Schnabel ENGINEERING

September 15, 2023

David Griffin, PE
Program Manager
Safe Dams Program
2 Martin Luther King, Jr. Drive SE
Suite 1052 East Tower
Atlanta, Georgia 30334

via email: David.Griffin@dnr.ga.gov

Subject: **Proposal for Engineering Services, Seismic Stability Analysis Review, Lake Petit Dam, Pickens County, Georgia (Schnabel Reference Number 23170093.00P)**

Dear Mr. Griffin:

SCHNABEL ENGINEERING, LLC (Schnabel) is pleased to provide this proposal for engineering services related to the Lake Petit Dam. The engineering services include a review of a seismic stability analysis of the subject dam performed by others. In general accordance with the "Scope of Work, Seismic Analysis Review, Lake Petit Dam, Pickens County, GA", this proposal defines our scope of services and specifies our fees for the associated work.

PROJECT BACKGROUND

Lake Petit Dam is located within the Big Canoe development in Pickens County, Georgia. The Big Canoe Property Owners Association owns and operates the dam. The 126-foot tall earthen embankment dam has a maximum storage capacity of 5,635 acre-feet and is currently classified by the Georgia Safe Dams Program (SDP) as a Category I structure. Category I structures are regulated by the SDP and must comply with the criteria defined by the Rules and Regulations of the State of Georgia, to include the embankment meeting minimum slope stability factors of safety for specific loading conditions.

In April 2023, Geosyntec Consultants submitted a reported entitled "Stability Analysis of Lake Petit Dam" (Geosyntec Report) to the SDP for review. The Geosyntec Report presents data, engineering calculations, methodology, stability models/evaluations, results, and conclusions for various applicable and required slope stability loading conditions for Lake Petit Dam. One such loading conditions analyzed for the report is an earthquake, or seismic ground acceleration. The results presented in the Geosyntec Report indicate that the existing embankment dam complies with the minimum factor of safety for a seismic loading condition.

On September 5, 2023, the SDP provided Schnabel with a Request for Proposal to perform a review of the seismic analysis presented in the Geosyntec Report. The review would be performed in support of the SDP's review of the entire Geosyntec Report.

SCOPE OF SERVICES

In general, our scope of services will include the following tasks:

- Review of provided data, model inputs, methodology, and model outputs relevant to the seismic analysis presented in the Geosyntec Report.
- Evaluation of the results of the seismic analysis presented in the Geosyntec Report.
- Preparation of report presenting Schnabel's opinion of the appropriateness of the seismic analysis as prepared by Geosyntec Consultants. The report will also include comments regarding the seismic analysis for consideration by the SDP.
- Coordination with the Engineer and SDP to discuss the report prepared as part of this engagement.

At this time, Schnabel has been provided with a copy of the Geosyntec Report. The SDP has not provided Schnabel with any other information or documents related to this project as of the date of this proposal. Our detailed review of the seismic analysis by Geosyntec Consultants for Lake Petit Dam will be related to data, engineering calculations, methodology, stability models/evaluations, results and conclusions relevant to the seismic analysis presented in the Geosyntec Report. Schnabel understands that there exists other reports and documents regarding the design and analysis of the subject dam. We assume that these other reports and documents will be provided to Schnabel by the SDP for cursory review. The purpose of the cursory review is to determine whether the data contained therein is pertinent to the review and evaluation of the seismic stability analyses presented in the GeoSyntec Report.

The 'Engineer's prerogative' is a deeply held principle for Schnabel Engineering. The Engineer (Geosyntec Consultants) is closest to the project and most deeply understands the site, so considerable discretion is warranted. In our review, we remember that each of us in the dam engineering profession tends to develop approaches and evaluation philosophies based on our own experiences and the teachings of our mentors. We are far more comfortable with methodologies that we have personally used in the past and are satisfied will work. Each engineer has learned and/or adopted many techniques that may differ from others regarding evaluation of data, modeling methods, and interpretations of results. We also recognize that Geosyntec Consultants has had a much greater involvement with the project, its materials and setting, its opportunities and constraints, and its unique demands. Differences in how we approach an evaluation will be a consideration only where we identify alternative treatments or approaches that enhance safety and performance.

Depth of experience on similar projects and a trained eye can be very effective in identifying oversights, inconsistencies and errors. However, given that Schnabel is expected to adopt a moderate budget and a limited time frame to review a complex evaluation for a major project, independent external review does not replace the long-term, in-depth judgements and characterizations provided by the Engineer. Therefore, we will direct our focus on issues likely to reflect upon the safety and effective performance of the dam, as well as compliance with the Rules and Regulations of the SDP.

Schnabel will present its comments in a letter report. Comments will be appended with figures, as needed, to clarify discussion of any points of consideration, and to identify safety, performance, and compliance concerns. Comments will, in general, be presented to coordinate with the review of the overall Geosyntec Report to be completed by the SDP. The scope of services described herein will be led by a Professional Engineer registered in the state of Georgia who is recognized as an Engineer of Record by the SDP. A seismic engineering specialist with extensive experience in earthquake engineering and seismic stability analyses will support the lead engineer. In addition, an engineer licensed in Georgia with extensive geotechnical engineering experience in Georgia will also support the review. Resumes for the engineers proposed to be involved with this project are attached.

Following the issuance of a report, Schnabel will participate in one meeting with Geosyntec and the SDP to discuss Schnabel's report. We assume that the meeting will be held at the SDP office in Atlanta, Georgia.

