encompassing three wastewater treatment plants, 1012 pump stations, and 870 miles of force main, ranging from 4 inch to 102 inch in diameter. Developed model using InfoWorks CS. The built-in statistical packages were used to efficiently review/summarize extended period modeling results for more than 1,000 pump stations.

Bowery Bay WPCP Raw Sewage Pump Station, NYCDEP, Queens, NY
Project Engineer for Hydraulic Modeling. Developed a hydraulic model to simulate pump station hydraulics. Performed a variety of hydraulic analyses to evaluate numerous alternatives. Provided the client a user-friendly, custom built program showing operating points in graphs with given inputs.

Hazen

Nichole Johnson, PE

Senior Associate

Ms. Johnson specializes in the design of water and wastewater projects. Her experience includes wastewater collection system evaluation and rehabilitation, water distribution mains, and wastewater treatment plant upgrades.

Education

BSCE, The University of Toledo, 2004

Certification/License

Professional Engineer: NC

Construction Specifications Institute: Construction Documents Technology, 2011

Areas of Expertise

- Water distribution main design
- Wastewater collection system design and evaluation
- Wastewater treatment facility evaluations and design

Experience

- 20 total years
- 9 years with Hazen

Professional Activities

American Water Works Association

Technical Publications

Johnson, N., Design and Construction of 8 Miles of 48" Critical Transmission Main Through a Highly Congested Urban, Transportation, and Residential Corridor, NC AWWA Conference, Winston-Salem, NC. November 16, 2010.

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Reclamation Authority, Monmouth Beach, NJ

Gravity Sewer and Force Main. The project includes a 50 mgd Main Pump Station at the Two Rivers Water Reclamation Authority, which will be fed by a new Pleasure Bay Interceptor Tunnel and Monmouth Beach Interceptor extension. Ms. Johnson has led the design effort for the new 30" Monmouth Beach Interceptor gravity sewer extension and new force main.

Upper Big Hollow Conveyance Project, Pennsylvania State University, State College, PA

Project Engineer for preliminary design and specifications for 3,800 feet of 12-inch sanitary sewer forcemain. Project was routed through the university campus and included review of and conflict resolution for many existing utilities.

Lower Roanoke Outfall and Sub Basin A Sewer Rehabilitation, Roanoke Rapids Sanitary District, Roanoke Rapids, NC

Project Engineer. Sanitary sewer and manhole rehabilitation in the RRSD collection system. Project includes CIPP lining of 6,400 feet of 30-inch concrete sewer outfall, 3,800 feet of 8-inch to 12-inch VCP gravity sewer, and rehabilitation and repair of 33 manholes. The project was funded through the DWI CWSRF. Responsible for design, plans, specifications, and permitting including the funding application, engineering report, and environmental information document as well as bidding and construction administrative services.

Sub Basins C and D Sewer Rehabilitation, Roanoke Rapids Sanitary District, Roanoke Rapids, NC

Project Engineer. Sanitary sewer replacement and rehabilitation in two sub basins of the RRSD collection system using a "find and fix" method based on an existing SSES with input from operations staff. The project was funded through the DWI CWSRF. Responsible for design, plans, specifications, and permitting including the funding application, engi-

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neering report, and environmental information document as well as bidding and construction administrative services.

Roanoke Outfall Replacement, Roanoke Rapids Sanitary District, Roanoke Rapids, NC
Project Manager and engineer responsible for design plans, specifications, and permits. The projects included the replacement and rerouting of approximately 1,000 FL of 21-inch clay gravity sanitary sewer.

East-West Reinforcing Main Route Study, City of Durham, NC
Project Engineer. Project includes a Routing Study and Preliminary Engineering Report for a new 36-inch transmission main through the Downtown Durham area. Services include route development and evaluation, hydraulic modeling, limited SUE and geotechnical evaluation, and cost opinion.

Hillsborough Street Transmission Main Replacement, City of Raleigh, NC
Project Engineer. Project includes approximately one mile of 36-inch diameter ductile iron pipe to replace an existing 36-inch PCCP transmission main. The new pipe is through residential, commercial, and institutional areas. Services include a Replacement Route Analysis TM, Level A and B SUE designation, survey, final design, specifications, traffic control, permits, public outreach, and assistance with bidding.

Chamberlain Tank Connection, City of Raleigh, NC
Project Engineer. Project includes 225 feet of 36-inch diameter ductile iron pipe to provide a secondary connection from the existing Chamberlain Water Storage Tank to the distribution system. The project included connection to an existing 36-inch DIP transmission main and a 16-inch water line, as well as disconnection from the existing 36-inch PCCP transmission main. Services include Level B SUE designation, survey, final design, specifications, permits, and assistance with informal bidding.

Sanitary Sewer Evaluation, City of Havelock, NC
Project Manager and Engineer. A sanitary sewer evaluation study was performed to identify areas with excessive inflow where rehabilitation and improvements could be made to reduce or eliminate extraneous flows. Study included temporary flow monitoring, flow analysis, and recommendations for sanitary sewer cleaning and inspection.

MacDonald Downs Pump Station Relocation, City of Havelock Water Department, NC
Project Manager and Engineer. Project includes relocation of an existing pump station and gravity sewer. Work on the project included the design of the gravity sewer, easement acquisition, and permitting in conjunction with an North Carolina DOT road relocation.

Richard Pope, PE, BCEE

Vice President

Mr. Pope is responsible for managing Hazen's corporate-wide odor control services. He heads a company team of odor specialists who provide full-service, long-term odor control planning by conducting field investigations, performing odor dispersion modeling to further define off-site impacts, and assisting in selecting the level of control required.

Education

MS, Environmental Engineering Manhattan College, 1979

BS, Civil Engineering Manhattan College, 1977

Certification/License

Professional Engineer: MA, NY, MI

Board Certified Environmental Engineer (BCEE)

Areas of Expertise

- Odor control
- Public outreach
- Corrosion plans

Experience

- 44 total years
- 8 years with Hazen

Professional Activities

American Academy of Environmental Engineers and Scientists

American Society of Civil Engineers

Water Environment Association of New York, New Jersey and New England

New York State Society of Professional Engineers

Water Environment Federation

Water Environment Research Foundation

- Research Review Committee

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ
Odor Control Specialist. Responsible for the design and construction services of a new 54-inch FRP interceptor that will be installed in a 10-foot maximum diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay to avoid existing soft marine soils below the Pleasure Bay. As part of the design, a new 30-inch FRP Monmouth Beach Interceptor with a length of 950 feet will be rerouted from the existing offsite Main Pump Station (MPS) to the new onsite 50-mgd MPS located on the property of the Authority's WWTP. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout, designed to minimize pump station cycling and surges into the WWTP; and will utilize a high flow/low flow dry pit submersible pump arrangement, consisting of two low flow pumps and four high flow pumps. The new station's layout meets Hydraulic Institute standards as confirmed by a physical hydraulic model. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. As part of the MPS improvements, a new 36-inch DIP force main with a length of 700 feet will convey flows from the new on-site MPS on to the existing on-site Headworks/Blower Building for this NJ I-Bank funded project. The design phase is currently complete, permitting applications submitted, and project is entering the NJ DCA approved contractor pre-qualification phase given complexity and magnitude.

Manhattan Pump Station Upgrade, NYCDEP, New York, NY
Developed the Environmental Impact Statement (EIS) odor section planning documents, directed the odor dispersion modeling efforts, inspected the two activated carbon odor control technology installed, and completed the air permitting necessary to demonstrate compliance with

Hazen

Technical Publications

Pope, R.J., *Problem Identification: Testing, Data Gathering, Soliciting Public Input, presented at the WEF Seminar: Making Scents Out of Wastewater Odors - A Step-by-Step Guide to Managing Your Odor Problems,* Washington D.C., June 8, 2015.

