

# RIZZO

EXPRESSION OF INTEREST  
WEST VIRGINIA DIVISION OF NATURAL RESOURCES  
WILDLIFE RESOURCES SECTION  
DAM MODIFICATIONS AND REPAIRS  
SOLICITATION NO.: AEOI 0310 DNR1800000005

PROJECT #17-5863  
DECEMBER 13, 2017

*RIZZO*

SUBMITTED TO:



**Wildlife Resources  
Section**

**Corporate Headquarters**

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## SPECIALIZED EXPERIENCE

RIZZO provides professional engineering services for dam safety inspections, engineering assessments, hazard assessments, civil/structural/geotechnical engineering, hydrology and hydraulics engineering, design of remediation, permitting, bid support, engineering support during construction, and construction management.

RIZZO has been focusing on Dam Engineering since and is now recognized as one of the leading consultants in the field of Dam Safety. RIZZO personnel have extensive experience in inspection, planning, design and construction for all types of dams across the United States and internationally. RIZZO has worked on seismic evaluation and rehabilitation design and construction for several projects including the Saluda Dam Remediation.



Why choose RIZZO? Some important considerations can be summarized as follows:

- RIZZO has over 30 years of professional engineering and consulting experience with emphasis on the investigation, study, evaluation and design of dams and appurtenant structures.
- RIZZO has qualified dam engineers who have strong regulatory knowledge and working experience with many regulatory agencies including the FERC, US Army Corps of Engineers, and many state dam safety agencies. We are familiar with Canadian Dam Safety Regulations, and have experience in Canada including with dams owned by BC Hydro.
- RIZZO offers technical excellence from engineering professionals who are actively involved with national dam safety professional associations and who have contributed numerous technical papers delivered at national engineering conferences and workshops, which help to advance the state-of-the-practice of dam design, dam performance, and remediation.
- RIZZO has a commitment to deliver the best total solution for our clients.

RIZZO personnel have been involved in dams, hydroelectric projects and water supply projects for more than 50 years, including feasibility studies; design and construction services; remediation projects; inspection services, including FERC Part 12 Inspection; and navigation



### **Instrumentation and Monitoring**

RIZZO has extensive experience with the design, installation, and data evaluation of dam safety instrumentation for both existing and new dams. This experience includes the installation, operation, and monitoring of piezometers (vibrating wire and Casagrande), inclinometers, survey monuments, seepage flumes, and crack meters.

We recently prepared and supervised the instrumentation and monitoring program for the refilling of the Taum Sauk Upper Reservoir Dam. We also performed extensive instrumentation monitoring for the Saluda Dam Remediation, Wyaralong Dam Construction and the Bear Creek Project.

### **Stability Analyses and Evaluations**

RIZZO routinely performs static and dynamic stability analyses for earth embankment, rock fill, and gravity dams. We have also performed numerous seepage and slope stability analyses for large excavations located adjacent to dams and other water resources facilities. We also perform two-dimensional static and dynamic finite element analyses for both gravity and embankment dams. Dynamic stability analyses for earth embankment dams typically includes: performing seismic risk analyses; liquefaction potential studies; and deformation analyses. RIZZO staff has the capabilities to perform all of these services in-house without support from external consultants or subcontractors.

### **Dam Engineering/Modification/Repair**

RIZZO is currently providing on-call professional engineering services under a five (5) year term contract for dam inspections and engineering services, including dam safety inspections, preliminary hazard assessments, dam engineering, modification and repair for twenty-nine (29) dams at various locations across New York State (NYS). The work includes site inspections; geotechnical investigations; hydrology & hydraulic analyses; preparation of design drawings and specifications; structural repair and dam modification designs, permitting support; and engineering support during construction. The projects are assigned on a task order basis and RIZZO accomplishes the work in an efficient manner as is evidenced by continued task order assignments.



- Engineering Assessments;
- Dam Rehabilitation and Modification Design;
- Sediment Transport/Scour Analysis; and
- Stream Stabilization and Dam Decommissioning.

RIZZO has performed Hydrologic and Hydraulic (H&H) analysis, dam breach simulations and development of inundation maps using GIS tools for Federal Energy Regulatory Commission (FERC) regulated projects. For watershed modeling, we apply a variety of computer programs, including FLOW-3D, FLO-2D, ADH, HEC-HMS, HEC-RAS, HEC-SSP, HEC-RPT, HEC-RESSIM, HMR-52, and ArcGIS.

Our H&H services cover a broad variety of projects, including different type of dams and power facilities, as well as other project applications. RIZZO provides an experienced risk-based perspective to hydrologic and engineering design. We are accustomed to working within the framework of federal, state and local regulatory requirements, as well as projects with stringent QA/QC requirements. In summary, the following RIZZO capabilities will allow us to accomplish the tasks of the engineering services required by USACE:

- RIZZO is experienced in developing comprehensive dam breach analysis, engineering assessments and emergency action plans (EAP) in compliance with FERC Regulations.
- RIZZO is experienced in developing remedial designs for dams and water resources structures including the preparation of design specifications to perform the work when they present deficiencies or to bring them into compliance with current regulations.
- RIZZO is experienced in developing the design, installation, and data evaluation of dam or water resources structures safety instrumentation such as piezometers, inclinometers, survey monuments, seepage flumes, and crack meters.
- RIZZO engineers have experience coordinating with FERC.
- RIZZO engineers routinely perform static and dynamic stability analyses for earth embankment, rock fill, and gravity dams.
- RIZZO engineers have served as contributors to various FERC and ASCE advisory panels on dam safety, performance monitoring, and EAPs.
- RIZZO engineers have served as Facilitators for Potential Failure Modes Analysis (PFMA) following many years as Core Team members for numerous dams.



technicians. Nationwide CTL Engineering sustains a staff of over 220 employees, providing additional professional expertise as well as staff and equipment resources for meeting project needs and goals.

Over our 34 years in West Virginia, CTL WV has provided numerous civil site designs, geotechnical designs, stormwater plans and surveys for commercial and residential developments and roadway projects. They have successfully prepared State and Federal 401 and 404 Permit submittals, Ms4 Phase II stormwater permits and conducted Environmental Site Assessments. CTL WV also has significant experience working on mining related projects including mine plans and permitting, mine refuse reclamation and subsidence evaluations and investigation. These projects were completed by conscientious interaction with Architects, Engineers, State and Federal Agencies and Owners.

CTL WV has certified engineering and laboratory technicians providing material testing and construction observation services. Our Morgantown lab is annually inspected by the West Virginia Division of Highways.

CTL WV maintains a fleet of four (4) drill rigs including truck, rubberized track and ATV mounted. Their crews have experience in steep terrain and barge drilling and deep boring exploration to depths greater than 300 feet. Additionally, CTL Engineering has a total of ten (10) drills allowing CTL to place multiple rigs on one site, if project schedule demands.

**Additional Services Provided By CTL:**

- Ground Penetration Radar;
- GIS Mapping;
- ALTA Surveys;
- GPS Surveys;
- Nondestructive Testing and Inspection;
- Forensic Science;
- Analytical Laboratories; and
- Metallurgy Services.



has experience related to a wide range of geotechnical and civil engineering projects, including waterfront facilities, pumped storage facilities, dams, spillways, power plant structures, and mines. He is an international leading consultant in seismic safety of hydro dams, tailings dams, and other heavy civil structures including mine crushers, material transport and tunnels. He has served on numerous panels, committees, and consulting boards charged with the deliberation of seismic hazard evaluation, seismic design basis, soil-structure interaction, and other seismic issues related to geotechnical engineering for various types of projects. Dr. Rizzo is a registered professional engineer in West Virginia.

Mr. John Osterle, P.E. is Vice President of Dams and Water Resources with RIZZO. He is a registered professional engineer with more than 30 years of experience on a variety of geotechnical, foundation, structural, and civil engineering projects. He regularly participates in the design, analysis, permitting, and construction of industrial facilities, power plants, dams, and transportation facilities. Mr. Osterle conducts all aspects of subsurface exploration and foundation evaluation studies for industrial, commercial, educational, and transportation facilities. He has coordinated drilling and laboratory activities, performed site reconnaissance, evaluated field and laboratory data, developed geotechnical recommendations, and drafted geotechnical reports. He is an approved Federal Energy Regulatory Commission (FERC) Part 12 inspector and has conducted many dam safety inspections, including leading PFMA sessions and also participating as a member of the Core Team. Mr. Osterle is a registered professional engineer in West Virginia.

Mr. Tom Edwards, P.E. is an Engineering Supervisor with RIZZO. He completed his bachelor's degree in civil engineering at the University College London and is a registered professional engineer with more than 10 years of experience. His project experience includes design and analysis of potential development sites, nuclear power plants, and numerous dam and water resource projects. Mr. Edwards is currently the Independent Consultant's Assistant for the FERC Part 12D inspections for two large high hazard dams in California, which includes participating in the safety inspections and PFMA workshops, in addition to authoring the final Part 12D and PFMA reports. Mr. Edwards has also co-authored a paper regarding the application of risk analyses for numerical modeling of levee overtopping. Mr. Edwards is a registered professional engineer in West Virginia.

Mr. Mark Schwartz, P.E. is an Engineering Supervisor with RIZZO. He has over twenty five years' experience in surface and ground water modeling, integrated surface and ground water modeling, ground water remediation analysis, wind and wave analysis; and computer interface



excavation, structural fill placement, and clay liner and concrete structure construction. He has also supervised the installation of geomembrane, geonet, geogrid, geosynthetic clay liner, and geotextile materials. Mr. Zullo's experience includes closely coordinating with representatives of numerous federal, state, and local agencies, private citizens, and public and private operators of water resource facilities on a variety of environmental projects. Mr. Zullo has a working knowledge of building codes, the American Concrete Institute (ACI) 318 concrete code, and the American Institute of Steel Construction Allowable Stress Design (AISC ASD) steel code. Mr. Zullo is a registered professional engineer in West Virginia.

Mr. Ronald Matthews is an Engineering Associate with RIZZO. He has over 20 years of project experience and has been RIZZO's Lead Construction Inspector on multiple projects. Mr. Matthews has experience working with several engineering codes including ACI and AWS welding codes and has worked within the nuclear quality program compliant as it refers to 10CFR50 Appendix B. He has served as a Roller Compacted Concrete (RCC) Quality Assurance Assistant and Lead Quality Control Plant Inspector; a RCC Quality Control and Placement Supervisor; a RCC and Bedding mix designer and as a Consultant during the RCC Mix Design Process and field testing programs. Mr. Matthews has developed bid grouting packages, design drawings, prepared schedules utilizing Primavera scheduling software, performed slope stability analysis, performed geotechnical investigations, performed expansive materials studies, and reviewed laboratory test results for various clients throughout his career.

Mr. Patrick E. Gallagher P.E., CPGS is President – CTL Engineering of West Virginia, Inc. Projects successfully completed under Mr. Gallagher's direction include: Civil Site Design, Foundation Design, Storm Water Management, Waste Water Design, Roadway Design, Parking Lot Design, Geotechnical Investigations & Design, Site Stability Analyses, Mine Subsidence Evaluations, Failure Investigations and Environmental Investigations and Expert Witness Testimony. Prior to joining CTL Engineering, Mr. Gallagher was the chief of the Abandoned Mine Reclamation Program for the State of Maryland, Department of Natural Resources, and Bureau of Mines. In addition, he was also responsible for overall engineering/geologic support to the Maryland Bureau of Mines Program. His career began in Pittsburgh as a project geotechnical engineer with Orbital Engineering. Mr. Gallagher is a registered professional engineer in West Virginia.

Mr. Carl Selfridge is Manager – Geotechnical & Drilling Services for CTL WV and annually manages 100+ various geotechnical projects including; education, transportation, commercial development and a variety of public and private clients. Mr. Selfridge is responsible for directing all aspects of the Geotechnical Engineering Department for CTL WV. This includes the



Mr. Tim Darrah is Manager – Civil Site and Surveying Departments for CTL WV and is responsible for department management for civil site design and surveying projects including topographic, property and construction layout. Mr. Darrah also serves as project manager on various types of civil engineering projects including residential and commercial developments, and reclamation design projects. Office work includes site designs, hydrology calculations, quantity calculations, and various other forms of engineering related duties.

Resumes for the above listed people can be found in **Attachment 1**.

### **PAST PERFORMANCE**

RIZZO's performance over the past five (5) years on similar contracts with respect to cost control, quality of work, ability to work independently and compliance with performance schedules has been positive. Projects were completed on time and within budget. We have done similar projects for the New York Power Authority and New York Office of General Services. Project descriptions are included in **Attachment 2**.

### **QUALITY MANAGEMENT SYSTEM**

The RIZZO Quality, Health, Safety, and Environmental (QHSE) Program is integrated into one QHSE Manual that is ISO 9001 certified for the "Design and provision of professional engineering and consulting services" and complies with the requirements of ISO 14001 "Environmental Management Systems Requirements", OHSAS 18001 "Occupational Health and Safety Standard", and the nuclear requirements that includes 10CFR50 Appendix B, 10CFR21, ASME NQA-1 (includes 1994, 2008, 2009 Addenda) and the International Atomic Energy Agency (IAEA) GS-R-3. The QHSE methods and processes are defined in the RIZZO QHSE Manual and lower level implementing procedures.

The RIZZO Quality Assurance Program was implemented in 1985, and continues to expand to meet new requirements and respond to changing industry needs. RIZZO employees world-wide are committed to performing work in accordance with the RIZZO QHSE Program, as well as committed to meeting client and regulatory requirements and providing our professional services in a highly safe and quality manner. Safety is the paramount commitment, overriding all other demands.





Engineering Services related to:

- Combined Construction and Operating License Applications (COLA's);
- Site Characterization;
- RAI/RFI responses; and
- Engineering Support for Operating Plants.

Testing Services:

- Laboratory Testing of Construction Materials; and
- On-site Testing of Construction Materials.

## **PROJECT CONTROLS**

### **Project Management**

The Project Manager (PM) is one of the most important roles on a project and is responsible for ensuring the project runs smoothly with minimal issues. The PM is responsible for all project reporting and a detailed monitoring of the project scope, schedule, and budget and document management. As will be described below, RIZZO has the systems and tools to allow PM's to be successful in their roles.

### **Communication/Responsiveness**

#### **Project Team Collaboration**

The PM has the overall responsibility for the project and is considered the single point of contact. The PM establishes the appropriate communication channels for all members of the project team and will facilitate communication and the flow of information to the client. Effective communication is achieved through regularly schedule project meetings (typically weekly) in addition to an internal kickoff meeting which will occur at the start of the project. RIZZO would recommend a kickoff meeting with the client to review the project objectives, deliverables, schedule, budget, and communication plan for the project. In the event an issue is discovered, the PM will communicate with the team and client to ensure a positive resolution.



solicit feedback from clients on RIZZO's performance on their projects. This has proved to be a valuable tool in the overall continuous improvement area. PMs will use the results of lessons learned and client surveys as tools for future projects including this one.

### **Scope Management**

The PM shall be responsible for clearly defining the scope at the start of the project. This will ensure that there is common understanding of the work to be performed. The PM will document the agreed upon scope in the Project Plan which the client will have the opportunity to review. The scope will be broken up into manageable pieces/activities that will have an associated schedule and budget so to aid in tracking. The PM is responsible for making sure the project team is completing the agreed upon scope as directed by the Project Plans and avoiding scope creep.

In the event it is determined that additional scope needs to be complete to meet the project objective, the PM will immediately communicate with the client before any additional work is undertaken. A consensus will be reached by all parties for any additional scope and the impact to the schedule and budget will be assessed prior to proceeding.

### **Budget and Schedule Management**

Once a budget and schedule is agreed upon, the PM is responsible for executing the project within that those parameters. This will be done, by weekly monitoring of all expenditures and progress on associated tasks within our project management software program, Ajera.

Once the tasks are defined in Ajera, progress status can be entered and data in graph form is provided to the PM to track the budget and schedule. Ajera's project scheduling tool, Schedule Manager, provides an easy to use way to manage the project employees and project workloads on a weekly basis. Ajera incorporates time entered into this same screen so everything can be managed in one place. Ajera's Schedule Manager is designed to give a flexible resource management system that offers a consistent clear picture of the project workloads, even if the project is constantly changing.

