Schnabel ENGINEERING

August 11, 2015

City of Saratoga Springs
Office of the Commissioner of Accounts
474 Broadway
Saratoga Springs, NY 12866

Subject: **Proposal Response for RFP #: 2015 – 34 – Dam Safety Compliance**

Dear Sir or Madam:

SCHNABEL ENGINEERING OF NEW YORK (Schnabel) appreciates the opportunity to present our dam engineering services proposal to the City of Saratoga Springs (City) for bringing Loughberry Lake Dam into compliance with the current New York State dam safety regulations. We have reviewed your Request for Proposals (RFP), thoroughly understand the project goals and requirements for an Engineering Assessment (EA), and assembled a local team ideally suited for this opportunity.

The City previously issued a request for these services under RFP # 2015 – 11 in February 2015. The original bid results were read at the bid opening and distributed to the bidders via email. Schnabel was notified in March 2015 that the City Engineer recommended our selection for this work. Based on conversations with Assistant Purchasing Agent, Stefanie Richards, it is our understanding that Schnabel was not contracted for this work because a prescriptive time table had expired.

Our review of the original and current solicitations has confirmed that the scopes of work are identical. We believe that our original submittal presented the best value to the City in terms of firm qualifications, technical approach, and fee, and remain confident that we are the right firm for this project. The release of the fees proposed by others does not cloud our professional judgment relative to our proposed scope of work and fee or influence our response to this latest request. As such, the enclosed submittal is identical to that which we submitted in February augmented with updated forms and insurances.

We are excited about the opportunity to work with Saratoga Springs. I hope that your procurement process will result, again, in our selection for this important infrastructure project. I reaffirm my commitment to dedicate the resources and talent necessary to fulfill the goals of this project. Please feel free to contact me at 518-348-8575, or via email at gdaviero@schnabel-eng.com, should you have any questions or require any clarification.

Sincerely,

SCHNABEL ENGINEERING OF NEW YORK

Gregory J. Daviero, PhD, PE
Principal

Statement of Specifications

Dam Safety Compliance

See Attached Documents:

1. **City of Saratoga Springs Dam Break Innundation Study, 2005**

The specification herein states the minimum requirements of the City. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The City will consider as "irregular" or "non-responsive" any bid not prepared and submitted in accordance with the bid document and specification, or any bid lacking sufficient technical literature to enable the City to make a reasonable determination of compliance to the specification.

It shall be the bidder's responsibility to carefully examine each item of the specification. Failure to offer a completed bid or failure to respond to each section of the technical specification will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions and/or deviations shall be fully described in the appropriate section.

TOTAL BID PROPOSAL IN FIGURES: $ $56,700

TOTAL BID WRITTEN: Fifty-six thousand seven hundred dollars

COMPANY NAME: Schnabel Engineering of New York

ADDRESS: 28 Corporate Drive, Suite 104

Clifton Park (City) NY (State) 12065 (Zip) Phone No. ( ) 518-348-8575

E-MAIL ADDRESS: gdaviero@schnabel-eng.com

AUTHORIZED SIGNATURE: _____

PRINTED NAME: Gregory Daviero, PhD, PE

TITLE: Principal DATE: 8/11/2015

Waiver of Immunity Clause

Section §139(a) State Finance Law

Upon the refusal by a representative of your firm, when called before a grand jury to testify concerning any transaction or contract with the City of Saratoga Springs, New York, or to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant question concerning such transactions or contracts,

(a) such person, and any firm, partnership or corporation of which he is a member, partner, director or officer shall be disqualified from thereafter selling to or submitting bids to or receiving awards from or entering into any contracts with any municipal corporation or fire district, or any public department, agency or official thereof, for goods, work or services, for a period of five years after such refusal, and to provide also that

(b) any and all contracts made with any municipal corporation or fire district, or any public department, agency or official thereof, since the effective date of this law, by such person, and by any firm, partnership or corporation of which he is a member, partner, director or officer may be cancelled or terminated by the City without incurring any penalty or damages on account of such cancellation or termination, but any monies owing by the City for goods delivered or work done prior to the cancellation or termination shall be paid.

Non-Collusive Bidding Certification

Section §139(d) State Finance Law

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and, in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of his knowledge and belief:

(1) The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and
(3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition."
A bid shall not be considered for award nor shall any award be made where (1), (2), (3) above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefore.

Signature: _____ Print Name: Gregory Daviero, PhD, PE

Title: Principal Date: 8/11/2015

Company: Schnabel Engineering Address: 28 Corporate Dr., Suite 104, Clifton Park, NY 12065

Subscribed to under penalty of perjury under the laws of the State of New York, this 11th day of August, 2015 as the act and deed of said corporation of partnership.

Vendor/Supplier Code of Conduct

The City of Saratoga Springs is committed to conduct business in a lawful, ethical and moral manner and expects the same standards from vendors/suppliers that the City conducts business with. The City requires that all vendors/suppliers abide by this Code of Conduct. Failure to comply with this Code may be sufficient cause for the City to exercise its' rights to terminate its' business relationship with vendors/suppliers. Vendors/suppliers agree to provide all information requested which is necessary to demonstrate compliance with this Code.

At a minimum, the City requires that all vendors/suppliers meet the following standards:

- Legal: Vendors/suppliers and their subcontractors agree to comply with all applicable local, state and federal laws, regulations and statutes.
- The City expects vendors/suppliers to respect the City's rules and procedures.
- Conflict of Interest: The vendor/supplier represents and warrants that it has no conflict, actual or perceived, that would prevent it from doing business with the City of Saratoga Springs.
- Wages & Benefits: Vendors/suppliers will set working hours, wages, and NYS statutory benefits and overtime pay in compliance with all applicable laws and regulations. Where applicable, as defined by NYS Labor Law, the vendor/supplier must comply with prevailing wage rates.
- Health & Safety: Vendors/suppliers and their subcontractors shall provide workers with a safe and healthy work environment that complies with local, state and federal health and safety laws.
- Discrimination: No person shall be subject to any discrimination in employment, including hiring, salary, benefits, advancement, discipline, termination or retirement on the basis of gender, race, religion, age, disability, sexual orientation, nationality, political opinion, party affiliation or social ethnic origin.
- Working conditions: Vendors/suppliers must treat all workers with respect and dignity and provide them with a safe and healthy environment.
- Right to organize: Employees of the vendor/supplier should have the right to decide whether they want collective bargaining.
- Subcontractors: Vendors/suppliers shall ensure that subcontractors shall operate in a manner consistent with this Code.
- Protection of the Environment: Vendors/suppliers shall comply with all applicable environmental laws and regulations. Vendors/suppliers shall ensure that the resources and material they use are sustainable, are capable of being recycled and are used effectively and a minimum of waste. Where practicable, vendors/suppliers are to utilize technologies that do not adversely affect the environment and when such impact is unavoidable, to ensure that it is minimized.

Vendor Acknowledgement

The undersigned vendor/supplier hereby acknowledges that it has received the City of Saratoga Springs Vendor/Supplier Code of Conduct and agrees that any and all of its facilities and subcontractors doing business with the City will receive the Code and will abide by each and every term therein.

Vendor/supplier acknowledges that its failure to comply with any condition, requirement, policy or procedure may result in the termination of the business relationship. Vendor/supplier reserves the right to terminate its agreement to abide by the Code of Conduct at any time for any reason upon ninety (90) days prior written notice to the City.

Signature: _____ Printed name: Gregory Daviero, PhD, PE

Title: Principal Date: 8/11/2015

Company Name: Schnabel Engineering

City of Saratoga Springs, NY: *Risk and Safety Agreement for Professional Services*

City Project Number: RFP #2015-34 **City Project Name:** Dam Safety Compliance
City Department: Accounts **Department Contact Person:** Stephanie Richards **City Ext.** _____
Company Name: Schnabel Engineering
Company Address: 28 Corporate Drive, Suite 104, Clifton Park, NY 12065
Company Telephone No.: 518-348-8575 **Company Fax No.:** _____
Consultant Primary Contact for This Project: Gregory Daviero, PhD, PE **Title:** Principal

The City of Saratoga Springs herein requires the following terms and conditions regarding the agreement for the provision of professional services as outlined above:

The Consultant shall procure and maintain during the term of this contract, at the Consultant's expense, the insurance policies listed with limits equal to or greater than the enumerated limits. The Consultant shall be solely responsible for any self-insured retention or deductible losses under each of the required policies. Every required policy, including any required endorsements and any umbrella or excess policy, shall be primary insurance. Insurance carried by the City of Saratoga Springs, its officers, or its employees, if any, shall be excess and not contributory insurance to that provided by the Consultant. Every required coverage type shall be "occurrence basis" with the exception of Professional Errors and Omissions Coverage which may be "claims made" coverage. The Consultant may utilize umbrella/excess liability coverage to achieve the limits required hereunder; such coverage must be at least as broad as the primary coverage (follow form). The Office of Risk & Safety Management must approve all insurance certificates. The City of Saratoga Springs reserves its right to request certified copies of any policy or endorsement thereto. All insurance shall be provided by insurance carriers licensed & admitted to do business in the State of New York and must be rated "A–:VII" or better by A.M. Best (Current Rate Guide). If the Consultant fails to procure and maintain the required coverage(s) and minimum limits such failure shall constitute a material breach of contract, whereupon the City of Saratoga Springs may exercise any rights it has in law or equity, including but not limited to the following: (1) immediate termination of the contract; (2) withholding any/all payment(s) due under this contract or any other contract it has with the vendor (common law set-off); OR (3) procuring or renewing any required coverage(s) or any extended reporting period thereto and paying any premiums in connection therewith. All monies so paid by the City of Saratoga Springs shall be repaid upon demand, or at the City's option, may be offset against any monies due to the Consultant. The City of Saratoga Springs requires the Consultant name the City as a Certificate Holder for the following coverage for the work covered by this Agreement:

- **Commercial General Liability** Including Completed Products and Operations and Personal Liability Insurance: One Million Dollars per Occurrence with Two Million Dollars Aggregate including One Million Dollars Pollution Liability Insurance ***(City is also an Additional Insured on a Primary and Non-contributory Basis for this coverage);***
- **Commercial Automobile Insurance:** One Million Dollars Combined Single Limit for Owned, Hired and Non-owned Vehicles
- **Excess Liability Insurance:** Three Million Dollars per Occurrence Aggregate
- **Professional Errors and Omissions Insurance:** One Million per Occurrence with Two Million Aggregate
- **NYS Statutory Workers Compensation, Employer's Liability and Disability Insurance**

If awarded the bid, it shall be an affirmative obligation of the Consultant to advise City's Office of Risk and Safety via mail to Office of Risk and Safety, City of Saratoga Springs, 474 Broadway, Saratoga Springs, NY 12866, within two days of the cancellation or substantive change of any insurance policy set out herein, and failure to do so shall be construed to be a breach of this Agreement. The Consultant acknowledges that failure to obtain such insurance on behalf of the municipality constitutes a material breach of contract and subjects it to liability for damages, indemnification and all other legal remedies available to the City. The Consultant is to provide the City with a Certificate of Insurance naming the City as ***Additional Insured on a primary and non-contributory basis*** prior to the commencement of any work or use of City facilities. The failure to object to the contents of the Certificate of Insurance or the absence of same shall not be deemed a waiver of any and all rights held by the municipality. In the event the Consultant utilizes a Subcontractor for any portion of the services outlined within the scope of its activities, the Subcontractor shall provide insurance of the same type or types and to the same extent of coverage as that provided by the Consultant. All insurance required of the Subcontractor shall name the City of Saratoga Springs as an ***Additional Insured on a primary and non-contributory*** basis for all those activities performed within its contracted activities for the contact as executed. **For the purposes of this bid, the Certificate of Insurance shall name the Certificate Holder as follows: City of Saratoga Springs, Attention: Purchasing Agent, 474 Broadway, Saratoga Springs, NY 12866.**

The Consultant, to the fullest extent provided by law, shall indemnify and save harmless the City of Saratoga Springs, its Agents and Employees (hereinafter referred to as "City"), from and against all claims, damages, losses and expense (including, but not limited to, attorneys' fees), arising out of or resulting from the performance of the work or purchase of the services, sustained by any person or persons, provided that any such claim, damage, loss or expense is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of property caused by the tortious act or negligent act or omission of Consultant or its employees or anyone for whom the Consultant is legally liable or Subcontractors. Without limiting the generality of the preceding paragraphs, the following shall be included in the indemnity hereunder: any and all such claims, etc., relating to personal injury, death, damage to property, or any actual or alleged violation of any applicable statute, ordinance, administrative order, executive order, rule or regulation, or decree of any court of competent jurisdiction in connection with, or arising directly or indirectly from, errors and/or negligent acts by the Consultant, as aforesaid.

The City of Saratoga Springs specifically reserves the right to suspend or terminate all work under this contract whenever Consultant and/or Consultant's employees or subcontractors are proceeding in a manner that threatens the life, health or safety of any of Consultant's employees, subcontractor's employees, City employees or member(s) of the general public on City property. This reservation of rights by the City of Saratoga Springs in no way obligates the City of Saratoga Springs to inspect the safety practices of the Consultant. If the City of Saratoga Springs exercises its rights pursuant to this part, the Consultant shall be given three days to cure the defect, unless the City of Saratoga Springs, in its sole and absolute discretion, determines that the service cannot be suspended for three days due to the City of Saratoga Springs' legal obligation to continuously provide Consultant's service to the public or the City of Saratoga Springs' immediate need for completion of the Consultant's work. In such case, Consultant shall immediately cure the defect. If the Consultant fails to cure the identified defect(s), the City of Saratoga Springs shall have the right to immediately terminate this contract. In the event that the City of Saratoga Springs terminates this contract, any payments for work completed by the Consultant shall be reduced by the costs incurred by the City of Saratoga Springs in re-bidding the work and/or by the increase in cost that results from using a different vendor.

Consultant, having agreed to the terms and the recitals set forth herein, and in relying thereon, herein signs this Agreement.

Consultant Signature: _____ **Date:** 8/11/2015

CITY OF SARATOGA SPRINGS
DAM SAFETY COMPLIANCE

February 24, 2015

Schnabel ENGINEERING

submitted by
SCHNABEL ENGINEERING OF NEW YORK
28 Corporate Drive, Suite 104
Clifton Park, NY 12065
518/348-8575

Schnabel ENGINEERING

February 24, 2015

City of Saratoga Springs
Office of the Commissioner of Accounts
474 Broadway
Saratoga Springs, NY 12866

Subject: **Proposal Response for RFP #: 2015 – 11 – Dam Safety Compliance**

Dear Sir or Madam:

SCHNABEL ENGINEERING OF NEW YORK is pleased to present our proposal to the City of Saratoga Springs (City) to provide dam engineering services to bring Loughberry Lake Dam into compliance with the current New York State Department of Environmental Conservation (NYSDEC) dam safety regulations. The development of your EA is the beginning of a process that could result in a significant capital improvement project. Loughberry Lake is an important component of your community and is a source of economic development, water supply, and recreational activity. The long-term reliability of the dam is essential, and your upcoming decisions could carry financial consequences for an extended period. Therefore, the approach to performing the EA needs to be informed, thoughtful and deliberate, and the need for improvements should be fully vetted so that appropriate measures are implemented to support the City's long-term objectives. We have reviewed the RFP, thoroughly understand the project goals and requirements for an Engineering Assessment (EA), and assembled a local team ideally suited for this opportunity.

WHY SCHNABEL

As noted in the RFP, the state has issued DOW TOGS 3.14 - Guidance for Dam Engineering Assessment Reports (Guidance Document) which define the typical elements of an EA. Just as reading a cookbook doesn't make one a chef, reading the Guidance Document doesn't make one a dam engineer. Hiring a firm that ***focuses solely on dam engineering*** will result in a superior outcome, protect one of your greatest assets, and result in the lowest total cost for your project. Schnabel is unique in that more than 90 of our nearly 300 engineering and scientific professionals are dedicated entirely to the dam engineering profession. We are not dabblers in dam engineering, we are industry leaders, who define, and in some cases create, the state of the practice. Our engineering professionals have exceptional experience in all disciplines pertinent to dams including civil engineering, hydrology and hydraulics (H&H), geotechnical engineering, structural analysis and design, permitting, and construction engineering. Since 1994, we have performed engineering assessment, design, and construction support services for more than 1,000 dam projects. We provide dam engineering services from four locations in the eastern US, including our Clifton Park, New York, office.

T/ 518-348-8575
28 Corporate Drive, Suite 104 / Clifton Park, NY/ 12065

OUR SUBMITTAL

We have provided you with a submittal that details our significant experience with dam projects just like yours. Though the RFP did not provide specific criteria by which each proposal will be judged, we have summarized the sections of our submittal which we believe will distinguish us from our competitors and will facilitate a more timely review.

1. Firm Qualifications:

This section presents Schnabel's industry-leading comprehensive dam engineering qualifications. Schnabel was honored at the 2012 Association of State Dam Safety Officials National Conference with the prestigious *Dam Rehabilitation Project of the Year Award* for our work on the Lake Townsend Dam water supply project in Greensboro, North Carolina. This is the *second* time that Schnabel has received this award in the past 12 years. Schnabel was also awarded the United States Society on Dams 2013 Project Award for our work on the Deep Creek Watershed Dam 5D in Yadkin County, North Carolina. Schnabel advanced both of these projects from the initial EA through construction. These awards demonstrate Schnabel's commitment to excellence in dam engineering, as well as the respect Schnabel has earned from our peers.

2. Project Team:

This section presents our organizational chart and resumes of each of our project team members. Our staff assigned to this work resides in our local Clifton Park, NY office. Together Kevin Ruswick and I have participated in engineering evaluations on more than 40 dams, including more than 25 in NYS. We are both licensed NYS Professional Engineers and active advocates for dam safety education. We developed the NYS American Water Works Association's *Fundamentals of Dam Safety* workshop and for the last ten years have presented it along with representatives from the NYS DEC Dam Safety Section across the state to water system owners, engineers and operators (and are scheduled to do so again in Ballston Spa in June 2015). Through these interactions we have developed insight into the state's interpretation of the new dam safety regulations and are well known and well regarded by NYS DEC Dam Safety staff.

3. Project Approach:

This section presents our project approach for completing this work. The RFP was quite detailed in its explanation of the work and closely followed the requirements set forth in the Guidance Document. Because the EA sets the stage for future required improvements, it's important that knowledgeable and experienced engineers are intimately involved in the technical development and review of the findings. We have provided commentary on the specific tasks identified highlighting some of our concerns and insights derived for our significant experience in NYS and elsewhere.

4. Similar Experience:

This section presents our experience on projects similar to yours. Because of the combination of project elements – principal water supply reservoir with an earthen embankment and achieving NYS Dam safety compliance, we have elected to highlight fourteen projects. Similar to Loughberry Lake Dam, these

projects required a diversified and expert staff to address unique technical and historical elements and to navigate through specific regulatory requirements. Individual project summaries are provided.