Pope, R.J., Federici, N.J., *Satisfying a Neighborhood Concern,* presented at the Session on Wastewater Treatment Plant Odor Control of the 87th Annual Conference and Exposition of the Water Environment Federation (WEFTEC 2014), New Orleans LA, October 1, 2014.

Pope, R.J., *How to Manage the Public, presented at Session 1: Have an Odor Problem: What are the Steps to Solving it?* of the Water Environment Federation (WEF) Odors and Air Pollutants Specialty Conference, Miami FL, June 1, 2014.

New York State Ambient Air Quality Standards (fewer than 10 parts per billion, ppb, of H2S beyond the fence line) and City of NY Guidelines (fewer than 1 ppb of H2S at the nearest sensitive receptor) and to operate the system. The Manhattan Pump Station (MPS) is the largest (1,514 mld, 400-mgd) capacity and 681 mld, 180 mgd average daily flow) pump station that directs the wastewater collected from the mid and lower east side of Manhattan to NYC's largest wastewater resource recovery facility, Newtown Creek WRRF. Positioned in the middle of an urban community with adjacent high rise apartment buildings, a high degree of permanent odor control was a priority.

Headworks Building Odor Control System Evaluation, Somerset Raritan Valley Sewerage Authority (SRVSA), Bridgewater, NJ

Provided services to investigate the Authority's options for returning an approximate 3,500 cfm carbon adsorber odor control system back into service after having been out of service for several years. The work included internal and external inspection of the FRP carbon vessel after the carbon was removed, inspection of the FRP odor control fan and ductwork and inspection of the electrical controls. In addition, the work included assisting the Authority to take continuous samples of air quality in the Headworks Building and analyzing air sampling data to determine if the existing carbon adsorber, with new carbon, would be sufficient to help control the odors from the building. A specification for carbon replacement was also prepared and submitted to the Authority for carbon that would be most effective in controlling the measured odors.

Odor Control for Wastewater Treatment Plant and Collection Systems, City of Dallas Water Utilities, TX

Responsible for directing the on-site odor assessment of the Central Wastewater Treatment Plant and evaluation of the wastewater key force main pump station. The Central Plant is broken up into two separate plants: White Rock (low odor potential) and Dallas (high odor potential). The force main was a leading cause for the elevated hydrogen sulfide concentrations at the Dallas plant headworks. The 28 open trickling filters were determined to be minor in comparison to the off-site impact of the Dallas headworks. Air dispersion modeling was performed to assess the degree of off-site impact of both existing and controlled conditions. All odor sources identified during the field investigations were included in the air dispersion model. An odor control master plan was developed and approved. The first phase of odor control, which addresses odors from the headworks and treats them in a biofilter, has been designed and constructed, and is currently operating effectively.

Kimberly Hanson, PE

Principal Engineer

Ms. Hanson is experienced in the evaluation, design, and construction administration of municipal water and wastewater treatment and conveyance projects. Her background also includes pipeline assessment, design, replacement, and rehabilitation.

Education

MS, Civil Engineering, North Carolina State University, 2015

BS, Ocean Engineering, United States Naval Academy, 2009

Certification/License

Professional Engineer: NC

Areas of Expertise

- Pipelines
- Wastewater treatment
- Construction administration

Experience

- 4 total years
- 4 years with Hazen

Professional Activities

American Water Works Association

Water Environment Federation

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ
Tunneling/Pipeline services for a new 54-inch FRP interceptor that will be installed in a 10-foot maximum diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay to avoid existing soft marine soils below the Pleasure Bay. As part of the design, a new 30-inch FRP Monmouth Beach Interceptor with a length of 950 feet will be rerouted from the existing offsite Main Pump Station (MPS) to the new onsite 50-mgd MPS located on the property of the Authority's WWTP. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout, designed to minimize pump station cycling and surges into the WWTP; and will utilize a high flow/low flow dry pit submersible pump arrangement, consisting of two low flow pumps and four high flow pumps. The new station's layout meets Hydraulic Institute standards as confirmed by a physical hydraulic model. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. As part of the MPS improvements, a new 36-inch DIP force main with a length of 700 feet will convey flows from the new on-site MPS on to the existing on-site Headworks/Blower Building for this NJ I-Bank funded project. The design phase is currently complete, permitting applications submitted, and project is entering the NJ DCA approved contractor pre-qualification phase given complexity and magnitude.

Difficult Run Force Main Sewer Rehabilitation, Fairfax County, VA
Assistant Project Engineer and Resident Project Representative. Part-time inspection of cleaning and repairs to an existing 36-inch sanitary force main approximately 30,936 lf in length. The project included 1000 feet of open cut replacement, 3,496 lf of cured in place lining (CIPP), and the installation of seven permanent access vaults to allow cleaning and inspection of the existing line to identify further repairs. Responsibilities included directing the execution of CCTV inspection using NASHTO standards and procedures, CCTV review to identify areas requiring re-

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habilitation, and inspection of CIPP installation, access vault installation, and sewer cleaning. Prepared figures for client to show type and location of additional repair or replacement required along the length of the sewer main.

Hillsborough Street Water Main Replacement, Orange Water and Sewer Authority, Chapel Hill, NC
Construction Administration and Resident Project Inspection. Full-time inspection of the open cut replacement of approximately 2,960 lf of 8-inch asbestos cement water main. The project included installation of 8-inch ductile iron pipe, valves, and hydrants as well as connections to existing mains and service lines, testing, and disinfection, and the abandonment of the existing AC water main. Project also involved the replacement of 210 lf of 12-inch VCP sanitary sewer with 24-inch Protecto 401 lined ductile iron. The project was located near the University of North Carolina, which required public relations and overall site monitoring throughout construction activities. Ms. Hanson was responsible for review of all submittals and change orders, payment application review, and construction progress meetings and minutes.

Broad Run Interceptor Parallel Potomac Interceptor Phase 5 and Horsepen Run Parallel Sewer, Loudoun County, VA
Assistant Project Engineer and Resident Project Representative. Assisted with construction administration and part time construction inspection for the Broad Run Interceptor Parallel Potomac Interceptor and Horsepen Run Parallel Sewer. The project included approximately 25,000 lf of gravity sewer sized 18-inch through 96-inch, including installation by both open cut and trenchless methods. Ms. Hanson assisted with submittal coordination and review and part-time construction inspection of trenchless installation

Southeast Regional Lift Station, Lick Creek, Durham, NC
Assistant Project Engineer. This project included the design of a regional lift station and associated force main and gravity interceptors. Assisted in developing population and flow projections, flow monitoring and processing, and development of a preliminary engineering report.

Southwest Cary Parkway Water Line Reinforcement, Town of Cary, NC
Assistant Project Engineer. This project included construction of 17,500 lf of 20-inch pipe with five interconnections with existing water mains. Assisted with researching permit requirements and completing permit applications for submittal to CSX, Duke Energy, and PSNC Energy.

William Russell, AIA, LEED AP BD+C

Senior Associate

Mr. Russell has 34 years of experience in the architectural design of water and wastewater treatment plants, maintenance buildings, laboratories, and other industrial facilities.

Education

BA-Design Clemson University, 1984

Certification/License

Registered Architect: NY, NC, VA, IL, MD, CT, OH, NH, TX, AZ, CO, ME, NM, CA

LEED AP BD+C

NCARB Certificate

Areas of Expertise

- Programming and design of water, wastewater, laboratories, and industrial facilities
- Laboratories and industrial facilities
- Sustainable design of water and wastewater facilities
- Utilization of computer applications in the design of water, wastewater, and industrial facilities

Experience

- 35 total years
- 23 years with Hazen

Professional Activities

American Institute of Architects

The Society for Protective Coatings

International Code Congress

National Fire Protection Association

Technical Publications

Lab Remodeling: Considerations and Pitfalls; Lab Technology Day; May 8, 2012.