In addition, an overall project schedule (created in either Microsoft Project or Primavera) will be created and updated regularly.



Ameren Missouri contracted RIZZO to provide a conceptual and then a detailed design of the new dam as well as manage the construction of this \$400 million rebuild. The Taum Sauk project is located in Reynolds County in Southeastern Missouri, about 100 miles south of St. Louis. The project was completed in 1963 as a reversible pumped storage project with an Upper and Lower Reservoir, used to supplement the generation and transmission facilities of the utility with a 450-MW, two-unit pump-turbine. The Lower Reservoir, operated as a run-of-river reservoir with outflow being maintained at approximately equal to natural inflow, providing storage for water to be pumped to the Upper Reservoir at night or during periods of low power demand. The project structures include a concrete faced rockfill dam (dike), that encircles and forms the Upper Reservoir; a concrete gravity dam impounding the Lower Reservoir (the lower dam was designed as a uncontrolled overflow spillway with no spillway gates so that flood waters could safely pass over the dam); a reversible turbine powerhouse; a gravel trap dam located upstream of the outlet canal in the lower reservoir, and a small dike that impounds the seepage collection pond at the toe of the Upper Reservoir.

The surface area of the reservoir is 54.5 acres, with a total storage of 4,350 acre-feet, and live storage of 2,560 acre feet used for production of power. The new Upper Reservoir involved a complete rebuild of the dam consisting of approximately 2.8 million cubic yards of Roller Compacted Concrete (RCC) and 300,000 cubic yards of conventional concrete. The footprint of the new structure is similar to that of its predecessor, and is approximately 6,700 feet long, 120 feet tall, and 150 feet wide at the base. The Upper Reservoir is impounded by a kidney shaped rim dike at the top of a planed-off mountain.

At the time of construction, the Taum Sauk Upper Reservoir Rebuild was the largest RCC dam under construction in the U.S. RIZZO was the single point of contact for the Project and was the Owner's Representative on site and coordinated and managed the work of the Contractor

RIZZO's Scope of Work is detailed as follows:

**Forensic Analysis:** RIZZO conducted a detailed forensic engineering analysis to determine the causes of the failure. Analysis included stability and seepage, dam breach (to determine time and to evaluate mode of failure), complete review of instrument control systems, sediment transport, detailed mapping of breach zone, drilling and sampling of remaining portions of the dike, and a subsurface investigation to analyze both the existing dike and its foundation and the potential foundation of a new dam.



### Silver Lake Dam Reconstruction

RIZZO was retained in 2005 on behalf of the Upper Peninsula Power Company (UPPCO), to provide technical support and consultation related to the rebuild of the Silver Lake Dam on the Dead River, in Marquette Michigan. The Dam impounded Silver Lake Reservoir, which was a storage basin for two downstream hydroelectric installations operated by UPPCO.



The Dam sustained a catastrophic failure in May of 2003. The activation event drained approximately 25,000 acre feet of water from the impounded Silver Lake reservoir. RIZZO performed a field and geotechnical investigation and hydraulic modeling. After review of alternatives and costs, a decision was made by UPPCO to proceed with the rebuilding. RIZZO was responsible for preparing the detailed design, as well as the Environmental Report (ER) required by the Federal Energy Regulatory Commission (FERC).

RIZZO Responsibilities under the ER task included participating in strategy and agency meetings, developing and managing the implementation of the project's environmental strategy and program needs, and providing senior technical review. The ER involved identifying, reviewing, and documenting the currently known and available environmental, engineering, recreational, cultural, and socio-economic information related to the planned project and local region that may be impacted. Additional field studies were performed by RIZZO-managed and directed subcontractors to address possible impacts to wetlands, cultural and archeological resources, and identification of rare, threatened, or endangered species possibly present in the project area for the proposed rebuild. This task included participating in strategy and agency meetings, developing and managing the implementation of the project's environmental strategy and program needs, and providing senior technical review.

RIZZO developed calculations and design methodologies to reduce the overall length of the spillway. Final design had to address impact on environment, hydro power output, construction cost, and regulatory compliance. RIZZO engineers balanced competing factors to develop a cost-effective design that satisfied Owner's objectives. The final result was a 35% reduction in the length of the spillway. The goal of the construction was to restore the Silver Lake Reservoir and upgrade the Dam to meet all current FERC guidelines.



RIZZO's full scope of work included:

- Site survey and evaluation of existing conditions;
- Subsurface exploration, soils identification, and selection of index soil properties;
- Dam and spillway stability analyses;
- Hydrologic and Hydraulic evaluations for existing and remedial design alternatives;
- Design of a new, grouted rip-rap lined emergency spillway;
- Assisting with negotiation of Order of Consent with the DEC;
- Preparation of construction contract documents, drawings, and specifications;
- Preparation and filing of permit applications; and
- Engineering support during construction.

**RIZZO Contract Amount: \$80,000**

### **Cambridge Springs Dam**

RIZZO designed a replacement dam spillway and downstream flume for flood control and stream bank erosion control at the Cambridge Springs Dam. The existing dam is 240-ft. long and 14-ft. high. The dam impounds Polish Pond, which is used for fire protection at the Pennsylvania State Correctional Institute at Cambridge Springs.



The old spillway did not have an adequate capacity to pass the inflow design flood without overtopping the dam. Early conceptual designs of the spillway suggested that the width would need to be 80 feet to pass the inflow design flood. RIZZO reduced the design flood by two-thirds using an incremental dam breach analysis which resulted in significantly reducing the cost for constructing the new spillway.



The downstream face of the dam is being remediated and the dam is being stabilized to meet required factors of safety against sliding and overturning for all applicable load cases. The remedial design for the downstream face consists of removing the existing deteriorated concrete and replacing it with reinforced concrete doweled into the existing dam. A leakage conveyance system will direct water coming from cracks and lift joints in the existing concrete to the toe of the dam at the non-overflow sections. Stabilization consists of a combination of adding mass concrete between the spillway piers and installing high capacity post-tensioned anchors. The post-tensioned anchors will be installed from the downstream face of the dam and include up to 58 strands, with design loads up to 2,100 kips per anchor. The design of the stabilization includes calculations, drawings, specifications, and a design report.

As part of the stabilization design an updated stability analysis is being performed. The analysis includes updated foundation strength parameters that were determined through testing performed on rock core samples taken from the foundation of the Dam. The analysis also includes updated tailwater levels based on a CFD analysis and updated uplift pressures at the base of the Dam.

The CFD analysis was completed using FLOW-3D software to determine the tailwater elevation at the spillway during the PMF event. CFD Models were developed for a single bay of the Spillway and for the entire 12 gates at the spillway. Sensitivity analyses were performed in the single-gate model to confirm that the selected mesh size, boundary conditions, and model features (e.g., air entrainment, turbulence, material roughness, and potential cavitation) were appropriate. Model calibration was also performed, using the reported flow conditions for the Flood of Record. After completion of the sensitivity analyses and model calibration, the final model for all 12 gates was used to estimate water levels and water pressures on the downstream surface of the spillway.

**RIZZO Contract Value: \$650,000**

### **Santee Cooper Hydroelectric Project Upstream Slope Protection Analysis and Design**

RIZZO performed an extensive upstream slope protection analysis, design, and evaluation, including an inspection of approximately 24.3 miles of the 41 miles of dams and dikes constructed in 1941 to create Lakes Marion and Moultrie. The Santee Cooper Project is a large hydroelectric and navigational development located in central and southeastern South Carolina. The Project comprises two major impoundments: Lake Marion on the Santee River,



evaluated as part of this study: graded rip rap, uniform armor stone, articulated pre-cast concrete mats, steel gabion mattresses, plastic gabion mattresses, cast-in-place reinforced concrete, pre-cast concrete armor units, rip rap, soil cement, and Roller Compacted Concrete.

The graded rip-rap option was selected for construction and construction was self-performed by Santee Cooper.

**RIZZO Contract Amount: \$575,000**

### **NYSOGS Dam Inspections and Engineering Services Various Locations Statewide**

RIZZO is providing on-call professional engineering services under a five (5) year term contract for dam inspections and engineering services, including dam safety inspections and preliminary hazard assessments for twenty-nine (29) dams at various locations across New York State (NYS).

Assignments include dam site inspections and screening of potential downstream hazards; site surveys, soil and concrete testing; hydrology & hydraulic analysis; stability analysis; and, design of dam remediation and modifications for various NYSDEC owned dams.



As a result of the RIZZO inspections, recommendations for additional hazard assessments were provided to the NYSDEC for six (6) of the dam sites. RIZZO was retained by the NYSOGS and the NYSDEC to perform the following additional engineering services:

**BREACH ANALYSIS AND HAZARD EVALUATION:** RIZZO is currently performing a hydrology and hydraulics (H&H) analysis and a hazard classification evaluation as a follow-on to the RIZZO's preliminary hazard screening provided on the Dam Safety Inspection Reports. The analysis is being performed in accordance with NYSDEC Guidance for Dam Hazard Classification. RIZZO conducted HECRAS model simulations representing conditions with and without breach of the dam and developed inundation maps for use in Emergency Action Planning. The evaluation is being performed for the following Dams:



**RIZZO Contract Value: \$2,000,000**

### **New York State Canal Corporation Dam Safety Program**

RIZZO was retained by the New York Power Authority (NYPA) to provide professional engineering services for developing and implementing a Dam Safety Program for the New York State Canal Corporation (Canals) system that spans upstate New York State connecting the Hudson River with Lake Ontario, Lake Erie, and Lake Champlain.



The Canals which operate a navigable 524-mile inland waterway that passes through 25 counties and 200 villages, hamlets, and towns across New York State, was transferred to NYPA by an act of the state legislature on January 1, 2017. The Dam Safety Program developed for Canals by RIZZO is intended to establish the dam safety thinking and approach that is part of NYPA's culture. RIZZO was tasked to perform the following:

- Gain an understanding of current protocols for identifying and addressing emerging public safety issues;
- Provide recommendations for process improvement;
- Provide recommendations for Canals' future dam safety organization;
- Develop a draft dam safety program policy for the Canal System; and
- Provide highly qualified dam safety experts to act as the designated Dam Safety Engineer (DSE) and Deputy Dam Safety Engineer (DDSE) working out of Canal's Albany Headquarters for up to one year.

RIZZO staff are assisting Canals with prioritization of both O&M and capital expenditures relating to dam upgrades; development and implementation of improved safety monitoring of their more than 200 miles of raised embankments; developing plans for a \$3 million vegetation removal and control project on their dams and embankments; responding to emergency conditions along the embankment system; interfacing with state dam safety officials; developing formal Inspection & Maintenance Plans for their dams; directing dam upgrade





application forms, and assist with Contractor selection. RIZZO will provide engineering support during construction.

**Secondary Service Provided:** After construction work has been completed, RIZZO will update the corresponding Emergency Action Plans and Inspection & Maintenance Plans for each site.

**RIZZO Contract Amount: \$187,845**

### CTL Experience

**Project:** Mine Impoundment Annual Inspections

**Client:** Murray Energy

**Contact:** Brian Bogden

**Phone:** (304) 534-4735

**Location:** West Virginia



Perform annual & quarterly impoundment certifications for Murray American Energy, Inc. and Consol Energy, Inc. covering northern West Virginia and southwestern Pennsylvania as required by the WVDEP, PADEP and MSHA. The certifications consist of visual individual walking inspections of various AMD facilities of active and closed underground coal mines i.e. Loveridge Mine, Robinson Run Mine, Blacksville No. 1. Mine, Blacksville No. 2 Mine, Arkwright Mine, Osage Mine, Pursglove Mine, Dilworth Mine, Island Creek Coal Company and Laurel Run Mining Company for stability and proper outflow drainage which consist of various size major impoundments, miscellaneous treatment plant aeration and settling ponds. Piezometer data throughout each certification year is reviewed and analyzed for all the major impoundments to insure the designed phreatic surface is below the design levels to maintain a minimum required factor of safety of 1.5. This information and inspection comments/ conclusions are included on the certification forms signed by a qualified Professional Engineer which are submitted to the various agencies.



**Project:** Buckeye Lake ODNR

**Client:** Gannett Fleming

**Contact:** Robert Kine, PE

**Phone:** (717) 763-7211

**Location:** Ohio



CTL Engineering, Inc. performed contract drilling and laboratory testing as well as construction inspection services during the rehabilitation of this dam. The original dam was a 4.1 mile long earthen dam that was constructed nearly 200 years ago and was determined to be at a significant risk of failure. The project included the installation of a seepage barrier and buttress to strengthen the dam. These elements extend from 25 to 40 feet below the surface and were constructed by deep soil mixing which is the process of mixing Portland Cement Grout with the existing soil. The overall construction cost was approximately \$110M. CTL Engineering performed geotechnical borings of the completed seepage barrier to confirm the specified requirements were achieved. Laboratory unconfined compressive strength testing was performed on the core samples to determine the strength of the soil cement mixture. We also provided inspection of the soil buttress construction verifying proper methods were used, tracking production and assisting the project team in troubleshooting issues that arose.

**Project:** Clear Fork Reservoir: Seepage Investigations

**Client:** City of Mansfield

**Contact:** Robert Bianchi, PE

**Phone:** (419) 755-9702

**Location:** Mansfield, Ohio



CTL Engineering, Inc. conducted a geotechnical investigation to evaluate the stability of the existing Clear Fork Reservoir Dam by utilizing laboratory and field testing data to analyze pore water migration (seepage) through and under the dam, as well as installed and replaced ground water monitoring wells. Based on visual observations and the seepage analysis, the existing dam embankments required modifications to meet USACE requirements. CTL provided recommendations for grouting, downstream berm, and relief wells.



Concrete buttress to the face of the dam and the construction of a new bridge and concrete spillway. Over 43,000 cubic yards of embankment, 100,000 cubic yards of roller compacted concrete and 2,220 cubic yard of structural concrete. CTL provided soil compaction testing and inspection, concrete testing and roller compacted concrete testing.

Project descriptions are included in ***Attachment 2***.

#### **RIZZO's Ability to Complete Projects without Significant Cost Escalations or Overruns.**

RIZZO was the engineer of record and construction manager for two (2) of the largest dam remediation projects in the United States over the past 10 years: Saluda Dam Remediation and Taum Sauk Upper Reservoir Rebuild. RIZZO prepared a detailed design and associated tabulated cost estimate for both projects.

RIZZO has completed the following engineering projects that are described in other sections of this proposal without significant cost escalations or overruns:

- Pensacola Dam Inspection – project budget \$27,015, total amount billed to date \$25,160 (project nearing completion);
- Rio Dam Part 12 Inspection – project budget \$39,654, total amount billed \$39,654;
- Rimmel Dam Part 12 Inspection – project budget \$29,799, total amount billed \$17,609; and
- Magic Reservoir Part 12 Inspection – project budget \$34,820, total amount billed \$34,820.

RIZZO has a long history of completing projects on time and within budget. We keep our clients updated on cost and schedule to mitigate and cost/schedule issues.



**ATTACHMENT 1**  
**RESUMES OF KEY PERSONNEL**





## GEOTECHNICAL, CIVIL, AND MINING

Dr. Rizzo has experience related to a wide range of geotechnical and civil engineering projects, including waterfront facilities, pumped storage facilities, dams, spillways, power plant structures, and mines. He is an international leading consultant in seismic safety of hydro dams, tailings dams, and other heavy civil structures including mine crushers, material transport and tunnels. He has served on numerous panels, committees, and consulting boards charged with the deliberation of seismic hazard evaluation, seismic design basis, soil-structure interaction, and other seismic issues related to geotechnical engineering for various types of projects.

## ENVIRONMENTAL

Dr. Rizzo has more than 50 years of professional consulting experience related to the civil engineering aspects of hazardous and solid waste management facilities, mines, nuclear, thermal, and hydroelectric power plants, and earth and rockfill dams. He has lectured in the United States and Europe on environmental engineering, Phase II environmental assessments; facility and landfill siting; mine development and design and construction of landfill components. Dr. Rizzo has extensive experience in providing expert testimony, representing clients at public and regulatory meetings, and providing support for community relations programs.