5. Cost Proposal:

Our lump sum cost proposal and cost matrix have been provided as requested and in accordance with the RFP. We understand that cost is an important consideration, and in lieu of this we have identified an alternative approach to completing this project that could **save up to $25,000**. This is discussed in detail in this section.

To further demonstrate our value, we offer as an example the City of Plattsburgh project. The advancement of the EA could result in the identification of a dam safety deficiency and trigger a rehabilitation construction project. Approximately 80% of the total project cost will be borne by the implementation of the selected remedial design. Schnabel was recently commissioned to provide a peer review of the EA and design for Plattsburgh's Mead Reservoir Dam. Following our independent assessment, we are on the verge of securing changes to the basis of design criteria that will likely result in **construction cost savings of over $3M**. Thus, the fee allocated for the EA is a small but important percentage of total project cost. At the close of Section 5 we have included a summary of other recent or ongoing projects where we have delivered similarly significant project saving to our clients.

6. Forms:

This section includes the required City Forms and Insurance Certificates including the Dam Safety Compliance Bid Form.

CLOSING

We are excited about the opportunity to work with Saratoga Springs. On behalf of Schnabel, I commit to dedicate the resources and talent necessary to complete this assignment to your satisfaction. Please feel free to contact me at 518-348-8575, or via email at gdaviero@schnabel-eng.com, should you have any questions or require any clarification.

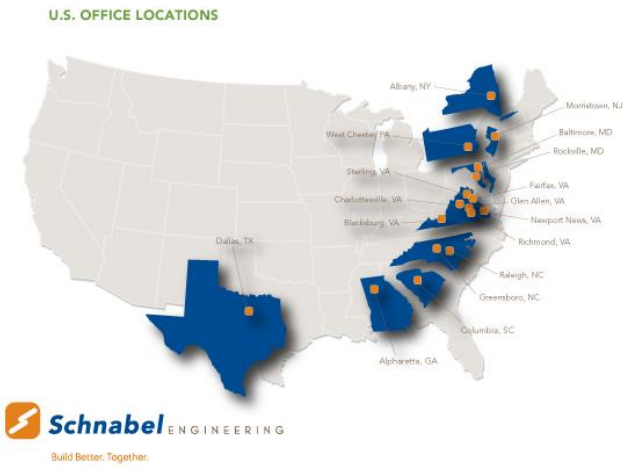
Sincerely,

SCHNABEL ENGINEERING OF NEW YORK

Gregory J. Daviero, PhD, PE
Principal

TABLE OF CONTENTS

SCHNABEL ENGINEERING of NEW YORK is pleased to present our proposal to the City of Saratoga Springs for performing engineering services related to Dam Safety Compliance. We are well qualified, experienced, attentive, and cost-effective consultants who specialize in providing dam engineering services.



Since 1956 we have been providing specialized expertise and design for dam, water resources, geotechnical, and tunnel engineering projects across the U.S. and worldwide. For more than 20 years, Schnabel has been recognized as a premier dam and reservoir engineering firm in the eastern United States and now delivers approximately $19 million in dam and water resources engineering services annually. Our dam engineers have provided engineering assessment, analysis, design, and construction support services for well over 1,800 dam and water resources projects.

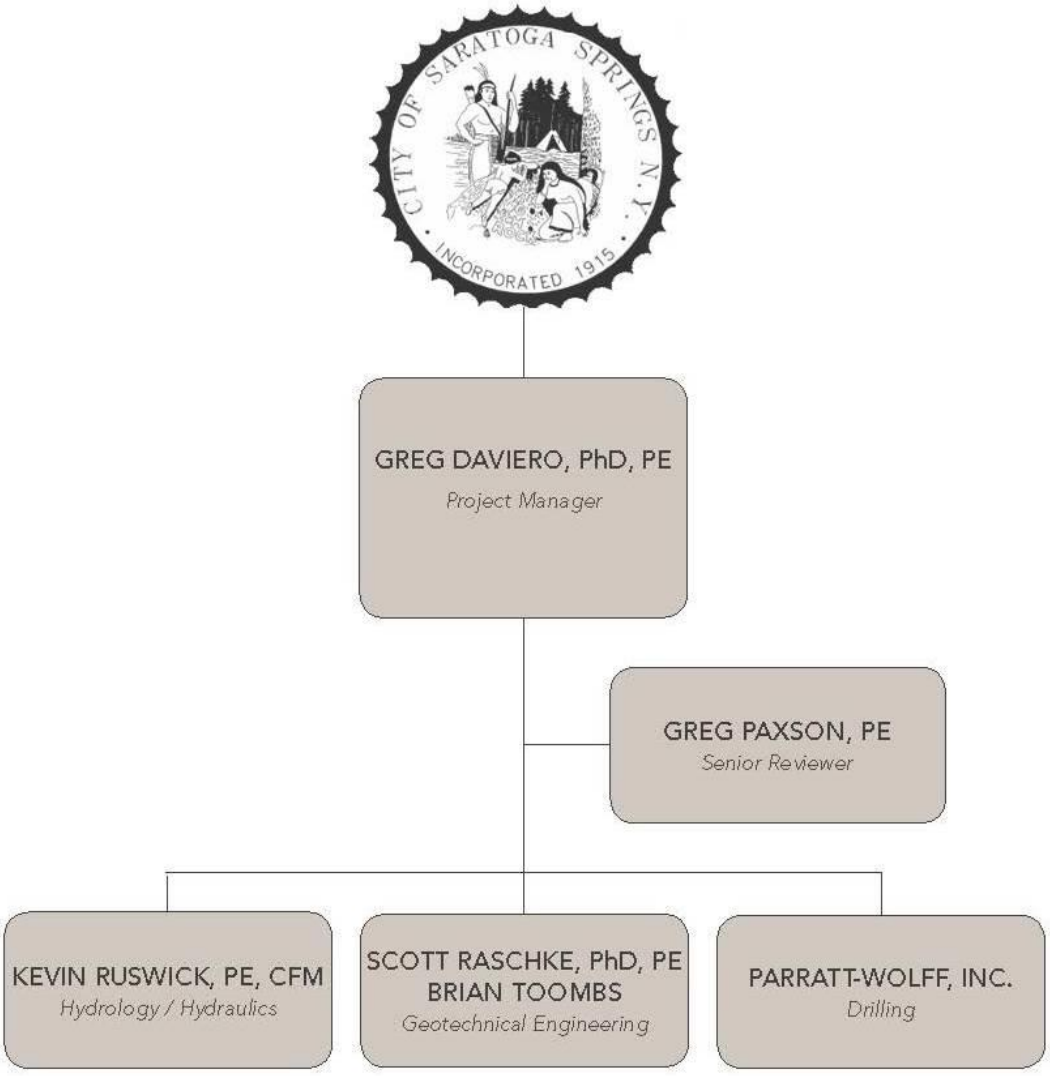
Dam engineering clients include federal, state, and local governments; water suppliers; lake associations; and other consulting engineers. We are a sustaining member of the Association of State Dam Safety Officials (ASDSO), a sustaining member of the United States Society on Dams (USSD), and a member of the National Hydropower Association (NHA). Many of our engineers are active in various committees within these organizations, as well as the American Water Works Association (AWWA) and the International Association for Hydro-Environment Engineering and Research (IAHR).

Schnabel's multi-disciplinary staff of more than 300 includes dam, water resources, geotechnical, civil, environmental, and geostructural engineers; hydrogeologists and hydrologists; geophysicists and geologists; wetlands specialists; program/project managers; and construction quality control managers. More than 90 of Schnabel's staff are dedicated dam and water resources engineering professionals. Our staff has experience in all engineering disciplines relevant to dams and water supply reservoirs, including hydrology and hydraulics, civil engineering, geotechnical and geologic engineering, structural analysis and design, and construction engineering.

To supplement our staff we have added Parratt-Wolff, Inc for drilling services. Parratt-Wolff was founded in 1969 in Syracuse, New York to provide geotechnical drilling services to the northeast and their current service area stretches from Maine to South Carolina and as far west as Michigan with their drillers holding individual licenses in Connecticut, Delaware, Georgia, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York and South Carolina. Parratt-Wolff's drillers are also certified by the National Ground Water Association and the National Drilling Association.

Schnabel personnel have a long history of providing dam engineering services throughout the country and New York State and we are eager to work with Saratoga Springs. Our Engineering Services for this project will be led by Dr. Gregory Daviero. Your project will be managed and staffed by a core group from our office in Clifton Park, New York. Staff here will utilize their extensive NYS dam, geotechnical and water resources engineering experience for the benefit of the City and will be supported by a deep bench of resources located in Morristown, New Jersey, and West Chester, Pennsylvania.

The proposed organization of our project team is presented on the organizational chart below and detailed resumes for this staff are provided on the following pages.



EXPERTISE

Dam Engineering and Hydraulic Design

EDUCATION

Doctorate - Civil Engineering (Environmental Fluid Mechanics and Water R, Georgia Institute of Technology / 1998

Master of Science - Civil Engineering, The Pennsylvania State University / 1991

Bachelor of Science - Civil Engineering, The Pennsylvania State University / 1989

REGISTRATIONS

Professional Engineer / NY

YEARS WITH SCHNABEL

2

TOTAL EXPERIENCE

22

Greg Daviero is a Principal in the Clifton Park, New York, office where he supports a New York State portfolio of clients in the water, wastewater, and dam engineering market areas. Greg has applied his expertise to a wide range of water resource engineering, design, and hydraulic and hydrologic analyses for the benefit of state, federal, municipal, and industrial clients. This experience includes flood control evaluations, dam break analyses, hazard classification assessments, incremental analyses, spillway and hydraulic structure capacity evaluations and design, and low level outlet evaluations and designs. He has been responsible for developing Inspection and Maintenance Plans, Emergency Action Plans, and Engineering Assessments for numerous clients throughout New York State.

Greg is a member of the Education Committee in the New York State Chapter of the American Water Works Association. He is the lead developer and instructor for the Fundamentals of Dam Safety training courses and serves as an instructor for the Fundamentals of Hydraulics course. He is also a member of the Association of State Dam Safety Officials and the New York State Water Environment Association (NYWEA), and is a frequent presenter at their national and regional conferences. Greg is also an Adjunct Professor at Rensselaer Polytechnic Institute where he teaches Applied Hydrology and Hydraulics.

RELEVANT EXPERIENCE

Otsego Lake Dam Hazard Class Assessment

Cooperstown, NY

Project Manager responsible for a comprehensive Engineering Assessment and Hazard Class Assessment of Otsego Lake Dam. Project components included a detailed hydrologic model of the watershed and a hydraulic analysis of the spillway to determine if it met regulatory requirements. Hydrologic and hydraulic modeling also included dam breach modeling and inundation mapping to support a revised hazard class assessment. Additional work included an evaluation of lake level management alternatives to reduce flooding around the lake. This analysis concluded that sedimentation in the channel between the lake and dam reduces spillway capacity and that dredging may be a viable alternative to reduce flooding around the lake.

Mead Reservoir Dam

City of Plattsburgh, NY

Project Manager for the comprehensive hydrologic and hydraulic evaluation of Mead Reservoir Dam, the primary water supply for the City of Plattsburgh. A value engineering type of analyses was performed on work done by another engineer which identified an elementary technical approach which lead to an over prediction in the spillway design flood and an unnecessarily overdesigned spillway capacity upgrade. Revised hydrologic analyses were performed and results were calibrated to a historic storm in August 2011 (Hurricane Irene). The revised hydrologic model resulted in significant reductions in peak flows during the regulatory Spillway Design Flood. Pending approval of the revised hydrologic analysis, the extent and cost of spillway rehabilitation will be substantially reduced. This change will result in reduction of over $3M dollars in construction cost.

City of Kingston, Dam Safety Evaluations and Water Supply Improvements
Ulster County, NY
Project Manager for the Engineering Assessment (EA) and design for the Cooper Lake Dam Improvements. Previously responsible for studies, EAs, designs, and construction oversight for three other dam safety and water supply projects for the Kingston Water Board. Dam Safety regulatory compliance activities included Dam Safety Inspections, Hazard Class Assessments, EAs, EAPs, and Inspection and Maintenance Plans for Cooper Lake Dam (high hazard), Reservoir No. 2 Dam (high hazard), and Binnewater Reservoir Dam (intermediate hazard). In addition, emergency engineering design and construction oversight as well as detailed design activities were performed for the replacement of the Mink Hollow raw water intake structure. Responsible for overall technical, financial, and client and subcontractor contractual items.

New York State Office of General Services: NYSDEC Owned Dams
Multiple Locations, NY
Project Manager for the determination of hazard class screenings of 23 dams owned by the NYSDEC. Responsible for overseeing the detailed review of documents and design drawings in regulatory dam safety files, development of estimates for dam dimensions, normal pool and maximum pool storage volumes, and screening level estimates of potential dam breach flows for each dam. Based on potential dam breach flows, performed a desktop inundation assessment using GIS and Google Earth datasets as well as capacity assessments at downstream hydraulic structures. The overall intent was to provide a risk based prioritization for application of funding for rehabilitation and dam safety compliance activities for state owned dams.

Village of Ossining, Indian Brook Reservoir Dam Rehabilitation
Ossining, NY
Project Manager for the studies and Engineering Assessments associated with NYS regulatory compliance for the Indian Brook Reservoir Dam. The dam is currently classified as a large, high hazard dam. Provided dam engineering services to the Village including all activities pertaining to NYS regulatory compliance. These activities included a dam safety inspection, the development of an EAP, the development of an Inspection and Maintenance Plan, and a comprehensive Engineering Assessment. The primary elements of the ongoing remedial design consist of a new spillway and spillway chute, filtered toe drain, and new low level outlet and water treatment plant inlet. Responsible for overall technical, financial, and client and subcontractor contractual items.

Tillson Lake Dam, Minnewaska State Park
Ulster County, NY
Project Manager for the evaluation for the Tillson Lake Dam Engineering Assessment and five other Class C and B dams owned and operated by the New York State Office of Parks, Recreation and Historic Preservation. Project activities included dam safety inspections, H&H assessments, and dam break modeling for the development of inundation maps, and the development of EAPs and Inspection and Maintenance Plans. The Engineering Assessment for the Tillson Lake Dam Project identified spillway capacity and dam stability as two dam safety deficiencies, and proposed a labyrinth spillway and

dam removal as alternatives to achieve regulatory compliance. Responsible for overall technical, financial, and client and subcontractor contractual items.

Loudonville Reservoir Basin A Rehabilitation
Albany, NY
Project Manager for the design of emergency repairs to Basin A of Albany's finished water storage at Loudonville Reservoir. A leak test was performed to estimated rate of seepage from the reservoir and, following its draining, the 10-acre concrete-lined basin was inspected using both a geophysical survey and analyses of a series of core samples. Developed and implemented recommendations for repairs and construction details.

Emergency Action Plans for Rensselaer Lake and Tivoli Lake Dams
Albany, NY
Project Manager for the development of the Emergency Action Plans for the Class B Rensselaer Lake and Tivoli Lake Dams. The documents were developed to address NYS regulatory requirements. Project activities included hydrologic and hydraulic assessments of the Patroon Creek and dam break modeling for the development of inundation maps.

Fulmer Creek Flood Reduction Study, Herkimer-Oneida County Comprehensive Planning Program
Mohawk, NY
Project Manager for the development of H&H models and the Pair Wise comparison for the evaluation and ranking of options for upstream flood storage facilities. Chronic flooding from summer storms and winter ice jams prompted the Herkimer-Oneida County Comprehensive Planning Program to evaluate the feasibility of a flow attenuation structure in the upper watershed.

Onondaga County Water Authority, Eastern and Western Reservoir Dam Decommissioning
Syracuse, NY
Technical Lead for providing H&H analysis and dam permitting services to support the removal of two earthen embankment finished water storage reservoirs and replacement with concrete storage tanks. The project required that the project team obtain independent dam modification permits for each of the Eastern and Western Reservoir. Each of the two projects required detailed site hydrology, dam break modeling, inundation mapping, dam hazard classification assessment, as well as development of interim EAPs for each facility. Work also included design and permitting for sequentially breaching each dam and removing them from the NYS regulatory dam safety classification system. The work required construction administration services that considered the maintenance of the water system operations during the removal of the two earthen embankments with sequential construction of the two replacement circular concrete tanks.

West Branch Dam and Three Controlled Lakes
Putnam County, NY
Directed the efforts related to the development of Emergency Action Plans for four New York City dams within the water supply system including one high hazard facility, two significant hazard facilities, and one low hazard facility. Emergency Action Plans were

updated utilizing Federal Recommendations for inspection, notification, preparedness, and training and response. Up-to-date hydrologic procedures utilizing the National Weather Service Hydrometeorological Reports 51 and 52 were integrated with previous analyses to determine appropriate spillway design floods for each dam. Inundation Maps were developed utilizing digital elevation models, GIS technologies and infrared aerial photography. Inundation areas were provided for sunny day and wet weather dam break scenarios along with specific design storms.

Denise Cover Floating Cover Design
Rochester, NY
Responsible for the design of a new reservoir overflow structure to accommodate the new floating cover for Denise Reservoir, a concrete lined uncovered finished water storage reservoir basin. To comply with NYS Dam Safety Regulations, this project required that dam break modeling be performed. A dam safety permit was required for the proposed installation of a floating cover over the reservoir. The Corps of Engineer's HEC-1 hydrologic model was used to estimate the peak outflow hydrograph during a catastrophic failure of the dam embankment. HEC-RAS was then used to estimate resultant flood profiles and development of approximate inundation limits. The results of the dam break analysis were used to determine the appropriate hazard classification of the dam.

Big Creek Lake Dam Spillway Rehabilitation
Mobile, AL
Project Engineer responsible for the hydrologic and hydraulic assessment of Big Creek Lake Dam and appurtenant structures. Big Creek Lake Dam is a large, high hazard dam that provides approximately 100,000 acre-ft of storage and serves as the primary water supply for the City of Mobile. A detailed hydrologic model of the tributary watershed was developed using HEC-HMS, HMR-52, and GIS applications to estimate inflow hydrographs during standard design storms as well as for the Probable Maximum Flood. The hydrologic model was calibrated to several stream flow gages in the tributary watershed. A hydraulic analysis was conducted with HEC-RAS to assess the capacity of the existing spillway and ascertain if the existing outlet structure was sufficient to pass the Probable Maximum Flood. Dam break models were also developed using the unsteady flow application in HEC-RAS to determine approximate inundation limits that would result from a catastrophic failure of the dam. Additional work included the development of several alternatives to increase the capacity of the deteriorating spillway channel to accommodate the Probable Maximum Flood.