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ
QA/QC and Design Assistance. Provided architectural design assistance and QA/QC for the main pump station (MPS) and electrical building related to the 54-inch FRP interceptor that will be installed in a 10-foot maximum diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout about 100 feet below grade. An above grade masonry building is provided to house electrical equipment, elevator, and stairwell. The lower levels are accessed by a stair and elevator. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. A single story masonry electrical building is provided adjacent to the MPS. The above grade structures harmonize with the aesthetic of the nearby treatment plant.

Brooks Road Pump Station, Booster Pump Station and Eastside Conveyance System Odor Control, Gwinnett County, GA
Provided design assistance and QA/QC services for the project. The project included facilities which housed the pump station, odor control systems, and a 1500 kW emergency generator.

Irwin Creek WWTP Influent Pump Station, Charlotte, NC
Provided architectural design for modifications to the Influent Pump Station that included reroofing, addition of a removable skylight to provide better access to the mechanical screens, and general architectural modifications. The project included to replacement of standby generators.

Linton Hall Lift Station and Force Main Replacement, Prince William County, VA
Project Architect for the design of the 28.4-mgd Linton Hall Lift Station and 36" Force Main (10,000 LF). The project included a deep dry and wet well and a masonry superstructure. Mr. Russell additionally provided Construction Administration during construction.

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Neabsco Lift Station Replacement, Prince William County, VA
Provided architectural design for the 25.4-mgd (expandable to32.3 mgd) Neabsco Lift Station. The project includes a grinder room. The floor of the lift station is about 43 feet below the electrical room. The electrical room is located within a brick faced super structure with standing seam metal roof. Mr. Russell provided Construction Administration during construction.

Main and O Street Pumping Stations Upgrade, DC Water, Washington, DC
Provided architectural design assistance for the design of infrastructure that houses mechanical / electrical equipment within the Main and O Street Pumping Stations. As part of this project, electrical rooms were added and the screenings rooms were reconfigured to separate hazardous and non-hazardous spaces in accordance with NFPA 820. Additionally provided office construction administration during construction.

North Buffalo Transfer Pump Station, City of Greensboro, NC
Provided architectural design for the pump station. The project included building code analysis, building design, review of contract documents, and a cost estimate. The building houses influent screens, compactors, pumps, electrical equipment, and connections to 2000 kW generator. Mr. Russell provided construction administration services during construction.

Groove Creek Effluent Pump Station, Renewable Water Resources, Greenville, SC
Provided architectural design assistance for the project which included reviewing all aspects of the architectural design.

Reedy Fork Pump Station, City of Greensboro, NC
Provided architectural design for the project which included building code analysis, building design, review of contract documents, and providing an opinion of cost. Mr. Russell additionally provided office construction administration services during construction.

Haw River Water Pump Station for the Department of Water Resources, Greensboro, NC
Provided architectural design and construction administration services for rehabilitating the Haw River Water Pump Station. Work included cleaning and repairing existing masonry, providing new openings, reroofing and refinishing all interior surfaces.

Elizabeth Moskalenko, RLA, ISA TRAQ, WEDG

Senior Principal Landscape Architect

Ms. Moskalenko is an experienced Landscape Architect and Arborist. She has worked on numerous projects for municipal and state clients in Long Island and New York City, several of which incorporate local parks.

Education

MS, Civil Engineering and Engineering Mechanics, Columbia University, 2018

BS, Landscape Architecture Degree, Cornell University, 2010

Certification/License

Registered Landscape Architect: NY

ISA Tree Risk Assessment Qualified

WEDG Associate (Waterfront Alliance)

ISA Certified Arborist

Wetland Delineator

OSHA 10-Hour Construction

Areas of Expertise

- Landscape Architecture
- Ecological Planning
- Environmental Engineering
- Environmental Assessments
- Stormwater BMPs

Experience

- 13 total years
- 5 years with Hazen

Professional Activities

American Society of Landscape Architects

- New York Chapter Past President

International Society of Arboriculture

- New York Chapter Member

Difficult Run Pump Station and Force Main Rehabilitation, Fairfax County DPW, VA

Arborist. Hazen provided preliminary engineering, detailed design, permitting, and services during construction for the complete rehabilitation of the Difficult Run Pump Station and the 36-inch force main. The design included selective demolition of existing facilities; replacement of pumps, piping, and valves; new influent grinders and isolation gates; a new surge tank; new electrical equipment including a new emergency generator; new HVAC equipment; new instrumentation and control equipment; and new flowmeter. Structural and architectural repairs and replacements.

NYCDDC On-Call Contract for Environmental Assessments and Services, New York, NY

Landscape Architect and *Arborist*. Lead designer for three multi-acre tidal wetland restoration projects in the Jamaica Bay Watershed in Queens, New York as part of the on-call task order contracts for New York City sewer, water main, roadway and green infrastructure capital projects. Wetland design restores native salt marsh habitat, mitigates invasive vegetation including Phragmites australis (common reed) and Reynoutria japonica (Japanese knot weed) and removes urban fill.

Bluebelt Stormwater Management Systems -Urban Stormwater Planning, NYCDEP, Staten Island, NY

Landscape Architect for the New York City Department of Environmental Protection's (NYCDEP) 1.2 acres as part of the Bluebelt Stormwater Management System (Bluebelt) for NC-4 sewershed on Staten Island. Led conceptual design for the NC-4 Bluebelt including site analysis, conceptual design and engineering, and preliminary planting plans. The design maximizes the site to provided storage capacity required to attenuate the peak 5-year runoff from the eastern portion of the NC-4 sewershed while mitigating its visual impacts to the surrounding residential community and the Richmond County Country Club golf course.

Hazen

Christopher Phillips, PE

Vice President

Mr. Phillips serves as the Corporate Lead for Hazen's Structural and Architectural Discipline Group and is an expert in the structural design and construction of water and wastewater treatment and pumping facilities.

Education

MCE, North Carolina State University, 1988

BSCE, North Carolina State University, 1985

Certification/License

Professional Engineer: NC, VA, NY, NJ, SC, OH, MD, DC

Areas of Expertise

- Structural design, analysis and construction of commercial, industrial, and environmental structures
- Structural condition assessments of environmental and building structures
- Behavior and composition of hydraulic cement concrete
- Personnel management of corporate staff of structural engineers and design technicians

Experience

- 35 total years
- 31 years with Hazen

Professional Activities

American Society of Civil Engineers

American Concrete Institute

Chi Epsilon

Concrete Reinforcing Steel Institute

International Concrete Repair Institute

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ
Structural Design Engineer. Provided input in conceptual design and approach and served as the engineer in responsible charge for the structural design. Supervised structural design and performed QA/QC Reviews at all milestones. Currently will be involved in construction administration as needed.

Jonathan Rogers Water Treatment Plant Ozone Facilities Upgrades Services, El Paso Water Utilities, TX
Structural Technical Advisor/Quality Assurance for upgrades to the ozone system at the 60-mgd surface water treatment plant. Includes the design and construction phase services for a new liquid oxygen based ozone generation system including structural modifications, tank foundation, pipe supports, and condition assessment and repair of ozone concrete tanks.

Newtown Creek Wastewater Resource Recover Facility, New York City Department of Environmental Protection (NYCDEP), New York, NY
Structural Design Lead for Contracts NC-30G and NC-36G including design of new electrical substation, screenings wing, odor control platform, and major modifications to the Brooklyn-Queens Pump Station including replacement of all five pumps and rerouting of discharge piping from wet well to new discharge tower.

EM Johnson Water Treatment Plant, City of Raleigh, NC
Lead Structural Design engineer on multiple projects involving new construction and modifications to the water treatment plant. Projects include new chemical facilities and upgrades and repairs to the Sedimentation Basins and other structures on site.

Dry Creek Wastewater Treatment Plant, Sanitation District No. 1 of Northern Kentucky, Villa Hills, KY
Structural Technical Advisor/Quality Assurance for design and construction of modifications and additions to the facilities at the wastewater treatment plant.