EXCLUSIONS

Items excluded from our scope of services include the following:

- Site reconnaissance and field inspections
- Surveying (Assuming that existing survey performed under separate Schnabel contract will satisfy project requirements).
- Seepage modeling of the dam embankment.
- Slope stability modeling of the dam embankment.
- Subsurface exploration.
- Laboratory testing.
- Engineering design.
- Any work items not specifically described within Scope of Services.

Schnabel assumes that the Geosyntec Report is sufficient for performing an adequate review of the seismic analysis presented in the report. However, as previously mentioned, we understand that there exists other reports and documents regarding the design and analysis of the subject dam. If Schnabel, the Georgia Safe Dams Program, GeoSyntec, or others are of the opinion that a detailed review of additional supporting documentation is deemed critical to the evaluation of the seismic stability of the subject dam, Schnabel reserves the right review the budget presented herein. A detailed review of these other reports and documents is not included in the current scope of services and would be performed for an additional fee, if authorized.

COMPENSATION

We will perform our work based on the outlined scope of services for a lump sum fee of $18,000. We note that the presented budget does not include meetings, telephone conference calls, and or other consultation services, except for the one meeting described above. If requested and/or required, Schnabel can participate in meetings, phone calls, and other consultations not specifically described above. These additional services that are requested outside of the scope presented herein will be billed on a unit rate basis in accordance with the attached Schedule of Fees.

Our invoices will be submitted monthly or at intervals when considerable time charges have accrued, with a final invoice submitted after completion of our services. Payment will be due upon receipt of our invoices and will be considered past due 30 days from the date of the invoice. Interest at 1.5 percent per month will be charged on all overdue amounts. On January 1, 2024, and annually thereafter, the rates on the Schedule of Fees and all remaining project budgets will increase by the amount indicated on the Schedule of Fees, with the remaining terms unchanged.

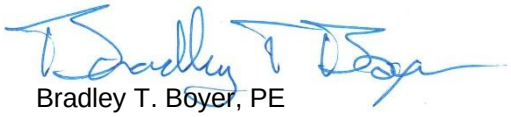
AUTHORIZATION

To formalize our agreement, we request that you sign and return one copy of this agreement and attachments for our files.

We appreciate the opportunity to work with you on this project.

Sincerely,

SCHNABEL ENGINEERING, LLC



Bradley T. Boyer, PE
Senior Associate

BTB:JD:GE

Attachments: Schedule of Fees 17-23.02 Dams
Standard Contract Terms and Conditions
Resume – Joseph S. Monroe
Resume – James Dismuke
Resume – Graham Elliott

The terms and conditions of this proposal, including the attached Standard Contract Terms and Conditions are:

ACCEPTED BY: _____

SIGNATURE: _____

PRINTED NAME: _____

DATE: _____

SCHEDULE OF PERSONNEL FEES – SCHNABEL ALPHARETTA
Effective until December 31, 2023

Senior Consultant	$307.00/hr
Principal	$303.00/hr
Senior Associate	$275.00/hr
Associate	$244.00/hr
Senior Engineer/Technologist/Scientist	$205.00/hr
Project Engineer/Technologist/Scientist	$177.00/hr
Construction Resident Engineer/Resident Project Representative	$177.00/hr
Senior Staff Engineer/Technologist/Scientist	$157.00/hr
Staff Engineer/Technologist/Scientist	$136.00/hr
Senior Technician II/Construction Resident Technician	$129.00/hr
Senior Technician I	$109.00/hr
Technician III	$ 95.00/hr
Technician II	$ 79.00/hr
Technician I	$ 70.00/hr
CAD Tech III	$145.00/hr
CAD Tech II	$131.00/hr
CAD Tech I	$110.00/hr
Administrative	$ 84.00/hr

NOTES:

1. Engineering fees will be based upon the actual hours charged for personnel multiplied by the appropriate hourly rate.
2. Travel by auto to and from jobs will be charged at the current IRS prevailing rate. All travel expenses, including mileage, will be marked up 15% to cover the cost of handling, insurance, and overhead.
3. Special pickup and delivery expenses will be billed at cost plus 15%, or our prevailing hourly and mileage rates for our own personnel.
4. Overtime for Technicians is time for work on Saturday, Sunday, and Federal holidays, time in excess of 8 hours per day and time between the hours of 7:00 P.M. and 7:00 A.M. A surcharge of $15/hr. is added to the above rate for overtime.
5. Subcontracts for subsurface exploration, bulldozers, surveys, etc. are marked up 15% to cover the cost of handling, insurance and overhead.
6. Preparation time for deposition and trial testimony, as well as actual time for deposition and trial testimony will be charged at the hourly rate multiplied by 1.5.
7. Per Diem Rates for out-of-town or overnight travel will be in accordance with U.S. General Services Administration rates published on website www.GSA.gov for the area in which the project is located, unless otherwise stated in the proposal.
8. Schedule of Fees will increase on January 1, 2024 and not less frequently than annually thereafter based on the Consumer Price Index as provided by the U.S. Department of Labor, Bureau of Labor Statistics – All Urban Consumers – U.S. City Average.