## CIVIL AND GEOTECHNICAL ACTIVITIES

### Pardee and Camanche Dams, FERC Part 12D Dam Safety Inspection

The East Bay Municipal Utility District | Oakland, California

09/2017 – Present

Dr. Rizzo is currently serving as FERC Part 12D Independent Consultant for EBMUD, providing professional services to inspect and evaluate the safety of two dams of FERC Project 2916, which includes Pardee Dam and Camanche Dam, the hydroelectric facilities, and their associated appurtenant water retaining structures. Dr. Rizzo will also lead a FERC dam safety workshop to audit the existing Potential Failure Mode Analysis (PFMA) for these dams. The inspection and evaluation will culminate in two FERC Part 12D Dam Safety Inspection Reports, one for each of the Pardee and Camanche Dams and Hydroelectric Facilities.

### John Hart Dam

BC Hydro | Campbell River, British Columbia

06/2014 – Present

Dr. Rizzo and RIZZO Associates lead to develop conceptual remediation options and to participate on an expert Board for the remediation of the Middle Earthfill Dam at the John Hart Hydro Project located on Vancouver Island. The Project consists of a main concrete dam with a gated spillway, the north and middle earthfill dams, and a concrete intake structure.

### Oroville Thermalito Hydroelectric Project

California Department of Water Resources | Oroville, California

2014 – Present

Dr. Rizzo is the FERC Part 12 Independent Consult for the for the Oroville Thermalito Hydroelectric Project including participating in Potential Failure Modes Analysis. The Part 12 Inspection was a comprehensive evaluation of the project and included a review of the stability analyses, hydrologic and hydraulic information, instrumentation monitoring program, and operation and maintenance program.

### Hope Mills Dam | Hope Mills

MBP | Raleigh, North Carolina

01/2011 – Present

Dr. Rizzo provided geotechnical and dam engineering services for the failed dam located in Hope Mills, North Carolina. Dr. Rizzo is the lead investigator and point of contact for the project. Services included a site inspection, reviewing all existing engineering information, reviewing the proposed remedial design for the failed dam, evaluation of the labyrinth spillway and developing an expert opinion on the causes of the dam and spillway failure.



preparation of portions of the design including design of the drainage gallery, dam instrumentation, and foundation preparation details. RIZZO also performed thermal analysis, finite element analysis, and the preparation of specifications. Wyaralong Dam is an RCC structure with an overflow spillway and a spillway chute on the left abutment. Dr. Rizzo advised on the rock scour analysis and stilling basin design, RCC mix, RCC Design, seismic analysis and seismic design, and the interpretation and accommodation of the jointed and bedded rock in the Dam foundation. He was engaged from the early stages of design throughout construction and then through the startup period.

### **C.W. Bill Young Regional Reservoir**

Confidential Client | Tampa Bay, Florida

02/2010 – 02/2011

As Principal-in-Charge, Dr. Rizzo was responsible for the oversight of the forensic investigation to determine the cause of soil-cement cracking on the reservoir's upstream slope. This investigation included a thorough review of project design and construction documents, performing seepage modeling to determine the phreatic conditions within the reservoir embankment, conducting slope stability analyses, and preparing a final report describing the cause of the slope distress to be entered as expert testimony.

### **Osage Hydroelectric Project Part 12D Inspection and Follow-up**

Ameren Missouri | Missouri

2008 – 2011

Dr. Rizzo was the Independent Consultant for the FERC Part 12D Inspection for the Osage Project including conducting a Potential Failure Modes Analysis (PFMA). The Osage Project consists of Bagnell Dam, a 2,540 foot long, 150 foot high concrete gravity dam. The total watershed area is 14,000 square miles and includes five major US Army Corps flood storage reservoirs. Instrumentation at Bagnell Dam includes piezometers, crack movement gages, alignment surveys, and foundation drains.

The Part 12 inspection was a comprehensive evaluation of the project and included a review of the stability analyses, hydrologic and hydraulic information, instrumentation, and operation and maintenance. An inspection report was prepared for submittal to the FERC. The Supporting Technical Information Document (STID) and PFMA report were prepared concurrently with the Part 12 Inspection Report. RIZZO also has performed work recommended in the Part 12 Report. The major projects include a rock scour evaluation during overtopping events, installation of additional piezometers, a re-evaluation of the Probable Maximum Flood (PMF), and an updated stability analysis. The rock scour evaluation was conducted to determine if there was potential for significant erosion of rock at the toe of the Dam due to overtopping of the Dam during the PMF. The evaluation included drilling borings into rock, characterizing the rock based on the coring and laboratory testing, and evaluating the erodibility of the rock using the Erodibility Index Method.

### **Taum Sauk Upper Reservoir**

Ameren Missouri | Lesterville, Missouri

01/2006 – 04/2010

Dr. Rizzo served as the Principal-in-Charge for the forensic analysis and the complete rebuild of the Taum Sauk Upper Reservoir. RIZZO analyzed and developed various options to re-build the project, prepared a detailed rebuild design, and performed construction management for the \$492 million Upper Reservoir rebuild. The rebuild of the dam consisted of the construction of an RCC dam approximately 6,600 feet long, consisting of 2,838,215 cubic yards of RCC. The following tasks were successfully completed:

- Performed a detailed forensic investigation and analysis
- Developed the design basis for a complete re-build of the Upper Reservoir Dam;
- Developed Construction Drawings and Technical Specifications for the re-build;
- Designed and supervised construction of the new overflow spillway;
- Supervised a site-specific Roller Compacted Concrete Mix Design Program;
- Developed a formal Environmental Report;
- Advised on the design of the Level Protection and Control System for dam safety and plant operation;
- Developed a Dam Safety Surveillance and Monitoring Program;
- Prepared the Reservoir Refill Plan;
- Developed remedial designs for the water conveyance system at the plant included the vertical shaft, unlined tunnel, and unlined tunnel;



1,500 acres of prior strip-mined land in the Egypt Valley Wildlife Area. The project included field investigation and design of a dam, outtake, emergency spillway, and recreational features.

### **Santee Cooper Project | East Dam and East Dam Extension**

Santee Cooper | Moncks Corner, South Carolina

04/1988 – 10/2004

Dr. Rizzo served as Principal-in-Charge of the investigation for this rolled earth dam on a loose sand foundation. He supervised the static and dynamic slope stability, liquefaction and deformation analyses. He worked with the FERC to define the seismic hazard and the associated seismic design criteria. Based on the results, he led the development of alternate remediation schemes and performance of a stone column pilot test program.

### **Blenheim-Gilboa Pumped Storage Project**

New York Power Authority | Gilboa, New York

05/2004 – 07/2004

Dr. Rizzo was the Principal-in-Charge for the duration of this \$700,000 design effort and 1,000 MW pumped storage plant. He focused on correcting slope movement that threatened interruption of the main transmission line and failure of a plant access road. Dr. Rizzo's thorough evaluation of the local geology and existing aerial infrared photography revealed the presence of an ancient landslide. Under his direction, subsurface investigations were conducted to confirm the presence of the ancient slide and fully define the subsurface conditions. Remedial efforts were focused on stabilizing the toe of the slope that could catastrophically fail and threaten the transmission line. The "fix" included both surface drainage improvements and a toe berm of about 400,000 cubic yards. The project results concluded that slope movements previously recorded, at about 2-inches per year over the last 20 years, were virtually eliminated. Total construction costs were about \$5 million.

### **Stevens Creek Hydroelectric Project**

South Carolina Electric and Gas | Georgia

07/1988 – 01/2003

As Principal-in-Charge, Dr. Rizzo led the investigation of this overflow type gravity concrete dam. He performed sliding and overturning stability analysis, including PMF and seismic conditions, definition of the seismic hazard and seismic design criteria, development of alternate remediation schemes, and design of a rock anchor system.

### **Carpenter Dam**

Entergy, Inc. | Hot Springs, Arkansas

09/1988 – 09/2002

Dr. Rizzo served as Principal-in-Charge for the site investigation and remedial design of this arched gravity concrete dam. His responsibilities included sliding and overturning stability analyses, including PMF and seismic conditions, definition of the seismic hazard and seismic design criteria development.

### **Alcona, Loud, Five Channels, Cooke, and Foote Hydroelectric Part 12D Safety Inspections**

Consumers Energy | Various Locations, Michigan

07/2000 – 12/2000

Dr. Rizzo was the lead Independent Consultant for the completion of the FERC Part 12D Safety Inspections of the Alcona, Loud, Five Channels, Cooke, and Foote Dams owned by Consumers Energy. RIZZO performed the Part 12 Safety Inspections for all five dams. The inspections included an assessment of the structural integrity, evaluation of the Spillway adequacy and stability analyses, and recommendations to improve operations at each Project; and working with a diver to inspect the draft tubes of the Powerhouses and a sounding survey team for the downstream aprons. The inspections revealed that the embankment at Five Channels Dam contained voids and RIZZO was retained to locate, evaluate, and oversee the repair of the voids. RIZZO also performed a detailed evaluation of the adequacy of the primary and emergency Spillways at Loud Dam.



### **Columbia Dam**

**South Carolina Electric and Gas | Columbia, South Carolina**

**12/1984 – 11/1987**

RIZZO converted this timber crib dam to a gravity dam. As Principal-in-Charge, Dr. Rizzo conceived the "fix" for the dam and supervised the design. He conducted negotiations with Federal and State Dam Safety Officials, environmental regulators, and historical preservation groups.

### **Rio Dam**

**Orange & Rockland Utilities | Sullivan County, New York**

**03/1985**

RIZZO stabilized an arch gravity dam with anchors and a hydraulic fill dam subject to liquefaction. As the Principal-in-Charge, Dr. Rizzo conceived the "fix," led all communication and negotiation with regulators, supervised the design, and negotiated with contractors. RIZZO resolved all FERC comments associated with previous stability analyses and developed remedial measures to ensure that all sections of the dam meet current FERC criteria. Twenty-one 2,600 kips, post-tensioned rock anchors, were installed to stabilize the spillway section of the dam.





## **Markham Ferry Hydroelectric Project – Grand River Dam Authority.**

Locust Grove, Oklahoma

8/2016 - Current

Mr. Osterle performed a dam safety inspection and PFMA review of the project in April of 2017. Mr. Osterle prepared the revised Potential Failure Mode Summary report for the project. The Markham Ferry Hydroelectric Project includes Robert S. Kerr Dam and is located near Lake Hudson on the Grand River, near Locust Grove, Oklahoma. The dam is a 4,494-foot-long, 90-foot-high earth embankment and concrete gravity dam with a 114 MW Powerhouse.

## **Osage Post-Tensioned Anchor Replacement**

Ameren Missouri | St. Louis, Missouri

05/2015 - Present

The dam at the Osage Hydroelectric Project is being stabilized to meet required factors of safety against sliding and overturning for all applicable load cases. Stabilization consists of a combination of adding mass concrete and large post-tensioned anchors. Mr. Osterle is serving as the project manager for the work and is overseeing the evaluation of updated foundation strength parameters, updated stability analysis, and the design of the new post-tensioned anchors and mass concrete. The analysis also includes updated tailwater levels based on a computational fluid dynamics (CFD) analysis and updated uplift pressures at the base of the dam.

## **Dam Safety Program – New York State Canal System**

New York Power Authority | Albany, New York

10/2016 - Present

This project consists of documenting and evaluating the current dam safety procedures for the New York State Canal System, evaluating the current dam safety procedures, providing recommendations for improvement, and developing a dam safety program for the New York State Canal System. Mr. Osterle is assisting with this project including conducting interviews with New York State Canal System staff.

## **Dam Safety Risk Screening – New York State Canal System**

New York Power Authority | Albany, New York

5/2016 - Present

Mr. Osterle is serving as part of the Senior Review Team for the dam safety risk screening of the New York State Canal System water impounding structures. The New York State Canal System is a navigable 524-mile inland waterway that spans upstate New York and includes more than 350 water impounding structures. The structures include state regulated dams, levees, dikes, culverts, and other structures. The project includes preparing a matrix with dam safety information that is being used in a qualitative screening level risk analysis for the structures.

## **New York OGS Dam Inspections & Engineering Services**

New York State Department of Environmental Conservation | New York

08/2014 - Present

Mr. Osterle performed dam safety inspections and preliminary hazard assessments for several New York State Department of Environmental Conservation-owned dams. A detailed inspection and downstream hazard evaluation was performed for each project, and dam decommissioning plans and specifications are being developed for two projects.

## **Franklin County Dam**

Strasburger & Price | Mount Vernon, Texas

11/2015 - Present

Mr. Osterle is the lead geotechnical engineer for the construction dispute between Franklin County and the design engineer over the remedial work performed for the dam. Mr. Osterle supervised and validated the slope stability analyses, conceptual design, and 90% design for remediating the damaged structure.



### **Crescent Hydroelectric Project**

New York Power Authority | White Plains, New York

08/2016 – 11/2016

Mr. Osterle performed a FERC Part 12D dam safety inspection and potential failure mode (PFM) review of the concrete dam, powerhouse, regulating structure and forebay area of the project.

### **Vischer Ferry Hydroelectric Project**

New York Power Authority | White Plains, New York

08/2016 – 11/2016

Mr. Osterle performed a FERC Part 12D dam safety inspection and PFM review of the concrete dam, powerhouse, regulating structure, lock, and right embankment of the project.

### **Rio Dam Penstock Failure**

Eagle Creek Renewables | Orange and Sullivan Counties, New York

11/2014 – 01/2015

For this project Mr. Osterle assisted with the forensic evaluation of the Rio Unit 3 penstock failure. He oversaw the slope stability analysis performed to design temporary stabilization measures for the failed slope and the analysis performed to analyze the cause of the failure. He also assisted with settlement, bearing capacity and sliding stability calculations for the forensic evaluation and assisted in the design of remedial measures for the failed slope consisting of new filters, drains, and a new rockfill berm.

### **Pensacola Dam | Dam Safety Inspection | PFM**

Grand River Dam Authority | Langley, Oklahoma

06/2014 – 09/2014

Mr. Osterle, along with two engineers from Burns and McDonnell, performed a dam safety inspection and PFM review of the project in May of 2014. Additional services consist of preparing the safety inspection report scheduled for September 2014. The dam and associated spillways and powerhouse were constructed in 1940. The dam is a concrete multiple arch buttress structure over 4,000 feet long and 150 feet high.

### **FERC Dam Environmental & Engineering Services**

Louis Berger | Washington, DC

04/2014 – 09/2014

Mr. Osterle, as a subcontractor to the prime contractor, is currently providing dam safety engineering support services to support FERC's licensing review of new hydroelectric facility applications.

### **Magic Reservoir Dam | Dam Safety Inspection | PFM**

Magic Reservoir Hydroelectric, Inc. | Blaine County, Idaho

10/2013 – 08/2014

Mr. Osterle performed a dam safety inspection and PFM review of the embankment dam, powerhouse, and penstock of the project in October of 2013 and May of 2014. Additional services will include reviewing background information associated with the project in preparation for the Third Part 12 Safety Inspection of the project scheduled for August 2014. The Magic Reservoir Hydroelectric Project consists of an earth embankment dam, spillway, dike, and associated 9 MW hydroelectric plant.

### **Hope Mills Dam | Litigation Support**

MBP, Raleigh | Hope Mills, North Carolina

01/2011 – 06/2014

Mr. Osterle provided geotechnical and dam engineering services for the failed dam located in Hope Mills, North Carolina. Mr. Osterle is the lead investigator and point of contact for the project. Services included a site inspection, reviewing all existing engineering information, reviewing the proposed remedial design for the failed dam, and developing an expert opinion on the causes of the dam failure.



## Multiple Projects

Tennessee Valley Authority | Tennessee

02/2012 – 09/2012

Mr. Osterle was the project manager for the stability analyses for three earth dams and one concrete gravity dam. The stability analyses required the development of an analysis criteria document, evaluation of soil and rock properties, and documentation and evaluation of the results. The stability analyses for the earth embankment projects included liquefaction analysis and seismic deformation analysis, and the concrete gravity dam analysis included evaluation of seismic load cases.