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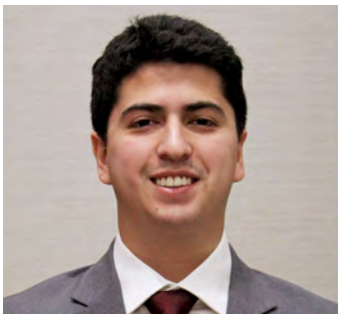
Rowlett Creek Regional Wastewater Treatment Plant Phase II Improvements, North Texas Municipal Water District, Plano, TX
Structural Technical Advisor/Quality Assurance. Project included evaluating wet weather and solids management strategies for the Rowlett Creek WWTP with an average daily flow of 24 mgd and ultimate peak 2-hour flow of 120 mgd. The project also included an opinion of probable cost for structural changes to treatment train to increase to ultimate peak 2-hour flow of 120 mgd.

Dry Creek Wastewater Treatment Plant, Sanitation District No. 1 of Northern Kentucky, Villa Hills, KY
Structural Technical Advisor/Quality Assurance for design and construction of modifications and additions to the facilities at the wastewater treatment plant.

Various Wastewater Treatment Experience
Mr. Phillips has also participated in the various phases of design and construction for numerous wastewater treatment plant projects. His various roles include structural design, responsible charge of structural design documents, quality control and assurance, and construction administration efforts. Among these efforts include the following:

- Arlington County WPCP Flow Equalization and Phase 4A Upgrades, Arlington County, VA (40 mgd)
- Celanese WWTP Upgrade, Allegany County, MD (2.86 mgd)
- T.Z. Osborne WWTP Expansions, City of Greensboro, NC (Two projects, years apart: 30 and 40 mgd)
- South Durham WRF Upgrade and Expansion, City of Durham, NC (20 mgd)
- Nansemond WWTP Upgrade and Expansion, Hampton Roads Sanitation District, Suffolk, VA (30 mgd)
- Neuse River WWTP Upgrades and Expansions, City of Raleigh, NC (Multiple projects, over many years: 60 and 75 mgd)
- Blue Plains WPCP Influent Screen Addition, DC Water, Washington, DC
- Newtown Creek WPCP Main Building Modifications, NYCDEP, New York, NY
- Totopotomoy WWTP Nutrient Improvements Phase 1, Hanover County, VA
- Roanoke Regional WPCP, Roanoke, VA (Multiple projects, over several years)
- Waynesboro WPCP, Waynesville, VA
- Culpeper WPCP, Culpeper, VA



Nicholas Bowen, EIT

Assistant Engineer II

Mr. Bowen has 7 years of New Jersey experience providing mechanical design expertise as well as technical administration for projects during the design and construction phases.

Education

BS, Mechanical Engineering, Boston University, 2015

Certification/License

Engineer-in-Training: NJ

OSHA - 30hr Construction

Areas of Expertise

- Wastewater treatment
- Pumping stations
- Preliminary treatment
- Process aeration
- Master planning
- Structures and materials
- Cost/benefit analysis
- Finite element analysis

Experience

- 7 total years
- 5 years with Hazen

Professional Activities

American Society of Mechanical Engineers

New Jersey Water Environment Federation

American Water Works Association

Contract B149: Decant Facility Rehabilitation Project, Passiac Valley Sewerage Commission (PVSC), Newark, NJ

Project Engineer and *Assistant Mechanical Engineer* for the detailed 3D design and construction of PVSC's decant facility. The decant facility is located immediately downstream of the Zimpro wet-air oxidation process and separates processed solids from liquid supernatant. The project will rehabilitate six 1-mgd covered concrete tanks as well as the supporting ancillary systems and infrastructure for the facility. The year-long design phase of the project will culminate with bid-ready documents and permitting approvals. The construction phase of the project is anticipated to last four years and will involve careful planning for the maintenance of plant operations.

Raritan Millstone WTP UV Feasibility Study, New Jersey American Water, Bridgewater WTP, NJ

Assistant Mechanical Engineer for the feasibility study which focused on the installation of UV treatment facilities at five existing pumping facilities at the Raritan Millstone WTP. A preliminary construction cost estimate and construction schedule were then produced to provide the owner with an estimated cost and level of effort required to complete this project as designed. Due to the importance of the existing facilities, the proposed construction schedule focused on compressing the amount of time that the facilities are required to come offline, while simultaneously mitigating risk to the Owner of an extended plant shutdown.

Grit Facility Repairs and Improvements Project, Bayshore Regional Sewerage Authority (BRSA), Monmouth County, NJ

Project Engineer for the design of necessary repairs and recommended improvements to the existing Grit Facility at the Authority's wastewater treatment plant near Union Beach, NJ. Repairs and improvements to the existing grit facility include replacement of grit and dewatering screws, reconfiguration of air piping, replacement of select valves, upgraded LED outdoor facility lighting, concrete repairs, and installation of a new MIC epoxy coating. CFD and hydraulic modeling was utilized extensively to determine optimal configuration of air piping inside the grit chambers to promote greater settling and capture of grit and other coarse materials.

Hazen

George Markou, PE

Associate Vice President

Mr. Markou has been responsible for leading the planning and design of electrical distribution, lighting, control, and energy improvement systems for many of the firm's projects for the past 34 years. His work involves close coordination with electric utility companies, local building codes, and industry standards.

Education

MS, Electrical Engineering, Polytechnic University, 1996

BE, Electrical Engineering, City College of New York, 1988

Certification/License

Professional Engineer: NY, CT, PA, MA, NJ, MI, ME, and Nova Scotia

Areas of Expertise

- Main plant power distribution and substation design
- Electrical distribution
- Lighting
- Resiliency flood protection
- Energy conservation and cogeneration
- SCADA and control

Experience

- 34 total years
- 34 years with Hazen

Professional Activities

American Water Works Association

Institute of Electrical and Electronics Engineers

H6/H7 Long-Term Control Plan Phase 1, North Hudson Sewerage Authority, Hoboken, NJ

Electrical Engineer for the initial phase of construction of a high-level sewer system in the H7 Drainage Basin, which includes a pump station and wet well, mechanical, and electrical control building, hydro-dynamic separation (vortex) pretreatment units, and piping and appurtenances. The project is crucial to protecting public health, minimizing public disruption, and protecting the environment by reducing stormwater flooding in the lowest-lying areas within the City of Hoboken.

Paerdegat Pump Station and CSO Facility: CM Services, NYCDEP, Brooklyn, NY

Technical Advisor, Con Edison Liaison. The project included the construction, start up, and commissioning of a new CSO facility designed to contain flows during storm events and significantly reduce pollutant loadings by minimizing CSO discharges. Work included a pump around system to maintain flow, installation of a new Con Edison electrical service, a new 2000kW emergency generator system, significant street and sidewalk restoration, and maintenance and protection of traffic.

Tarrytown Pump Station and Force Main Upgrades, Tarrytown, NY

Technical Advisor. The project included rehabilitation of the Tarrytown Pump Station and replacement of the force main. This pump station and force main are owned and operated by the Westchester County Department of Environmental Facilities. The average daily flow to the pump station is 3 mgd, while the installed pump capacity is 24 mgd. Staging of the pump replacement and portions of force main required careful planning and design to allow for continuous operation during construction. Provided QA/QC on the design and led design services during construction (DSDC).

Hazen

Marc Giordano, PE

Senior Principal Engineer

Mr. Giordano has 10 years of experience providing evaluation, design and construction services for odor control and HVAC systems at wastewater treatment plants. He has managed the odor control feasibility studies, conceptual designs, H_2S monitoring programs, and resulting upgrades for several major New York City plants.