SCHNABEL ENGINEERING, LLC
STANDARD CONTRACT TERMS AND CONDITIONS

1. DEFINITIONS
   - 1.1 Schnabel Engineering, LLC, the "Engineer," agrees to provide Professional Services, as delineated in the attached Proposal. "Engineer" means Engineer and its employees, and subcontractors.
   - 1.2 The "Client" is the other party to this "Agreement."
   - 1.3 The "Contractor" is the responsible party providing construction for the subject Project.
2. ENTIRE AGREEMENT, SCOPE OF WORK
   - 2.1 The Agreement between Engineer and Client consists of the Proposal, these Standard Contract Terms and Conditions, and any other exhibits or attachments referenced in the Proposal. Together these elements will constitute the entire Agreement, superseding all prior written or oral negotiations, statements, representations, correspondence, and/or agreements. The Services to be provided by Engineer pursuant to this Agreement are described in the attached Proposal and include the Scope of Work. Both Client and Engineer must mutually acknowledge any changes to this Agreement in writing. All work performed by Engineer on or relating to the Project is subject to the terms and limitations of this Agreement.
   - 2.2 If work is performed, but the parties do not reach agreement concerning modifications to the Scope of Work or compensation, then the terms and conditions of this Agreement apply to such work. Disputes concerning modifications to Scope of Work or compensation shall be resolved pursuant to Article 12, "Dispute Resolution."
3. STANDARD OF CARE, DISCLAIMER OF WARRANTIES
   - 3.1 Engineer will strive to perform Services under this Agreement in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation and no warranty or guarantee, either express or implied, is included or intended by this Agreement.
4. SITE ACCESS, SITE CONDITIONS, SAMPLES
   - 4.1 Client will provide rights of entry and access for Engineer to perform its Services.
   - 4.2 Engineer will take reasonable precautions to avoid damage or injury to subterranean structures or utilities in the prosecution of his work. Client agrees to advise Engineer of known or suspected underground features in the area of the work, and Engineer will not be responsible for damage to below grade features not brought to its attention, or incorrectly shown on plans provided.
   - 4.3 Client shall promptly pay and be responsible for the removal and lawful disposal of contaminated samples and cuttings, and hazardous substances, unless other arrangements are mutually agreed in writing.
5. OWNERSHIP OF DOCUMENTS, RESTRICTIONS ON REUSE
   - 5.1 All documents, including opinions, conclusions, certificates, reports, drawings and specifications and other documents, prepared or furnished by Engineer and Engineer's independent professional consultants pursuant to this Agreement (collectively "Documents") are instruments of Service. Engineer retains all ownership and property interests in the Documents, including all common law, statutory and other reserved rights, including copyrights, whether or not the Project is completed. Client may make and retain copies of them for information and reference in connection with the use and occupancy of the Project; however, such copies are not intended or represented to be suitable for reuse by others, and may not be used on other projects or for additions to this Project outside the Scope of the Work.
   - 5.2 At Client's request, client may negotiate with Engineer to acquire ownership of Documents for a mutually agreed amount. If Client acquires ownership of Documents prepared by Engineer, Client agrees: a) that any subsequent reuse or modification of them by Client or any party obtaining them through Client will be at Client's sole risk and without liability to Engineer, and b) client will defend, indemnify and hold harmless Engineer from and against any claims, damages, and liabilities arising from or related to any use, reuse or modification of Documents by Client or any party obtaining them through Client. Client agrees that Engineer may retain copies of all documents for its files.
   - 5.3 Electronic communications and CADD data transferred by Email, websites or computer disks (collectively "E-Data") are provided only as an accommodation by Engineer for the benefit of Client. Signed paper prints of documents constitute the contract deliverables. Client assumes the risk that E-Data may differ from the paper deliverables. Client agrees to indemnify and hold harmless Engineer from and against claims, damages, and liabilities for defects or inappropriate use of E-Data created or transmitted by Engineer.
6. THIRD PARTY RELIANCE UPON DOCUMENTS
   - 6.1 Engineer's performance of the Services, as set forth in this Agreement, is intended solely and exclusively for the Client's benefit and use. No party may claim under this Agreement as a third party beneficiary. Client agrees not to distribute, publish or otherwise disseminate Engineer's Documents, without first obtaining Engineer's prior written consent.
   - 6.2 No third party may rely upon Engineer's Documents including, but not limited to, opinions, conclusions, certificates, reports, drawings and specifications unless Engineer has agreed to such reliance in advance and in writing.