## Safe Harbor Dam | Inspection for Remediation Plan

Safe Harbor Water Power Corporation | Conestoga, Pennsylvania

04/2012 – 08/2012

Mr. Osterle was the project manager for this project, which consisted of a visual inspection of the downstream T-beam along the Safe Harbor Dam for the purposes of developing a remediation plan to rehabilitate the structures. The project included performing a detailed structural analysis of the T-beam on various loading conditions and levels of demolition to develop a design and plan for remediating each T-beam section according to the level of need.

## Santee Cooper Hydroelectric Project Part 12D Inspection

Santee Cooper | Moncks Corner, South Carolina

10/2011 – 04/2012

Mr. Osterle is the independent consultant for this project and conducted the Tenth Part 12D Safety Inspection of the 40 miles of dams and dikes, hydroelectric facility, and lock facility.

## Dry Comal County Creek Flood Retarding Structure | Vibration Evaluation | Design Review

Comal County, Texas

08/2010 – 04/2012

Mr. Osterle provided design review services for the proposed Dry Comal Creek Flood Retarding Structure (DCCFRS) located in Comal County Texas. The DCCFRS is a 70-foot high RCC dam currently under construction. The dam will be used for flood protection. The excavation for the foundation of the dam revealed that the subsurface conditions were not consistent with the design assumptions utilized by the original designer. Therefore, the construction was stopped pending a substantial re-design of the dam to address the actual subsurface conditions at the site. Comal County has subsequently terminated their agreement with the original designer and has hired another firm to complete the redesign of the dam. RIZZO is responsible for performing an independent design review of both the original and the revised dam designs. Mr. Osterle is the project manager and lead investigator for the project.

## Blue Ridge Dam and Appurtenances

Tennessee Valley Authority | Blue Ridge, Georgia

2003 – 02/2012

Mr. Osterle is the project manager for this project, which consists of the inspection and remedial design the intake tower, steel-lined penstock, and embankment dam. He is also the project manager for the construction services provided by RIZZO during construction. His responsibilities include: conducting the penstock inspection including a subsurface investigation, preparing work plans and reports, developing design drawings and specifications, and preparing invoices. Mr. Osterle was also responsible for the design of the dewatering system required for construction.

## Rommel Dam | Part 12D Inspection

Entergy Arkansas | Little Rock, Arkansas

06/2011 – 11/2011

Mr. Osterle was the independent consultant for this project and conducted the Tenth Part 12D Safety Inspection of the dam and hydroelectric facility. Rommel Dam is a modified slab and buttress dam located near Hot Springs, Arkansas.



### **Taum Sauk Penstock Liner Replacement**

Ameren Missouri | Lesterville, Missouri

2008 – 2009

Mr. Osterle assisted in the preparation of the preliminary engineering evaluation and conceptual design of the steel liner for the Taum Sauk project.

### **Church Mountain Pumped Storage Facility**

Ameren Missouri | Lesterville, Missouri

2008

Mr. Osterle assisted in the preparation of a revised conceptual design and associated cost estimate for the proposed pumped storage facility located near the existing Taum Sauk Plant in Missouri.

### **Keokuk Dam**

Ameren Missouri | Keokuk, Iowa

2006

Mr. Osterle assisted in the design of a reinforced concrete scour protection structure for the toe of the existing Keokuk Dam located on the Mississippi River. His responsibilities included performing a field inspection during construction of two of the structures.

### **Silver Lake Hydroelectric Dam**

Wisconsin Public Service Corporation (previously Upper Peninsula Power Company) | Marquette, Michigan

2005 – 2008

Mr. Osterle was the assistant project manager responsible for developing 50% design drawings and specifications for the rebuild of the Silver Lake Dam on the Dead River. RIZZO was the engineer-of-record and was responsible for the preliminary studies, modeling, 100% design, and construction oversight.

### **Santee Cooper Upstream Slope Protection**

Santee Cooper | Moncks Corner, South Carolina

2005 – 2006

Mr. Osterle served as project manager for the Santee Cooper Upstream Slope Protection Project, where he was in charge of performing an extensive upstream slope protection analysis, design, and evaluation, which included an inspection of approximately 24.3 miles of the 41 miles of dams and dikes constructed in 1941 to create Lakes Marion and Moultrie. The objective of the project was to identify the critical sections of the dam that were vulnerable to damage from waves resulting from substantial and extreme wind events, and to develop a probabilistic framework for determining the type and extent of additional slope protection required to minimize the potential for damage that could impact dam safety. The site inspection was used to determine the capacity of the existing slope protection system against waves generated by storms at various recurrence intervals. A probabilistic wind event model was developed by the Atmospheric Technologies Group of the Savannah River National Laboratory. This wind event model was used to perform both historical and design storm wave analysis for the site. The project included physical modeling of various wave protection geometries at Oregon State's O.H. Hinsdale Wave Research facility. The final design of the upstream slope protection was both location and event-specific so that the owner could select the appropriate and cost-effective level of slope protection upgrade to minimize its risk of dam failure from a significant and/or extreme wind event.

### **FERC Operation Inspections**

FERC New York Regional Office

2005 - 2006

Mr. Osterle performed triennial operation inspections for two low-hazard hydroelectric facilities under the jurisdiction of the New York Regional Office of FERC. The work was performed as part of a nation-wide pilot project for FERC. The inspections consisted of a visual inspection of the projects and a review of all available documentation at the facilities and in the FERC New York Regional Office files. Mr. Osterle prepared draft FERC Operation Inspection reports for the projects which addressed dam safety, public safety, security, environmental, and license compliance issues. Final reports were prepared addressing comments provided by FERC. The project also included a project kickoff and project closeout meetings held at the FERC New York Regional Office.



abutment walls and the conversion of the spillway of the dam into a gravity section. Mr. Osterle performed stability analyses, reviewed hydraulic analyses performed by others, and assisted in the preparation of the bid documents.

### **Eastvale Dam**

**Beaver Falls Municipal Authority | Beaver Falls, Pennsylvania**

1993 - 1994

Mr. Osterle was involved in the stability analysis and remedial design of the dam, including the preparation of construction drawings and specifications for bidding purposes. The remedial design consisted of grouting the existing toe buttress with cement grout, constructing a concrete ogee spillway on the grouted toe buttress, and installing post-tensioned anchors in the spillway to ensure stability for large flood flows. He also observed construction activities including grouting, formwork construction, concrete placement, and post-tensioned anchor installation.



### **Osage Anchor Replacement Project | CFD Spillway Analysis**

Ameren Missouri | St. Louis, Missouri

03/2016 – 06/2016

Mr. Edwards reviewed the FLOW-3D computational fluid dynamics model of the Bagnell Dam spillway during probable maximum flood conditions, which was utilized to determine appropriate tailwater conditions for stability analyses and post-tensioned anchor design.

### **Crescent and Vischer Ferry Hydroelectric Projects**

New York Power Authority | White Plains, New York

04/2017 – 05/2017

Following completion of the Federal Energy Regulatory Commission (FERC) Part 12D dam safety inspections and potential failure mode reviews, Mr. Edwards assisted the independent consultant with preparation and review of the Part 12D and supporting technical information document reports for submittal to FERC.

### **Technical Research Paper | Probabilistic Flooding Hazard Assessment for Storm Surge with an Example Based on Historical Water Levels**

Electric Power Research Institute | Palo Alto, California

03/2016 – 07/2016

Mr. Edwards is a project engineer for a technical research paper on development of a storm surge probabilistic flooding hazard assessment (PFHA) which provides an overview of PFHA methodologies and presents an example study. Mr. Edwards was responsible for technical documentation reviews.

### **Diablo Canyon NPP | Flood Calculation Review**

PG&E | ENERCON | California

12/2015 – 01/2016

Mr. Edwards performed technical third-party review for post-Fukushima flooding hazard reevaluation analyses at the Diablo Canyon Nuclear Power Plant. The review focused on the local intense precipitation hazard, with a goal of providing a robust investigation in advance of formal submittal to the U. S. Nuclear Regulatory Commission (USNRC).

### **Comanche Peak NPP Site-Specific PMP Study | Flood Hazard Reevaluation**

Westinghouse Electric Corporation | Somerville County, Texas, US

07/2014 – 09/2016

Mr. Edwards prepared a flood hazard reevaluation report supplement based on revised probable maximum flood, storm surge, and combined event calculations, to document additional refinements and recent responses to USNRC requests for additional information. Mr. Edwards was recently been involved with developing site-specific probable maximum precipitation values including associated temporal distributions.

### **Glenwood Lake Dam | Breach Inundation Mapping**

City of New Rochelle | Westchester County, New York

06/2015 – 11/2015

Mr. Edwards completed a breach analysis and produced inundation mapping. Due to the flat topography and urbanized nature of the area, a two-dimensional model was utilized to determine extents of inundation and evaluate time lag between failure and inundation. Hydrological analysis was also completed to determine the inflow to the lake during flood events.

### **Larchmont Dam | Engineering Assessment**

Village of Larchmont | Westchester County, New York

06/2015 – 11/2015

Mr. Edwards developed a hydrologic model to simulate runoff from the upstream watershed and determine the spillway design flood based on updated rainfall data, using HEC-HMS to calculate flood flows, and represent upstream lakes and dams. The results were presented in a hydrologic and hydraulic analysis calculation which was used to support the engineering assessment of the dam.



## PREVIOUS EXPERIENCE

### URS Infrastructure & Environment UK

London | Bristol, UK

09/2007– 11/2013

Mr. Edwards, as a senior flood risk consultant, was responsible for construction, and development of a variety of fluvial, coastal, and direct rainfall hydrologic and hydraulic models. He also completed numerous site-specific and district-wide flood risk assessments and technical investigations for public and private sector client organizations. Mr. Edwards was responsible for detailed design of flood alleviation scheme elements including production of engineering calculations, design verification, supervision of drawing packages and production of specification documents. He experienced project manager throughout the complete project lifecycle from initial tender submission through to completion. Ability to deliver cost-effective and timely project completion to meet or exceed client expectations. Mr. Edwards also has effective written and oral communicator with clear and concise reporting skills, in addition to excellent client management skills, which enable relationships to be built and developed to generate additional/future project work, Mr. Edwards worked on projects such as:

#### Flood Alleviation Scheme Detailed Design (2011 - 2012)

Detailed design of channel widening and upstream storage elements of flood alleviation scheme for a licensed nuclear site incorporating sheet pile walls, two stage channels, erosion protection features, stilling basin, riffles, outfalls and ancillary structures. Responsible for design calculations, verification, specification, and production of construction drawing packages.

#### Thames Tunnel River Wandle Hydraulic Modeling (2011 - 2012)

Lead modeler for the development of a 1D-2D linked hydraulic model of the River Wandle using ISIS and TuFLOW software to assess implications on floodplain storage and conveyance resulting from construction of a combined sewer overflow interception in King George's Park. As lead modeler, Mr. Edwards was responsible for ongoing liaison and communication with the project design team and numerous stakeholders to collaboratively develop the site's design and mitigation measures in the context of significant environmental constraints.

#### Flood Alleviation Scheme Modeling and Optioneering (2010 - 2011)

Construction and development of 1D-2D linked Infoworks ICM model representing river channel, drainage network and floodplain interactions for flood alleviation scheme optioneering and outline design works, for a licensed nuclear site.

#### National Reservoir Inundation Mapping Project (2009)

Lead modeler responsible for technical support and quality assurance of over seventy reservoir breach models throughout Thames, Anglian, and North-West regions. Involved with Tuflow model construction, troubleshooting and staff training & support.

### Waterman Civils

London, UK

07/2006– 09/2007

Mr. Edwards, as flood risk engineer, developed flood risk assessments for numerous private sector development sites; including liaison with clients, designers, and statutory planning authorities to determine and agree flood risk design mitigation measures. He also developed cost-effective two-dimensional breach modeling methodology to quantify residual risk to proposed development sites to satisfy planning requirements. Mr. Edwards worked on a project such as:

#### Flood Risk Assessments for Various London Developments (2006 - 2007)

Project manager and lead modeler for numerous flood risk assessments located throughout London. Detailed 2D modeling undertaken to determine residual risk and appropriate land use, based on flood depth and velocity hazard rating. Negotiation and liaison carried out with Environment Agency and local authorities from master planning through to detailed design stage.



Mark A. Schwartz, P.E.

Engineering Supervisor

Years Experience: 23

Level: 7

Education

M.S., Civil Engineering, Auburn University – Auburn, Alabama – 1989

M.S., Agriculture, North Carolina State University – Raleigh, North Carolina – 1983

B.S. Agriculture, University of Florida – Gainesville, Florida – 1980

Professional Registration

Professional Engineer: Colorado (0051376), Florida (0046758), Pennsylvania (084225), Texas (128424)

Publications

Applying Probabilistic Concepts in External Applications at Nuclear Power Plants TopSafe 2017, Vienna Austria, February 12-16, 2017.

Accounting for Uncertainty in Probabilistic Flood Evaluations to Reduce Cost, 10th Nuclear Plants Current Issues Symposium, Charlotte, NC, December 11-14, 2016.

Cost-effective Numerical Modeling for Evaluation of Overtopping Protection Systems, 2nd International Seminar on Dam Protection Against Overtopping, September 7-9, 2016, Fort Collins Colorado.

Hydrodynamic Simulations of Restoration Alternative 1 Tenoroc Fish Management Area, Stormwater Management Conference, Orlando, Florida, December 4-6, 2002.

Integrated Surface and Ground Water Modeling of the Upper Peace River Basin, Land and Water Resource Management, 21st Annual Water Management Seminar, Vail, Colorado, January 2002.

Can Compacted Limestone be Used to Create Water Holding Basins in Reclaimed Jamaican Bauxite Pits? Proceeding of International Workshop on Rehabilitation of Mined Bauxite Lands and Red Mud Disposal Ponds, Jamaica

Skill Areas:

GIS programming
Wind and Wave Analysis
Groundwater Modeling
Fluid Structure Analysis

Surface Water Modeling
Integrate Surface and GW Model
Computation Fluid Dynamics Model
Flood Hazard/Uncertainty Analysis

Mr. Schwartz over twenty years' experience in surface and ground water modeling, integrated surface and ground water modeling, ground water remediation analysis, wind and wave analysis; and computer interface development. His areas of specialization include hydrology, hydrologic modeling, groundwater modeling, GIS, probability hazard assessment, programming, permitting, and project management.

Mr. Schwartz has conducted numerous floodplain analyses, including simulations of embankment erosion and sediment transport, and used statistical methods such as L-Moments to evaluate return period for rainfall and wind events. He has developed, designed, and integrated ground water and surface water flow models to use in wellfield impact, contamination impact, mining impact, dam breach, and floodplain studies.

Mark developed BCIFLO96, an integrated surface and ground water model which links MODFLOW, EXTRAN, and a Geographic Information System (GIS). He also developed numerous tools for GIS to assist in watershed management projects. His program experience includes FORTRAN, VBA, and Python. He as has used ADCRIC, HEC-RAS, HEC-HMS, ICPR, MODFLOW, Mike-She, Runup, and other hydrologic/hydraulic software. He has performed modeling investigations of sites ranging from a few hundred acres to the integration of hydrological components encompassing more than 200 square miles.

Gordon Dam, South Lake Dam, Lake Louise Marie Dam, Conesus WMA

New York State Office of General Services | Albany NY, USA

05/2016 - Present

Mr. Schwartz is using HEC-HMS to calculate runoff discharge to reservoirs upstream of the dam and HEC-RAS was used to simulate and map the extents of flood inundation with breach of the dams. A series of inundation maps appropriate for emergency action planning were developed for these sites.

New York State Canals – Qualitative Screening Level Risk Analysis

New York Power Authority | White Plains, NY USA

05/2018 - Present

Dam safety risk screening was performed for structures along the New York Barge Canals. The inundation area and hazard assessments were made for potential sunny day breach of structures using structure dimensions, water levels, and water volumes.





**Bruce A&B NPP, External Flooding Hazard**

ERIN, Ontario Power Generation | Ontario, Canada

12/2012 – 06/2014

Mr. Schwartz has provided technical review, implemented numerical modeling, and assisted in probabilistic hazard assessments in support of a Flood Hazard Evaluation Report for Bruce A and B Power Plants. The work was evaluated based on hydrological-related site characteristics, performance requirements, and bases for operation of Structures, Systems, and Components (SSCs) important to safety. All of the flood reevaluation is performed according to the guidance and requirements of NRC's NTTF Recommendation 2.1 and NUREG/CR 7046. The software used for this Flood Hazard Evaluation includes HEC-RAS, HEC-HMS, and Delft 3-D. The Flow and SWAN components of Delft 3-D are used for the storm surge evaluation.