Education

MS, Mechanical Engineering, Manhattan College, 2008

BS, Mechanical Engineering, Manhattan College, 2007

Certification/License

Professional Engineer: NY

Areas of Expertise

- Odor control
- HVAC
- Plumbing
- Fire Protection
- NFPA 820

Experience

- 10 total years
- 10 years with Hazen

Professional Activities

The American Society of Mechanical Engineers

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ
Odor Control services for a new 54-inch FRP interceptor that will be installed in a 10-foot maximum diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay to avoid existing soft marine soils below the Pleasure Bay. As part of the design, a new 30-inch FRP Monmouth Beach Interceptor with a length of 950 feet will be rerouted from the existing offsite Main Pump Station (MPS) to the new onsite 50-mgd MPS located on the property of the Authority's WWTP. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout, designed to minimize pump station cycling and surges into the WWTP; and will utilize a high flow/low flow dry pit submersible pump arrangement, consisting of two low flow pumps and four high flow pumps. The new station's layout meets Hydraulic Institute standards as confirmed by a physical hydraulic model. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. As part of the MPS improvements, a new 36-inch DIP force main with a length of 700 feet will convey flows from the new on-site MPS on to the existing on-site Headworks/Blower Building for this NJ I-Bank funded project. The design phase is currently complete, permitting applications submitted, and project is entering the NJ DCA approved contractor pre-qualification phase given complexity and magnitude.

26th Ward Wastewater Treatment Plant, NYCDEP, Brooklyn, NY
As HVAC Engineer, Mr. Giordano provided HVAC design services during construction of operational improvements to the treatment plant. Responsibilities included a review of HVAC equipment shop drawing.

Hazen

Avenue V Pumping Station, NYCDEP, Brooklyn, NY
As HVAC engineer, Mr. Giordano provided HVAC design services during construction of operational improvements to the treatment plant; responsibilities included a review of HVAC equipment shop drawings.

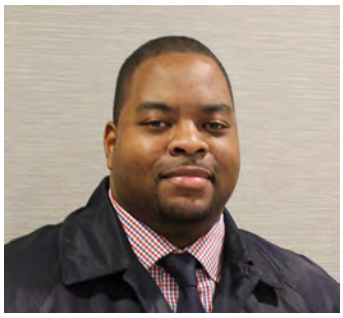
Interceptor Sewer Corridor Odor Control Study, Town of Bethlehem, NY
Project Supervisor. Hazen performed an odor control study for the Town of Bethlehem after they received odor complaints from the community following the installation of a new force main sewer and gravity interceptor. As Project Supervisor, assisted in the management and execution of the odor control study with responsibilities including budget management, client interface, development of an H2S monitoring program, management of the field monitoring, contributions to the evaluation report, and presentation of findings to the client.

Bay Park Wastewater Treatment Plant, Nassau County DPW, NY
HVAC Engineer. Hurricane Sandy caused damage to the Administration Building at the facility, which required renovations to repair the HVAC system. The building was also repurposed to serve as the on-site CM office. Responsibilities included assessment of damage to the existing system and design of a new HVAC system to serve CM office.

Manayunk Combined Sewer Overflow Detention Facility, PWD, Manayunk, PA
As HVAC Engineer, Mr. Giordano provided HVAC design services during construction of the facility. Responsibilities included reviewing shop drawings for HVAC equipment and resolving RFI responses.

Gilboa Dam Reconstruction (CAT-212C), New York City Department of Environmental Protection (NYCDEP), Gilboa, NY
Part of team for the design of two propane systems to fuel the new emergency generators; propane generators were added to provide power to multiple facilities during an emergency.

Gowanus Canal CSO Facilities, NYCDEP, NY
HVAC and Odor Control Design Lead. This $800 million, ten-year program includes two CSO abatement facilities designed to treat CSOs to the Gowanus Canal, the 323-mgd Red Hook facility and the 205-mgd Owl's Head facility. The odor control and HVAC design consisted of a 60,000-cubic feet per min odor control system and five virgin-activated adsorbers, a central hot water system, air conditioning, and NFPA 820 compliant ventilation systems for screening rooms, odor control rooms, electrical rooms, boilers rooms, and below grade CSO tanks.



Jared Lewis, CSP

Associate

Mr. Lewis is an Environmental Health & Safety Professional, with 16 years of experience developing, implementing, and monitoring risk-based programs. He has a background in identifying and mitigating operational risks while maintaining a balance with operational efficiency.

Education

BS, Business Management, St. John's University, 2006

Certification/License

Certified Safety Professional (CSP)

Associate Safety Professional

OSHA 510 for Construction

OSHA 500 Authorized trainer

RCRA Hazardous Waste Training

National Traffic Incident Responder Training

Trained NYS DOL Asbestos Supervisor

National Safety Council AED/CPR

FDNY Certified Construction Site Fire Safety Manager

NYC DOB 4-hour Scaffold Course

UMDNJ Systems of Safety Focus-Four Hazard Categories

30-hour OSHA Safety Course

40 hour HAZWOPER

7.5 Globally Harmonized System of Classification and labeling of Chemicals

40 hour NYC DOB Site Safety Manager Course

The Practicing Institute of Engineering, Inc. Soft Ground Tunneling Seminar

NYCT QA/QC Master Workshop

NYCT Core Analyst training program

LIRR/NYCT/MNR/Amtrak railroad safety training

Areas of Expertise

- Safety inspection
- Code compliance
- Strategic planning/analysis
- Records management
- Risk management

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority (TRWRA), Monmouth Beach, NJ

EHS Manager/Safety Professional. Providing review of contractor submittals, plans, and associated protocols to ensure contract and regulatory compliance. Pleasure Bay Crossing and Main Pump Station Replacement. The Project involves construction of two new interceptor sewers (30" and 54" diameters respectively), along with a new 50-mgd pump station with a 36" force main extending to the Plants existing headworks facility. The new approximately 3,250-foot long, 54" diameter Pleasure Bay Interceptor will be installed by a 10-foot diameter tunnel boring machine and will cross under the Pleasure Bay portion of the Shrewsbury River at a depth of approximately 90-feet. The launch shaft will be at the Plant site and will also serve as the wet well for the Main Pump Station. The reception shaft will be located across the river in Oceanport, NJ. The project will also include demolition of the existing, off-site, main pump station, along with the construction of a new electrical building to serve the new 50 MGD main pump station, and miscellaneous site improvements. Coordinated with the NJDEP I-Bank on funding for the project. Responsibilities included gathering of all on-site information along with organization and distribution to all design disciplines, assisted the project manager with design coordination with all disciplines. Participated in all meetings with the Owner including intermediate design coordination meetings, and monthly progress meetings. Provided constructability reviews and oversaw the QAQC process for the intermediate and final work products. Coordinated with the Owner and prepared the Division 00 and Division 01 specifications for the project along with coordinating the specifications for all other disciplines. Prepared submittals to the NJDEP I-Bank and State Comptroller's office for "Authorization to Advertise". Assisted with the process to prequalify bidders in accordance with NJ Statutes, prepared addenda for the project, and reviewed bids received.

Hazen

- Budget analysis
- Corporate governance
- Site security
- Plant operations

Experience

- 16 total years
- 3 years with Hazen

Professional Activities

American Society of Safety Professionals

Construction Management Services for Croton Falls Pump Station, New York City Department of Environmental Protection (NYCDEP), Carmel, NY

Environmental Health & Safety (EHS) Management/Safety Professional. Conducted regular site visits and assisted in EHS Management Plan implementation and other project related safety needs. Hazen is providing construction management services to assist the NYCDEP with several important goals and objectives, including demolition of the existing hydraulically driven pump and turbine system adjacent to the Croton Falls Dam and construction of the new electrically powered 150-mgd pumping system.