7. ASSIGNMENT, SUBCONTRACTING
   - 7.1 Neither Client nor Engineer may delegate, assign, sublet, or transfer all or any part of this Agreement, including its duties or interest in this Agreement without the written consent of the other party.
   - 7.2 Notwithstanding Section 7.1, Engineer may subcontract subsurface exploration, testing, and other supplemental services and assign accounts receivable as security for financial obligations without notification or consent of Client.
8. TERMINATION, SUSPENSION
   - 8.1 Either party upon 7 days' written notice may terminate this Agreement for convenience or material breach of Agreement. In the event of termination for convenience or material breach of Agreement, Engineer shall be paid for Services performed to the termination date, plus reasonable termination expenses.
9. ALLOCATION OF RISK
   - 9.1 Engineer's total cumulative liability to Client (including, but not limited to, attorneys' fees and costs awarded under this Agreement) irrespective of the form of action in which such liability is asserted by Client or others, shall not exceed the total compensation received by Engineer under this Agreement or $25,000, whichever is less. Upon Client's written request, Engineer may negotiate an increase to this limitation in exchange for an additional agreed consideration for the increased limit.
   - 9.2 Client and Engineer agree to limit each's liability to the other in the following respects: Neither party will have liability to the other for any special, consequential, incidental, exemplary, or penal losses or damages including but not limited to losses, damages or claims related to the unavailability of the other party's property or facility, shutdowns or service interruptions, loss of use, lost profits or revenue, inventory or use, charges or cost of capital or claims of the other party's customer.
   - 9.3 The limitations of liability of this Agreement shall survive the expiration or termination of this Agreement.
10. INDEMNIFICATION
   - 10.1 Indemnification of Client. Subject to the provisions and limitations of this Agreement, Engineer agrees to indemnify and hold harmless Client, its shareholders, officers, directors, employees, and agents from and against any and all claims, suits, liabilities, damages, expenses (including without limitation reasonable attorney's fees and costs of defense) or other losses (collectively "Losses") to the extent caused by Engineer's negligent performance of its Services under this Agreement.
   - 10.2 Indemnification of Engineer. Subject to the provisions and limitations of this Agreement, Client agrees to indemnify and hold harmless Engineer from and against any and all Losses to the extent caused by the negligence of Client, its employees, agents and contractors. In addition, except to the extent caused by Engineer's sole negligence, Client expressly agrees to defend, indemnify and hold harmless Engineer Entities from and against any and all Losses arising from or related to the existence, disposal, release, discharge, treatment or transportation of Hazardous Materials, or the exposure of any person to Hazardous Materials, or the degradation of the environment due to the presence, discharge, disposal, release of or exposure to Hazardous Material.
11. INVOICES, PAYMENTS
   - 11.1 Payment is due without retainage upon presentation of invoice and is past due thirty (30) days from invoice date, and will not be contingent upon receipt of funds from third parties. Client agrees to pay a service charge of one and one-half percent (1-1/2%) per month or fraction thereof on past due payments under this Agreement.
   - 11.2 It is further agreed that in the event a lien or suit is filed to enforce overdue payments under this Agreement, Engineer will be reimbursed by Client for all costs of such lien or suit and reasonable Attorney's fees in addition to accrued service charges, where the court of appropriate jurisdiction enters a finding in favor of Engineer.
12. DISPUTE RESOLUTION
   - 12.1 Claims, disputes, and other matters in controversy between Engineer and Client caused by or any way related to this Agreement will be submitted to non-binding mediation as a condition precedent to litigation. The cost for mediation including the mediator's fees, reproduction of documents, and miscellaneous out-of-pocket expenses will be borne equally by each party to this Agreement.
   - 12.2 The law of the Commonwealth of Virginia will govern the validity of these terms, their interpretation and performance. Client and Engineer agree that venue for any litigation will be in the courts of the Commonwealth of Virginia and Engineer and Client both hereby waive any right to initiate any action in, or remove any action to, any other jurisdiction.
13. SEVERABILITY
   - 13.1 This Agreement reflects the entire agreement of the parties with respect to its terms and supersedes all prior agreements, whether written or oral. If any portion of this Agreement is void or voidable, such portion will be deemed stricken and the Agreement reformed to as closely approximate the stricken portions as the law allows.

Joseph (Joe) S. Monroe, PE

PRINCIPAL ENGINEER

Expertise
Dam Design (Geotechnical Analyses, Hydrologic and Hydraulic Analyses, Structural Analyses, and Construction Document Preparation), Management of Construction Phase Engineering Services

Education
Master of Science, Civil Engineering, Clemson University

Bachelor of Science, Civil Engineering, University of North Carolina, Charlotte

Registrations
Professional Engineer / AL, GA, ME, NC, SC, TX, VA

Certifications
Georgia Safe Dams Engineer of Record: Civil Engineering,
Georgia Safe Dams Engineer of Record: Geotechnical Engineering

Affiliations
ACEC, GBA
ASDSO: Co-Chair of the Dam Design and Construction Committee

Years with Schnabel/Total
26/29

Joseph Monroe, a Georgia Safe Dams Program 'Engineer-of-Record' in both geotechnical engineering and civil engineering, has more than twenty-five years of geotechnical engineering evaluation and design experience specifically related to dams. During this period, Joe has evaluated, designed, or consulted on more than 100 geotechnical related dam projects through-out the United States and more than 50 geotechnical related dam related dam projects in the Southeast with the preponderance of the Southeastern projects being in the State of Georgia. In addition to geotechnical related dam engineering projects in the United States, Joe has also been involved with solving geotechnical related problems for dams and reservoirs located overseas. The breadth and depth of the geotechnical engineering studies varied depending on the project but ranged from global/embankment stability, to include seismic stability analyses, seepage through/under dams, and settlement of dam and/or associated spillways. For the majority of the projects, the geotechnical engineering work was associated with remediating existing structures that were deemed to be out of compliance with current accepted engineering practices and involved addressing uncontrolled seepage, slope stability concerns, and/or spillway modifications.

Inland Lake Dam / Birmingham, AL

Technical Reviewer. Responsible for comprehensive geotechnical investigations, site characterization, and analysis for a 1,000-foot-long, 195-foot-tall, zoned earth and rockfill embankment with a long history of sinkhole formation and recent increases in seepage. Temporary risk reduction measures were developed and instituted. Rotosonic borings, piezometers, bulk test pits, and extensive field and laboratory testing revealed fill likely subject to episodic suffusion events. Technical member of PFMA workshop panel for the evaluation of potential failure modes for a 195-foot-high zoned earth and rock fill dam. The dam has a history of seepage issues including sinkhole, incompatible filters, and other issues. During the PFMA workshop, participants worked with a Board of Consultants to identify and define potential failure modes, evaluate risk reduction opportunities, and identify changes in dam safety and surveillance monitoring to enhance safety/reduce risk.

Langley Pond Dam / Aiken, SC

Technical Leader, Senior Reviewer, and Client Manager. Responsible for the design of remedial measures for a century old dam and spillway system that did not meet accepted engineering guidelines for dam safety. Schnabel's involvement with the project began as an emergency response to the presence of a well-defined boil at the downstream toe. Schnabel aided Aiken County with the development of emergency measures to lower the reservoir and proceeded with the development of plans to bring the dam in general compliance with accepted engineering guidelines. Remedial measures include the construction a new labyrinth crested chute spillway, construction of a cement-bentonite seepage control wall, construction of internal seepage control/collection measures, flattening of the embankment slopes to address stability, to include seismic stability, related concerns, and removal of the existing ogee crested concrete spillway that was constructed on wooden piles.