**Callaway 1 NPP, Flood Hazard Reevaluation**

Westinghouse Electric Corporation | Callaway, Missouri, USA

11/2012- 02/2014

Mr. Schwartz has provided technical review of numerical modeling conduct in support of the Flood Hazard evaluation Work Plans for Callaway Energy Unit 1.

**Point Beach NPP Units 1&2 Flood Hazard Reevaluation**

NextEra Energy Resources, LLC | Wisconsin, USA

06/2013 – 07/2013

A Flood Hazard Reevaluation was performed by another engineering firm. RIZZO conducted an independent review on their deliverables. Mr. Schwartz developed a water balance model for Lake Michigan-Huron as part of this review.

**PREVIOUS EXPERIENCE:**

**Senior Water Resources Engineer**

AMEC Environmental Infrastructure | Lakeland, Florida

1997 – 2012

Mr. Schwartz used ADCIRC and other wind and wave analyses as part of a levee certification projects.

He has modeled floodplain extents caused by potential dam failures at reservoirs in satisfaction of the minimum requirements for earthen dams as specified in 62-672.550 of the FAC.

Mr. Schwartz uses computerized data management systems, including GIS and performs computer analysis on a wide variety of hydrologic problems. He has also assisted in data collection for long-term aquifer tests, ground water monitoring programs, and other field investigations.

He has used two-dimensional finite element programs to estimate the rates of seepage and potential effectiveness of dam seepage management for earthen embankments.

Mr. Schwartz modeled the hydrology of about 140-square miles of the upper Withlocochee and Ocklawaha Rivers as part of an investigation to determine potential impacts of sand mining in the Green Swamp area of Florida.

Mr. Schwartz modeled the hydrology of about 5-square-miles of the Upper Peace River as part of the permitting process required for drainage improvements in the Winter Haven area of Florida. The hydrologic modeling was used in this project to determine the potential downstream impacts especially of wetland hydrology caused by drainage improvements around lakes upstream of Lake Hancock.

Mr. Schwartz calibrated and verified single event and long-term (one to two years) hydrology of clay settling areas within the phosphate mining area of central and north Florida. This project funded by the Florida Institute of Phosphate Research (FIPR) was in part used to develop model parameters that better represent the hydrology of the mined areas and to aid in developing methods to better reclaim these areas.



Juan J. Gutierrez, Ph.D., P.E.

Senior Engineering Associate

### Years Experience

8 Years

### Level

8

### Education

Ph.D., Civil Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania – 2010

M.S., Civil Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania – 2008

B.S. Civil Engineering, Universidad de los Andes, Bogotá, Colombia – 2003

### Professional Registrations

Professional Engineer (PE) – Pennsylvania – 2015, #PED083775

### Awards

Outstanding Student Research Paper Award, American Society of Civil Engineers, Pittsburgh Geological Society, Association of Environmental and Engineering Geologists – 2010

### Publications

El Ganainy, H., Demirkan, M.M., Gutierrez, J.J., Ramanathan, R., Hatpoglu, B., Adib, M.E., Barton, D. (2015), Stability of Solution Cavities in Urban Developments: A Case Study Towards Enhancing Geohazard Risk Assessment, *Geotechnical and Geological Engineering*, Springer Vol. 34, Issue 1, pp 125-141.

Gap, Y., Ramanathan, R., Hatpoglu, B., Demirkan, M.M., Adib, M.E., Gutierrez, J.J., El Ganainy, H., Barton Jr, D. (2015), Development of Cavity Probability Map for Abu Dhabi Municipality Using GIS and Decision Tree Modeling, 14<sup>th</sup> Sinkhole Conference NCKRI Symposium 5.

### Skill Areas:

Soil-Structure Interaction  
Mine Subsidence  
Foundation Engineering  
Groundwater Hydrology

Soil Mechanics  
Slope Stability  
Finite Element Modeling  
Tunnel Engineering

Dr. Juan J. Gutierrez, P.E. is a Senior Engineering Associate with RIZZO. He has over 8 years of experience in soil mechanics and foundation engineering. He has designed and coordinated Field Investigation Programs involving drilling, SPT testing/sampling, Cone Penetration Testing (CPT), Pressuremeter Testing (PMT) and geophysical testing. Dr. Gutierrez has analyzed the results of the programs and performed settlement and liquefaction analyses. He has performed seismic soil – structure interaction numerical modeling and design tunnel support systems. His experience includes the following: soil retaining structures and slope stability, water seepage, rock mechanics, seismic soil-structure interaction, tunnel design, and numerical methods applied to geotechnical problems along with various computer programs such as Plaxis 3D, SASSI, FLAC 3D, LS-DYNA and Slope/W.

### NYPA Canal Embankment Evaluations | Dams and Water Resources

NYS Canal Corporation | Albany, New York  
08/2017 – Present

Dr. Gutierrez has been involved in the evaluation of canal embankments of the Erie Canal in New York State. His involvement includes detailed physical inspections of the embankments and associated reports.

### Middle East Power Plant | Soil Improvement

RIZZO Associates SCARL | Genoa | Italy  
01/2017 – Present

Dr. Gutierrez developed specifications for deep soil mixing (DSM) and jet grouting (JG). Two specifications were developed, one for a field validation test section and one for construction. In addition, Dr. Gutierrez is actively involved in planning and oversight of the laboratory bench scale testing program.

### Sweetheart Lake Hydroelectric Development | Geological Evaluation and Geotechnical Design Report | Power and Diversion Tunnels

Juneau Hydropower, Inc. | Juneau, Alaska  
11/2016 – Present

Dr. Gutierrez designed tunnel support systems for the Power and Diversion Tunnels and contributed in defining the scope of additional geotechnical field investigations. Dr. Gutierrez produced calculations based on the Q-system for tunnel supports and reviewed calculations based on the convergence-confinement methodology.



### Publications (continued)

Gutierrez, J.J., Vallejo, J.S. Lin (2010). *A Study of Highway Subsidence Due to Longwall Mining Using Data Collected from I-79*. Prepared for the Pennsylvania Department of Transportation.

J. Gutierrez, J.J., L.E. Vallejo, and C.I. Garcia (2008). *The Hydraulic Conductivity of Sands with Dispersed Oversized Particles*. 17<sup>th</sup> International Conference on Soil Mechanics and Geotechnical Engineering, October 5-9, Alexandria, Egypt.

### Software

Plaxis Foundation 3D  
Plaxis 2D  
ACS-SASSI  
LS-DYNA  
FLAC3D

### Ameren Pawnee Buildings | Subsidence Evaluation | Mine Subsidence Analysis

Ameren Services Company | Pawnee, Illinois | United States  
06/2016

Dr. Gutierrez performed mine subsidence analysis and predicted differential settlements for Ameren buildings in Pawnee, Illinois.

### Christchurch Sample Testing

Robertson and Company | Christchurch, New Zealand  
01/2014 – 12/2015

Dr. Gutierrez developed three-dimensional numerical models of foundation beams and slabs supported on soils reinforced with stone columns as part of an investigation on bearing capacity and demand of the reinforcing elements. Dr. Gutierrez also assisted the client in reviewing numerous technical reports to obtain a more complete understanding of the structural behavior of damaged buildings.

### Geotechnical, Geophysical, and Hydrogeological Investigation Project (GGHIP) | Geotechnical Analysis

Abu Dhabi City Municipality (ADM) | Abu Dhabi | United Arab Emirates  
09/2013 – 04/2015

Dr. Gutierrez reviewed numerical cavity collapse models; developed dewatering guidelines for Abu Dhabi Municipality; was actively involved in an integrated geohazard evaluation and preliminary risk map development; contributed to developing terms of reference for further field investigation.

### Siemens Wind Turbines | Foundation Design

Siemens | Orlando, Florida | United States  
11/2014 – 11/2014

Dr. Gutierrez provided preliminary foundation design for concrete towers under various soil and rock conditions.

### Kozloduy NPP | Due Diligence

Westinghouse Electric Company, LLC | Kozloduy | Bulgaria  
01/2014 – 06/2014

Dr. Gutierrez was actively involved in due diligence support for KNPP, in aspects such as excavation schemes, cooling water capabilities, dewatering needs, soil quality, site grade, and environmental considerations.

### Christchurch Central Library | Geotechnical and Structural Analysis

Robertson & Co. | Christchurch | Canterbury, New Zealand  
09/2013 – 11/2013

Dr. Gutierrez reviewed geotechnical calculations including settlement and liquefaction analyses.

### Christchurch Art Gallery | Geotechnical and Structural Analysis

Robertson & Co. | Christchurch | Canterbury, New Zealand  
04/2013 – 07/2013

Dr. Gutierrez designed and coordinated a field investigation program for the Site. The field investigation program involved drilling, SPT testing/sampling, Core Penetration Testing (CPT) and MASW soundings. Dr. Gutierrez analyzed the results of the field investigation program and performed settlement and liquefaction analyses.



A. Hans Hasnay, P.E.

Vice President / New York Regional Manager

**Years Experience**  
40+

**Level**  
11

**Education**  
B.S. Civil and Environmental Engineering, Clarkson University – 1976

**Professional Registrations/Certifications**  
Professional Engineer, New York PE #60329 1983, New Jersey and Pennsylvania

**Professional Affiliations**  
American Society of Civil Engineers  
Association of State Dam Safety Officials

**Skill Areas:**

- Dam, Hydro, and Power Plant Inspections
- Penstocks & Outlets Works
- Electrical Substations
- Water and Wastewater Treatment
- Hydroelectric Facilities
- Transmission Structures
- Structural Engineering
- Fossil Fuel Plants
- Gas Turbine Generators

Mr. Hasnay has over 40 years of experience on a wide variety of engineering projects. He has an extensive electric utility background including the design, construction, inspection, and management of major projects associated with fossil fuel plants, hydroelectric facilities, gas turbine generators, transmission structures, electrical substations, water and wastewater treatment facilities, and industrial buildings.

Prior to joining RIZZO, Mr. Hasnay was employed for 15 years by a major New York metropolitan area electric and gas utility. He served in a variety of roles including: Manager, Hydro, and Gas Turbine Generation; Supervisor, Power Development; and Senior Civil Engineer. His responsibilities included the operation and maintenance of several hydro and gas turbine generation facilities, the design, and construction of major new electrical substations, transmission system upgrades, dam stabilization projects and generating facility improvements.

Mr. Hasnay is an approved FERC Part 12D Independent Consultant. He has over 20 years of experience in the inspection of dams, gates, penstocks and other associated equipment. Mr. Hasnay was part of the RIZZO team that performed 25 low hazard inspections under direct contract with FERC. Mr. Hasnay performed inspections in Alaska, New Hampshire, New Jersey, New York, Vermont, and Washington.

Mr. Hasnay's engineering experience includes preparation of bid documents (calculations, drawings and specifications); Coordinating the FERC licensing effort for three hydroelectric facilities; project presentation to State and Federal Regulatory Agencies and Local Town Planning and Zoning Boards; preparation of construction cost estimates; overseeing construction for various projects; and development of detailed engineering reports.

**New York State Canal Corporation – Qualitative Screening-Level Risk Analysis Evaluation for Water-Impounding Structures**

Various Locations Statewide | New York

9/2016 – Present

Mr. Hasnay is the Project Manager for Qualitative Screening-Level Risk Analysis (QSLRA) Evaluation for Water-Impounding Structures. Assignments included: develop a QSLRA for more than 600 structures on the New York State Canal System. Additional work consisted of performing NYSDEC based hazard classifications for 34 structures; evaluating public benefit and use reports for the large off channel reservoirs and performing Potential Failure Mode Analysis for the higher risk structures.

**Lake Louise Marie Dam (LLM) Dam Rehabilitation**

Rock Hill, New York

2014 – Present

Mr. Hasnay was the Project Manager for LLM Dam rehabilitation. The project included Analysis, Design, and Construction Documents for the necessary improvements to the Class "C" High-hazard Dam. The dam is approximately 900 feet long with a maximum height of 15 feet. The project included improvements to the existing service spillway; construction of a new concrete auxiliary spillway and a new low-level outlet facility.



### **Mongaup Falls Dam | Part 12D Inspection**

Alliance Energy Renewables (AER) NY-Gen, LLC | Lumberland, New York

08/2009 – Present

Mr. Hasnay was the Independent Consultant for the Mongaup Falls Project. Part 12D dam safety inspections are conducted every five years in accordance with the dam safety program required for projects regulated by the FERC. He performed detailed site inspections, reviewed the available hydraulic and structural data, verified the stability analysis for the structures, and prepared detailed reports for submission to FERC.

### **Browns Dam Upgrade**

First Taxing District | City of Norwalk, Connecticut | Lewisboro, New York

09/2008 – 5/2015

Mr. Hasnay is the Project Manager for the Browns Dam Upgrade. Design work includes raising and stabilization of the downstream slope of the 1,200 ft. long, by 60 ft. high earthen embankment; upgrade of the outlet works, including a new gate house; valve replacement and automation; new security systems; and a new stilling basin. In addition, the 226 ft. concrete spillway is being stabilized and modified to pass the ½ PMR spillway design flood.

### **Crescent and Vischer Ferry Hydroelectric Project**

New York Power Authority | White Plains, New York

8/2016 – 11/2016

Mr. Hasnay is the lead structural and operations expert for the FERC Part 12D dam safety inspection and PFM review for these two High Hazard hydroelectric projects on the Mohawk River in upstate New York. He is supporting the approved Independent Consultant with the review of the stability analysis for the project structures, assessment of the condition of the dams and gates and evaluation of the operation of the facilities.

### **Minisceongo Creek Utility Crossing | Stream Restoration**

GenOn Bowline, LLC | Haverstraw, New York

08/2011 – 9/2012

On August 29, 2011 the utility crossing that provides natural gas to the 1,200 MW Bowline Power Plant and brings power out to the grid was compromised by Tropical Storm Irene. A fifty foot high cut in the embankment exposed the crossing which consists of two 345 KV transmission lines and a 16" and 14" high pressure gas lines. Both gas lines were damaged and had to be replaced and one of the 345 KV transmission lines needed extensive repairs. Mr. Hasnay led the RIZZO team that designed the fortification of the crossing, obtained permits, and coordinated the repair. The fortification included a large concrete buttress, hardening of the streambed and the addition of grouted rip-rap on either side of the stream. RIZZO designed the three phase cofferdam system required to repair and protect the utilities as they cross the stream and to install the hardening facilities. The total cost of the project will exceed \$20 million.

### **Blenheim-Gilboa Lower Dam | Evaluation and Upgrade**

New York Power Authority | Blenheim, New York

03/2009 – 02/2012

Mr. Hasnay led the effort that included re-analysis of stability for both the concrete spillway section and the right earthen embankment of the lower dam at the 1,000 MW Blenheim-Gilboa Pumped Storage Generating Facility. NYPA had previously determined a new and larger PMF for the Dam requiring the re-analysis of the safety factors and raising a portion of the crest to accommodate the revised storm flows. RIZZO designed and detailed the modifications to the Dam and provide engineering services during construction.

### **Blue Ridge Dam and Appurtenances**

Tennessee Valley Authority | Blue Ridge, Georgia

04/2003 – 2012

Mr. Hasnay was the Project Manager on this multi-faceted upgrade at TVA's Blue Ridge Generating Facility. Work included a comprehensive inspection of the facility including a geotechnical program, complete inspection of the 900-foot-long, 14 foot diameter penstock, and 170 foot tall intake tower. Remediation work will include



correlation and time-history curves for the monitoring data; performed the preliminary evaluation of the monitoring data; and directly supervised the preparation of the dam stability calculations. He checked the final calculations prior to submittal to the Owner.