Delaware Department of Natural Resources and Environmental Control Dams, Dam Safety Program Plans
Wilmington, DE
Project Manager for the various dam safety activities for the five dams owned by the State of Delaware. The projects entailed performing dam safety inspection, developing inundation mapping for the purpose of determining an appropriate hazard classification, and the development of Inspection and Maintenance Plans and Emergency Action Plans for each dam. For the dam break analysis inundation mapping, dam breach hydrographs were developed using the USACE HEC-HMS model. The breach hydrographs were then routed through the downstream drainage way using the USACE HEC-RAS model. The

peak water surface profiles were then used in a GIS environment with HEC-GeoRAS to develop automated inundation boundaries. The modeling accounted for potential multiple dam failures for dams located in series on the same stream.

Bridge Creek and East Branch Dams Safety Program
Akron, OH
Directed the hydrologic and hydraulic analyses related to the determination of the spillway adequacies for the East Branch Reservoir and LaDue Reservoir dams and the preparation of Emergency Action Plans for the dams. Both dams are classified as high hazard (Class I) under the Ohio Administrative Code. The National Weather Service Hydrometeorological Reports 51 and 52 were applied to determine the most critical hydrologic condition for both reservoirs in order to evaluate the spillway adequacy for each dam. As part of the Emergency Action Plans, watershed delineations and associated data such as elevations, hydrological data, and surface cover properties were utilized with state-of-the-art GIS technologies. US Army Corps of Engineering HEC-1 and HEC-2 hydrologic models were utilized for project analyses.

South Dam
Birmingham, AL
Responsible for the hydraulic design of modifications to the labyrinth spillway, a new spillway energy dissipation structure, and a storm water detention pond. The design was for South Dam, an existing earthen embankment which stores raw water for the Shades Mountain Filtration Plant in Birmingham, Alabama. Modifications to the labyrinth spillway involved changing the length to width ratio in order to maximize the hydraulic capacity with limited available head. The spillway, spillway chute, and hydraulic jump energy dissipation structure for this high hazard facility were sized to handle the computed Probable Maximum Precipitation (PMP) and Probable Maximum Flood (PMF). The design of the spillway chute and energy dissipation structure involved the use of HEC-RAS to perform the hydraulic modeling of the proposed improvements.

Paulinskill Lake Dam
Newton, NJ
Conducted the hydraulic and hydrologic assessment for the rehabilitation of a privately held, Class II dam in Sussex County, New Jersey. The analysis included the determination of the probable maximum flood and spillway design floods, dam break analyses and the development of downstream inundation mapping for the preparation of an Emergency Action Plan. Projected inundation areas were determined by integrating HEC-1 modeling results with USGS digital elevation data verified with spot survey data. Inundation areas were displayed over aerial photography. Responsible for the hydraulic design of the new energy dissipation structure and low level outlet . Construction for the rehabilitated facility was completed in 2004.

AFFILIATIONS

Association of State Dam Safety Officials - Member
New York State American Water Works Association's Fundamentals of Dam Safety - Instructor

EXPERTISE

Dam Evaluation and Design; Civil Site Design; Hydraulic and Hydrologic Analyses

EDUCATION

Master of Science - Civil Engineering, Villanova University / 2000

Bachelor of Science - Civil Engineering, University of Delaware / 1993

REGISTRATIONS

Professional Engineer / DE, MD, MI, NH, NJ, PA, OH, VA

YEARS WITH SCHNABEL

20

TOTAL EXPERIENCE

21

Greg Paxson has experience in analysis and design for dam and water resource projects, including evaluation and upgrading of existing dams and design of new dams. Specific experience includes hydrologic and hydraulic (H&H) analyses, gravity dam stability, labyrinth spillways, roller compacted concrete (RCC), and slope stability and seepage analyses for earth dams. Greg also has extensive experience in site layout and design. Greg has authored and co-authored more than 20 technical papers, mostly on dam rehabilitation and H&H. In addition, Greg currently serves on ASDSO's Affiliate Member Advisory Committee and is the Vice Chair of the USSD Committee on Hydraulics of Dams.

RELEVANT EXPERIENCE

George B. Stevenson Dam Rehabilitation

Cameron County, PA

Project Manager for an engineering assessment, geotechnical analysis, H&H analysis, evaluation of alternatives, and design for rehabilitation of this 166-ft high-zoned earth dam embankment. Previous analyses and engineering evaluations (by others) indicated several dam safety concerns, the most significant related to the potential for heave at the downstream toe during elevated pool levels, leading to a piping failure. Schnabel performed an extensive exploration and instrumentation program and monitored foundation and embankment pressures during a controlled pool raising. Mr. Paxson served as the facilitator of a risk assessment for the potential failure mode related to heave and piping. The assessment utilized the results of the subsurface exploration program, piezometer levels during the controlled pool raise, and the procedures used by USACE and Reclamation related to internal erosion and piping risks. The risk assessment led to the conclusion that the risk related to this failure mode was not credible. This results justified that previously recommended grouting of the foundation was not required., resulting in savings of an estimated $5 to $10M in construction costs. In addition. Mr. Paxson led a detailed H&H study that incorporated watershed parameters developed by USACE based on calibration with historical storm events. Schnabel validated these parameters by comparing model results with observed data from three additional storm events. This H&H study demonstrated that the dam has adequate capacity to pass the Probable Maximum Flood as required by state dam safety regulations, likely resulting in savings of another $5-10M in previously anticipated construction costs. Mr. Paxson also facilitated a Potential Failure Modes Analysis to evaluate various spillway failure modes (scour and undermining, stagnation pressure failure, etc.)

Schuylkill County Municipal Authority Evaluation of Alternatives of Four Dams

Schuylkill County, PA

Reviewer for evaluation and design of rehabilitation alternatives to safely pass the Spillway Design Flood for four high hazard dams with slope stability and seepage issues and inadequate spillway capacity. The dams impound water supply reservoirs and some have been in place for over 100 years. Several rehabilitation alternatives were evaluated based on hydraulic and hydrologic analyses and geotechnical analyses. The upgrading at these projects includes replacement of structural spillways with either labyrinth and other spillway configurations, and embankment modifications to address seepage and stability issues.

Lake Townsend Dam
Greensboro, NC
Lead Engineer for hydrologic and hydraulic analysis, and design and civil engineering layout for the replacement of this 45-ft high earth dam with a gated concrete spillway that suffered severe deterioration due to alkali silicate reaction, and has inadequate hydraulic capacity to pass the state-mandated design flood. Lake Townsend is located on a 105-square mile watershed, and serves as the City of Greensboro's primary water supply. The replacement includes a labyrinth spillway with a weir height of 20 ft and total weir length will be on the order of 1,000 ft. Greg managed physical and numerical hydraulic modeling of the spillway performed by Utah State and Idaho State universities. The project received the 2012 Dam Rehabilitation Project of the Year from the Association of State Dam Safety Officials.

Lake Oneida Dam
Butler County, PA
Senior Reviewer for the rehabilitation for this 39-ft high, 880-ft long zoned earth fill embankment with a concrete cutoff wall extending into the dam's foundation. Provided investigations and development of conceptual alternatives in selecting a rehabilitation alternative for this water supply dam. Pennsylvania American Water Company desired to complete the rehabilitation without materially increasing the discharge rating curve from the dam up to the 100-year design storm; increasing or decreasing the storage capacity of the dam; or changing the top of dam elevation. To address spillway capacity concerns, various alternatives were considered to safely pass the spillway design flood.

Reservoir Site Evaluation and Conceptual Design
City of Newark, DE
Conceptual project layouts and cost estimates were performed for several potential pumped storage water supply reservoir sites. Once the City selected a prime site, a more detailed evaluation was performed for this site. This included geotechnical and environmental field reconnaissance and laboratory testing. Several possible reservoir configurations were developed and preliminary cost estimates performed for the reservoir site, serving as the basis for final design and construction of the reservoir. The 200+ MG facility included excavations of nearly 40 ft and a ring-dike type embankment with a maximum height of about 90 ft.

Coles Run Dam
Augusta County, VA
Lead Engineer and Project Manager for the rehabilitation design of the water supply reservoir owned by Augusta County Service Authority. The dam was found to have inadequate spillway capacity to meet Virginia dam safety regulations, and Greg was responsible for the development of conceptual and final design for an enlarged replacement concrete spillway, raising the dam with a concrete parapet, flattening the downstream embankment slope, and replacement of the water supply and drawdown piping and intake structure.

EXPERTISE

Water Resources and Dam Engineering

EDUCATION

Master of Science - Water Resources Engineering, University of California - Berkeley / 1995

Bachelor of Science - Civil Engineering, Northwestern University / 1993

REGISTRATIONS

Professional Engineer / CO, DE, IL, NY

CERTIFICATIONS

Certified Floodplain Manager

CSI - Construction Documents Technology

YEARS WITH SCHNABEL

2

TOTAL EXPERIENCE

21

Kevin Ruswick is an Associate in Schnabel's Clifton Park, NY, office where he supports a portfolio of clients in the water resources and dam engineering market. Kevin has over 20 years of experience focused on water resources and dam engineering. He provides an excellent combination of education, experience in all phases of water resources related projects, and proficiency in state of the art hydrologic and hydraulic modeling. His educational background includes Environmental Engineering, Hydrology, Hydraulics, River Mechanics, Sediment Transport, Watershed Management and Stream Bank Stabilization. Through his experience in the consulting engineering field and working for the U.S. Army Corps of Engineers, he has had the opportunity to apply this knowledge to real world applications. His continuing education and formal training have allowed him to stay abreast of emerging technologies in the water resources field including GIS-based hydrology and hydraulics models. He is responsible for floodplain studies, steady-state and unsteady hydrologic and hydraulic studies, dam safety analysis, 1-d and 2-d dam break modeling, wetland and river restoration design, master drainage studies, and construction observation. Kevin is an active member of the Association of State Dam Safety Officials and is an instructor for the New York State American Water Works Association's Fundamentals of Dam Safety training workshop. He is also a Certified Floodplain Manager.

RELEVANT EXPERIENCE

Mead Reservoir Dam

City of Plattsburgh, NY

Lead Water Resources Engineer responsible for performing a comprehensive hydrologic and hydraulic evaluation of Mead Reservoir Dam, the primary water supply for the City. Previous analyses by another engineer had used the SCS unit hydrograph method and concluded that the dam had inadequate spillway capacity. Detailed engineering plans were subsequently developed for a spillway rehabilitation project but project bids came in substantially higher than anticipated. Schnabel Engineering was retained to perform a peer review and to subsequently revise the hydrologic analysis for Mead Reservoir Dam. The revised hydrologic analysis utilized the Snyder Unit Hydrograph methodology and was calibrated to a historic storm in August 2011 (Hurricane Irene). The revised hydrologic model resulted in significant reductions in peak flows during the regulatory Spillway Design Flood. Pending approval of the revised hydrologic analysis, the extent and cost of spillway rehabilitation will be substantially reduced.

Fulmer Creek Flood Reduction Study, Herkimer-Oneida County Comprehensive Planning Program

Mohawk, NY

Fulmer Creek is a tributary to the Mohawk River that flows through the Town of German Flatts and the Village of Mohawk. Chronic flooding from summer storms and winter ice jams prompted the Herkimer-Oneida County Comprehensive Planning Program to evaluate the feasibility of a flow attenuation structure in the upper watershed. Kevin led the development of hydrologic and hydraulic models to evaluate several options for upstream flood storage facilities. HEC-HMS was used to generate and route inflow hydrographs through the proposed structures to quantify potential flow reductions for storms ranging from the 2-year to 100-year recurrence intervals. The predicted flows were then used in HEC-RAS hydraulic models to estimate peak flood elevations downstream and estimate potential reduction in flooding of residential and commercial structures.

Emergency Action Plans for Rensselaer Lake and Tivoli Lake Dams
Albany, NY
Lead Engineer responsible for the development of the Emergency Action Plans for the Class B Rensselaer Lake and Tivoli Lake Dams. The documents were developed to address NYS regulatory requirements. Project activities included hydrologic and hydraulic assessments of the Patroon Creek and dam break modeling for the development of inundation maps.

City of Kingston: Cooper Lake Dam
Kingston, NY
Lead Engineer responsible for the hydrologic and hydraulic modeling for Cooper Lake Dam for the City of Kingston Water Department. Work included development of a detailed hydrologic model of the watershed using HEC-HMS and assessment of spillway compliance with the regulatory 50% PMF Spillway Design Flood. The modeling was also used to assess the compliance of the existing outlet works to serve as a Low Level Outlet. Work also included detailed dam break modeling and inundation mapping for the Saw Kill downstream of the dam to assess the hazard classification and to support the development of an Emergency Action Plan. Led the development of proposed remedial designs for spillway capacity and Low Level Outlet capacity improvements which include a labyrinth spillway and new intake piping. Also in the process of performing a safe yield analysis for the proposed vertical expansion of Cooper Lake Dam.

Otsego Lake Dam
Cooperstown, NY
Lead Water Resources Engineer responsible for a comprehensive Engineering Assessment and Hazard Class Assessment of Otsego Lake Dam. Developed a comprehensive hydrologic model of the 78-square mile watershed and calibrated to a historic 2006 storm event. Performed detailed dam breach modeling and inundation mapping to support a hazard class assessment of the dam. The dam break modeling was performed using the USACE HEC-RAS unsteady flow model, and the inundation mapping was performed in a GIS environment using the USACE HEC-GeoRAS extension. The modeling resulted in the successful hazard class reduction for Otsego Lake Dam.

Village of Ossining: Indian Brook Reservoir Dam Safety Compliance
Ossining, NY
The Indian Brook Reservoir is a 500-ft long, 43-ft high embankment dam constructed in 1909 and impounding approximately 350 acre-feet of potable water storage for the Village of Ossining. Recent work includes the completion of a detailed Engineering Assessment to identify deficiencies and provide conceptual level engineering alternatives to bring the dam into compliance. Previous hydrologic and hydraulic assessments had concluded that the existing spillway was severely inadequate to safely pass the regulatory Spillway Design Flood (SDF). Kevin developed a revised hydrologic model and used historic reservoir water surface elevation data to calibrate the hydrologic parameters representing the watershed rainfall/runoff process. The calibrated hydrologic model resulted in significant reductions in peak flows required to pass the SDF. As a result, hydraulic analysis of the spillway concluded that the existing spillway could be modified to bring the dam into compliance in terms of spillway capacity. Led the design of a new 2-cycle labyrinth spillway and concrete spillway channel with stilling basin.

New York State Office of General Services: NYSDEC Owned Dams
Multiple Locations, NY
Lead Engineer for hazard class screenings of 23 dams owned by the NYSDEC. Performed detailed review of documents and design drawings in regulatory dam safety files. Developed estimates for dam dimensions, normal pool and maximum pool storage volumes for each dam and developed screening level estimates of potential dam breach flows. Based on potential dam breach flows, performed a desktop inundation assessment using GIS and Google Earth datasets as well as capacity assessments at downstream hydraulic structures. The overall intent was to provide a risk based prioritization for application of funding for rehabilitation and dam safety compliance activities for state owned dams.

George B. Stevenson Dam Rehabilitation, Sinnemahoning State Park
Cameron County, PA
Lead Water Resources Engineer responsible for performing an engineering assessment including evaluation of spillway capacity of this 166-ft high zoned earth dam embankment. The dam was constructed by the Commonwealth of Pennsylvania in coordination with the USACE Baltimore District as part of a flood control project for the Susquehanna River Basin. Preliminary hydrologic and hydraulic evaluations performed by another consultant in 2002 concluded that the dam could only pass approximately 77% of the Probable Maximum Flood and a significant spillway expansion project would be required to bring the dam into regulatory compliance. Kevin led a revised hydrologic analysis of the 230 square mile watershed that included calibration to three historic flood events including Hurricane Agnes in 1972. The resulting hydrologic model indicated substantial reductions in peak flows during the SDF and concluded that the existing spillway has adequate capacity.

Pymatuning Dam Rehabilitation, Pymatuning State Park
Crawford County, PA
Lead Water Resources Engineer responsible for design of bank stabilization measures for the Shenango River downstream of the Pymatuning Dam. The channel receives releases from the dam and 155 square mile watershed as well as inflow from Sugar Run, which drains approximately 8.9 square miles. The north bank of the Shenango River through the 400-ft long project reach has experienced significant erosion which has been exacerbated by the deposition of a gravel bar at the mouth of Sugar Run. Kevin performed hydrologic and hydraulic analyses of the channel and a fluvial geomorphic assessment to support the restoration design. The stabilization measures include flattening of the bank slopes, installation of riprap toe protection, provision for a floodplain bench, and live stakes/native grass plantings. The design also includes a boulder J-hook vane to improve flow distribution toward the center of the channel as well as dredging of the gravel bar. The proposed stabilization measures are slated for construction in 2015.

EXPERTISE

Geotechnical Engineering

EDUCATION

Doctorate - Geotechnical Engineering, The University of Michigan / 1996

Master of Science in Civil Engineering - Geo-environmental Engineering, The University of Toledo / 1991

Bachelor of Science in Civil Engineering - Civil Engineering, The University of Toledo / 1989

REGISTRATIONS

Professional Engineer / PA

CERTIFICATIONS

FOPP - Fundamentals of Professional Practice (ASFE)

YEARS WITH SCHNABEL

7

TOTAL EXPERIENCE

25

Scott Raschke has experience in a career spanning civil engineering consulting and academics, with an emphasis on geotechnical and geo-material applications. He currently serves as the Corporate Levee Practice Leader for Schnabel while operating out of Schnabel's Morristown, New Jersey, location. His recent focus has been on dam, levee, and flood control projects in New York, Virginia, Maryland, Pennsylvania, Delaware, California, Kansas, Texas, Georgia, Missouri, Oklahoma, Kentucky, and Louisiana.

Scott is an active member on two USSD committees ("Levees" and "Monitoring of Dams and their Foundations") and is currently contributing to a white paper on Monitoring and Instrumentation of Levees. He was also a contributing author for two chapters of the International Levee Handbook (ILH) relating to instrumentation and monitoring applications for levees. The ILH was published by CIRIA in late 2013.

RELEVANT EXPERIENCE

Cooper Lake Dam & West Dike Preliminary Engineering Phase 1

Ulster County, NY

Senior Geotechnical Reviewer for evaluation of the dam and west dike rehabilitation concept developed in response to a previous Engineering Assessment Report, and advance the concept through a preliminary engineering phase, into final design, bid and construction. Cooper Lake dam is classified by New York State as a large, high hazard (Class C) dam.

USACE, Los Angles District, Prado Dam Flood Control Basin - Auxiliary Embankment and Floodwall

Santa Ana, CA

Expert Reviewer (Geotechnical Engineering) on a Type II IEPR/SAR Panel for improvements as part of the Santa Ana River Mainstem (SARM) due to the raising of Prado Dam by 28.4 ft and its spillway by 20 ft. The resulting higher water surface elevations behind Prado Dam required alteration of the existing basin limits for operational control that includes two new project features, a 75 ft-high mile-long auxiliary dike embankment and 16 ft-high 1000 ft-long floodwall. Peer review included design, construction, and operation maintenance, repair, replacement and rehabilitation (OMRR&R) project phases.