Schnabel ENGINEERING

Joseph (Joe) S. Monroe, PE

PRINCIPAL ENGINEER

Tennessee Valley Authority Independent Review of Licensing Concepts / Knoxville, TN

Project and Client Manager for a series of project for TVA in which Schnabel provided guidance regarding licensing basis concepts for the proposed Watts Bar Unit 2 Nuclear Plant. Responsible for coordinating the technical review of dam stability calculations, including loads imposed by seismic loads, and hydrology/hydraulic calculations to be used for computing the peak flood elevation at the proposed nuclear facility. Schnabel's key role is to identify technical dam related issues that could impede or delay the permitting of the proposed facility.

Puerto Rico Aqueduct and Sewer Authority (PRASA) Dam Inspections / Multiple Locations, Puerto Rico

Project Manager and Lead Engineer. Responsible for the visual inspection of eight dams in Puerto Rico (three concrete gravity dams, one rockfill dam, and four earth embankment dams). The dams ranged in height from 45 feet to in excess of 200 feet. The dams were evaluated for obvious deficiencies, such as slope instability, seepage, and spillway deterioration, and to determine whether previous recommendations for maintenance and repair had been implemented.

Lake Inverness Dam / Gwinnett County, GA

Technical Reviewer. Reviewed laboratory materials testing and geotechnical engineering studies performed in relation to the rehabilitation of the existing Category I or high hazard dam. Coordinated and reviewed seepage and slope stability analyses, as well as settlement evaluations for the proposed modifications which included the construction of new principal spillway riser tower, 60-inch diameter reinforced concrete conduit, and an articulated block overtopping protection auxiliary spillway. Performed technical review of the geotechnical engineering report, which contained the results of the analyses and recommendations for the design and construction.

Shoal Creek Dam / Morrow, GA

Project Manager and Technical Leader. Responsible for the subsurface exploration, laboratory testing, and engineering analyses performed to evaluate the cause of the evaluated pore pressures beneath the 50-foot-high earthen embankment dam. The high hazard dam, which was designed and constructed in the late 1980s, is founded on relatively deep alluvium. Schnabel determined that the elevated pore water pressures were being caused by seepage occurring in a clean sand layer at the base of the alluvial layer in the dam foundation. Based upon slope stability analyses, the referenced seepage is not currently impacting the stability of the embankment. However, in an effort to address the seepage and limit the potential for piping of foundation soils, Schnabel designed a soil-cement-bentonite cutoff through the embankment and alluvial foundation materials. The constructed soil-cement-bentonite cutoff wall has reduced the rate of seepage and the measured uplift pressure beneath the dam.

Walton County Water Supply Study (Hard Labor Creek Reservoir Dam) / Walton County, GA

Technical Leader. Responsible for the geotechnical design of the 102-foot-tall new earthen embankment dam. Geotechnical design consisted of settlement, seepage, and slope stability analyses, as well evaluation of laboratory and field data. Recommendations for internal drainage system, seepage control, and slope stability were made based upon the results of the analyses. During construction of the dam, which was completed in 2015, he provided technical guidance regarding the geotechnical aspects of the project.

Joseph (Joe) S. Monroe, PE

PRINCIPAL ENGINEER

Blue Creek Dam / White County, GA

Project and Technical Manager. Responsible for the hydrologic, hydraulic, embankment, and structural design for a high hazard, privately owned dam. The spillway system for the dam is comprised of a 52-foot-tall reinforced concrete riser designed for the one in 2,500-year earthquake, a 30-inch reinforced concrete pipe through the base of the dam, and a 150-foot-wide earth cut auxiliary spillway in the left abutment. The auxiliary spillway was modeled using the SITES program to estimate the extent of spillway erosion during the ½ PMP design storm event.

Cedar Creek Dam / Hall County, GA

Senior Reviewer. Reviewed geotechnical engineering calculations performed in conjunction with the design of the 97-foot earthen water supply dam for Hall County completed in 2003, at a cost of $10.4 million. Critical to the design of the dam was the use three-stage analyses in the evaluation of the stability of the upstream slope during rapid draw down conditions.

Deep Creek Dam Watershed Dam 5D Site Investigation and Design / Yadkin County, NC

Senior Reviewer. Reviewed geotechnical engineering analyses/calculations for the design and construction of the 80-foot-tall earthfill and RCC dam. A composite dam was selected based upon the geologic conditions encountered the initial phase of the subsurface exploration. The dam serves as a municipal water supply and flood protection facility.

Upper Dam Development / Oxford County, ME

Technical Reviewer and Client Manager. Responsible for the design of remedial measures for the remediation of an existing earthen embankment dam and gated spillway system. The remedial measures, which were reviewed approved by FERC, included the removal of the existing gated spillway system, construction of an auxiliary spillway that contained one radial gate, construction of a service spillway that contained one radial gate, two split leaf gates, and numerous cycles of labyrinth weir, and improvements to the embankments. In addition to the remediation of the permanent project features, Schnabel was also responsible for the design of surface water and groundwater control measures which included sheetpile, cellular, and H-pile and lagging cofferdams that were required to remain in service for several years and maintain the reservoir at or near the historic normal operating levels.

Tobesofkee Creek Dam / Monroe County, GA

Technical Manager. Responsible for the geotechnical engineering design of the RCC gravity dam and foundation. The dam impounds the raw water supply for the City of Forsyth and was completed in October of 1999, at a contract bid price of $1.3 million.