### **Ameren Dam Safety Program Development**

**Ameren Missouri | St. Louis, Missouri**

05/2006 – 2010

Mr. Hasnay managed the long-term development program that establishes a formal dam safety program for the Ameren Corporation in St. Louis Missouri. The program will include the development of a dam safety inspection plan for each dam owned by the utilities, a detailed instrumentation and monitoring plan for the facilities and the development of mandatory dam safety training for the operating personnel.

### **Bear Creek Dam Remediation | Design and Construction Support**

**Tennessee Valley Authority | Hodges, Alabama**

04/2003 – 2009

RIZZO was selected to investigate, design, and provide oversight for the construction of this project. Mr. Hasnay worked on the gallery design, the retaining wall concepts along the spillway and the beams spanning the existing discharge channel. RIZZO's responsibilities include: preparing reports, work plans, cost estimates, and technical specifications; performing stability analyses for the dam; developing design drawings; and managing the overall preparation of all design documents.

### **Ogdensburg and Kayuta Dams | Part 12 Inspections**

**Algonquin Power Systems, Inc. | Upstate New York**

03/2008 – 12/2008

Mr. Hasnay was the Approved FERC Independent Consultant to perform the Part 12 Dam Safety Inspections on FERC regulated High Hazard Classification Dams. He performed detailed site inspections of the Ogdensburg and Kayuta facilities, reviewed the available hydraulic and structural data, developed updated stability analysis for some of the structures, and prepared detailed reports for submission to FERC.

### **Pleasure Lake Dam Upgrade**

**Fallsburg Fishing and Boating Club | Thompsonville, New York**

09/2002 – 10/2008

As Project Manager, Mr. Hasnay was responsible for upgrade of the existing emergency spillway and structural stabilization of existing primary spillway for this earth fill dam in Sullivan County New York. Mr. Hasnay conducted a comprehensive inspection of the dam and outlet works, supervised the geotechnical exploration, and prepared a detailed analysis and design report for submission to the NYSDEC. In addition, the work included a complete hydrologic/hydraulic study, dam break analysis, development of a site specific Inflow design Flood (IDF) and NYSDEC permitting.

### **Osage Head Gate Upgrade**

**Ameren Missouri | Lake of the Ozarks, Missouri**

08/2007 – 02/2008

Mr. Hasnay was Project Manager for the evaluation of the existing 26'x 26' head gates at the Ameren operated Osage Hydroelectric Facility. Work included an inspection of existing conditions, design of a new vertical rolling head gate, including updated designs for the seals and wheel assemblies, preparation of design drawings and specifications, and development of a QCIP for FERC submittal.

### **Taum Sauk Upper Reservoir | Inundation Maps**

**Ameren Missouri | Lesterville, Missouri**

03/2007 – 02/2008

Mr. Hasnay was responsible for the development of new inundation maps for the Taum Sauk Project. Ortho maps were developed based on new dam break runs for both the lower and upper reservoirs. In addition, GIS data was developed for submission to the FERC.



### **Willow Brook Dam | EAP and Dambreak Study**

Monroe, New York

04/2004 – 12/2004

As Project Manager, Mr. Hasnay was responsible for the update of Emergency Action Plan for the Willow Brook Dam. Work included running a new dam break analysis and developing enhanced inundation and evacuation maps for the basin, and developing response procedures for the dam operators.

### **PREVIOUS EXPERIENCE**

#### **Mongaup Basin Project Downstream Hazard Reduction Program**

Sullivan County, New York

05/1995 – 01/1998

Mr. Hasnay served as the Project Manager in charge of developing detailed inundation mapping of the area downstream of three high hazard dams, and the subsequent acquisition of 14 private residences and 3 commercial business properties. The dams did not meet FERC requirements for spillway capacity under the PMF. In negotiations with FERC staff, it was agreed that a program of property acquisition and an enhanced Emergency Action Plan would be implemented to reduce the hazard classification of the dams from "high" to "significant." The project resulted in estimated savings of \$5 million.

#### **Rio Dam Upgrade**

Orange & Rockland Utilities | Sullivan County, New York

01/1994 – 04/1997

As Project Engineer, Mr. Hasnay was in charge of directing the efforts of three separate consulting firms, four contractors, and the owner's operating and maintenance personnel in the upgrade of the concrete overflow and earthen abutment section of the 90-foot high Rio Dam. Mr. Hasnay's work included an extensive geotechnical investigation, and seismic and stability analysis. The concrete overflow section upgrade included a rock anchor system that ranked among the largest available.

#### **Swinging Bridge**

Orange & Rockland Utilities | Sullivan County, New York

12/1992 – 12/1993

As Project Manager, Mr. Hasnay was responsible for the event investigation and repair of the 1993 Penstock buckle at the Swinging Bridge Hydroelectric Project. He lead the investigation effort which included and extensive condition inspection; a detailed geometric survey; and an in depth geotechnical investigation. The remediation included repair of the bulge, installation of a pressure relief system and developing a monitoring and dewatering plan.

#### **New Jersey Flood Control Project**

Lower Montville | Montville, New Jersey

01/1984 – 10/1987

Mr. Hasnay was Senior Project Engineer on the Lower Montville, New Jersey Flood Control Project. He was responsible for the design of a new 1,800 foot long earthfill dike with a maximum height of 35 feet. The project included a concrete spillway and an inline pumping station. The purpose of the project was to prevent flood waters from the Rockaway River from inundated a populated area in the southeast corner of the Town. Mr. Hasnay developed the dike design, performed the stability analysis for the dike and the structural analysis for the pumping station incorporated into the dike. In addition, he was responsible for the development of construction drawings and permit applications.



### Publications (continued)

Zullo, E.G., "Ground Motion Amplification Studies for Sites in the Charleston Area," Proceedings, Third U.S. National Conference on Earthquake Engineering, Charleston, SC, Volume 1, pp. 333-344

Zullo, E.G., D. Lange, "Landfill Leachate Recirculation Design in Mexico," Proceedings from Wastecon 1995, SWANA's 33rd Annual International Solid Waste Exposition, Baltimore, MD, pp. 21-30

the contractor for compliance with the contract documents. Mr. Zullo notified the construction manager of compliance or non-compliance, and recommended approval or rejection of the contractors' submittals to the construction manager.

### NYS Canal Corporation Qualitative Screening Level Risk

NYPA | New York  
9/2016 – 11/2016

The canal system is a navigable 524 mile waterway that spans upstate New York. Mr. Zullo performed a dam safety risk screening of 350 NYS Canal Corporation water impounding structures. A matrix of basic information needed to perform risk screening, e.g., location, coordinates, physical characteristics, structure age, last major overhaul (if known), hazard class, maintenance history, dam safety related findings of previous inspections, date of last inspection, potential failure modes, whether a surveillance and monitoring plan exists, whether the structure has an emergency action plan, inflow design flood, etc., was compiled..

### NYS Canal Corporation Dam Safety Program

NYPA | New York  
9/2016 – 11/2016

Mr. Zullo evaluated the NYS Canal Corporation's Safety Program based on interviews conducted at several locations throughout the Erie Canal system. He documented results of the interviews into the Center for Energy Advancement through Technological Innovation (CEATI) Maturity Matrix containing 10 factors of the dam safety. The factors were graded at 5 levels of maturity from "Needing Development" to "Leading Edge." Based on this evaluation, recommendations were made to improve safety operations of the existing organization. A new Owners Dam Safety Plan was developed for the organization.

### East Branch Dam | Drilling and Grouting

Bencor, Inc. | Pennsylvania  
1/2016 – 3/2016

Mr. Zullo oversaw exploratory drilling, logging and grouting borings at the East Branch Dam, owned by the U.S. Army Corps of Engineers, near Wilcox, Pennsylvania. The project involved drilling two rows of borings through the embankment and into the rock to prevent slurry loss of during barrier wall construction. A hydro-mill machine will form a concrete wall within the dam to a depth of 300 feet to prevent leakage and possible failure of the dam.

### Rough River Dam | Exploratory Drilling and Grouting

Advance Construction Techniques, Inc. | Kentucky  
1/2016 – 3/2016

Mr. Zullo oversaw exploratory drilling, logging and grouting borings at the Rough River Dam, owned by the U.S. Army Corps of Engineers, near Falls of Rough, Kentucky. The project involves grouting foundation rock of a dam with solution cavities in the underlying limestone foundation to prevent leakage and dam failure.

### Taum Sauk Upper Reservoir | Forensic Investigation | Rebuild

Ameren Missouri | Lesterville, Missouri  
01/2006 – 01/2007

Mr. Zullo reviewed the field geotechnical program, blasting program, and grouting program. He developed proposed excavation cross-sections based on the boring data. Construction costs and schedule, as well as potential regulatory challenges with each option, were fully evaluated by RIZZO. The rebuild of the dam consisted of the construction of a roller-compacted concrete (RCC) dam approximately 100 feet high and 6,600 feet long, consisting of 2,838,215 cubic yards of RCC. Construction commenced in 2007 and was completed in 2010.





### **Fairfield Dam**

**South Carolina Electric & Gas Company | South Carolina**

07/1987 – 12/1987

As civil engineer, Mr. Zullo performed the stability analysis of a concrete intake structure of the dam. He evaluated the structure for overturning, sliding and soil bearing capacity under various water conditions.

### **Youghiogeny Hydroelectric Plant**

**D/R Hydro | Confluence, Pennsylvania**

06/1984 – 12/1986

As geotechnical engineer, Mr. Zullo performed geotechnical engineering calculations related to tap-in of a new penstock to the existing outlet tunnel. He interpreted soil and rock laboratory data and utilized it in slope stability and foundation analyses. He designed a rock and soil cofferdam and associated dewatering system so that construction of the powerhouse could be performed "in the dry." Mr. Zullo designed a pumping system that was used to dewater the draft tubes of the turbines for maintenance activities. He also performed the field investigation for the design of the access road, and performed stability analysis of the road embankments.

### **Columbia Dam**

**South Carolina Electric & Gas | South Carolina, Columbia, South Carolina**

12/1984 – 04/1985

As senior project engineer, Mr. Zullo used streamflow data and the log Pearson Type III distribution to determine the probability of flood events. The scope of this project entailed converting a timber crib to a gravity dam. He also calculated upstream and downstream water level stability of the dam under several different flood events. Mr. Zullo also prepared construction drawings and specifications for the repair of the dam.



### **East Branch Clarion River Lake Dam Project**

Bencor Global, Inc. | Wilcox, Pennsylvania

3/2016 – 6/2016

Mr. Matthews, in his role as Qualified Drilling Inspector, assists in all the sonic drilling and samples description, as well as initial stage and following multistage grouting of embankment, foundation soils and rock interface, in the field investigation for the Army Corps of Engineers Pittsburgh District East Branch Interim Risk Reduction Project.

### **Muddy Run Pumped Storage Facility**

Exelon Power | Susquehanna River, Drumore Township, PA

05/2015 – Present

Mr. Matthews performed an evaluation of the current Upper Reservoir Embankment (Main Dam) monitoring Instrumentation system at Muddy Run. The review included design documents, construction history, operation history, dam safety monitoring program and data. Site visits include interviews with on-site personnel, a visual inspection of the dam instrumentation and review of the real time monitoring output in the operations area. Reports reviewed consist of the Part 12D Safety Inspection Report, Supporting Technical Information Document, Dam Safety Surveillance and Monitoring Plan, Dam Safety Surveillance & Monitoring Report, Federal Energy Regulatory Commission Operations Reports, and Correspondence provided by the client. RIZZO made several recommendations for the existing monitoring program and recommendations for a new monitoring program including types of instrumentation, recommendations for reduction of failures during lightning strikes and how the output of the information is displayed.

### **Bloomsburg Flood Control Project**

Borton-Lawson Engineering, Inc. | Bloomsburg, Pennsylvania USA

11/2013 – 05/2015

Mr. Matthews as a Project Engineer Associate, provided construction support services during the site field investigation program as well as geotechnical design services. The geotechnical investigation was completed in 2 phases, with 12 borings being completed during phase 1 and 28 borings completed during phase 2. The findings contributed to the final flood wall design for the Project. Mr. Matthews developed daily reports, chose samples for laboratory testing, and developed profiles for future use. He also contributed to the Draft and Final Subsurface Investigation Reports to the client. Currently Mr. Matthews has been retained to perform field classifications of materials to confirm the slurry wall is keyed into competent material and meets the design intent.

### **Gouldsboro Park Dam | Geotechnical Investigation**

PA Department of General Services

04/2015 – Present

Mr. Matthews is assisting with the design and analysis for this spillway upgrade project. His responsibilities include preparing and updating a Primavera schedule, overseeing the geotechnical investigation and preparing the geotechnical report, and developing quantities and cost estimates. The geotech investigation included SPT and auger borings, rock coring, and laboratory testing.

### **Flower Creek Dam | Design**

Morrison-Maierle, Inc. | Libby, Montana USA

01/2013 – 03/2016

Mr. Matthews, as a Project Engineer Associate, performed the initial paper mix design for the mass concrete for Flower Creek. He also reviewed results and updated the mixes as information was supplied. Mr. Matthews also prepared specifications for mass concrete, foundation preparation, expansion joints, and formwork.

### **Spring Grove | Mill Dam**

P.H. Glatfelter Company | York County, Pennsylvania USA

10/2012 – 2014

Mr. Matthews was chosen to perform Quality Control for the Abutment Wall Grouting Program at this site. The program included primary and additional secondary holes, changes to the mix designs in the field as conditions warranted and a structural component to the grouting effort. He also oversaw the grouting contractor, prepared daily field and progress reports, lead team meetings, acted as a liaison between the contractor and the client



State Canal Corporation Lock E-7. On August 28, 2011, Tropical Storm Irene produced significant rainfall and the resulting peak headwater at the dam reached a record creating seepage along the embankment and a potential risk of failure. RIZZO was retained to upgrade this embankment.

### **Browns Reservoir Dam**

Norwalk First District Water Department | Lewisboro, New York USA

05/2012 – 08/2012

Mr. Matthews is currently reviewing submittal packages from the Contractor for this project. Design work for the Browns Reservoir Dam includes raising and stabilization of the downstream slope of the 1,200 ft. long, by 60 ft. high earthen embankment; upgrade of the outlet works, including a new gate house; valve replacement and automation; new security systems; and a new stilling basin. In addition, the 226 ft. concrete spillway is being stabilized and modified to pass the ½ PMR spillway design flood.

### **Mongaup Falls Dam**

Eagle Creek | Forestburgh, New York USA

05/2012 – 06/2012

Mr. Matthews was the onsite Construction Manager for this project. His responsibilities included the oversight of four geotechnical borings, the installation of 2 vibrating wire piezometers, and the installation of 15 toe drains drilled at a 60 degree angle to the vertical to help reduce uplift pressures under the dam, and the preparation of daily logs, cost estimates, and project closeout. The project finished on schedule and under budget.

### **Blue Ridge Dam**

Tennessee Valley Authority | Georgia USA

06/2007 – 11/2007 | 06/2010 – 04/2012

Mr. Matthews developed design drawings, prepared specifications and cost estimates, and developed preliminary construction schedules utilizing Primavera scheduling software. He also performed Quality Control Services for the Blue Ridge Dam. This includes Rock Criteria Acceptance, field activities and site meetings.

### **Thorn Run Dam | Rehabilitation**

Golden Triangle Construction | Butler, Pennsylvania USA

05/2011 – 11/2011

Mr. Matthews served as the RCC Quality Control and Placement Supervisor for the project. This project consisted of placing approximately 13,000 Cubic Yards of RCC to provide overtopping protection for the Dam. His duties included verifying the properties of the RCC through calibration of the pugmill/batch plant and on site laboratory and field testing. He was also responsible for verifying that adequate material was on site for RCC placement and that proper construction techniques and equipment were used to meet job specific specifications. Mr. Matthews also provided daily reports summarizing construction progress and materials used.

### **Wisecarver Reservoir Dam | Rehabilitation and Improvements**

Geotechnics | Franklin County, Pennsylvania USA

06/2011 – 10/2011

Mr. Matthews provided oversight and technical support for the RCC trial mix designs. His duties included setting the initial mix design per job site specifications. He prepared mix designs at Geotechnics laboratory and reviewed materials handling, data and final mix design report. Mr. Matthews provided technical support to the Contractor for onsite testing and inspection and performed combined gradation analysis for pugmill production.