George B. Stevenson Dam Rehabilitation

Cameron, County, PA

Lead Geotechnical Engineer responsible for performing an engineering assessment, geotechnical analysis, evaluation of alternatives, and design for rehabilitation of this 166-ft high zoned earth dam embankment. The dam was constructed by the Commonwealth of Pennsylvania in coordination with the US Army Corps of Engineers (USACE) Baltimore District as part of a flood control project for the Susquehanna River Basin. Through geotechnical analysis, the dam was found to have the potential for instability at the downstream toe of the embankment during floods causing high lake levels. Final selection and design of the rehabilitation approach will include risk-informed decision making methods in coordination with the state dam safety regulators.

Inland Lake Dam, Birmingham Water Works and Sewer Board
Birmingham, AL
Lead geotechnical engineer for slope stability and seepage evaluation of this 190-ft high zoned earth/rock fill embankment dam. Based on a review of recent and historical data, including test borings, laboratory and field testing, and data from instrumentation, developed probability distributions for engineering parameters required for seepage and slope stability evaluation using Monte Carlo techniques. Results of the probabilistic slope stability study are being used for a formal Risk Assessment of the dam, and evaluation of potential failure modes. The study will be extended for further risk evaluation by refining the results of the evaluation to reflect the impact of mechanisms suspected of causing historic sinkholes on the crest and upstream slope of the dam, including internal erosion and piping. Other analyses included evaluation of rapid drawdown and seismic evaluation using pseudo-static procedures, as well as seismic deformation analysis.

Shoal Creek Dam, Clayton County Water Authority (CCWA)
Clayton County, GA
Senior Geotechnical Reviewer of remedial design and construction of a soil-cement-bentonite cutoff wall to address existing seepage issues within the foundation of the dam. The dam is classified as a 'High Hazard" or Category I structure by the Georgia Safe Dams Program (Safe Dams) and is located approximately 7 miles south of Jonesboro, Georgia. In an effort to control the observed seepage through the alluvial foundation, Schnabel recommended construction of a cutoff wall through the embankment, alluvial foundation and into the underlying residuum. The project included analyses to support the design, and development of plans and specifications for construction of a cutoff wall to address the seepage occurring in the foundation.

City of Richmond Flood Protection System
Richmond, VA
Senior Reviewer of a geotechnical evaluation of the flood protection system for the City of Richmond, Virginia, which was used to provide supporting documentation for FEMA accreditation for its levee system according to Section 65.10 of the National Flood Insurance Program Regulations (44 CFR 65.10) prepared by FEMA.

Lafarge North America Gypsum Plant New Crane Barge
Buchanan, NY
Senior Geotechnical Reviewer for a new floating crane barge and conveyor that was added at the existing barge unloading facility for the plant, approximately 200 ft off the east bank of the Hudson River. The existing unloading platforms (which sit in approximately 40 ft of water) were founded on vertical and batter piles. As part of plant upgrading, the existing platforms were reinforced by new pipe piles, which were socketed into rock. Scott evaluated the subsurface conditions at the site, and provided recommendations regarding the design of foundations. Provided personnel for full time monitoring and logging during barge-based test boring activities. During construction, provided pile observation and testing services for the installation of test piles, probe piles, and performance of the load test.

EXPERTISE

Geotechnical Engineering
Dam Engineering
Geotechnical Instrumentation
Earthworks Observation and Materials Testing

EDUCATION

Master of Science - Geotechnical Engineering, University of Massachusetts Amherst / 2011

Bachelor of Science - Civil and Environmental Engineering, University of Massachusetts Amherst / 2010

Bachelor of Arts - English, Gordon College / 2006

REGISTRATIONS

Engineering Intern/Engineer-in-Training / MA

YEARS WITH SCHNABEL

1+

TOTAL EXPERIENCE

3

Brian Toombs is a Senior Staff Engineer in the Clifton Park, NY office. He has experience in geotechnical engineering, including classification and analysis of soil and rock, soil slope stability analysis, embankment and foundation settlement analysis, and finite element seepage analysis, as well as foundation design and testing, and design of temporary soil and rock excavation support systems. Additionally, Brian has experience in managing and performing subsurface drilling and test pit explorations in soil and rock and in developing laboratory testing programs and interpreting results. He has spent considerable time on active construction sites and has coordinated and performed construction observation and materials testing services for heavy-civil projects in the commercial and residential development and municipal and federal infrastructure sectors, including extensive construction experience with the installation of underground water conveyance and piping systems and associated earthworks.

RELEVANT EXPERIENCE

Cobbs Creek Regional Water Supply Reservoir

Columbia, VA

Senior Staff Engineer responsible for geotechnical analyses for a new 160-ft tall, high-hazard embankment dam, including review and interpretation of laboratory test results, and performed static, drawdown, and seismic slope stability analysis, and construction and long-term embankment settlement analysis. Brian also developed estimates of available on-site dam core and shell borrow materials, and performed additional field exploration activities to identify and quantify additional borrow materials. He was responsible for the design of the geotechnical instrumentation system for the new dam, including developing design drawings, specifications, and construction cost estimates. Brian assisted in development of the earthworks specifications for the project, and performed project management and coordination activities including organizing and delegating comment response assignments during the 90- and 100-percent design review tasks.

Williams Water Treatment Plant Terminal Reservoir Phase 1, Site Evaluation and Exploration

Durham, NC

Senior Staff Engineer performed a geotechnical evaluation of an existing embankment and concrete reservoir liner at a pump-storage reservoir. Brian performed the field exploration program including a visual site inspection of the embankment and liner, as well as geotechnical borings and test pits in the embankment. He was responsible for soil sample classification, interpretation of laboratory test results, and geotechnical reporting tasks.

Williams Water Treatment Plant Terminal Reservoir Phase 2, Design Alternatives and Geophysics

Durham, NC

Senior Staff Engineer assisted with development of design alternatives for the replacement of the deteriorated concrete reservoir liner. Brian also reviewed geophysical survey results and developed estimates of sediments accumulated on the bottom of the reservoir due to water treatment facility filter backwash activities.

Bullock Pen Lake Dam Rehabilitation
Grant County, KY
Senior Staff Engineer responsible for design of the instrumentation and monitoring system for the new spillway and embankment rehabilitation. Design of the instrumentation system involved layout of instrumentation including vibrating wire piezometers, structure monitoring points, and reservoir staff gages, as well as selection of all instrumentation system components, cabling routes, and system operations. Brian also developed the design drawings, project specifications, and the engineer's opinion of construction costs for the instrumentation system. In addition, Brian provided review of geotechnical analyses for the project, including load distribution and anticipated settlement and heave of the new labyrinth spillway.

Dominion Possum Point Ash Ponds ABC, Phase 2, Embankment Stability Evaluation
Dumfries, VA
Senior Staff Engineer responsible for development and management of a geotechnical exploration program of existing ash pond embankments, including layout of borings and sampling schedules, soil sample classification, and lab testing assignments and interpretation of testing results. Brian performed geotechnical slope stability analyses for static and seismic loading conditions and wrote the geotechnical report summarizing the findings of the field exploration and engineering analyses, including recommendations for improvements to the embankment.

2014 Dam Safety Inspections at North Fork Dam and Bee Tree Dam
Asheville, NC
Senior Staff Engineer assisted with safety inspections of two high-hazard earthen embankment dams and associated outlet works, including the outlet towers, large-diameter underground outlet conduits, and concrete chute spillways. Brian aided in the preparation of the inspection reports

SECTION 3: PROJECT APPROACH

The City of Saratoga Springs (City) is seeking a qualified engineering firm to bring the Loughberry Lake Dam (NYS ID No.: 206-0249) into compliance with the current New York State Department of Environmental Conservation (NYS DEC) dam safety regulations. The dam is an earthen embankment, approximately 25 feet high and 450 feet long constructed across Loughberry Brook in the City of Saratoga Springs, Saratoga County, NY impounding the reservoir known as Loughberry Lake. NYS Route 50 runs along the top of the dam crest. Discharges from the dam's service and auxiliary spillways are combined and conveyed by a pipe which runs beneath NYS Route 50 for approximately 1,100 feet before discharging to Spring Run. The dam is classified as a Small (height of less than 40 feet and impounds less than 1,000 acre feet at normal water surface) Intermediate Hazard, Class B structure. The Request for Proposal (RFP) identifies deadlines for completing an Emergency Action Plan (EAP), an Inspection and Maintenance (I&M) Plan, a dam safety inspection, and an Engineering Assessment (EA) as required deliverables within the 2015 calendar year.

Goals for the Regulatory Compliance of Loughberry Lake Dam

- Meet NYS DEC Dam Safety Regulations (EAPs, I&Ms, EAs, spillway capacity, seepage/stability)
- Prioritize projects and rehabilitation measures to address those issues presenting the greatest risk
- Reduce impacts on water supply system operations

This section presents our project approach for completing this work. The RFP is quite detailed in its presentation of background information, explanation of work and closely follows the requirements set forth in the *Draft DOW TOGS 3.1.5 – Guidance for Dam Engineering Reports* dated March 2011. Because the EA sets the stage for future required improvements/rehabilitation, it's important that knowledgeable and experienced engineers are intimately involved in the technical development and review of the findings. For clarity we have reiterated your detailed scope of work below *(in italics)* and have provided commentary on the specific tasks identified, highlighting some of our concerns and insights derived from our significant dam engineering experience in NYS and elsewhere.

SCOPE OF SERVICES

Task 1 – Review of Available Information

Perform a detailed review of information available for Loughberry Lake Dam and its associated inundation area. As part of this task, research and obtain relevant, available materials including:

- *Plans and Record Drawings for Loughberry Lake Dam*
- *Bathymetric Study Date for Loughberry Lake (1996)*
- *Boundary Survey for the Lake*

Considerable information is available for utilization in the development of the EA for Loughberry Lake Dam. Of particular importance is the Hudson-Hoosic-Deerfield LiDAR data (collected in 2012) which can be utilized to cost-effectively define site topography and for the development of detailed dam breach models. Record drawings depicting the piping beneath Route 50 will be essential to assessing the spillway capacity as both the service and auxiliary spillways utilize this conveyance system to reach the downstream drainage way.

- *Inspection Reports*
- *Boring Information*
- *Topographic Mapping (USGS)*
- *Soils Information*
- *Previous Hydrologic & Hydraulic Studies*
- *Aerial and Site Photos*
- *Hudson-Hoosic LiDAR DEM data (NYS GIS Interactive Mapping Gateway)*
- *Bridge Plans from New York State Department of Transportation (DOT) for Interstate 87*
- *NYS Route 50 Reconstruction Plans*
- *Bridge Plans for Local Roads, including Excelsior Ave., Excelsior Spring Ave., Weibel Ave., and Lake Ave.*
- *FEMA Flood Insurance Study (FIS) data for Saratoga County (August 1995), including backup data for Spring Run*
- *Closed Conveyance System Plans from the City of Saratoga Springs (Piping from the dam to Spring Ave.)*

Task 2 – Dam Safety Inspection

Perform a visual inspection of the dam in accordance with the procedures referred by the Association of State Dam Safety Officials (ASDSO) guidelines for a routine dam inspection for assessment of overall dam safety. The inspection should involve completing the following, where accessible:

Our dam safety engineers have performed numerous dam safety inspections and have extensive experience in using the recommended visual inspection forms for New York State. Engineers specializing in geotechnical and water resources engineering, conveniently located in our Clifton Park, NY office, will perform the visual inspection.

- *Inspection of the downstream and upstream embankment faces and crest of the dam for soft soils, wet areas, soil sloughing, erosion, evidence of burrowing rodents, and woody plant growth*
- *Inspection of the service and auxiliary spillways*
- *Inspection of concrete structures for degradation and/or movement*
- *Observation and monitoring of the seepage flow rate at wet areas*
- *Visual inspection of the accessible outlet works and appurtenance of the dam*

As required by the New York State Dam Safety Regulations, the inspection shall be performed by an engineer licensed in the State of New York. The EA Report (outlined in Task 6) shall include a narrative describing the results of the visual inspection. The report shall include completed inspection forms and dated photographs of the specific observations made, and any deficiencies or potential deficiencies identified during the visual inspection.

Task 3 – Survey Services (To be performed by the City Survey Group)

As noted in the RFP, the City will complete the following additional survey work with their own crew to support the effort of the chosen engineering firm:

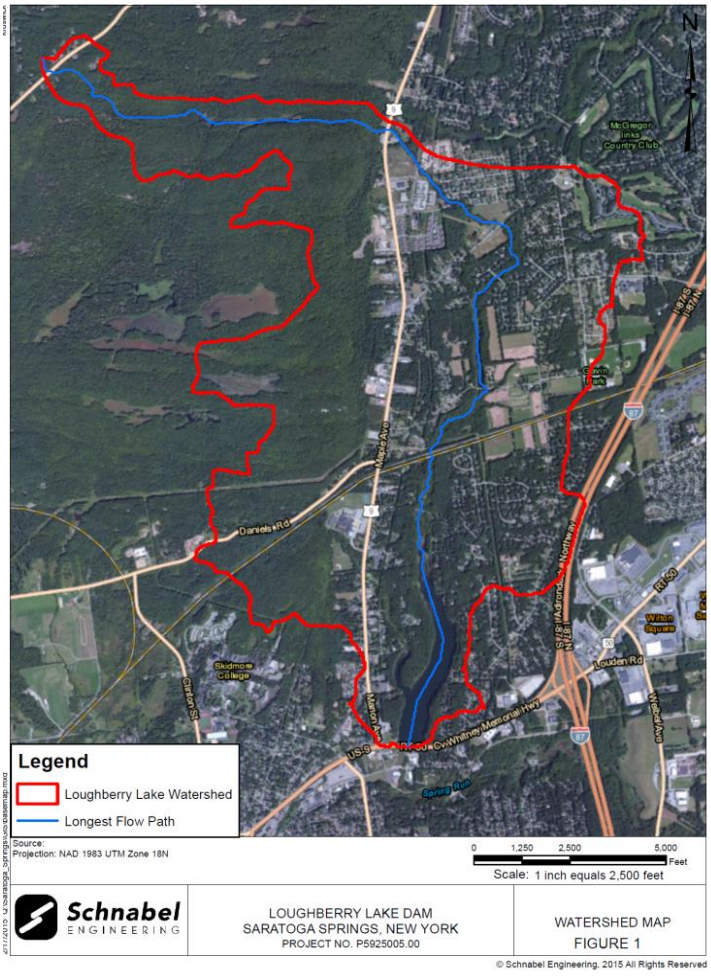
Site specific survey information is often required to resolve conflicts in background information or augment existing topographic and planimetric information. Self performing survey services will help keep engineering costs down and expedite the resolution of conflicts.

- *Obtain cross-sections at the dam at 50 foot intervals as follows: along the crest, along the toe and along the alignment of the proposed borings (as outlined in Task 5.1). This data will be used to develop modeling for the stability analysis outlined in Task 5.2. Topography will be provided in 1 foot contours.*
- *Additional survey may be required in order to confirm elevations at critical locations, including roadways and impacted structures, following the completion of the modeling described in Task 4.*

Task 4 – Hydrologic and Hydraulic Assessment

Given the information outlined in the NYSDEC Guidelines for Design of Dams (NYSDEC Guidelines) and based on the hazard classification of the dam, the following criteria should be applied to the evaluation of this structure:

- *The spillway should have adequate capacity to pass a spillway design flood (SDF) equal to 150% of the 100-year event without overtopping the dam.*
- *The service spillway should have sufficient discharge capacity to evacuate 75% of the storage between the auxiliary spillway crest and the service spillway crest within 7 days.*
- *The service spillway-auxiliary spillway combination should have sufficient discharge capacity to evacuate 100% of the storage between the maximum design high water and the auxiliary spillway crest within 12 hours.*
- *The low-level outlet should have significant discharge capacity to evacuate 90% of the storage below the spillway crest within 14 days assuming no inflow to the reservoir.*



Loughberry Lake Dam Watershed Map

Prior to the start of the tasks outlined below, an engineer, specializing in the field of water resources, shall visit the site to perform reconnaissance of the existing conditions. This task is necessary to document/verify existing information, to coordinate survey activities, and to verify the limits of the contributing watersheds.

Task 4.1 – Hydrology

Generate an inflow hydrograph to the dam for the spillway design flood (SDF), which is equivalent to 150% of the 100-year event for an Intermediate High Hazard, Class 'B" dam. The 100-year, 24-hour precipitation will be developed using an SCS Type II distribution and precipitation depths referenced from the National Regional Climatic Center (NRCC). This task shall include delineation of the contributing sub-watersheds, as well as the generation of curve numbers and times of concentration for each sub-watershed. Use standard Natural Resources Conservation Service (NRCS) methodologies to quantify the flow conditions for the storm-day scenarios. In addition, develop a downstream boundary condition for Spring Run using the 100-year water surface elevation (WSE) data referenced from the Saratoga County FIS (1995). Use current, acceptable methods in developing the hydrologic models (HEC-HMS and/or Bentley Pond Pack).

Though the NRCS Unit Hydrograph methodology is regularly used, we have found it to be unrepresentative and overly conservative for many watersheds in New York (i.e., over predicts peak flows) and drives unnecessary spillway capacity upgrades. Other unit hydrograph methodologies are available including the Clark and Snyder Unit Hydrographs. In our experience, use of these alternate unit hydrograph methodologies results in more representative predictions of peak flows and more appropriate decisions on spillway capacity upgrades. Independent of the selected unit hydrograph methodology, selection of hydrologic parameters should be supported through calibration to historic storm events.

Schnabel will utilize HEC-HMS to conduct the hydrologic modeling of the dam as well as to support the dam breach modeling and inundation mapping. For rainfall data, the Northeast Regional Climate Center (NRCC) is the current state of the practice for determining rainfall depths of standard recurrence interval design storm events and supersedes the outdated TP-40 rainfall data. The new rainfall data incorporated into NOAA's Atlas 14 also includes revised rainfall distribution data that can be developed on a site specific basis and also supersedes the previous SCS storm distributions.