Lake Ogletree Dam /Auburn, AL

Technical Reviewer. Reviewed geotechnical engineering analyses during the design and geotechnical related construction issues during the remediation of the Lake Ogletree Dam that were being implemented to meet or exceed generally accepted guidelines for dam safety. Remedial measures to the dam included the construction of a new labyrinth crested chute spillway, demolition/abandonment of the existing broad crested spillway, and lining of the existing low-level conduit to improve structural integrity and water tightness.

Joseph (Joe) S. Monroe, PE

PRINCIPAL ENGINEER

Mountain Run Dam and Lake Pelham Dam / Culpeper, VA

Technical Reviewer. Reviewed geotechnical engineering analyses during the design of remedial measures to bring the dams into compliance with generally accepted guidelines for dam safety. Remedial measures to the dams included the construction of a new labyrinth crested chute spillways and modifications to the embankment to improve stability.

New Ragged Mountain Dam / Charlottesville, VA

Senior Technical Consultant and Geotechnical Engineer. Responsible during the design of the proposed earthen replacement dam for the Lower Ragged Mountain Dam. Through continuous dialogue with the design team, he provided input on key components of the design for the new dam and outlet works/tunnel through rock in the abutment. Provided consultation on key geotechnical issues, to include modifications to the tunnel portal to accommodate field condition during the construction phase.

Hemphill Reservoirs Number 1 and 2 / Atlanta, GA

Senior Reviewer and Client Manager. Schnabel was retained to evaluate ongoing historic seepage issues with the water supply reservoirs constructed circa 1900. Critical to the supply of water to the residents of Atlanta, the Hemphill dams have undergone numerous remedial measures in an effort to address the seepage issues. Based upon a comprehensive review of both the original design and the remedial measures design by another engineering firms, Schnabel concluded that the dams were constructed of poorly to marginally compacted soils and contained ineffective drainage systems containing filter fabric. The potential remedial measures included the installation of a seepage control barrier for the entire length of the reservoir and/or the removal and reconstruction of the entire embankment system. Prior to proceeding with detailed design of one of the potential remedial measures, Schnabel recommended that additional detailed explorations of the structure, including the installation of numerous piezometers, be implemented.

James Dismuke, PE, GE, CPEng

SEISMIC PRACTICE LEADER

Expertise
Geotechnical Engineering, Foundation Design, Ground Improvement Design, Seismic Hazard Analysis, Earthquake Ground Motion Selection, Seismic Ground Response Analysis, Geotechnical Earthquake Engineering

Education
Master of Science, Geotechnical Engineering, University of California at Davis

Bachelor of Science, Civil Engineering, University of California at Berkeley

Registrations
Professional Engineer / AR, CA, OR, TX, WA

Geotechnical Engineer / CA

Certified Professional Engineer / NZ

Affiliations
ASCE
Earthquake Engineering Research Institute

Years with Schnabel/Total
1/24

James Dismuke is a Geotechnical engineer with 24 years of experience. He has delivered seismic engineering advice for a variety of global infrastructure and development projects, including analysis, design, and construction of foundations, earth structures, and ground improvement. He is a specialist in earthquake engineering evaluations including seismic stability analyses, probabilistic seismic hazard analyses, ground motion development, seismic ground response analyses, liquefaction, and seismic hazard mitigation.

PRIOR EXPERIENCE

Bear Creek Dam Seismic Response Analysis / Lee County, AR (2023-Ongoing)

Engineer responsible for overseeing dynamic finite element seismic stability analysis of the existing embankment and spillway. The nonlinear deformation analysis was performed to assess the potential permanent seismic deformation of the dam and spillway at the 5,000-year return period hazard level, and to assess the potential for liquefaction or cyclic failure.

Tailings Storage Facility Seismic Stability Assessment, Thompson Creek Mine / Custer County, ID (2020-2021)

Task manager for probabilistic seismic hazard analysis and earthquake ground motion development for seismic stability analyses of the tailings dam. Work included performing site-specific probabilistic seismic hazard analyses (PSHA) to assess ground motion intensity up to a 10,000-year return period, using the 2018 USGS National Seismic Hazard Model with local refinements to the seismic source model.

Manila Solar City Reclamation Project Seismic Stability Assessment / Manila, Philippines (2023)

Engineer responsible for seismic stability analyses of the Manila Solar City Reclamation Project, comprising three artificial islands stretching up to 2 km seawards of Metro Manila. The work included an assessment of the liquefaction potential of the fill and native soils, assistance in the development of fill compaction criteria to meet the requirements, and assessment of the static, seismic, and post-earthquake performance of the edge structures using simplified slope displacement analyses and nonlinear dynamic finite element analyses.

Manila International Airport Seismic Stability Assessment / Bulacan, Philippines (2021-Ongoing)

Engineer responsible for seismic stability analyses for land reclamation and slope stabilization to support this design-build project. The work included an assessment of the liquefaction potential of the fill and native soils, assistance in the development of fill compaction criteria to meet the requirements, and assessment of the static, seismic, and post-earthquake performance of the edge structures using simplified slope displacement analyses and nonlinear dynamic finite element analyses.

Schnabel ENGINEERING

James Dismuke, PE, GE, CPEng

SEISMIC PRACTICE LEADER

Pasay Harbor City Seismic Stability Assessment / Manila, Philippines (2021-Ongoing)
Engineer responsible for seismic stability analyses for land reclamation and slope stabilization to support this design-build project. The work included an assessment of the liquefaction potential of the fill and native soils, assistance in the development of fill compaction criteria to meet the requirements, and assessment of the static, seismic, and post-earthquake performance of the edge structures using simplified slope displacement analyses and nonlinear dynamic finite element analyses.