### **Confidential Dam | Construction Oversight**

Washington County | Pennsylvania USA

05/2010 – 12/2010

Mr. Matthews submitted budgetary and engineering estimates for the Confidential Dam which included two phases.

Phase 1 consisted on subcontracting a drilling company and construction materials testing laboratory to perform subsurface exploration, submit boring logs, perform water pressure testing and write a final report including recommendations for Phase 2.



**Mr. Patrick E. Gallagher P.E., CPGS**  
*President – CTL Engineering of West Virginia, Inc.*

Projects successfully completed under Mr. Gallagher's direction include: Civil Site Design, Foundation Design, Storm Water Management, Waste Water Design, Roadway Design, Parking Lot Design, Geotechnical Investigations & Design, Site Stability Analyses, Mine Subsidence Evaluations, Failure Investigations and Environmental Investigations and Expert Witness Testimony. Prior to joining CTL Engineering, Mr. Gallagher was the chief of the Abandoned Mine

Reclamation Program for the State of Maryland, Department of Natural Resources, and Bureau of Mines. In addition, he was also responsible for overall engineering/geologic support to the Maryland Bureau of Mines Program. His career began in Pittsburgh as a project geotechnical engineer with Orbital Engineering.

#### Education

B.S., Civil Engineering, 1975, Virginia Polytechnic Institute and State University, Blacksburg, Virginia  
Geology (Minor), 1975 Virginia Polytechnic Institute and State University, Blacksburg, Virginia

#### Professional Registration / Certification

Registered Professional Engineer, Ohio, #48459; Maryland, #13256; West Virginia, #9297; Pennsylvania, #PE-044930-R; Wyoming, #11033; North Carolina, #032503; Kentucky, #24988  
Certified Professional Geological Scientist, #6575  
Professional Surveyor, WV  
Adjunct Professor – Civil Engineering – Fairmont State College, 2001 – Present

#### CTL Project Experience

##### Transportation

Emerson Avenue-Slope Stabilization Investigation & Design. Wood County, W.V.  
I-81 Martinsburg to Marlow Interchange-Design Build. Martinsburg, W.V.  
Morgantown Municipal Airport-Geotechnical Services. Morgantown, W.V.  
Black Water Bridge Abutments-Surveying & Design Services. Tucker County, W.V.  
Charles Point Roadway Cut Evaluation-Geotechnical Services. Bridgeport, W.V.

##### Education facilities

New University High School-Variou Services. Morgantown, W.V.  
Church Properties: Central School-Surveying & Design Services. Morgantown, W.V.  
South Jefferson High School-Variou Services. Jefferson County, W.V.  
Morgantown High School Stadium Renovations-Variou Services. Morgantown, W.V.  
Huff Consolidated School-Geotechnical Services. Wyoming County, W.V.  
Fairmont State Athletic Field-Geotechnical Services. Fairmont, W.V.

##### Other

Bridgeport Burger King-Evaluations. Bridgeport, W.V.  
Charleston Sanitary Board Slip-Variou Services. Charleston, W.V.

#### Healthcare

Mon General Site Development-Site Design. Morgantown, W.V.  
Ambulatory Care Center-Geotechnical Services. Morgantown, W.V.  
Preston Memorial Hospital Construction-Variou Services. Preston County, W.V.  
WVUH Data Center-Geotechnical Services. Morgantown, W.V.  
Fresenius Medical Center-Geotechnical Services. Preston County, W.V.

#### Energy

Harrison Step II Construction Monitoring-Variou Services. Harrison County, W.V.  
Harrison Power Station Phase V Step I-Construction Services. Harrison County, W.V.  
Harrison Power Station Cell A Repair-Construction Services. Harrison County, W.V.  
Overland Conveyor Permitting-Permitting & Surveying. Monongalia County, W.V.  
Harrison Power Station Landfill QA/QC Leachate Collection Layer Expansion-Variou Services. Harrison County, W.V.

#### Building Development

University Place-Site, Civil & Geotechnical Services. Morgantown, W.V.  
Grand Central Apartments-Geotechnical Services. Morgantown, W.V.  
Gateway Development-Site & Civil Services. Morgantown, W.V.  
Federal Correctional Institute-Variou Services. Hazelton, W.V.  
Parkview Heights Retaining Wall-Geotechnical Services. Bridgeport, W.V.

#### Mine Related

Morgantown Anderson Highwalls-AML Reclamation Design. Morgantown, W.V.  
Schramm, Gordon, East Franklin Landslide-AML Reclamation. Maryland.  
Douglas Avenue Stormwater System-Geotechnical & Hydrologic Services. Allegheny County, M.D.  
Fairmont Subsidence-AML Reclamation & Geotechnical Services. Fairmont, W.V.  
Ottawa State Route 2 Mine Subsidence-Geotechnical Services & Grouting Plan. Ottawa County, O.H.

#### Forensic / Expert Testimony

Mr. Gallagher has been involved in numerous Failure Investigations and Forensic Projects over the past 40 years. He has been approved as an expert in the areas of Foundation Failures, Blasting, Flooding, Slope failures, Construction Defects, Structural, and Residential Construction Defects.



**Mr. Gregory Foreman, P.E.**  
*Manager*  
Water Systems Development

Mr. Foreman serves as Project Manager and Design Engineer for a multitude of civil site design projects for municipal, commercial and private developers. Design services provided include site grading, potable water, sanitary sewer, storm sewer, pedestrian walkways, vehicular thoroughfares, preparation

of permits, project specifications, plans and engineering calculations.

**Education**

B.S. Civil Engineering Technology  
Fairmont State College, Fairmont, West Virginia 1989  
A.S. Mechanical Engineering  
Fairmont State College, Fairmont, West Virginia 1989  
A.S. Drafting and Design  
Fairmont State College, Fairmont, West Virginia 1989

**Professional Registration / Certification**

Registered Professional Engineer: West Virginia, 1999,  
No. 014165; Pennsylvania, 2010, PE077796

**CTL Project Experience**

**Mine Related**

Fairview Feasibility Study – Abandoned Mine Lands  
Feasibility Study, Marion County, West Virginia  
Craigsville/Tioga Water Well Hydrologic Study, Nicholas  
County, West Virginia  
Feasibility Study for Oakland Public Service District –  
Abandoned Mine Lands Feasibility Study, Hancock County,  
West Virginia  
Morgantown Anderson Portals & Highwall – Abandoned Mine  
Lands Reclamation Design, Morgantown, West Virginia

**Water / Wastewater and Water Tanks**

Pee Wee Hill Potable Water Design – Maryland Department  
of Environmental, Maryland  
Pallsades Place-Sewage Collection - Treatment and  
Disposal, Morgantown, West Virginia  
Fairmont Water Treatment Plant, Fairmont, West Virginia

**Building Development**

West Minister Apartments Phase II, Martinsburg, West  
Virginia  
University Place, Morgantown, West Virginia  
Canterbury Housing Development, Fairmont, West Virginia  
Premier Chevrolet, Morgantown, West Virginia  
St. Mary's Roman Catholic Church – Site Improvements,  
Morgantown, West Virginia  
Immaculate Conception Church – Proposed Parish,  
Clarksburg, West Virginia

Mountain State Blue Cross Blue Shield, Parkersburg, West  
Virginia  
Total Dental Office - Civil Site Design, Bridgeport, West  
Virginia  
West Run Apartments Flood Plain, Morgantown, West  
Virginia  
Woodford Oil Company – Civil Site Design, Morgantown,  
West Virginia

**Other**

Bridgeport Burger King Evaluations, Bridgeport, West  
Virginia  
Preston County High School Evaluations, Preston County,  
West Virginia  
-Sewage Plant  
-Wetland Delineation  
Salem International University Soccer Field Improvements,  
Salem, West Virginia  
Industrial Avenue Streetscape, Morgantown, West Virginia  
Dorsey's Knob Park Road Improvements, Monongalia  
County, West Virginia  
Boyers Avenue – Demolition Plans, Morgantown, West  
Virginia

**Civil & Municipal**

Mr. Foreman's experience includes roadway and street  
design, permitting, bid package development, and  
construction oversight. Representative experience includes:

**Mount Morris Municipal Authority, Greene County,  
Pennsylvania**

-Lead engineer for the sewer system remediation design.

**Fairview, West Virginia**

-Project engineer for sidewalk improvements within the WV  
DOH right of way. This effort involved designing and  
preparing construction plans and specifications for the  
removal and replacement of 1,000 square yards of concrete  
sidewalk, as well as the installation of handicap access  
ramps along Main Street.

**Star City, West Virginia**

-Project engineer for Industrial Avenue and Boyers Avenue  
Streetscapes and Revitalization. The effort involved  
designing and preparing construction plans and  
specifications for the concrete sidewalks in WV DOH right of  
way. Responsibilities included site evaluation, utility  
relocation and removal, preparation of specifications and  
construction bid packages. Project included over 870 linear  
feet of public streets widening and improvement.

**Fairmont, West Virginia**

-Project engineer for sanitary sewer improvements including  
field investigation and evaluation of the existing sewer  
system. Responsibilities included design, specifications, and  
permitting for the sewer replacement and force mains in the  
WV DOH right of way including aspects related to  
replacement of impacted pavements. This project involved  
over 10,000 linear feet of impacted public roads.



**Mr. Terence R. Allison,  
P.S.**  
*Land Surveying Manager*

Terence R. Allison, P.S. has recently joined the CTL Engineering team bringing along over 35 years of all types of surveying in Ohio, around the country and around the world. He is responsible

for the supervision, coordination, reporting and consultation of land surveying and construction surveying related services. These responsibilities include reviewing of the scope of work, project plans and specifications prior to the start of work, assigning appropriate field crews and cad personnel to projects, supervise the training of technicians, reviewing all field and office work for the project and delivering the final plats, deeds and other surveying products requested.

Mr. Allison has been the project manager on a variety of surveying projects that include, but are not limited to boundary and topographic surveys, municipal infrastructure and park surveys, oil and gas well plats and design surveys, FEMA LIDAR check surveys, cell towers, subdivisions, site developments, roads, bridges, sewers and other utilities, flood control studies, and construction layout for major buildings, roads, and bridges.

**Education**

A.A.S. Surveying and Construction Technology, 1979  
A.A.S. Computer Technology, 1985  
Weatherhead School of Management Career Management Series, Case Western Reserve University

**Professional Registration / Certification**

Registered Professional Surveyor, Ohio  
Registered Professional Surveyor, West Virginia

**CTL Project Experience**

**Transportation**

Orchard Street Topo, Akron, Ohio  
Stark County Public Library, Offsite Parking Lot, Canton, Ohio  
City of North Canton – Deerfield Drive Improvements  
City of Cleveland – Grayton Road Improvements, Euclid Corridor, Detroit Avenue Streetscape, E. 40th Street Streetscape Survey, E. 9th Street Streetscape Survey  
City of Akron – Kenmore Blvd Streetscape  
City of Norton – Barber Road Improvement Survey  
Ohio Turnpike Commission – Third Lane Addition

**Sanitary Sewers**

Cleveland Sanitary Engineering Department – Manhole survey and inspection, St. Clair Avenue Force Main Survey

Akron Environmental and Pollution Control – Botzum Truck Line Manhole Survey

**Sanitary Sewers (Continued)**

**NEORS**

-Site Survey of Doan Brook site, Construction Survey for Southerly Plant improvements, Millcreek Interceptor Survey, Cuyahoga County Manhole inventory Survey  
-Heights Hilltop Interceptor ROW easements  
-Easterly District CSO Phase II Design Survey, Easements  
-Cuyahoga Valley Interceptor, Design Survey  
City of Cleveland  
-Warrensville Broadway Water Supply Line Design Survey  
-Westerly Waste Water Treatment Plant, Construction Survey (plant revisions)  
-Easterly Waste Water Treatment Plant, Construction Survey (plant revisions)  
-Coit Road Force Main Design Survey  
Alcoa Plant Sanitary Sewer Inventory  
Cleveland International Airport Sewer Inventory Survey

**Water Distribution, Storm Sewer, and Drainage**

NEORS – Millcreek project-ROW easements and mapping  
Chesapeake Energy – Multiple pipeline routing and lease acquisition surveys  
AEP – ROW survey in Western West Virginia  
City of Norton, Ohio – State Route 21 ROW survey  
City of Cleveland Water Department, City-wide Facility plan survey  
Cochran Harper & Sheldon Road Waterline Design Survey  
Crown Water Plant Expansion Survey  
Topographic Surveys  
-Morgan  
-Baldwin  
-Nottingham  
-Kirkland

**Building Development**

Kent State University, Stark Performing Arts Center, North Canton, Ohio  
Chippewa Local Schools, Doylestown, Ohio  
Case Western Reserve University, Cleveland, Ohio  
Lake Sherman Mobile Home Park Expansion, Bethlehem Township, Ohio  
Case Western Reserve University, CWRU Adelbert Gym - Bingham Hall Steam Replacement Topographic Survey, Cleveland, Ohio  
UPS Columbus Hub Expansion and Modernization, Columbus, Ohio

**ATTACHMENT 2**  
**PROJECT DESCRIPTIONS**



## TAUM SAUK UPPER RESERVOIR REBUILD – PAGE 2

RIZZO's Scope of Work is detailed as follows:

**FORENSIC ANALYSIS:** RIZZO conducted a detailed forensic engineering analysis to determine the causes of the failure. Analysis included stability and seepage, dam breach (to determine time and to evaluate mode of failure), complete review of instrument control systems, sediment transport, detailed mapping of breach zone, drilling and sampling of remaining portions of the dike, and a subsurface investigation to analyze both the existing dike and its foundation and the potential foundation of a new dam.

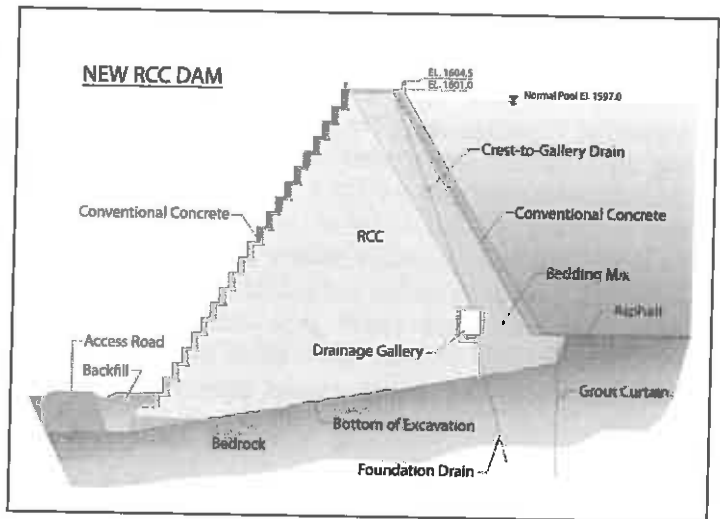
**DESIGN ENGINEERING:** RIZZO prepared both conceptual and a detailed designs of the Rebuild, including analyzing and developing various options to rebuild the Project. Construction costs and schedule, as well as potential regulatory challenges with each option, were fully evaluated.

Based on substantial investigation and design, RIZZO determined that a repair of the existing Dike was not technically feasible due to flaws in the original construction. Substantial areas of the existing dike were founded on residual soil. Additionally, few construction controls were utilized to control the gradation and character of the rock fill. Due to this and other factors, a complete rebuild of the upper reservoir was required.

RIZZO evaluated several alternatives for a Rebuild and selected a symmetrical (0.6H to 1.0 V upstream and downstream) RCC dam. The symmetrical slopes reduce the demand on the rock foundation and allow for inclusion of less than ideal aggregate to create the RCC mix. This allowed the use of recycled aggregate for the RCC. The existing rockfill dike material (rhyolite) will be processed and utilized to create aggregate for the RCC.

RIZZO developed an appropriate seismic design basis for the site and completed a series of finite element analyses to predict seismic stresses during a design basis earthquake event. All calculations, design reports, and construction documents were reviewed by the FERC and an Independent Board of Consultants (BOC). RIZZO formally presented various design alternatives to both the FERC and the BOC for review and approval.