Gowanus Facility Upgrades and New Force Main, NYCDEP, Brooklyn, NY

EHS Manager/Safety Professional. Provided construction management and EHS oversight and conducted regular site visits assisting with accident/incident investigations and other project related safety needs. Hazen provided construction management services to assist NYCDEP with several important goals and objectives, including the improvement of water quality in the Gowanus Canal by upgrading the Flushing Tunnel, CSO screening system, and wastewater pumping stations along with associated facilities such as new hydraulically actuated bending weirs and wastewater force main.

H6/H7 Long-Term Control Plan Phase 1: Engineering Services During Construction, North Hudson Sewerage Authority, NJ

Construction Management Environmental Health & Safety Officer (CMEHSO). Providing periodic site visits as well as contractor JHA and program development assistance. Hazen provided both DSDC as well as construction administration and resident inspection services for the initial phase of this $21 million construction project, which was crucial in protecting the environment and public health by reducing stormwater flooding in the lowest-lying areas within Hoboken. The project consisted of the construction of a high-level storm sewer system and pump station in the H6/H7 drainage basin. The pump station includes deep foundation concrete wet well, along with a stand-alone mechanical and electrical control building, hydro-dynamic separation (vortex) pretreatment units, and piping and appurtenances. The storm sewer system consisted of 54" centrifugally cast, glass-fiber-reinforced, polymer mortar (CCFRPM) piping as well as precast concrete access and inlet structures. The pump station and control building work were performed within the City's Northwest Resiliency Park construction site and the storm sewer work was constructed within the abutting residential neighborhood streets. Construction of the new Control Building included coordination of a new PSE&G electrical service, transformer, and electrical switchgear.

Rose Jesse, CPE, ENV SP

Senior Associate

Ms. Jesse has 21 years of experience managing, directing, evaluating and performing work in the construction industry, with proven success in the areas of cost estimating, budgeting, scheduling, document control, and project controls. She currently oversees the estimating team, providing transparent, defensible cost estimates by utilizing the recommended practices of the AACE, real data on cost, and construction knowledge.

Education

BS, Civil Engineering Technology, Rochester Institute of Technology, 1996

Training/Certification

American Society of Professional Estimators (CPE)

Envision Sustainability Professional (ENV SP)

OSHA 10 & 30 hour Construction Outreach

Risk Management (AACE)

Cost and Schedule Control (AACE)

Earned Value Management (AACE)

GHS/HAZCOM Training

Confined Space Entry Training

NYCDEP Hot Work Training

Lock Out – Tag Out Training

Behavior Based Safety Training

Areas of Expertise

- Construction cost estimating
- Constructability review
- Risk assessment
- Construction sequencing/ scheduling

Experience

- 21 total years
- 4 years with Hazen

Professional Affiliations

Project Management Institute

Association for the Advancement of Cost Engineering International

National Association of Women in Construction

New York Water Environment Association

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ
Cost Estimating Manager. Provided estimating for the construction of two new interceptors with 30" and 54" diameters, a new 50-mgd pump station and 36" forcemain to replace aging facilities and provide added capacity. The 54" interceptor will be constructed under Pleasure Bay at a depth of 90 feet using a tunnel boring machine.

Eltingville Pump Station, New York City Department of Design and Construction (NYCDDC), Staten Island, NY
Conducted a thorough review of pump station estimate prepared in Sage Estimating software (Timberline). The project includes temporary bypass station, bypass pumping, and replacement of main sewer line.

Offshore Ocean Outfall Replacement, Township of Ocean Sewerage Authority, Oakhurst, NJ
Cost estimating review to evaluate three options for the Authority's existing 3-inch ocean outfall pipe which was constructed between 1966 and 1968. The goal is to determine the most advantageous course of action on both a short and long-term basis. The total length of outfall is approximately 6,000 feet, including 4,200 feet on land and 1,800 feet offshore. Selection of the most advantageous and viable options are based on several factors that were developed with the Authority, along with Hazen's subconsultant Pure Technologies' who provided condition assessment analyses using PipeDiver. The evaluation findings and recommendations are being presented in report along with conceptual/budget construction costs.

Hazen

NIH Pipeline Project - Section 110, Massachusetts Water Resources Authority (MWRA), Stoneham, MA
Lead Estimator and Reviewer. Provided oversight and reconciliation for a third party estimate for the installation of over 1.5 miles of 36" water-main and associated appurtenances. Work included reconstruction of roadways; maintenance and protection of traffic, vaults and meters, and other miscellaneous associated work.

Piscataway Wastewater Treatment Plant Pump Station Upgrades, Washington Suburban Sanitary Commission, Accokeek, MD
Prepared cost estimate for the construction of a new 60-mgd raw wastewater pump station and force main.

Gowanus CSO Facilities, NYCDEP, New York, NY
Cost Estimating Manager/Cost Estimator. Prepared preliminary cost estimates for micro-tunneling to support wastewater treatment systems. Performed review of all cost estimates associated with combined sewer overflow facilities including demolition, construction and restoration.

Kensico – Eastview Connection, NYCDEP, New York, NY
Cost Estimator and Reviewer of Estimates for intake structures, screen chambers, tunnels, connections, and bypasses. The scope of this project includes new structures, repair and renovation of existing structures and all sitework, equipment, electrical and instrumentation work to be done for a new connection between the Kensico Dam and an existing water treatment facility.

CMOM Conceptual Costs, Town of Nantucket, MA
Provided oversight and estimating for cost analysis of sanitary sewer collection systems in the Town of Nantucket. Work included sewer lining, manhole lining, sewer repairs, pipe bursting, new sewer installation, and all related installations.

White Plains Water Storage Tanks and Pressure Basin Demolition, City of White Plains, NY
Reviewed and managed cost estimates for two new water tanks and the demolition of the existing pressure basin. Work includes extensive site work, installation of precast concrete tanks, and upgrade of all piping and connection.

Stamford Water Treatment Plant Residual Alternative Analysis, Aquarion Water Company of Connecticut, CT
Support and review of estimates for the installation of new lagoons in a greenfield location. Project involved excavation and removal of over

James Soroush

Senior Technician

Mr. Soroush has over 15 years of experience in construction management with an emphasis in wastewater treatment facilities. He possesses broad knowledge in construction practices including scheduling, project controls and administration, cost estimating and inspections.

Education

BS, Public Relations, Oswego State University, 2003

MS, Construction Management, Drexel University, 2015

Certification/License

OSHA 10 Hour Class

Permit Authorizing Individual

Project Management Information System

Automated Procurement Tacking

Permit Tracking Database Training

Expedition

Primavera 6

Areas of Expertise

- Project controls
- CPM scheduling
- Cost estimating
- Change orders
- Construction management
- Permitting
- ePMIS

Experience

- 15 total years
- 11 years with Hazen

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority (TRWRA), Monmouth Beach, NJ

CPM Scheduler. Responsible for project controls including CPM schedule analysis and reporting, and claim and delay mitigation.

PS-287: Eltingville Pump Station, NYCDEP, Staten Island, NY

Project Controls Member during the design phase for this rehabilitation and upgrade of the Eltingville Pump Station which included installation of temporary and permanent force mains; interim pump station; and upgrades to the existing pump station, including wet well, dry well, roof/exterior, electrical and screenings room. Responsible for project controls including planning and development of the construction schedule for design at each stage of design and performing a P80 Risk analysis for risk mitigation during design.

Fritz Island Wastewater Treatment Plant Upgrade (WWTP) Upgrade Project, City of Reading, PA

Project Controls Member for this $150M+ rehabilitation of Fritz Island WWTP including upgrades to metering vaults, primary and final clarifiers, odor control system, new aeration reactors, blower building, new mixed liquor distribution structure, new RAS and WAS pump station, sludge blend tanks, gravity belt thickener, sludge holding tank, administration building, chlorination and declorination systems, and HVAC and electrical system upgrades throughout. Responsible for project controls, including CPM schedule analysis and reporting and claim and delay mitigation and analysis with associated documentation.