Task 4.2 – Sunny-Day and Storm-Day Dam Break Analyses

Develop a HEC-RAS model that encompasses the study reach, and the potential flood impact areas. The study shall extend downstream from the dam for a distance of approximately 2.1 miles to a point just downstream of Lake Ave. The model shall be utilized to perform a dam break analysis and hazard classification assessment as well as evaluate the ability of

Schnabel will utilize the HEC-RAS unsteady flow hydraulic model for dam breach hydrograph generation and routing through the downstream drainage way. The model will be developed from recent LiDAR-based Digital Elevation Model (DEM) data and supplemented with hydraulic structure data from FEMA regulatory models and/or field measurements. The results will be post-processed with HEC-GeoRAS in a GIS environment and overlain on aerial imagery.

the current spillway configuration, and any conceptual spillway rehabilitation/repair configurations, to safely pass the SDF. Modeling shall include sunny-day and storm-day (as necessary) dam break scenarios and shall be developed so that it can be utilized for the hazard assessment, as well as to establish the water surface profiles required to generate inundation mapping for the emergency action plan (EAP). Information for the model shall be referenced form existing data when available and field verified to the extent possible. The hydraulic cross-sections for the dam break model shall be generated using the Hudson-Hoosic LiDAR DEM (coverage includes a large portion of Saratoga County) supplemented with limited field survey data and data collected during field reconnaissance, as well as record plan data for relevant bridges. In addition, information collected during the field reconnaissance, as well as field survey data, shall be utilized to define downstream structures and roadway crossings as needed. The sunny-day and storm-day dam failure scenarios will be in accordance with NYSDEC Guidelines. The sunny-day scenario should be based on normal flows prevailing in the contributing watersheds and the impoundment at normal water levels (i.e. at the spillway crest elevation), and the storm-day scenario should be based on the SDF in the watershed and the 100 year flood event in the downstream watersheds. Downstream flows shall be provided based on the FEMA FIS.

Task 4.3 – Hazard Classification Evaluation

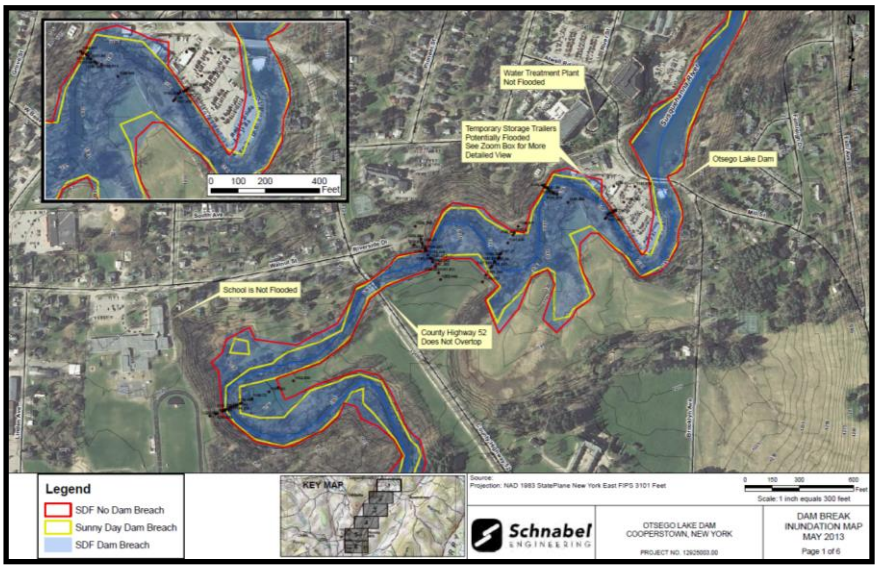
Perform a hazard classification evaluation to determine if the current classification is appropriate, per the NYSDEC Guidelines.

Kevin Ruswick and Greg Daviero will be presenting their paper titled, *Implementation of New York State's Guidance for Dam Hazard Classification* at the United States Society on Dams national conference in April. This paper is based on their experience with establishing appropriate hazard classification on more than 25 dams in NYS.

Task 4.4 – Prepare Inundation Mapping

Utilize the dam break analysis developed in Task 4.2 to examine the required dam break scenarios and prepare inundation mapping for Loughberry Lake Dam. These scenarios include:

- *Sunny-day (normal flows prevailing) with breach*
- *Storm-day (SDF) without breach*
- *Storm-day (SDF) with breach*



Example Inundation Map from Otsego Lake Dam

Based on the results of the breach analyses, inundation mapping shall be prepared in accordance with DEC Guidelines and accepted engineering standards. The maps will present the inundated areas and will call-out distance downstream of dam, depth of flooding, maximum velocity, time to wave arrival and time to peak stage at critical cross sections and other important locations (i.e. road crossings). The inundation mapping shall be presented as a GIS layer (shapefile) on a base map consisting of orthoimagery, contours, political boundaries and roadways. The scale of the maps should be determined based on the resolution of the available orthoimagery and shall be appropriate for identifying downstream inhabited areas. The size of the inundation map sheet (11" x 17" or 22" x 34") shall be discussed with DEC prior to map development.

Task 4.5 – Evaluation of Spillway Capacity

Based on the results of the hydrologic model and using the hydraulic model described in previous tasks, evaluate the capacity of the spillway relative to the SDF and prepare a summary of the performance of the spillway to be included in the EA Report. If necessary, develop up to three conceptual spillway configuration alternatives (including rehabilitation/repair, replacement, etc.) that will provide the required capacity to safely pass the SDF. Each of these alternatives shall be assessed based on constructability, cost, maintenance, etc. Prepare an alternatives analysis matrix presenting relevant information for each alternative as well as a brief narrative describing each alternative and why each alternative is or is not worth pursuing (i.e. the pros and cons).

Schnabel has imported the Hudson-Hoosic LiDAR based Digital Elevation data and utilized it to develop a preliminary hydrologic model of the watershed and estimate stage versus storage capacity of the dam to preliminarily evaluate reservoir and service spillway capacity. Our preliminary modeling results indicate that Loughberry Lake Dam has sufficient spillway capacity to pass the Class B spillway design flood requirement of 150% of the 100-year event. This is primarily due to high infiltration capacity of the watershed soils and the available surcharge storage volume which significantly attenuates the inflow peak and volume through the reservoir.

Task 4.6 – Evaluation Outlet Works Capacity

The outlet works, located in the gatehouse, are used by the water treatment plant, and will be considered as the existing low level outlet at the dam. Evaluate the outlet works at the dam for the ability to meet NYSDEC's drawdown requirements. A summary of the performance of the outlet works will be included in the EA Report.

The RFP indicates that the low-level outlet should be assessed to determine if it has significant discharge capacity to evacuate 90% of the storage below the spillway crest within 14 days assuming no inflow to the reservoir. Our experience with NYS DEC Dam Safety Section indicates that they will consider mitigating factors in their application of this requirement providing a functional LLO exists with a greater priority placed on having a reliable means of drawing down the reservoir in case of an emergency.

Task 5 – Stability Analyses

One of the requirements of the EA is to evaluate the stability of the dam. To evaluate and report on the stability, the engineering firm shall perform a subsurface exploration that will evaluate the stability of the earthen embankment and the seepage through the dam and perform the work outlined in Tasks 5.1 and 5.2

This subsurface exploration represents more than 40% of the project on a cost basis. We believe that this program is more consistent with a Class C dam and that project savings may be derived using an alternative approach which could reduce or eliminate this activity. This approach is detailed in Section 5.

Task 5.1 – Subsurface Exploration

The subsurface exploration shall consist of advancing borings for soil and bedrock characterization and installing piezometers for piezometric level measurement within the dam embankment and foundation. These services shall include:

The RFP places an emphasis on the collection of site-specific soils and piezometric information. We have selected Parratt-Wolff as our drilling subcontractor for this Task and have included a summary of their qualifications in this submittal. Together, Schnabel and Parratt-Wolff have executed similar explorations at more than 25 dams. While there were specific unit quantities identified for number and depth of borings and piezometers there are still many outstanding assumptions that will impact cost including specific locations of explorations, depth and type of installed piezometers, sampling techniques, laboratory testing, etc. We have presented these assumptions in our cost matrix.

A. *Providing a geotechnical engineer to coordinate and manage the geotechnical field exploration.*

B. *Coordinate approvals with NYSDOT and obtain ROW work permit as required.*

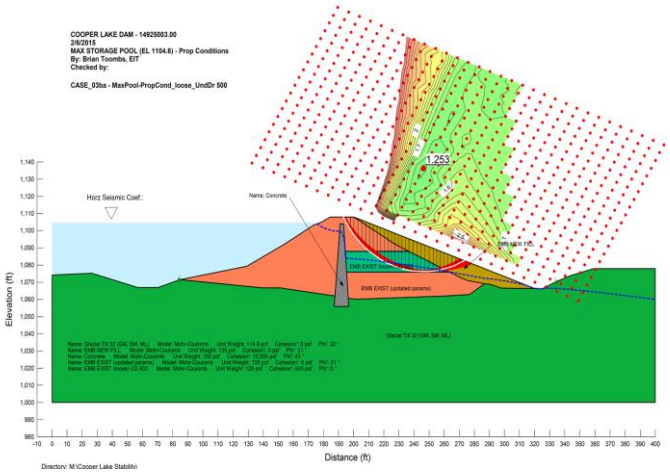
C. *Subcontract the advancement of four borings and installation of piezometers. Advance two borings in the crest of the dam to average a depth of 55 feet and two borings near the toe of the downstream slope to an average depth of 35 feet, for an estimated total of 180 linear feet of drilling. Should bedrock be encountered in the borings, one five-food rock core will be obtained from two of the borings for an estimated total of 10 linear feet of rock coring. Piezometers will be installed in the four borings.*

D. *Perform field observation of the drilling program. Provide a geotechnical engineer to supervise the subsurface exploration to ensure proper drilling and sampling methods are utilized. The engineer shall describe samples and prepare field logs documenting subsurface conditions.*

The EA Report (outlined in Task 6) shall include a narrative summarizing the subsurface exploration, the subsurface stratigraphy, and piezometric and seepage conditions observed during the exploration. The EA Report shall include completed boring logs, log legends and dated photographs from the drilling operations.

Task 5.2 – Stability Analysis

Perform a stability analysis of the earthen embankment based on geometry developed from the survey data to be obtained at the dam and based on onsite measurements and observations. Soil and bedrock parameters to be used in the analysis shall be developed based on review of conditions encountered during the subsurface exploration (Task 5.1). A computer-aided embankment slope stability analysis shall include computing factors of safety (FOS) for the dam embankment to determine if it meets generally accepted standard safety levels as outlined by the Army Corps of Engineers in EM 1110-2-1902 Table 3-1 and the NYSDEC Guidelines for the five different loading conditions described below:



Example of GeoStudio SLOPE/W Stability Output for Cooper Lake Dam, Kingston, NY

- *Normal Pool, Steady State Seepage – Lake at the maximum, normal pool elevation, upstream and downstream embankment slopes modeled.*
- *Rapid Drawdown – Condition in which the phreatic surface mirrors the upstream slope to model elevated pore pressures in soils that may not drain as rapidly as anticipated in the event the lake is drained rapidly with the upstream embankment slope modeled.*
- *Maximum Surcharge Pool – Water level at the required design storm (150% of the 100-year event for an Intermediate High Hazard, Class 'B' dam) with the downstream embankment slope modeled.*
- *Seismic Loading – Water at normal pool elevation with peak seismic ground acceleration as determined using USGS method for the dam site with the upstream and downstream embankment slopes modeled.*
- *Liquefaction, if applicable to subsurface conditions encountered during the geotechnical investigation – Condition in which*

Brian Toombs, located in our Clifton Park, NY office, has considerable experience performing and interpreting embankment stability analyses under a range of loading conditions, and recently presented on the subject at the Association of State Dam Safety Officials national conference. Our geotechnical engineers have an in-depth understanding of the critical parameters controlling each stability case, and are well-acquainted with the capabilities and limitations of commercial software tools.

seismic induced pore pressures in saturated, loose granular materials temporarily reduce the soil effective stresses to at or below zero and cause the soil to flow as viscous fluid. Calculations and a summary of the analysis shall be provided in the EA Report (Task 6).

Task 6 – Engineering Assessment Report

Upon completion of Tasks 1 through 5, prepare a draft EA Report summarizing the results of the subsurface exploration, evaluations and analyses. The report will comment on the existing condition of the dam relative to the appropriate safety criteria. The EA Report will identify deficiencies and provide recommendations, as appropriate, for remedial repairs, operational restrictions, monitoring, and/or modifications. The report will also identify analyses and/or studies needed to access and determine solutions to identified deficiencies. The engineering firm shall submit a draft EA Report to the City for review. Within two weeks of receiving review comments from the City on the draft report, the engineering firm shall finalize the Engineering Assessment Report. Three (3) signed and sealed copies of the report will be prepared; one copy along with a CD containing electronic copies of the models developed shall be submitted to the NYSDEC as outlined in their guidance for dam engineering assessment reports and two copies will be sent to the City for your records. Following the submission of the EA Report, the engineering firm shall respond to one round of comments from the NYSDEC.

Task 7 – Prepare an Emergency Action Plan

Prepare an Emergency Action Plan (EAP) as required by New York State Dam Safety Regulations. As outlined in the NYSDEC DOW TOGS 3.1.3 – Emergency Action Plans for Dams, dated December 2012, the EAP for an Intermediate Hazard dam should at a minimum include the following:

1. *Emergency notification procedures, including a notification flowchart*
2. *An Emergency Notification Information Form*
3. *Inundation maps*

Using the inundation mapping developed in Task 4, prepare an EAP document specific to the Loughberry Lake Dam. As part of the preparation for the EAP, contact state and county emergency management officials and local emergency responders having jurisdiction in the inundation area to obtain appropriate points of contact for the development of the notification flowchart.

Greg Daviero coordinated and conducted workshops with staff from the NYS Office of Parks Recreation and Historic Preservation, Orange and Rockland County Emergency Managers and first responders for the promulgation and concurrence of EAPs for six Class B and C dams. The content of the EAPs were presented to the group and changes to the EAPs were implemented based on feedback to facilitate their effectiveness. One addition included the presentation of depth of anticipated flooding at all inundated roadways.

An EAP is a working document, which will need to meet the unique needs of the City of Saratoga Springs. Therefore, submit a draft EAP to the City for review and comment prior to holding an orientation meeting, as described in Task 7.1 below. Following the City of Saratoga Springs' review of the draft EAP, make appropriate revisions and prepare up to fifteen (15) color copies of the draft EAP. Transmit these hard copies to individuals identified as recipients within the plan.

Following the orientation meeting, make updates to the draft EAP to incorporate comments received and transmit updated pages to plan holders to finalize the EAP. In addition, prepare a Promulgation and Concurrence Form for submission to the NYSDEC to document the coordination with local emergency management officials during the development of the EAP. This form is required to be completed and submitted to the NYSDEC in order for the EAP to be considered final. Upon completion of the EAP, a digital copy (provided on a CD) of the EAP and mapping and other related materials shall be provided to the City of Saratoga Springs and the NYSDEC Dam Safety Section.

Task 7.1 – Orientation Meeting

Coordinate an orientation meeting with EAP holders (City of Saratoga Springs, NYSDEC, Saratoga County Department of Emergency Services and state, county and local officials and first responders) to introduce and discuss the draft EAP, and generate feedback on how to modify the document, if necessary, to accommodate the specific needs of those involved in an emergency response. Feedback received will be incorporated into the final EAP.

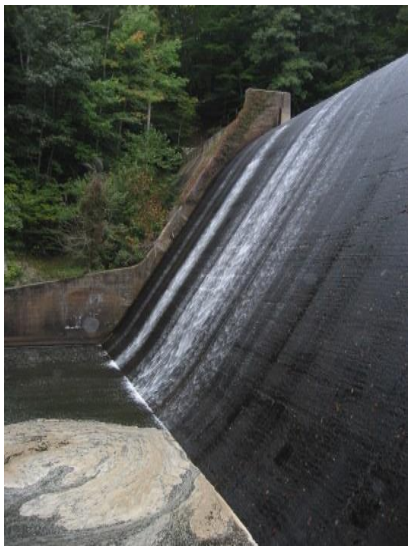
Task 8 – Prepare Inspection and Maintenance Plans

The NYSDEC requires that the I&M Plan include the following items:

1. *Detailed descriptions of all procedures governing: the operation, monitoring, and inspection of the dam, including those governing the reading of instruments and the recording of instrument readings; the maintenance of the dam; and the preparation and circulation of notifications of deficiencies and potential deficiencies.*
2. *A schedule for monitoring, inspections, and maintenance.*
3. *Other elements as may be required by the NYSDEC based on its consideration of public safety and the specific characteristics of the dam and its location. Prepare the I&M Plan for the Loughberry Lake Dam owned by the City of Saratoga Springs in general conformance with the NYSDEC guidelines titled "An Owners Guidance Manual for the Inspection and Maintenance of Dams in the State of New York", dated June 1987.*

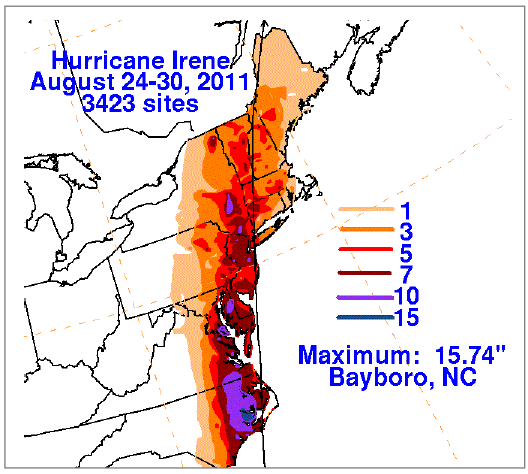
Schnabel has significant experience working for Municipalities, Authorities, and State and Federal Agencies who are responsible for a portfolio of dams requiring Engineering Assessments for the determination of the need for and prioritization of improvements.

On the following pages we have presented a selection of project profiles that provide an overview of some of our more recent similar projects in NYS and elsewhere. We encourage you to review these project summaries and trust that you will see many similarities between Schnabel's project experiences and your needs.



MEAD RESERVOIR DAM

Plattsburgh, NY



Mead Reservoir Dam is the water supply reservoir owned by the City of Plattsburgh and located just outside the Adirondack Park boundary. Another consultant was retained by the City in 2009 to conduct an Engineering Assessment (EA) for the Class C dam. An H&H analysis was conducted as part of the EA which concluded that the existing spillway was severely inadequate in terms of spillway capacity. Subsequently the City authorized detailed design services for construction of a new labyrinth spillway system, new spillway chute, a new concrete stilling basin, and replacement of outlet works gates/valves. The project was advertised to bid and all of the contractors' bids came in substantially higher than the engineer's estimate and budget. All bids were rejected and Schnabel was retained to provide a peer review of the previous hydrologic and hydraulic analyses.

Through Schnabel's peer review it was determined that the previous analyses used the very conservative SCS unit hydrograph (UH) methodology that has often been found to over-predict peak flows by two to three times. Schnabel developed an independent H&H analysis for the dam including validation of the selected hydrologic parameters through analysis of Hurricane Irene using hourly gridded rainfall data which provided for both spatially and temporally distributed rainfall over the watershed. The results of our modeling matched excellently with observed lake levels, while the SCS methodology estimated peak reservoir elevations substantially higher than observed. Schnabel subsequently evaluated the SDF for the Dam with the revised hydrologic model, and the results indicated a peak flow of less than half of the previous estimates.