Pasay Reclamation Development Project Seismic Stability Assessment / Manila, Philippines (2019-2020)
Engineer responsible for seismic stability analyses for land reclamation and slope stabilization to support this design-build project. The work included an assessment of the liquefaction potential of the fill and native soils, assistance in the development of fill compaction criteria to meet the requirements, and assessment of the static, seismic, and post-earthquake performance of the edge structures using simplified slope displacement analyses and nonlinear dynamic finite element analyses.

Noxon Rapids Dam Comprehensive Assessment / Noxon, MT (2023)
Seismic subject matter expert responsible for providing technical review and summary of available seismic hazard analyses and information for the pre-inspection preparation report. Presented summary of seismic conditions in PFMA workshop. Project is ongoing.

Brownlee Dam Comprehensive Assessment / Cambridge, ID (2023)
Seismic subject matter expert responsible for providing technical review and summary of available seismic hazard analyses and information for the pre-inspection preparation report. Project is ongoing.

Consultant Review Board, Hyrum Dam / Hyrum, UT (2022-2023)
Provided project peer review for assessment of rammed aggregate pier ground improvement for support of a proposed new spillway. The project review included probabilistic seismic hazard analysis, ground motion selection and spectral matching, rammed aggregate pier design, and seismic analyses of the spillway and dam.

Moose Creek Dam Seismic Stability Assessment (USACE Alaska District) / Fairbanks, AK (2020)
Task manager for probabilistic seismic hazard analysis and earthquake ground motion development for seismic stability analyses of the flood control structure. Site-specific probabilistic seismic hazard analyses (PSHA) were performed to assess ground motion intensity up to a 10,000-year return period. The PSHA used the 2014 USGS National Seismic Hazard Model and incorporated local refinements to the seismic source model.

Alcona Dam Seismic Stability Assessment / Alcona County, MI (2018)
Provided project peer review for seismic stability analyses of a hydroelectric dam. The project review included probabilistic seismic hazard analysis, ground motion selection and spectral matching, 2D dynamic dam response analysis, and liquefaction evaluation.

Graham Elliott, PhD, PE, CEng MICE

PRINCIPAL

Expertise
Geotechnical Engineering

Education
PhD, Postgraduate Research Institute for Sedimentology, University of Reading

Master of Science, Soil Mechanics and Environmental Geotechnics, Imperial College of Science, Technology & Medicine, University of London

Bachelor of Science (Hons), Geography, University College of Swansea

Registrations
Professional Engineer / DE, GA, NC, SC, VA, WA
Chartered Civil Engineer CEng MICE

Affiliations
MASCE, MICE, DFI

Georgia ACEC / GDOT GPTQ Bridge Sub-Committee (2023 – current)

Treasurer, ASCE Geo-Institute Georgia Chapter (2022 – current)

Member, Editorial Advisory Panel for Proceedings of the ICE: Geotechnical Engineering (2009 – 2012)

Years with Schnabel/Total
6/24

Graham Elliott has 24 years in geotechnical engineering practice. He has served as lead geotechnical engineer on major infrastructure projects, including design of foundations, slopes, dams, excavations, retaining walls, and temporary works. He has led subsurface exploration programs on land and over water in various geological conditions, including the Piedmont, Valley and Ridge, and Coastal Plain provinces of the southeastern US.

Graham was the geotechnical engineer of record on the recent award-winning GDOT College Street bridge replacement in Macon, GA that included innovative anchored bridge abutments, and he was the geotechnical discipline lead on the first Accelerated Bridge Construction (ABC) project in Georgia for the SR299 bridge replacement over I-24. Graham currently serves on the ACEC Georgia / GDOT GPTQ Bridge sub-committee.

SELECT GEOTECHNICS EXPEREINCE

USACE Weston Dam Improvements, Fort Jackson, Columbia, SC: Design of Dewatering
Engineer of Record for Temporary Dewatering Design. Dewatering was required for a deep open cut excavation through a toe berm of an existing embankment dam in sandy soils. This cut was needed for installation a new seepage control system. Design tasks included subsurface exploration, seepage modelling, plans and specifications for a well point system, and geotechnical special inspections.

NRCS SE USFS Bear Creek Lake Dam / AR
Technical oversight of the geotechnical evaluation of an existing dam in the Ozark-St. Francis National Forest. Tasks included technical oversight of subsurface exploration program including drilling, in-situ testing (CPT) and laboratory testing in a complex ground profile comprising loess, and soft clayey soils. Evaluation of liquefaction potential, and slope stability issues arising from high seismic demands from the New Madrid earthquake zone. Mentorship of JV partner protégé with regard to geotechnical evaluation for new spillway outlet works.

I-5/SR 16 Interchange: Construct HOV Connections Project (WSDOT PIN 300566A, WSDOT Olympic Region) / Tacoma, WA
Geotechnical Group Manager (GGM) to design and construct four new bridges with drilled shafts and spread foundations, numerous retaining walls, cut and fill slopes, luminaires and signage along new HOV roadway alignments. The project elements included seismic design considerations.

The I-16/I-95 Interchange Reconstruction and I-16 Widening from I-95 to I-516 MMIP Projects - Pre-Bid Phase (GDOT PI # 0012757 and 0012758) **/ Chatham County, GA**
Geotechnical Discipline Lead for the Pre-Bid Phase of this Major Mobility Improvement Project (MMIP) being let under a design-build procurement by the GDOT. Led the pre-bid geotechnical design effort within one of the design-build teams. Evaluated embankment settlements on soft foundation soils, including staged construction on ground improvements. Planned and directed subsurface explorations and laboratory testing program to evaluate subgrade soils and borrow pit soils. Evaluated seismic site class.