Bay Park Sewage Treatment Plant (STP) Program Management Services, Nassau County DPW, East Rockaway, NY

Project Controls Member on the program management team for the Hurricane Sandy Recovery Effort at the Bay Park STP and Related Infra-

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structure program in Nassau County, New York. The $830+ million program consists of the design and construction of permanent repairs and rehabilitation to damaged facilities, including potential storm mitigation measures. The affected facilities include: Sludge dewatering building; outfall pump station; fire protection building; electrical distribution system including switchgear, substations, and MCCs; effluent screening and disinfection building; grit building; plant-wide odor control systems; final clarifiers including RAS and WAS pumps, sludge and scum collector drives; life safety systems; plant-wide HVAC systems; process air blowers; auxiliary power generation; primary tank scum and sludge collectors and pumps; digester facility; sidestream demmonification facility; and related sewage pump stations and collection systems. Responsible for project controls including CPM schedule analysis and reporting, and claim and delay mitigation and analysis with associated documentation.

Westchester CSO Modifications, NYCDEP, Bronx, NY

Assistance Resident Engineer for the CSO modifications of CSO-29 and CSO-29A which includes deep excavations to raise the overflow weir crest, extend the overflow and combined sewers, and relocation of utilities. Responsible for the project controls, including CPM schedule and delay analysis with associated documentation and reporting, change management and cost control, ePMIS administration, and the safety of the project. Also assist the resident engineer in submittal and specification review and implementation, safety, and coordination amongst project staff, contractors, and field operations.

RLCY-BB-01 & RLCY-PR-01: Bowery Bay Wastewater Resource Recovery Facility (WRRF) & Port Richmond WRRF, NYCDEP, Queens/Staten Island, NY

Responsible for project controls during design phase for flood resilient upgrades to Bowery Bay WRRF and Port Richmond WRRF to provide a more flood resilient facility with safe, reliable, sustainable and low maintenance flood protection measures. The project involved elevating existing and/or installing new mechanical and electrical equipment and installing flood protection barriers and reinforced walls throughout the facility. Responsible for Master Project Schedule and reporting from facility planning/design to procurement, construction and close-out phases including P80 Analysis on both schedule and costs, for risk mitigation during design and construction.

Ruby Wells

Senior Associate

Ms. Wells assists with leading Hazen's Funding Support Services Group by navigating various local, state, and federal grant and loan programs in order to secure critical capital funding for the firm's clients.

Education

BS, Chemical Engineering, University of South Florida, 2004

Areas of Expertise

- Environmental Impact Statements, Environmental Impact Reports, and Environmental Assessments (CEQR/CEQA/SEQRA/NEPA)
- Funding support
- Inter-agency coordination and planning
- Water supply planning
- Permitting
- Natural resource analysis

Experience

- 22 total years
- 11 years with Hazen

Professional Activities

American Council of Engineering Companies of New York

- New York Environmental Facilities Corporation Committee

General Engineering Services, Springfield Water and Sewer Commission, MA

Funding Assistance. Providing critical support to secure Drinking Water SRF and WIFIA funding for the Commission's West Parish Water Treatment Facility plant upgrade, which is comprised of a 65-mgd DAF/Filtration facility encompassing approximately $200M of capital improvements.

Rye Lake Water Treatment Facility, Westchester Joint Water Works (WJWW), Westchester County, NY

Funding Assistance. Obtained a $5M Water Infrastructure Improvement Act grant (WIIA) grant for the Rye Lake Water Treatment Facility. The proposed water filtration plant is necessary to maintain the health and safety of WJWW customers and to comply with a United States Environmental Protection Agency (US EPA) Administrative Order as well as a New York State Court Order.

East of Hudson Community Wastewater Planning Assistance, Town of Carmel, NY

Funding Assistance. Provided a detailed assessment of viable local, state, and federal funding support options associated with the alternatives being evaluated under this study. This study is evaluating potential wastewater solutions and the associated water quality impacts from septic systems on local water bodies.

Bergen Basin Sewer Project, NYCDEP, Queens, NY

Project Manager for the Environmental Assessment that details construction of a new 48-inch parallel interceptor across the Belt Parkway at 150th Avenue. The purpose of the project is to reduce combined sewer overflow (CSO) discharges into Bergen Basin and Jamaica Bay by relieving an existing hydraulic bottleneck in the West Interceptor to the Jamaica Wastewater Treatment Plant. Responsible for overseeing EA preparation, including an evaluation of noise, traffic, air, hazardous materials, cultural resources, and open space impacts, including any mitigation measures that would be taken to avoid impacts.

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John Fortin, PE

Senior Associate

Mr. Fortin is the firm's Northeast Region Operations Assistance Services Group Manager. He specializes in process control, operation and maintenance, field testing, commissioning, start-up, troubleshooting, and pumping station evaluations, CSO facilties, and wastewater treatment facilities.

Education

ME, Environmental Engineering, Manhattan College, 1994

BS, Chemical Engineering, Polytechnic Institute of New York, 1981

Certification/License

Professional Engineer: NY

Certified OSHA 30 Hour Construction

Certified S4 Wastewater Treatment Plant Operator in New Jersey

Areas of Expertise

- Operation assistance
- Plant start-up
- Process engineering
- Biological nitrogen removal (BNR)
- Field testing
- Training

Experience

- 38 total years
- 31 years with Hazen

Professional Activities

National Society of Professional Engineers

American Water Works Association

New York Water Environment Association

- Wastewater Facilities Committee Member

Water Environment Federation

- Task Force Committee

Pleasure Bay Crossing and Main Pump Station Replacement, Two Rivers Water Reclamation Authority, Monmouth Beach, NJ

Operability Reviewer. Responsible for operability reviews at 60% and 90% design of a new 54-inch FRP interceptor that will be installed in a 10-foot maximum diameter tunnel, with a length of 3,250 feet and depth of approximately 85 feet below Pleasure Bay to avoid existing soft marine soils below the Pleasure Bay. As part of the design, a new 30-inch FRP Monmouth Beach Interceptor with a length of 950 feet will be rerouted from the existing offsite Main Pump Station (MPS) to the new onsite 50-mgd MPS located on the property of the Authority's WWTP. The new 50-mgd state-of-the-art MPS will have a combination dry pit/wet pit layout, designed to minimize pump station cycling and surges into the WWTP; and will utilize a high flow/low flow dry pit submersible pump arrangement, consisting of two low flow pumps and four high flow pumps. The new station's layout meets Hydraulic Institute standards as confirmed by a physical hydraulic model. The new biofilter will be a state-of-the-art, built-in-place biofilter, designed to treat the foul air from the Main Pump Station. As part of the MPS improvements, a new 36-inch DIP force main with a length of 700 feet will convey flows from the new on-site MPS on to the existing on-site Headworks/Blower Building for this NJ I-Bank funded project. The design phase is currently complete, permitting applications submitted, and project is entering the NJ DCA approved contractor pre-qualification phase given complexity and magnitude.

Avenue V Pumping Station, NYCDEP, Brooklyn, NY

Operations Assistance Services Manager for the commissioning of the newly upgraded 80-mgd pumping station including start-up, training, staffing plans, computerized maintenance management system, operations budget, start-up plans and acceptance procedures, O&M manual, and standard operating procedures development.

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Technical Publications

Contributing Author: Wastewater Fundamentals Training Manual. "Volume 1 - Liquid Processes."

Contributing Author: Revision of MOP 11, Operation of Municipal Wastewater Treatment Plants, "Chapter 20 – Activated Sludge."

Contributing Author: Revision of MOP 11, Operation of Municipal Wastewater Treatment Plants, "Chapter 22 – Biological Nutrient Removal Processes."

Contributing Author: Revision of MOP 11, Operation of Municipal Wastewater Treatment Plants, "Chapter 30 – Anaerobic Digestion."