The revised analysis is currently pending approval by the NYS DEC, will likely result in **project cost savings in excess of $3M**, and will allow a revised rehabilitation project to proceed within the constrained City budget.

PROJECT SERVICES
Peer Review
Hazard Class Assessments
H&H Modeling
Spillway Capacity Assessment

CLIENT
City of Plattsburgh,
41 City Hall Place
Plattsburgh, NY 12901
Jonathan Ruff, Environmental Manager

OWNER
City of Plattsburgh

COMPLETION
2014

COOPER LAKE DAM AND WEST DIKE

Woodstock, NY

Schnabel has been retained by the City of Kingston and the Kingston Water Department to evaluate alternatives for and design improvements to the Cooper Lake Dam and West Dike, the primary water supply source for the City of Kingston, New York. The project will refine the design approach to achieve New York State regulatory requirements for achieving spillway capacity and stability requirements and includes and underwater investigation of the existing raw water intake and low level outlet. The alternatives will also consider long term water supply planning elements including consideration of a dam raising for additional water supply storage.

Cooper Lake Dam is an earthen embankment dam with a length of approximately 460 feet and a height of approximately 45 feet. The dam impounds approximately 3,700 acre-feet of water at normal pool elevation. Schnabel is currently evaluating alternatives to address identified deficiencies in spillway capacity, embankment slope stability and outlet works. Alternatives for achieving spillway capacity include implementing a labyrinth spillway for increased hydraulic capacity and incorporating a parapet wall to provide additional surcharge storage to reduce the footprint of the required spillway improvements. Embankment modifications include flattening of the downstream slope of the main dam to meet required factors of safety. Schnabel is also currently conducted an underwater investigation of the existing outlet structure to determine its condition and structural integrity for its continued long term use. Depending on the outcome of this investigation a new raw water intake and low level outlet structure may be designed and constructed.

PROJECT SERVICES
Peer Review
Alternatives Analysis
H&H Modeling
Spillway Capacity Assessment
Seepage and Stability Analyses
Outlet Works Investigations

CLIENT
Kingston Water Department
11 Jansen Place
PO Box 1537
Kingston, NY 12402
Judith Hansen, Superintendent

OWNER
City of Kingston

COMPLETION
Ongoing

INDIAN BROOK RESERVOIR DAM DESIGN

Ossining, NY

Indian Brook Dam is a 500-ft long earthen embankment dam with a masonry core wall and a maximum height of 43 ft. Owned by the Village of Ossining and constructed in 1889 to serve as the primary water supply storage for the Village, the dam impounds 300 acres of water and is classified as a large high-hazard dam.

Evaluations performed as part of a 2011 Engineering Assessment of Indian Brook Reservoir Dam concluded that the dam had seepage issues, the existing spillway did not have adequate capacity to safely convey the regulatory spillway design flood, and the downstream embankment did not meet requisite factors of safety for embankment stability. Subsequently, the Village retained the team to develop remedial design plans to bring the dam into regulatory compliance.

Schnabel was retained to assist with detailed design and project delivery. To support the new spillway design, a US Army Corps of Engineers HEC-HMS hydrologic model was developed for the reservoir watershed. The regulatory spillway design flood for existing high hazard dams in New York is 50% of the Probable Maximum Flood. Arc-GIS software was utilized to estimate hydrologic parameters to determine the approximate rainfall runoff response of the watershed. Hydraulic analyses of various spillway alternatives were evaluated to increase spillway capacity to safely convey the Spillway Design Flood. The final design included a new, two-cycle, labyrinth-weir crest, a new, concrete-lined spillway chute and stilling basin, raising the dam crest, and placement of riprap on the upstream embankment.

Multiple alternatives were evaluated to increase stability of the embankment. The selected remedial improvement included installation of a toe drain system. An additional component of the dam rehabilitation project included replacement of the inlet and outlet piping.

PROJECT SERVICES
New Spillway Design Support
Hydraulic Analyses
Alternatives Evaluations

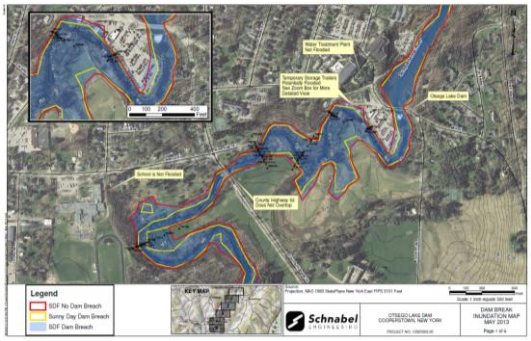
CLIENT
Malcolm Pirnie Inc.
Arcadis
855 Route 146
Suite 210
Clifton Park, NY 12065-3890
Todd Minehardt
5182507308

OWNER
VIllage of Ossining
Department of Public Works

COMPLETION
2013

OTSEGO LAKE DAM

Cooperstown, NY



As a result of pending regulatory compliance activities associated with current hazard classification, Cooperstown retained Schnabel to perform a detailed hazard class assessment of the dam in accordance with New York State Department of Environmental Conservation's "Guidance for Dam Hazard Classification." The Class B dam is a run-of-river structure located on the Susquehanna River, 0.5 miles downstream from its source at the south end of Otsego Lake.

A concrete buttress structure with a total length of 70 ft and a height of 11 ft, Ostego Lake Dam has a normal pool storage of 341,094 acre-ft, a maximum storage of 345,320 acre-ft, a surface area of 4,225 acres, and a drainage basin of 68.34 square miles. Schnabel developed a detailed hydrologic model of the watershed using the US Army Corps of Engineers (USACE) HEC-HMS. Watershed parameters were refined through calibration of the model to a historic flood in June 2006 when more than seven inches of rain fell on the watershed. The calibrated hydrologic model was used to develop and route a storm equivalent to 150% of the 100-year spillway design flood. Dam breach models were developed for a sunny day breach of Otsego Lake Dam as well as for a breach during the regulatory SDF. A detailed hydraulic model of the Susquehanna River was developed using the USACE HEC-RAS and HEC-GeoRAS programs. The inundation boundaries were plotted on aerial imagery to determine whether any structures would be impacted by a dam failure.

The results indicated that Otsego Lake Dam may be more appropriately classified as a Class A, low-hazard dam. Schnabel petitioned for a hazard class reduction from Class B to Class A, which was approved by NYS DEC. Because the 2009 regulations focused on high and intermediate hazard dams, this result provided an immediate benefit to the Village. The Village is no longer obligated to complete specific dam safety regulatory submittals and is free to advance their dam safety program at a schedule and with design standards consistent with their accepted level of risk.

PROJECT SERVICES
Dam Inspections
Dam Breach Analyses
Inundation Mapping
Hazard Class Assessments
H&H Modeling
Spillway Capacity Alternatives

CLIENT
Village of Cooperstown
P.O. Box 346
22 Main Street
Cooperstown, NY 13326
Teri Barown, Village Clerk

OWNER
Village of Cooperstown

COMPLETION
2013

NYSDEC DAM INSPECTIONS & ENGINEERING SERVICES

Multiple Locations, NY

Schnabel Engineering was retained by the New York State Office of General Services (NYS OGS) as part of a team for a Term Contract to provide Dam Inspections and Engineering Services on 23 dams owned by the New York State Department of Environmental Conservation (NYS DEC). The NYSDEC owns a portfolio of more than 100 dams throughout the state and is working to bring the dams into compliance with the state dam safety regulations revised in August 2009. This initial set of dams represents structures with known deficiencies and/or concerns about hazard classification. An overall goal of the project is to perform an assessment of the 23 dams to aid in the prioritization of funding for dam rehabilitation and compliance activities.

Schnabel is leading the hydrologic and hydraulic analyses elements of the work including hazard class assessments, development of appropriate spillway design flows, and concepts for spillway rehabilitation. Schnabel's initial work has focused on performing hazard class screenings for each of the 23 dams. This work has included:

- Review of documents in NYS DEC dam safety files
- Confirmation of dam length and height
- Computation of normal pool and maximum pool storage volumes
- Drainage area delineation
- Screening level dam breach analysis
- USGS StreamStats Flow Analysis
- Downstream drainage structure capacity analysis
- Review of aerial imagery and topographic mapping for structures downstream from each dam

The results of the hazard class screening are generally intended to determine if adequate information exists to confirm the hazard classification of each dam. The approach is to provide a semi-quantitative application of the NYSDEC's recent document, *DOW TOGS 3.1.5 – Guidance for Dam Hazard Classification*. For those dams where uncertainty is found in establishing an appropriate hazard classification, recommendations for more detailed dam breach modeling are made. This overall approach allows the dam owner to cost effectively apply available funding to those dams with the greatest potential risk to the downstream population.

PROJECT SERVICES
Dam Hazard Class Screening
Dam Break Modeling
Spillway Capacity Assessments
Bridge/Culvert Capacity Assessments

CLIENT
CHA Consulting, Inc.
111 Winners Circle, PO Box 5269
Albany, NY 12205-0269
Warren Harris
Vice President – Dam Safety
Phone (518/453-4500)
WHarrisIV@chacompanies.com

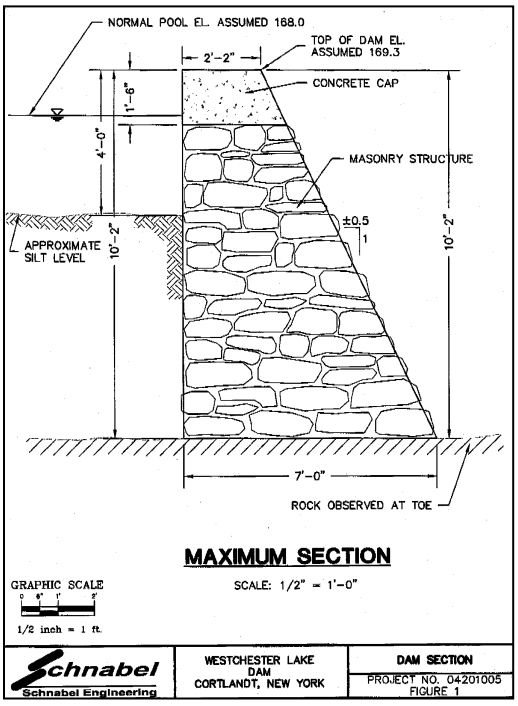
OWNER
NYS DEC

COMPLETION
Ongoing

CORTLANDT LAKE AND WESTCHESTER LAKE DAMS

Cortlandt, NY

Westchester Lake Dam Primary Spillway



Under two separate contracts, Schnabel performed engineering services for the Cortlandt Lake Dam and Westchester Lake Dam both owned by the Town of Cortlandt in Westchester County, NY. Cortlandt Lake Dam is a high hazard (Class C) dam and Westchester Lake Dam is and intermediate hazard (Class B) dam.

For Cortlandt Lake Dam, Schnabel performed a review of the gravity dam stability analyses considering the supporting subsurface investigations, loading conditions, and physical and mechanical properties such as unit weight, foundation contact friction and cohesion, internal construction joint friction, cohesion, and uplift. Schnabel coordinated our efforts with the New York State Department of Environmental Conservation, Division of Water to verify the criteria required for factor of safety and loading conditions. Schnabel also performed independent stability calculations including a sensitivity analysis of various design parameters. Ultimately, the dam did not meet current criteria for several loading conditions. Our report recommended recalculation of the PMP and resulting tailwater for the flood surcharge loading condition. We also recommended the design of a post tensioned anchoring system to rehabilitate the structure to meet current criteria.

For Westchester Lake Dam, Schnabel performed a visual inspection, hydrologic and hydraulic analysis, and a gravity dam stability analysis for loading conditions required by the NYS DEC. The results concluded that the dam did not meet the required factors of safety, could not pass the required spillway design flood and did not have an operable low level outlet. Preliminary dam rehabilitation and removal alternatives were developed.

PROJECT SERVICES

Dam Safety Inspection
Hydrologic and Hydraulic Modeling
Stability Analysis

CLIENT

Cortlandt Lake Dam
Structures Consulting Engineers
PO Box 125
Swarthmore, PA 19081

Westchester Lake Dam
Ed Vergano, PE
Town of Cortlandt
1 Heady Street125
Cortlandt Manor, NY 10567

OWNER

Continental Village Park District
(Cortlandt Lake Dam)

Westchester Lake Association
(Westchester Lake Dam)

COMPLETION

2004

LOUIS CALDER CENTER LAKE DAM

Armonk, NY

The Louis Calder Center Lake Dam, owned and operated by Fordham University, serves as a biological field station for the university. Schnabel was retained to perform a hazard class assessment of the dam to ascertain regulatory requirements. While the dam is not currently in the regulatory dam database, it is subject to dam safety regulations administered by the New York Department of Environmental Conservation, and design criteria are based on hazard classification.

Originally constructed as a dry laid masonry structure and fortified with a concrete cap and upstream face, the dam has an overall length of approximately 67 ft and a maximum height of approximately five feet. Deterioration over the years produced significant cracks in the concrete cap and face, leading to substantial seepage and concerns over the dam's stability. Fordham University hired the team to develop rehabilitation plans for the dam.

A Sunny Day dam breach analysis was first conducted to develop an initial opinion of hazard classification. The results of the breach analysis indicated there would be minimal impacts to downstream structures, and that a Class A hazard classification would be appropriate. Schnabel then developed a detailed hydrologic model of the watershed using the HEC-HMS model. The hydrologic model was used to analyze a storm equivalent to the 100-year spillway design flood and develop a wet weather breach hydrograph from the dam. The wet weather breach hydrograph was input to the breach hydraulic models and routed through the downstream drainageway. The results of the wet weather breach modeling confirmed that Calder Lake Dam is appropriately classified as a Class A, low-hazard dam.

PROJECT SERVICES
Hazard Class Assessment
Sunny Day Dam Breach Analysis
Hydrologic Model

CLIENT
GeoDesign Incorporated
984 Southford Road
Middlebury, CT 06762
Michael Taylor, Vice President
203-758-8836

OWNER
Fordham University

COMPLETION
2013

SWINGING BRIDGE RESERVOIR DAM

Forestburgh, NY

Swinging Bridge Reservoir Dam is a 120-ft high dam constructed in the 1920s, and located on the Mongaup River north of Port Jervis, New York. In May 2005, the embankment developed numerous sinkholes, including a large one above the diversion tunnel that resulted in cracking and fractures in the penstock pipe. Subsequent erosion by piping occurred through the tunnel cracks and along the substructure. These findings called for emergency drawdown of the reservoir behind this hydroelectric dam.

Schnabel was retained to provide rapid response engineering and remedial design analyses for this dam under contract to the Owner's engineer. We performed forensic studies including detailed evaluations of events and causes, and assessed potential for further impacts on the structure. Subsequent tasks included exploration, drilling, sampling, review of piezometric instrumentation installed in the embankment and diversion tunnel, defining geologic conditions, and evaluating seepage and slope stability. Being a FERC-regulated dam, it was required that all documents and construction activities be subject to FERC review, as well as review by a board of consultants.

Remediation design was approached in two phases. Phase 1 included remediation of sinkholes at the crest of the dam; design, installation, and startup of construction dewatering at the toe of the dam; and contact grouting along the diversion tunnel to fill voids. Phase 2 included design and construction of a downstream conduit filter and toe drain, blanket drains, and a toe berm. Schnabel also considered open cut excavation and filter, or a diaphragm filter to encapsulate the diversion tunnel and penstock as alternatives to this design. Observation services during construction were also provided.

PROJECT SERVICES
Emergency Response
Filter and Drain Design
Dewatering System
Grouting
Seepage and Stability Analysis
Geophysical Investigations
Construction Monitoring

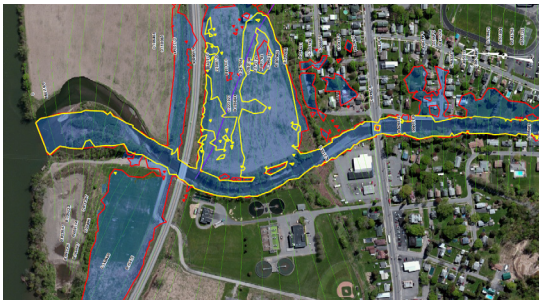
CLIENT
Devine Tarbell & Associates Inc.
[Acquired by HDR]
970 Baxter Boulevard
Portland, ME 04103
207-775-4495

OWNER
Devine Tarbell & Associates Inc.

COMPLETION
2007

FULMER CREEK STUDY FOR UPSTREAM FLOW ATTENUATION

Mohawk, NY



The Village of Mohawk has a long history of flooding along Fulmer Creek, a tributary to the Mohawk River. Following historic floods in June 2006 and August 2011 (Hurricane Irene), it became evident that summer storm induced flooding was a significant concern. Subsequently, Schnabel Engineering of New York was retained by the Herkimer-Oneida Counties Comprehensive Planning Program and the Town of German Flatts to evaluate the potential for flood flow reduction though construction of upstream storage facilities. The goal was to ascertain if flood storage facilities in the upper portions of the Fulmer Creek watershed could successfully reduce flooding impacts in the Village of Mohawk while also providing enhanced habitat and recreation opportunities.

Schnabel developed an HEC-HMS hydrologic model of the 25-sq.-mile watershed. The watershed was divided into 12 sub-basins to represent major tributaries to Fulmer Creek. Hydrologic parameters were estimated using GIS software and available soils, land use and topographic mapping. The study initially focused on a single site but was expanded to six potential sites. At each location, a proposed stage versus storage relationship was developed based on available topographic mapping. The HEC-HMS model was then modified to include reservoir routing through each proposed facility. The model was executed for the 2-, 10-, 25-, 50-, and 100-year storm events.

A hydraulic analysis of Fulmer Creek was also conducted to determine the potential reduction in flood elevations through the Village of Mohawk. The results of the hydrologic and hydraulic modeling indicated that upstream storage facilities could reduce flooding within the Village of Mohawk but the cost of implementation would not meet requisite benefit/cost ratios.

PROJECT SERVICES
Hydrologic Modeling
Pre- and Post-Development Hydraulic Modeling
Inundation Mapping
Flood Mitigation

CLIENT
Herkimer-Oneida Counties Comprehensive Planning Program

OWNER
Town of German Flatts

COMPLETION
2013

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL, DAM SAFETY SERVICES

Multiple Locations, DE

Beginning in 2000, the Delaware Department of Natural Resources and Environmental Control (DNREC) contracted with Schnabel to provide inspections for 10 high hazard dams. Schnabel provided DNREC with inspection reports for each dam and developed a statewide template for use in future inspections.

In 2003, Schnabel provided engineering services for the rehabilitation of Records Pond Dam. The project included performance of a dam breach and incremental inundation analysis in HEC-RAS to develop the spillway design flood (SDF). The flat topography required the Schnabel incorporate the DELMARVA unit hydrograph and develop a regional lag time relationship based on previous studies and calibration to historical storm events. Schnabel designed upgrade measures to pass the SDF including installation of a sheetpile wall designed to protect the dam from an overtopping failure.