Schnabel ENGINEERING

I-26 Volvo Interchange, Ridgeville, SC

Geotechnical Engineer during construction of three new bridges over I-26 with associated approach embankments, that included considerations for high seismic demand. This project was a “state finalist” in the ACEC SC Engineering Excellence Awards, it won the ASCE South Carolina Section “Project of the Year” Award, and also won a DBIA award.

Indian Creek Reservoir Dam Final Design / Carroll County, GA

Principal, Lead Geotechnical Engineer. Responsible for the leadership, senior review, and technical oversight of the geotechnical subsurface exploration, laboratory testing, and geotechnical design analyses for the design of a new 120 ft high earthen embankment dam in the Piedmont physiographic province of west Georgia. Planned a program of SPT borings, vertical and inclined rock cored borings, optical televiewer, water pressure testing with packers, test pit explorations of potential borrow sources, geophysical surveys to identify depth to rock and rippability characteristics (seismic, and ERI). Scoped laboratory program to include triaxial, permeability, consolidation, dispersion, gradations, and geotechnical index testing.

CR5813/College Street at NS #718370R in Macon, Bridge Replacement, Bibb County, Georgia (GDOT PI # 0014899)

Geotechnical Engineer of Record. Changed GDOT’s concept from MSE walls to soldier pile and tieback walls and soil nailed wing walls, eliminating significant temporary support of excavation and earthwork within the constrained limits of the existing railway. This project won the “ACEC Georgia / GDOT GPTQ Pre-Construction Awards – Category 5, Bridge/Structural Design, November 2021”.

Parks Creek Reservoir Dam / Jefferson, GA

Responsible for the leadership, senior review and technical oversight of a subsurface exploration program for a new proposed 100 foot high earthen embankment dam in Piedmont geology. The exploration comprised of SPT borings, rock coring in vertical and inclined borings with double and triple wireline techniques, multi-stage single and double water pressure testing with packers, borehole televiewer imaging, and a geotechnical laboratory testing program. Prepared the Geotechnical Engineering Report for the 90 % design submittal.

Basin #4 Stability Improvements / Quincy, FL

Senior Geotechnical Reviewer for the project comprising a waste clay surface impoundment slope remediation design. Work involved re-grading the downstream slope and installation of slag-cement-cement-bentonite (SCCB) shear walls as ground improvement in the soft alluvium foundation soils. Performed subsurface exploration, and geotechnical analyses for slope stability, seepage analyses, shear walls, and drainage system. Provided engineering office support to field representatives during construction of the shear walls, trench drain and earthfill. Performed geotechnical special inspections during construction.

SR 299 at I-24 Bridge Replacement (Accelerated Bridge Construction) / Dade County, GA

Geotechnical Discipline Lead for the first ABC bridge replacement project in Georgia that replaced an existing curved two span steel girder bridge over I-24, under a design build procurement. Prepared the scope, plan and specification for the subsurface exploration. Performed oversight tasks during the field and laboratory work. Worked with the contractor and roadway lead on median fill material requirements to comply with GDOT specifications. Analyzed global stability for an abutment MSE wall overlying a thick stratum of soft clay. Responsible for quality assurance (QA) of a sub-consultant's geotechnical deliverables including Bridge Foundation Investigation Report (BFI), Retaining Wall Foundation Investigation Report (RWFI) and Soil Survey Report (SSR) per GDOT requirements, and the project Design Quality Management Plan (DQMP). Interdisciplinary Design Review (IDR) of the preliminary plans for the geotechnical discipline. Developed, specified and supervised the execution of a compaction trial for #57 stone to serve as backfill behind bridge abutments to facilitate rapid placement and compaction during the ABC period.

Graham Elliott, PhD, PE, CEng MICE

PRINCIPAL

RECENT PUBLICATIONS

Elliott, G., Dean, J.T., and Monroe, J.S. (2022) Rebuilding dams in the Sand Hills: challenges of seepage control and embankment stability. *Proceedings of the 6th International Conference on Grouting and Deep Mixing, New Orleans, Louisiana, January 15 – 18, 2023. Deep Foundations Institute,* 474 – 483.

Elliott, G., Shull, B.P. and Wilde Grant, K. (2022) Design and construction of a soldier pile and lagging wall in piedmont residual soil. *In:* Lemnitzer, A. and Stuedlein, A.W. (Eds) *Selected Papers from Sessions of Geo-Congress 2022, Charlotte, North Carolina, March 20 - 23*, 2022, *ASCE Geotechnical Special Publication*, 335, 536 – 549.

Elliott, G., Marini, N., Meyer, M, and NeSmith, N. (2017) Design and construction of augered cast in place piles for the MLK bridge, new stadium project, Atlanta. *Geotechnical Frontiers 2017*, *ASCE Geotechnical Special Publication*, 279, 305 - 313.

RECENT PRESENTATIONS

ASCE Georgia Section, South Metro Branch, March 17, 2023 - *Soldier Pile and Lagging Walls for Earth Retention: Recent Examples in Georgia*

ASCE Georgia Section, March 02, 2023 - *Managing Geotechnical Risk: Some Recent Examples from the Southeastern USA*

ASCE Geo-Institute Georgia Chapter, March 16, 2021 - *Recent Transportation Geotechnics in the Coastal Plain: Examples from the Southeastern US*