Gowanus Pumping Station, NYCDEP, Brooklyn, NY
Operations Assistance Services Manager for the commissioning of the upgraded 30-mgd pumping station including start-up, training coordination and facilitation, and development of duty station checklists.

Manhattan Pumping Station, NYCDEP, New York, NY
Operations and Maintenance Services Manager for the start-up of the newly upgraded 400-mgd pumping station including, start-up, training, start-up plans and acceptance procedures, O&M manual, and standard operating procedures development.

Warnerville Pump Station, NYCDEP, Queens, NY
Operations and Maintenance Services Manager. For this newly constructed sanitary sewage pumping station; developed clean water testing procedures, 48-hour system test procedures and alternative commissioning testing procedures, standard operating procedures, preliminary O&M manual, and start-up and acceptance plan.

Paerdegat Basin Combined Sewer Overflow (CSO) Facility, NYCDEP, Brooklyn, NY
Operations and Maintenance Services Manager. For this newly constructed 50-mgd CSO facility; managed the O&M group responsible for commissioning, training; plan of operations; O&M manual; pocket guides; color flow diagrams; start-up plans and acceptance procedures; emergency operation plans; staffing plans; computerized maintenance management system and an operations budget. Additional services after start-up included a monitoring and sampling program for compliance with the SPDES permit and plant performance assistance and first-year certification.

26th Ward Wastewater Resource Recovery Facility (WRRF), NYCDEP, Brooklyn, NY
Operations and Maintenance Services Manager. Developed recommendations for implementation and long-term stability of biological nitrogen removal (BNR) operation for the upgrade of this 85-mgd facility. Reviewed the design of numerous BNR-related process systems including submersible mixers, diffused aeration and surface wasting.

Newtown Creek WRRF, NYCDEP, Brooklyn, NY
Operations Assistance Manager at this 310-mgd facility for the commissioning of the newly constructed egg digesters and ferric chloride struvite control system; influent screening and main sewage pumping; grit removal; secondary treatment facilities (aeration and final settling); disinfection system; central hot water system; emergency power system and centrifuge thickening. Responsibilities included training, start-up, O&M manual, and standard operating procedure development. Also involved in all process related issues that affected the current and future operation of the plant.

Subconsultant Resumes

Bahram Farzaneh, PE, PP

Senior Engineer | Site/Civil

Mr. Farzaneh has more than 37 years of diverse experience and widespread knowledge in the planning and engineering design of various municipal, site, and transportation projects. His responsibilities include designing and managing engineering projects from the conceptual planning stage to the preliminary and final design stages. Mr. Farzaneh has extensive experience in preparing permit applications and supporting documentation for roadway drainage, water and wastewater treatment plants and infrastructure, recharge/infiltration basins and swales, hydraulic/hydrological analysis, and stormwater management designs on numerous public and private projects. He has extensive knowledge of the existing New Jersey Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A) and Flood Hazard Area Control Act Rules (N.J.A.C. 7:13) and is a member of the NJDEP Bridges and Culverts/Transportation Projects Focus Group, which reviews and comments on pending flood hazard rules amendments prior to adoption.

Mr. Farzaneh's expertise in hydrological and hydraulic (H&H) design includes residential and commercial development, bridge replacement projects over state-regulated waterways, dams/spillway structures, and roadway improvement projects. His responsibilities included serving as Lead Designer on projects ranging from simple site assessments to complex watershed stormwater management reports. He is familiar with roadway drainage design according to NJDOT's drainage design manual and NRCS design guidelines. Mr. Farzaneh also coordinates the preparation of regulatory permits for state and federal agencies, including the US Army Corps of Engineers, US Coast Guard, and NJDEP (Waterfront Development and CAFRA).

He has performed and managed various engineering functions, such as: horizontal and vertical road alignment; storm and sanitary sewer design; and hydrologic analysis using the Rational and TR-55 Methods; as well as detention basin design; floodplain delineation and stream encroachment analysis using the HEC-RAS and HEC-2 computer program; and dam hazard classification and dam safety and failure analysis using HEC-1, HMR-51, and HMR-52 computer programs. He has also prepared emergency action plans, flood inundation maps, and O&M manuals for dams. His additional experience includes site grading, earthwork analysis, and preparing specifications, contract documents, and construction cost estimates. He has reviewed site plans and subdivision applications submitted to municipal clients for consideration by planning and zoning boards, as well as prepared municipal, county, state, and federal permit applications for the NJDEP for water main and sanitary sewer extensions, stream encroachment, and freshwater wetlands general permits.

Career Snapshot

- Over 37 Years of Experience
- Experience in stormwater management
- Proficient in regulatory permitting
- Extensive knowledge of NJ Freshwater Wetlands Protection Act & Flood Hazard Area Control Act rules
- Member of the NJDEP Bridges & Culverts/ Transportation Projects focus group

Education

- BS, Civil Engineering, University of Texas

Registrations / Licenses

- Professional Engineer: NJ, DE
- Professional Planner: NJ

Affiliations

- Association of Dam Safety Officials
- American Society of Civil Engineers
- New Jersey Society of professional Engineers

Training

- NJDEP Flood Hazard Control Act

Robert Knotz, PE

Project Consultant | Geotechnical

Mr. Knotz has more than 20 years of experience in engineering design and construction administration with a specialization in geotechnical engineering for public and private clients. His responsibilities include project coordination and implementation, performing engineering analyses and design, preparing reports, and preparing plans and specifications. He has also served as Project Manager for various multi-disciplinary projects overseeing tasks involving many of FPA's technical disciplines. This experience has given him strong project coordination and communication skills, including serve as a client's single point of contact.

Mr. Knotz has participated in a range of projects, including buildings, bridges, storage tanks, earth retaining structures, bulkheads, dams, pipelines, highway embankments, pedestrian walkways/trails, and roadways. His involvement has included inspections, construction monitoring, and engineering analysis and design.

Mr. Knotz has extensive geotechnical related experience, including engineering analyses for slope stability, settlement and consolidation, seismic analyses, lateral earth pressures, bearing capacity evaluation, and dewatering evaluations. His design work has included shallow and deep foundations, earth retaining structures, soil and rock anchor design, soil improvement projects, pavements, and under drain system design.

Mr. Knotz has evaluated and designed various earth retaining structures, including cantilever and anchored seawalls, gabion wall systems, reinforced concrete gravity structures, and mechanically stabilized earth walls. This has included evaluating external and internal stability, slope stability, structural design, and preparing construction plans.

Mr. Knotz also has extensive experience in water and wastewater projects, including rehabilitating and installing below-grade pipelines and outfall structures and improving and rehabilitating water and wastewater treatment plants. He has been involved with industrial projects, including pipelines and major facility upgrades at petroleum/chemical storage facilities and improving rail, marine, and port facilities throughout the northeast United States. Mr. Knotz has also been involved in a variety of water resources projects, including dams, hydraulic structures, and spillways. He has participated in dam rehabilitation, stability analyses, seepage analyses, and regular and formal dam inspections, including preparing visual inspection checklists and inspection report summaries. Mr. Knotz has also prepared operation and maintenance manuals (O&M) and emergency actions plans (EAPs)

Career Snapshot

- Over 20 years of experience
- Multi-discipline management experience
- Expertise with earth retaining structures
- Expertise in foundation engineering
- Extensive experience at industrial facilities

Education

- BS, Civil Engineering, Rutgers University
- BS, Physics, Richard Stockton University

Registrations / Licenses

- Professional Engineer: NJ, NY, PA, CT, RI, NC, VA, WV, OH, MD, NH, MA

A Specialized Training

- NJDCA Special Inspector, Reinforced Concrete
- OSHA 10-Hour General Industry Safety
- OSHA Certified Space Training
- Transportation Worker Identification Credential (TWIC)

Affiliations

- American Society of Civil Engineers (ASCE)
- Association of State Dam Safety Officials
- NJ Water Environmental Association

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