In 2006, we evaluated Haven and Silver Lake Dams as well as three other dams within the 30 square mile drainage area (Griffith, Abbotts Pond, and Blairs Pond Dams). Schnabel performed visual inspections, hydrologic and hydraulic (H&H) modeling for all of the lakes, which are located in series. The modeling of the upstream lakes and river reaches was performed using HEC-RAS and was used to develop the SDF for Haven and Silver Lake. The H&H analysis indicated that each dam had inadequate capacity for which Schnabel performed evaluations of alternatives to upgrade spillway capacity. Alternatives included armoring the embankments with roller compacted concrete and/or articulating concrete blocks.

In 2009, Schnabel provided visual inspections, dam breach analyses, inundation mapping, Emergency Action Plans (EAPs) and Operation and Maintenance manuals, and topographic and bathymetric surveys for 10 high hazard dams owned by the State. Schnabel also provided emergency response for the partial failure of Abbotts Pond Dam.

PROJECT SERVICES
Engineering Assessments
Dam Safety Inspections
Emergency Action Plans
Operation and Maintenance Plans
Hydrologic and Hydraulic Modeling
Seepage & Stability Analysis
Alternatives Evaluation
Design

CLIENT
Delaware Department of Natural Resources and Environmental Control
89 Kings Highway
Dover, DE 19901
David Twing
302-739-4411

OWNER
Delaware Department of Natural Resources and Environmental Control

COMPLETION
2013

USACE NORFOLK DISTRICT NAVY AND MARINE CORPS DAM SAFETY PROGRAM

Virginia, Indiana, and California

The Norfolk District was assigned responsibility for the dam safety program for 33 dams located on U.S. Navy and Marine Corps Facilities nationwide. For more than nine years, Schnabel provided geotechnical and dam engineering services to the Norfolk District under an indefinite delivery contract.

Schnabel's support of the District included visual inspections, hydrologic and hydraulic analyses, dam breach analyses and inundation mapping, development of Emergency Action Plans, and geotechnical engineering. A detailed evaluation of two high hazard dams at Quantico Marine Corps Base, Breckinridge (concrete gravity dam) and Lunga (earth embankment) was provided. This evaluation included subsurface explorations, seepage and stability analysis, low-level outlet inspections, hydrologic and hydraulic analysis, and rehabilitation alternatives to meet USACE dam safety guidance documents.

In addition to providing engineering services for dams on Navy and Marine Corps Facilities, Schnabel provided services for the USACE-owned Gathright Dam, a 257-ft high zoned rockfill dam built on a karstic limestone foundation and abutments which, in part, led the USACE to assign the dam a Dam Safety Action Classification (DSAC) of II (Urgent – Unsafe or Potentially Unsafe). USACE requested Schnabel to perform an independent evaluation of the existing seepage conditions and monitoring program at the dam.

PROJECT SERVICES
Dam Inspections
Emergency Action Plans
Hazard Classification

CLIENT
U.S. Army Corps of Engineers, Norfolk District
803 Front Street
Norfolk, VA 23510-1096
Raymond Dridge, Chief, Geo Environmental Engineering Section
757-201-7086

OWNER
U.S. Army Corps of Engineers

COMPLETION
2011

PA DCNR DAM EVALUATIONS AND DESIGN

Multiple Locations, PA

Schnabel provided dam and geotechnical engineering services as a subconsultant on two separate open-end contracts with the Pennsylvania Department of Conservation and Natural Resources (DCNR). We were selected for a five-year contract to provide dam engineering services, including hydrologic and hydraulic (H&H) analysis, geotechnical explorations and analyses, engineering assessments and evaluation of rehabilitation alternatives, design, and construction services including:

- Poe Valley Dam
- Gunter Valley Dam
- Promised Land, Little Buffalo, and Memorial Lake Dams
- Gouldsboro and Lower Lake Dams
- Ryerson Station Dam
- Chapman Dam
- Tobyhanna Dam
- George B. Stevenson Dam
- Pymatuning Dam

Schnabel has also provided engineering services for Parker, Riley's Pond, and Lyman Run Dams, owned by DCNR. In addition, We have provided dam safety training for DCNR engineering and maintenance staff related to H&H, geophysical methods, operation and maintenance plans, and EAPs for dams.

PROJECT SERVICES

Subsurface Investigation
Seepage & Stability Analysis
Alternatives Evaluation
Hydrology and Hydraulics
Dam Breach Analysis
Roller Compacted Concrete
Structural Design for Intake Tower Rehabilitation
Risk Assessment
Plans and Specifications
Construction Services
PADEP Division of Dam Safety Approvals

CLIENT

Commonwealth of Pennsylvania
Department of Conservation and Natural Resources
Bureau of Facility Design/Construction
Rachel Carson State Office Building
PO Box 8451
Harrisburg, PA 17105-8451
Edward Raptosh, Civil Engineer Manager
717-783-3329

OWNER

Commonwealth of Pennsylvania

COMPLETION

Ongoing

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY
DAM REHABILITATIONS

Schuylkill County, PA

Schnabel provided geotechnical and dam engineering for four high hazard dams owned by the Schuylkill County Municipal Authority. Each of these earth embankment dams has been found to have inadequate spillway capacity to pass the Probable Maximum Flood, as required by the dam safety regulations of the Pennsylvania Department of Environmental Protection (PADEP). Seepage and stability issues have also been identified. Our initial services included geotechnical explorations and evaluation; hydraulic and hydrologic analyses; and development and evaluation of alternatives to upgrade the dams to meet PADEP Dam Safety criteria for spillway capacity and embankment stability.

Beginning in 2009, Schnabel developed designs for the recommended upgrading measures for all four dams.

The dam rehabilitations included the following upgrades to address inadequate spillway capacity:

- Pine Run Dam (2010): labyrinth replacement spillway
- Indian Run Dam (2012): labyrinth replacement spillway
- Mt. Laurel Dam (2013): replacement drop spillway, articulating concrete block armored auxiliary spillway, and a siphon low level outlet
- Kauffman Dam (2013): labyrinth replacement spillway

Embankment toe drains and slope stabilization measures were constructed at each dam. The modifications were completed with limited reservoir drawdown to maintain water supply at each dam. Schnabel provided observation services and technical support during construction.

PROJECT SERVICES
Hydrologic and Hydrologic Analysis
Alternatives Evaluation
Subsurface Exploration
Geotechnical Evaluation
Plans and Specifications
Bid and Construction Services

CLIENT
Alfred Benesch & Company
400 One Norwegian Plaza
P.O. Box 1090
Pottsville, PA 17901-1090
Eli Peleschak, Senior Project Manager
570-622-4055

OWNER
Schuylkill County Municipal Authority

COMPLETION
2013

PYMATUNING DAM REHABILITATION

Jamestown, PA

Pymatuning Dam is a 2,400-ft long earth embankment with a maximum height of 50 ft and impounds a 14,500-acre lake at normal pool (ogee EL 1008). The dam has a drainage area of approximately 158 square miles. The outlet works at the dam consist of a concrete and masonry tower and gate house and two 6-ft wide by 8-ft high rectangular concrete conduits. The Shenango River downstream of the dam has experienced significant erosion along the north bank following significant storm events and releases from the dam. This has been exacerbated by deposition of a gravel bar at the mouth of Sugar Run, a tributary that empties into the Shenango River near the outlet channel from the dam. The gravel bar directs flows from Sugar Run towards the steep north bank of the Shenango River which is causing undercutting and sloughing of the bank. As part of the rehabilitation of Pymatuning Dam, Schnabel was retained to develop plans and specifications to stabilize the north bank and enhance in-stream habitat for approximately 400 feet of the Shenango River downstream of the dam's outlet works. To support the work, a hydrologic and hydraulic analysis was conducted for the project reach augmented with a fluvial geomorphic assessment. In-stream flood profiles and velocities were evaluated for a variety of geomorphic regimes ranging from channel forming flows to extreme storm events.

The proposed bank stabilization measures include flattening of the bank slopes, installation of riprap toe protection, provision for a floodplain bench, and live stake planting with native grasses for the upper portion of the bank. The design also includes a boulder J-hook vane extending from the north bank to the center of the channel and mouth of Sugar Run. The j-hook vane helps re-direct primary flow patterns away from the north bank and towards the center of the channel. This will help establish a natural pool and riffle regime and enhance in-stream habitat. Final plans and specifications have been developed and the proposed restoration is slated for construction in 2014.

PROJECT SERVICES
Stream Restoration
Geomorphic Assessment
Hydrologic Analysis
Hydraulic Analysis
Alternatives Evaluation
Outlet Structure Rehabilitation
Plans and Specifications

CLIENT
Department of Conservation and Natural Resources
PO Box 8451
Harrisburg, PA 17105-8451
Edward Raptosh, Civil Engineer Manager
717-783-3329

OWNER
Commonwealth of Pennsylvania

COMPLETION
2014

Schnabel appreciates the opportunity to submit our cost proposal for the Engineering Assessment of Loughberry Lake Dam. We are committed to a goal of providing the City with high quality, cost effective engineering and consulting services. We understand that cost is an important consideration, but it has been our experience that utilizing engineering costs as a basis for selection often does not achieve the intended objective for the owner. Too often, items not always clearly defined in the RFP (such as scope of soils laboratory testing in your RFP) will be omitted or qualified differently by competing firms, resulting in variations in scope and fee. Furthermore, the advancement of the EA could result in the identification of a dam safety deficiency and trigger a rehabilitation construction project. Approximately 80% of the total project cost will be borne by the implementation of the selected remedial design. Thus, the fee allocated for the EA is a small but important percentage of total project cost. For these reasons, we strongly recommend a Qualifications Based Selection (QBS) to achieve a total lowest cost (assessment, design and construction) solution.

AN ALTERNATIVE APPROACH

As a further example of our ability to provide value, we offer an alternative approach to completing this project. As is evident in the cost matrix presented on the following page, the subsurface exploration represents approximately 44% of our total fee. This portion of the fee is in accordance with the detailed scope as provided in the RFP. From our experiences and personal interactions with NYS DEC Dam Safety staff, we believe that the scope identified in the RFP is more consistent with the standard of care for performing an EA for a Class C (high hazard) dam. As engineers and scientists, we always prefer to have site-specific soils and piezometric information but as a dam engineering advisor, we view this from a risk-based perspective and suggest that the allocation of over $25,000 for subsurface exploration be deferred until such time that a stability failure is established as a realistic potential failure mode. Specifically, we recommend completing Task 1 - Review of Available Information, Task 2 – Dam Safety Inspection, Task 4.3 – Hazard Classification Evaluation and Task 5.2 Stability Analysis prior to finalizing the need for, and scope of, the subsurface exploration program. The preliminary stability analyses performed in Task 5.2 would utilize a sensitivity analysis to examine potential embankment instabilities for a range of typical soil parameters and loading conditions and would establish the likelihood of unsatisfactory factors of safety. Should the hazard classification or preliminary stability analyses indicate that subsurface explorations are warranted, then the subsurface exploration program can be developed based on a fundamental understanding of the dam and its potential failure modes. ***This approach could save over $25,000*** or at the very least result in a more informed, targeted, and cost effective exploration program.

OUR ESTIMATE

In order to be compliant with the requirement of the RFP, we have developed a Cost Matrix identifying the costs of the key tasks with accompanying staff hours. We have also provided notes clarifying some of our key actions or assumptions that have cost implications and included the details of the fee estimate provided by Parratt-Wolff.

Cost Matrix for the Engineering Assessment of Loughberry Lake Dam				
Task	**Estimated Hours**	**Sub Task Fee**	**Task Fee**	**Notes**
1 – Review of Available Information	16		$2,100	
2 – Dam Safety Inspection	24		$2,800	Local staff mobilized from Clifton Park
3 – Survey Services (To be performed by the City Survey Group)			$0	Survey services provided by City
4 – Hydrologic & Hydraulic Assessment	46		$6,200	Hydrologic & Hydraulic Assessment to be performed by staff in our Clifton Park, NY office.
4.1 – Hydrology	8	$1,200		Watershed delineation shown in Section 3
4.2 – Sunny-Day and Storm-Day Dam Break Analyses	6	$800		
4.3 – Hazard Classification Evaluation	6	$800		Loughberry Lake Dam is regulated as a Class B structure. Proposal assumes this classification is appropriate.
4.4 – Prepare Inundation Mapping	14	$1,800		Mapping extend to identified downstream limits.
4.5 – Evaluation of Spillway Capacity	6	$800		Preliminary modeling suggest adequate spillway capacity exists for a Class B dam
4.6 – Evaluation Outlet Works Capacity	6	$800		
5 – Stability Analyses	104		$30,000	Please see Alternative Approach discussion above for an opportunity to reduce the cost of this task.
5.1 – Subsurface Investigation	68	$25,200		Parratt-Wolff is our drilling subcontractor. This task includes $14,000 in drilling costs and assumes a 5-day, 9-hour/day, continuous sampling drilling program. Also included is laboratory testing for moisture content, sieve analyses, and Atterburg Limits not specified in the RFP. Parratt-Wolff proposal is included on the following page.
5.2 – Stability Analysis	36	$4,800		Stability Analysis to be performed by staff in our Clifton Park, NY office.
6 – Engineering Assessment Report	60		$8,000	
7 – Prepare an Emergency Action Plan	34		$4,600	
7.1 – Orientation Meeting	10	$1,400		Assumes, one 4-hour meeting with presentation by Engineer
8 – Prepare Inspection and Maintenance Plans	24		$3,000	Assumes Saratoga Springs staff will identify existing activities.
TOTAL FEE ESTIMATE	**308**		**$56,700**	Could be reduced to **$31,500** if Alternative Approach is implemented

SCHNABEL DELIVERS!

We close our proposal with examples of similar projects where Schnabel has delivered significant savings to dam owners. These projects are further demonstration of our expertise in the field and our ability to leverage this expertise for the benefit of our clients.

Test Borings and Piezometer Installations
Loughberry Lake Dam Investigation
Saratoga Springs, New York
February 18, 2015
Proposal No. P15085

Item	Estimated Quantity	Unit	Unit Price	Unit Total
Drill two (2) soil borings at the crest of dam to approximately 55 feet and two (2) soil borings at the toe of dam to approximately 35 feet with continuous split spoon sampling. Install 1 1/4-inch diameter PVC piezometers in each of the borings.				
NYSDOT highway work permit	1	lump sum	$ 100.00	$ 100.00
Mobilization and Demobilization - truck mounted drill rig and two man crew	1	lump sum	$ 400.00	$ 400.00
Truck mounted drill rig and two man crew (1, 2)	5	day	$ 1,800.00	$ 9,000.00
1 1/4-inch diameter PVC piezometers installed	180	linear foot	$ 12.00	$ 2,160.00
Flush mount protective covers installed	4	each	$ 150.00	$ 600.00
Grout backfill (if required)		linear foot	$ 3.00	$ -
Bentonite chip backfill (if required)		bag	$ 15.00	$ -
Rock core box (if required)		each	$ 40.00	$ -
Per diem	5	day	$ 225.00	$ 1,125.00
Shelby tube sample	6	attempt	$ 95.00	$ 570.00
Falling head test	6	each	No Charge(3)	$ -
Estimated total				**$ 13,955.00**

Notes:

1. Time is portal to portal (includes travel time), based on a 9-hour day with a 1/2 day minimum charge.
2. Assumes that borehole locations are accessible with a truck mounted drill rig.
3. Falling head tests performed under daily rate for rig and crew and would only impact cost by adding time to project.
4. Assumes "Shoulder Closure" plan for MPT and would require only signs and cones for implementation.
5. Assumes that Prevailing Wage Rates do NOT apply.

3. Parratt-Wolff will contact Dig Safely New York (Dig Safely) to clear underground facilities at the site prior to initiating the drilling program, however please note the following:

Dig Safely will only coordinate the clearance of underground facilities for those companies subscribing to the service. Parratt-Wolff will not take responsibility for locating underground facilities operated by organizations that do not belong to Dig Safely or for any damage that may occur to these utilities if they are not located.

Utility companies will generally only clear utilities located on public property or in a utility right-of-way. Service lines are privately owned and their mark-out will be the responsibility of the property owner. Parratt-Wolff will not take responsibility for damage to privately owned utilities/services that have not been properly cleared or marked.

Schnabel Projects that Delivered Significant Savings to Dam Owners

Schnabel ENGINEERING

Project and Location	Description	Complete	Reference	Approximate Savings to Owner	Participating Project Team Members
MEAD RESERVOIR DAM Plattsburgh, NY	Another consultant was retained to address dam safety issues. A recommendation for an increase in spillway capacity was made, accepted and estimated at $3.8M. Bids were received ranging from $6.9M to $8.5M. Schnabel was hired to provide a peer review and identified opportunities to reduce the spillway design flood (SDF) by a factor of two; meaning the proposed spillway was designed twice as large as required. Schnabel and the City are currently formalizing their request for the reduced SDF. This represents an estimated $3M cost savings to the City.	Ongoing	Jonathan Ruff, PE City of Plattsburgh (518) 536-7519	**$3M**	Greg Daviero Greg Paxson Kevin Ruswick Brian Crookston
SCHUYLKILL COUNTY MUNICIPAL AUTHORITY DAMS Schuylkill County, PA	Schnabel was tasked with evaluating upgrading alternatives following work performed by a previous consultant. Schnabel was successful in developing design concepts that incorporated creative and cost effective combinations of upgrades with labyrinth, straight drop and articulated concrete block (ACB) armored spillways for the four dams. The designs were approved by PADEP Division of Dam Safety, constructed while maintaining continuous water supply operations and resulted in over $13M in construction cost savings over the previous consultant's estimates.	2013	Pat Caulfield Schuylkill County Municipal Authority (570) 622-8247	**$13M**	Greg Paxson Gary Horninger Jeremy Young John Harrison Mike Canino Melinda Dirdal Evan Binder
OWL CREEK DAMS Tamaqua, PA	Schnabel was tasked with evaluating upgrading alternatives following an evaluation performed by a previous consultant. The previous concept at Upper Owl Creek Dam included constructing a new 50-ft primary spillway, armoring a 500-ft long section of the embankment with Roller Compact Concrete (RCC) and raising the remainder of the embankment 3-ft. Schnabel designed a labyrinth spillway eliminating the need for armoring. At Lower Owl Creek Dam, Schnabel improved upon the proposed concept with a more efficient drop inlet spillway thereby reducing the armored embankment length and the proposed raise height. These designs were approved by PADEP Division of Dam Safety and resulted in construction cost savings of about $4M over the previous consultant's estimates.	2012	Eli Peleschak, PE Alfred Benesch & Company (570) 622-4055	**$4M**	Greg Paxson Gary Horninger Jeremy Young John Harrison Mike Canino Melinda Dirdal Dave Campbell Evan Binder
GEORGE B. STEVENSON DAM Cameron County, PA	Schnabel was retained to design rehabilitation measures to address geotechnical issues and demonstrated that the previously identified failure mode was not credible, thereby reducing estimated construction costs by $5M, from $15M to $10M. Schnabel then performed hydrologic modeling based on calibrated watershed parameters to demonstrate that the existing spillway has adequate capacity to pass the PMF, saving the owner an additional $5M in anticipated rehabilitation costs. The reduction in the SDF has been approved by PADEP Division of Dam Safety and the proposed design is under review. *These findings significantly reduced Schnabel's scope of work and design fee.*	Ongoing	Edward Raptosh Commonwealth of PA (717) 783-3329	**$10M**	Greg Paxson Kevin Ruswick Jeremy Young John Harrison Brian Crookston Melinda Dirdal Evan Binder Sharon Krock Scott Raschke
GREEN LANE DAM Green Lane, PA	A stability analysis performed by another consultant indicated that the dam did not meet stability criteria. Schnabel was retained to perform subsurface investigations, stability analyses, and design of anchors. Our file review, sub-surface investigations, laboratory analyses, and hydraulic modeling identified opportunities for project savings. The file review uncovered documents and photographs indicating that the dam was "socketed" into rock; laboratory testing showed higher than expected concrete unit weight; and hydraulic analysis indicated higher tailwater conditions. New stability analyses concluded that the dam met stability criteria, enabling the owner to avoid an estimated $2M project. These findings were approved by PADEP and significantly reduced Schnabel scope of work and design fee.	2005	Anthony Fernandes Aqua Pennsylvania (610) 645-1144	**$2M**	Greg Paxson Jeremy Young John Harrison Sharon Krock Dave Campbell

Statement of Specifications

Dam Safety Compliance

See Attached Documents:

1. **City of Saratoga Springs Dam Break Innundation Study, 2005**

The specification herein states the minimum requirements of the City. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The City will consider as "irregular" or "non-responsive" any bid not prepared and submitted in accordance with the bid document and specification, or any bid lacking sufficient technical literature to enable the City to make a reasonable determination of compliance to the specification.

It shall be the bidder's responsibility to carefully examine each item of the specification. Failure to offer a completed bid or failure to respond to each section of the technical specification will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions and/or deviations shall be fully described in the appropriate section.

TOTAL BID PROPOSAL IN FIGURES: $ $56,700

TOTAL BID WRITTEN: Fifty-six thousand seven hundred dollars

COMPANY NAME: Schnabel Engineering of New York

ADDRESS: 28 Corporate Drive, Suite 104

Clifton Park (City) NY (State) 12065 (Zip) Phone No. ( ) 518-348-8575

E-MAIL ADDRESS: gdaviero@schnabel-eng.com

AUTHORIZED SIGNATURE:

PRINTED NAME: Gregory Daviero, PhD, PE

TITLE: Principal DATE: 2/20/2015

Waiver of Immunity Clause

Section §139(a) State Finance Law

Upon the refusal by a representative of your firm, when called before a grand jury to testify concerning any transaction or contract with the City of Saratoga Springs, New York, or to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant question concerning such transactions or contracts,

(a) such person, and any firm, partnership or corporation of which he is a member, partner, director or officer shall be disqualified from thereafter selling to or submitting bids to or receiving awards from or entering into any contracts with any municipal corporation or fire district, or any public department, agency or official thereof, for goods, work or services, for a period of five years after such refusal, and to provide also that

(b) any and all contracts made with any municipal corporation or fire district, or any public department, agency or official thereof, since the effective date of this law, by such person, and by any firm, partnership or corporation of which he is a member, partner, director or officer may be cancelled or terminated by the City without incurring any penalty or damages on account of such cancellation or termination, but any monies owing by the City for goods delivered or work done prior to the cancellation or termination shall be paid.

Non-Collusive Bidding Certification

Section §139(d) State Finance Law

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and, in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of his knowledge and belief:

(1) The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and
(3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition."
A bid shall not be considered for award nor shall any award be made where (1), (2), (3) above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefore.

Signature: _____ Print Name: Gregory Daviero, PhD, PE

Title: Principal Date: 2/20/2015

Company: Schnabel Engineering Address: 28 Corporate Drive, Suite 104, Clifton Park, NY 12065

Subscribed to under penalty of perjury under the laws of the State of New York, this 20th day of February, 2015 as the act and deed of said corporation of partnership.

Vendor/Supplier Code of Conduct

The City of Saratoga Springs is committed to conduct business in a lawful, ethical and moral manner and expects the same standards from vendors/suppliers that the City conducts business with. The City requires that all vendors/suppliers abide by this Code of Conduct. Failure to comply with this Code may be sufficient cause for the City to exercise its' rights to terminate its' business relationship with vendors/suppliers. Vendors/suppliers agree to provide all information requested which is necessary to demonstrate compliance with this Code.

At a minimum, the City requires that all vendors/suppliers meet the following standards:

- Legal: Vendors/suppliers and their subcontractors agree to comply with all applicable local, state and federal laws, regulations and statutes.
- The City expects vendors/suppliers to respect the City's rules and procedures.
- Conflict of Interest: The vendor/supplier represents and warrants that it has no conflict, actual or perceived, that would prevent it from doing business with the City of Saratoga Springs.
- Wages & Benefits: Vendors/suppliers will set working hours, wages, and NYS statutory benefits and overtime pay in compliance with all applicable laws and regulations. Where applicable, as defined by NYS Labor Law, the vendor/supplier must comply with prevailing wage rates.
- Health & Safety: Vendors/suppliers and their subcontractors shall provide workers with a safe and healthy work environment that complies with local, state and federal health and safety laws.
- Discrimination: No person shall be subject to any discrimination in employment, including hiring, salary, benefits, advancement, discipline, termination or retirement on the basis of gender, race, religion, age, disability, sexual orientation, nationality, political opinion, party affiliation or social ethnic origin.
- Working conditions: Vendors/suppliers must treat all workers with respect and dignity and provide them with a safe and healthy environment.
- Right to organize: Employees of the vendor/supplier should have the right to decide whether they want collective bargaining.
- Subcontractors: Vendors/suppliers shall ensure that subcontractors shall operate in a manner consistent with this Code.
- Protection of the Environment: Vendors/suppliers shall comply with all applicable environmental laws and regulations. Vendors/suppliers shall ensure that the resources and material they use are sustainable, are capable of being recycled and are used effectively and a minimum of waste. Where practicable, vendors/suppliers are to utilize technologies that do not adversely affect the environment and when such impact is unavoidable, to ensure that it is minimized.

Vendor Acknowledgement

The undersigned vendor/supplier hereby acknowledges that it has received the City of Saratoga Springs Vendor/Supplier Code of Conduct and agrees that any and all of its facilities and subcontractors doing business with the City will receive the Code and will abide by each and every term therein.

Vendor/supplier acknowledges that its failure to comply with any condition, requirement, policy or procedure may result in the termination of the business relationship. Vendor/supplier reserves the right to terminate its agreement to abide by the Code of Conduct at any time for any reason upon ninety (90) days prior written notice to the City.

Signature: _____ Printed name: Gregory Daviero, PhD, PE

Title: Principal Date: 2/20/2015

Company Name: Schnabel Engineering

City of Saratoga Springs, NY: *Risk and Safety Agreement for Professional Services*

City Project Number: RFP 2015-11 **City Project Name:** Dam Safety Compliance
City Department: Accounts **Department Contact Person:** Stefanie Richards **City Ext.** _____
Company Name: Schnabel Engineering
Company Address: 28 Corporate Drive, Suite 104, Clifton Park, NY 12065
Company Telephone No.: 518-348-8575 **Company Fax No.:** _____
Consultant Primary Contact for This Project: Gregory Daviero, PhD, PE **Title:** Principal

The City of Saratoga Springs herein requires the following terms and conditions regarding the agreement for the provision of professional services as outlined above:
The Consultant shall procure and maintain during the term of this contract, at the Consultant's expense, the insurance policies listed with limits equal to or greater than the enumerated limits. The Consultant shall be solely responsible for any self-insured retention or deductible losses under each of the required policies. Every required policy, including any required endorsements and any umbrella or excess policy, shall be primary insurance. Insurance carried by the City of Saratoga Springs, its officers, or its employees, if any, shall be excess and not contributory insurance to that provided by the Consultant. Every required coverage type shall be "occurrence basis" with the exception of Professional Errors and Omissions Coverage which may be "claims made" coverage. The Consultant may utilize umbrella/excess liability coverage to achieve the limits required hereunder; such coverage must be at least as broad as the primary coverage (follow form). The Office of Risk & Safety Management must approve all insurance certificates. The City of Saratoga Springs reserves its right to request certified copies of any policy or endorsement thereto. All insurance shall be provided by insurance carriers licensed & admitted to do business in the State of New York and must be rated "A-:VII" or better by A.M. Best (Current Rate Guide). If the Consultant fails to procure and maintain the required coverage(s) and minimum limits such failure shall constitute a material breach of contract, whereupon the City of Saratoga Springs may exercise any rights it has in law or equity, including but not limited to the following: (1) immediate termination of the contract; (2) withholding any/all payment(s) due under this contract or any other contract it has with the vendor (common law set-off); OR (3) procuring or renewing any required coverage(s) or any extended reporting period thereto and paying any premiums in connection therewith. All monies so paid by the City of Saratoga Springs shall be repaid upon demand, or at the City's option, may be offset against any monies due to the Consultant. The City of Saratoga Springs requires the Consultant name the City as a Certificate Holder for the following coverage for the work covered by this Agreement:

- **Commercial General Liability** Including Completed Products and Operations and Personal Liability Insurance: One Million Dollars per Occurrence with Two Million Dollars Aggregate including One Million Dollars Pollution Liability Insurance ***(City is also an Additional Insured on a Primary and Non-contributory Basis for this coverage);***
- **Commercial Automobile Insurance:** One Million Dollars Combined Single Limit for Owned, Hired and Non-owned Vehicles
- **Excess Liability Insurance:** Three Million Dollars per Occurrence Aggregate
- **Professional Errors and Omissions Insurance:** One Million per Occurrence with Two Million Aggregate
- **NYS Statutory Workers Compensation, Employer's Liability and Disability Insurance**

If awarded the bid, it shall be an affirmative obligation of the Consultant to advise City's Office of Risk and Safety via mail to Office of Risk and Safety, City of Saratoga Springs, 474 Broadway, Saratoga Springs, NY 12866, within two days of the cancellation or substantive change of any insurance policy set out herein, and failure to do so shall be construed to be a breach of this Agreement. The Consultant acknowledges that failure to obtain such insurance on behalf of the municipality constitutes a material breach of contract and subjects it to liability for damages, indemnification and all other legal remedies available to the City. The Consultant is to provide the City with a Certificate of Insurance naming the City as ***Additional Insured on a primary and non-contributory basis*** **prior** to the commencement of any work or use of City facilities. The failure to object to the contents of the Certificate of Insurance or the absence of same shall not be deemed a waiver of any and all rights held by the municipality. In the event the Consultant utilizes a Subcontractor for any portion of the services outlined within the scope of its activities, the Subcontractor shall provide insurance of the same type or types and to the same extent of coverage as that provided by the Consultant. All insurance required of the Subcontractor shall name the City of Saratoga Springs as an ***Additional Insured on a primary and non-contributory*** basis for all those activities performed within its contracted activities for the contact as executed. **For the purposes of this bid, the Certificate of Insurance shall name the Certificate Holder as follows: City of Saratoga Springs, Attention: Purchasing Agent, 474 Broadway, Saratoga Springs, NY 12866.**

The Consultant, to the fullest extent provided by law, shall indemnify and save harmless the City of Saratoga Springs, its Agents and Employees (hereinafter referred to as "City"), from and against all claims, damages, losses and expense (including, but not limited to, attorneys' fees), arising out of or resulting from the performance of the work or purchase of the services, sustained by any person or persons, provided that any such claim, damage, loss or expense is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of property caused by the tortious act or negligent act or omission of Consultant or its employees or anyone for whom the Consultant is legally liable or Subcontractors. Without limiting the generality of the preceding paragraphs, the following shall be included in the indemnity hereunder: any and all such claims, etc., relating to personal injury, death, damage to property, or any actual or alleged violation of any applicable statute, ordinance, administrative order, executive order, rule or regulation, or decree of any court of competent jurisdiction in connection with, or arising directly or indirectly from, errors and/or negligent acts by the Consultant, as aforesaid.

The City of Saratoga Springs specifically reserves the right to suspend or terminate all work under this contract whenever Consultant and/or Consultant's employees or subcontractors are proceeding in a manner that threatens the life, health or safety of any of Consultant's employees, subcontractor's employees, City employees or member(s) of the general public on City property. This reservation of rights by the City of Saratoga Springs in no way obligates the City of Saratoga Springs to inspect the safety practices of the Consultant. If the City of Saratoga Springs exercises its rights pursuant to this part, the Consultant shall be given three days to cure the defect, unless the City of Saratoga Springs, in its sole and absolute discretion, determines that the service cannot be suspended for three days due to the City of Saratoga Springs' legal obligation to continuously provide Consultant's service to the public or the City of Saratoga Springs' immediate need for completion of the Consultant's work. In such case, Consultant shall immediately cure the defect. If the Consultant fails to cure the identified defect(s), the City of Saratoga Springs shall have the right to immediately terminate this contract. In the event that the City of Saratoga Springs terminates this contract, any payments for work completed by the Consultant shall be reduced by the costs incurred by the City of Saratoga Springs in re-bidding the work and/or by the increase in cost that results from using a different vendor.

Consultant, having agreed to the terms and the recitals set forth herein, and in relying thereon, herein signs this Agreement.

Consultant Signature: _____ **Date:** 2/20/2015

SCHNA-1 OP ID: .i

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 02/18/2015

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Scott Insurance (Rich)
1700 Bayberry Court Ste. 200
Richmond, VA 23226
Nancy Ahrens-Richmond

CONTACT NAME: Joanie Denton, CIC
PHONE (A/C, No, Ext): 804-545-2223 FAX (A/C, No): 434-455-8939
E-MAIL ADDRESS: jdenton@scottins.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Hartford Fire Ins Co (A)	19682
INSURER B : Trumbull Insurance Co. (A)	27120
INSURER C : Sentinel Insurance Co, LTD(A)	
INSURER D : Hartford Casualty Ins Co (A)	29424
INSURER E :	
INSURER F :	

INSURED
Schnabel-Lachel Engineering PC
dba Schnabel Engineering of
New York
28 Corporate Dr. #104
Clifton Park, NY 12065

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR X Contractual X Per project aggre GEN'L AGGREGATE LIMIT APPLIES PER: POLICY PRO-JECT LOC	X		14UUNNA3025 PROFESSIONAL LIABILITY IS EXCLUDED	04/01/2014	07/01/2015	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ 500,000 $ 10,000 $ 1,000,000 $ 2,000,000 $ 2,000,000
C	AUTOMOBILE LIABILITY X ANY AUTO X ALL OWNED AUTOS SCHEDULED AUTOS X HIRED AUTOS X NON-OWNED AUTOS	X		14UUNNA3025	04/01/2014	07/01/2015	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (PER ACCIDENT)	$ 1,000,000 $ $ $
D	X UMBRELLA LIAB X OCCUR EXCESS LIAB CLAIMS-MADE DED X RETENTION $ 10,000	X		14XHUNA1581	04/01/2014	07/01/2015	EACH OCCURRENCE AGGREGATE	$ 10,000,000 $ 10,000,000
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N: N If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		14WECP8076	04/01/2014	07/01/2015	X WC STATU-TORY LIMITS OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 500,000 $ 500,000 $ 500,000
A	Equipment Floater			14UUNNA3025	04/01/2014	07/01/2015	rented eq deductibl	75,000 2,500

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

P5925005 - Dam Safety Compliance RFP #: 2015-11
The City of Saratoga Springs is named as additional insured per the attached provisions.

CERTIFICATE HOLDER

CITOSAR

City of Saratoga Springs
Purchasing Agent
474 Broadway
Saratoga Springs, NY 12866

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE
Becky Herzog

Umbrella Policy applies over General Liability, Auto Liability and Employers Liability.
General Liabilty does not exclude xcu coverages.
Workers Compensation applies in VA, GA, NC, MD, SC, PA, MD, NJ, NV, TX, NY, TN, KY and WV; and all other states except ND, OH, WA and WY.

IF REQUIRED BY WRITTEN CONTRACT, the following provisions apply:

30-day notice of cancellation except for 10 days for nonpayment of premium

Additional Insureds on a primary, noncontributory basis for General Liability, for ongoing & completed operations for work performed by the Named Insured; & for Auto Liability & Umbrella Liability

Waiver of Subrogation in favor of Addditional Insureds for General Liability, Auto Liability, Workers Compensation and Umbrella Liability.

Terra Insurance Company
(A Risk Retention Group)
Two Fifer Avenue, Suite 100
Corte Madera, CA 94925

TERRA INSURANCE COMPANY

CERTIFICATE OF INSURANCE

DATE
02/18/15

NAME AND ADDRESS OF INSURED

Schnabel-Lachel Engineering, P.C.
DBA Schnabel Engineering of New York
28 Corporate Drive, Suite 104
Clifton Park, NY 12065

This certifies that the "claims made" insurance policy (described below by policy number) written on forms in use by the Company has been issued. This certificate is not a policy or a binder of insurance and is issued as a matter of information only, and confers no rights upon the certificate holder. This certificate does not alter, amend or extend the coverage afforded by this policy.

The policy of insurance listed below has been issued to the insured named above for the policy period indicated. Notwithstanding any requirement, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the policy described herein is subject to all the terms, exclusions and conditions of such policy. Aggregate limits shown may have been reduced by paid claims.

TYPE OF INSURANCE Professional Liability

POLICY NUMBER	EFFECTIVE DATE	EXPIRATION DATE
215053	01/01/15	12/31/15

LIMITS OF LIABILITY
$1,000,000 EACH CLAIM
$2,000,000 ANNUAL AGGREGATE

PROJECT DESCRIPTION

P5925005 - City of Saratoga Springs Dam Safety Compliance, RFP #: 2015-11

CANCELLATION: If the described policy is cancelled by the Company before its expiration date, the Company will mail written notice to the certificate holder thirty (30) days in advance, or ten (10) days in advance for non-payment of premium. If the described policy is cancelled by the insured before its expiration date, the Company will mail written notice to the certificate holder within thirty (30) days of the notice to the Company from the insured.

CERTIFICATE HOLDER

City of Saratoga Springs
Attn: Purchasing Agent
474 Broadway
Saratoga Springs, NY 12866

ISSUING COMPANY:
TERRA INSURANCE COMPANY
(A Risk Retention Group)

President