Fly ash was the primary component of the RCC Mix, which contained 100 pounds of both cement and fly ash per cubic yard. The fly ash was excavated from an existing Ameren Missouri facility, which was processed, and utilized in the RCC Mix. In addition to cost savings by not having to purchase commercial fly ash, this created additional landfill space for use by Ameren. Additionally, the use of fly ash reduced the heat of hydration of the overall RCC Mix.





**CONSTRUCTION MANAGEMENT:** As Construction Manager, RIZZO retained a full staff of on-site personnel including: engineers, construction supervisors, AutoCAD personnel, surveyors, environmental compliance and safety personnel. RIZZO is the single point of contact for the Project and is the Owner's Representative on site and coordinates and manages the work of the Contractor. RIZZO's responsibilities include: scheduling, budget and cost control, inspection of the Contractor's work, approval of Pay Applications, contract administration, preparation of contract documents and technical specifications, health and safety programs, Request for Information and approval of Project Submittals. RIZZO provided on site supervision and coordination of all construction activities. These activities included schedule, budget and cost control, approval of submittals, responses to RFIs, Cost Estimates, Preparation of Bid Documents, Contract Administration, Document Control, Construction Monitoring, Cash Flow Projections, review of Value Engineering proposals, Claim Analysis and Negotiation, Dispute Resolution, Performance Analysis, and Pay Application Approvals.



**PART 12 INSPECTION AND FOLLOWUP:** RIZZO prepared a Supporting Technical Information Document (STID), participated in the Potential Failure Modes Analysis (PFMA) session, and performed the Ninth Part 12 Inspection for the Taum Sauk Project. RIZZO also performed several follow-up projects at the Lower Dam as a result of the inspection, including mapping of the abutments at the Lower Dam, an updated rating curve and hydraulic evaluation for the Lower Dam, and an updated stability analysis for the Lower Dam.

**UNIQUE PROJECT FEATURES:** The unique location of the reservoir on the top of a mountain resulted in many innovative solutions for the rebuild, including recycling flyash from a nearby waste pond for use in the concrete mixes, and adapting the fundamentals of gravity dam design and the use of RCC from a conventional shaped gravity dam to one of a symmetrical cross section (much like a steep sloped earthfill dam) with relatively low strength RCC – necessary for placing a gravity dam on the relatively poor rock at Taum Sauk. The Upper Reservoir is the first pumped storage project to utilize an RCC water retaining structure.

**AWARDS:** The Taum Sauk Upper Reservoir Rebuild Project won the 2010 USSD Award of Excellence for Construction Projects and the ESWP 2010 Project of the Year Award, and the 2010 American Society of Civil Engineering (ASCE) Outstanding Civil Engineering Achievement (OCEA) Award of Merit.

**RIZZO CONTRACT AMOUNT: \$45,566,044**

**RIZZO PROJECT #: 06-3551**



<b>PLEASURE LAKE DAM EVALUATION AND UPGRADE THOMPSONVILLE, NEW YORK</b>		<b>YEAR COMPLETED</b>
		<b>PROFESSIONAL SERVICES 2003 – 2008</b>
<b>PROJECT OWNER'S INFORMATION</b>		
<b>a. PROJECT OWNER</b> <b>Fallsburgh Fishing &amp; Boating Club</b>	<b>b. POINT OF CONTACT NAME</b> <b>Mr. William Voegelin</b>	<b>c. TELEPHONE NUMBER</b> <b>(845) 778-5539</b>

**RIZZO International, Inc. (RIZZO)** acquired RIZZO Associates, Inc. in November 2017. RIZZO remains a global engineering and consulting firm headquartered in Pittsburgh, Pennsylvania US. This project was contracted / completed under the RIZZO Associates name.

Pleasure Lake Dam is located in Thompsonville, New York and impounds a 200-acre recreational reservoir situated in the Catskill Mountains. Because roads, residences, and businesses are located downstream of the Dam, the Dam is classified as a Class "C" high-hazard dam. The dam is owned and operated by the Fallsburgh Fishing & Boating Club.

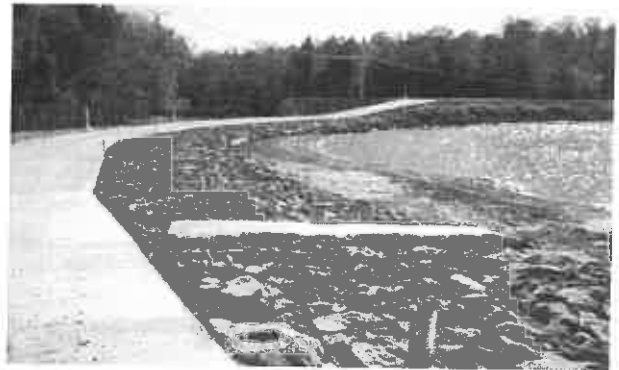
RIZZO was retained by the Fallsburgh Fishing & Boating Club to perform H&H analyses and to prepare a remedial spillway design. The H&H study included estimating the PMF using HMR 51/52 and floods with other return intervals. The discharge conditions of the spillway were evaluated for various flood events and conceptual remedial measures were proposed to address identified deficiencies. RIZZO performed incremental dam break analyses to identify potentially impacted structures downstream of the dam. From the incremental differences in impact, RIZZO was able to reduce the Spillway Design Flood (SDF) from the half PMF to 0.4 PMF. This reduced the required capacity of the remediated spillway by 20 percent.

The project also included preparing construction documents for the new emergency spillway and a stabilizing toe block at the existing auxiliary spillway. RIZZO evaluated the use of grouted riprap versus concrete for the spillway liner and was able to gain NYSDEC approval for grouted rip-rap, saving the Owner more than \$200,000 in construction costs.

RIZZO's full scope of work included:

- Site survey and evaluation of existing conditions;
- Subsurface exploration, soils identification, and selection of Index soil properties;
- Dam and spillway stability analyses;
- Hydrologic and Hydraulic evaluations for existing and remedial design alternatives;
- Design of a new, grouted rip-rap lined emergency spillway;
- Assisting with negotiation of Order of Consent with the DEC;
- Preparation of construction contract documents, drawings, and specifications;
- Preparation and filing of permit applications; and
- Engineering support during construction.

Pleasure Lake Dam project demonstrates our experience with dams that have inadequate spillway capacity and our ability to develop creative, cost-effective solutions which meet the needs of our clients.



**RIZZO Contract Amount: \$80,000**



<b>OSAGE HYDROELECTRIC PROJECT DAM REHABILITATION LAKE OZARK, MISSOURI</b>		YEAR COMPLETED
		PROFESSIONAL SERVICES <b>2015 - CURRENT</b>
PROJECT OWNER'S INFORMATION		
PROJECT OWNER <b>Ameren Missouri</b>	POINT OF CONTACT NAME <b>Mr. Thomas Hollenkamp</b>	TELEPHONE NUMBER <b>(314) 957-3406</b>

**RIZZO International, Inc. (RIZZO)** acquired RIZZO Associates, Inc. in November 2017. RIZZO remains a global engineering and consulting firm headquartered in Pittsburgh, Pennsylvania US. This project was contracted / completed under the RIZZO Associates name.

RIZZO prepared the design for the stabilization and the rehabilitation of the downstream face of the dam at the Osage Hydroelectric Project owned by Ameren Missouri, a utility company headquartered in St. Louis, Missouri.



The Bagnell Dam and the Osage Hydroelectric Plant are located on the Osage River, approximately 35 miles southwest of Jefferson City, Missouri, and approximately 82 miles upstream of the confluence with the Missouri River. The Reservoir is known as the Lake of the Ozarks, and extends approximately 93 miles upstream from the Dam to the Harry S. Truman Dam. The Reservoir encompasses approximately 86 square miles at the normal operating pool of elevation 660 feet, and has approximately 1,150 miles of shoreline. The Plant, with a 222 Megawatt (MW) capacity, is operated primarily to generate electricity during peak demand periods, but also provides recreational opportunities and flood control.

The downstream face of the dam is being remediated and the dam is being stabilized to meet required factors of safety against sliding and overturning for all applicable load cases. The remedial design for the downstream face consists of removing the existing deteriorated concrete and replacing it with reinforced concrete doweled into the existing dam. A leakage conveyance system will direct water coming from cracks and lift joints in the existing concrete to the toe of the dam at the non-overflow sections. Stabilization consists of a combination of adding mass concrete between the spillway piers and installing high capacity post-tensioned anchors. The post-tensioned anchors will be installed from the downstream face of the dam and include up to 58 strands, with design loads up to 2,100 kips per anchor. The design of the stabilization includes calculations, drawings, specifications, and a design report.

As part of the stabilization design an updated stability analysis is being performed. The analysis includes updated foundation strength parameters that were determined through testing performed on rock core samples taken from the foundation of the Dam. The analysis also includes updated tailwater levels based on a CFD analysis and updated uplift pressures at the base of the Dam.

The CFD analysis was completed using FLOW-3D software to determine the tailwater elevation at the spillway during the PMF event. CFD Models were developed for a single bay of the Spillway and for the entire 12 gates at the spillway. Sensitivity analyses were performed in the single-gate model to confirm that the selected mesh size, boundary conditions, and model features (e.g., air entrainment, turbulence, material roughness, and potential cavitation) were appropriate. Model calibration was also performed, using the reported flow conditions for the Flood of Record. After completion of the sensitivity analyses and model calibration, the final model for all 12 gates was used to estimate water levels and water pressures on the downstream surface of the spillway.

**RIZZO Contract Value: \$650,000**  
**RIZZO Project Number: 15-5398**



<b>NYSOGS DAM INSPECTIONS &amp; ENGINEERING SERVICES VARIOUS LOCATIONS STATEWIDE</b>		<b>YEAR COMPLETED</b>	
		<b>PROFESSIONAL SERVICES Aug 2014 – Aug 2019</b>	<b>PROJECT CONSTRUCTION N/A</b>
<b>PROJECT OWNER New York State Department of Environmental Conservation</b>			
<b>OWNER – POINT OF CONTACT NAME Thomas Miller</b>	<b>thomas.miller1@dec.ny.gov</b>	<b>OWNER – POINT OF CONTACT TELEPHONE NUMBER 518-402-9084</b>	
<b>CLIENT'S INFORMATION New York State Office of General Services</b>			
<b>CLIENT – POINT OF CONTACT NAME Michael Mitchell</b>	<b>CLIENT – POINT OF CONTACT EMAIL michael.mitchell@ogs.ny.gov</b>	<b>CLIENT – POINT OF CONTACT TELEPHONE NUMBER 518-486-4952</b>	

**RIZZO International, Inc. (RIZZO)** acquired RIZZO Associates, Inc. in November 2017. RIZZO remains a global engineering and consulting firm headquartered in Pittsburgh, Pennsylvania US. This project was contracted / completed under the RIZZO Associates name.

RIZZO is providing on-call professional engineering services under a five (5) year term contract for dam inspections and engineering services at various locations statewide.

Assignments include dam site inspections and screening of potential downstream hazards; site surveys, soil and concrete testing; hydrology & hydraulic analysis; stability analysis; and, design of dam remediation and modifications for various NYSDEC owned dams.

To date, RIZZO has been assigned:

- Dam safety inspections and preliminary hazard assessments for twenty-nine (29) dams. Inspection reports with recommendations for follow-up actions are being prepared and will be submitted during the 1<sup>st</sup> quarter of 2015.
- Development of dam decommissioning plans and specifications for two (2) dams.

Additional work orders for specific professional services will be assigned as needed for a period of three (3) years. The term of this agreement will not exceed five (5) years, to allow for the completion of work under this contract.



**RIZZO Contract Value: \$2,000,000**  
**RIZZO Project Number: 14-5236**



<b>PROJECT TITLE AND LOCATION</b> <b>NEW YORK STATE CANAL CORPORATION</b> <b>DAM SAFETY PROGRAM</b> <b>NEW YORK, NY</b>		<b>YEAR COMPLETED</b>	
		<b>PROFESSIONAL SERVICES</b> <b>2016 – Present</b>	<b>CONSTRUCTION (IF APPLICABLE)</b> <b>N/A</b>
<b>PROJECT OWNER'S INFORMATION</b>			
<b>PROJECT OWNER/CLIENT</b> <b>New York Power Authority</b>	<b>POINT OF CONTACT NAME</b> <b>Howard Goebel</b>	<b>POINT OF CONTACT TELEPHONE NUMBER</b> <b>(518) 449-6100</b>	

**RIZZO International, Inc. (RIZZO)** acquired RIZZO Associates, Inc. in November 2017. RIZZO remains a global engineering and consulting firm headquartered in Pittsburgh, Pennsylvania US. This project was contracted / completed under the RIZZO Associates name.

RIZZO was retained by the New York Power Authority (NYPA) to provide professional engineering services for developing and implementing a Dam Safety Program for the New York State Canal Corporation (Canals) system that spans upstate New York State connecting the Hudson River with Lake Ontario, Lake Erie, and Lake Champlain.

The Canals which operate a navigable 524-mile inland waterway that passes through 25 counties and 200 villages, hamlets, and towns across New York State, was transferred to NYPA by an act of the state legislature on January 1, 2017. The Dam Safety Program developed for Canals by RIZZO is intended to establish the dam safety thinking and approach that is part of NYPA's culture. RIZZO was tasked to perform the following:



- Gain an understanding of current protocols for identifying and addressing emerging public safety issues;
- Provide recommendations for process improvement;
- Provide recommendations for Canals' future dam safety organization;
- Develop a draft dam safety program policy for the Canal System; and
- Provide highly qualified dam safety experts to act as the designated Dam Safety Engineer (DSE) and Deputy Dam Safety Engineer (DDSE) working out of Canal's Albany Headquarters for up to one year.

RIZZO staff are assisting Canals with prioritization of both O&M and capital expenditures relating to dam upgrades; development and implementation of improved safety monitoring of their more than 200 miles of raised embankments; developing plans for a \$3 million vegetation removal and control project on their dams and embankments; responding to emergency conditions along the embankment system; interfacing with state dam safety officials; developing formal Inspection & Maintenance Plans for their dams; directing dam upgrade projects and reviewing plans developed by outside consultants; and developing and implementing a dam safety training program for Canals personnel.

**RIZZO Project Numbers: 13-5108D & 135108E**  
**RIZZO Contract Value: \$1,000,000**





**Project:** Mine Impoundment Annual Inspections

**Client:** Murray Energy

**Contact:** Brian Bogden

**Phone:** (304) 534-4735

**Location:** West Virginia

**Project Description:** Perform annual & quarterly impoundment certifications for Murray American Energy, Inc. and Consol Energy, Inc. covering

northern West Virginia and southwestern Pennsylvania as required by the WVDEP, PADEP and M.S.H.A.

The certifications consist of visual individual walking inspections of various AMD facilities of active and closed underground coal mines i.e. Loveridge Mine, Robinson Run Mine, Blacksville No. 1. Mine, Blacksville No. 2 Mine, Arkwright Mine, Osage Mine, Pursglove Mine, Dilworth Mine, Island Creek Coal Company and Laurel Run Mining Company for stability and proper outflow drainage which consist of various size major impoundments, miscellaneous treatment plant aeration and settling ponds. Piezometer data throughout each certification year is reviewed and analyzed for all the major impoundments to insure the designed phreatic surface is below the design levels to maintain a minimum required factor of safety of 1.5. This information and inspection comments/ conclusions are included on the certification forms signed by a qualified

Professional Engineer which are submitted to the various agencies.



**Project:** Point Marion Lock & Dam

**Client:** US Army Corp of Engineers

**Phone:** (412) 395-7100

**Location:** Pt. Marion, Pennsylvania

**Project Description:** CTL Engineering, Inc. provided surveying services and was in charge of the on-site batch plant daily mixing operations, including materials quality control testing of concrete and aggregates for this project. In addition, mixer uniformity tests, scale checks and quality control compaction testing on backfill were performed as needed. Special instrumentation, such as inclinometers, piezometers, sheer strips and horizontal and vertical survey, was used to monitor the movement of the existing lock wall while excavation was being performed behind the wall.

CTL Engineering also prepared the Contractors Quality Control plan for approval by the United States Army Corp of Engineers.

The project consisted of the construction of a new 720-foot lock chamber to allow for larger river traffic, as well as a new operations building. The Point Marion Lock and Dam is located on the Monongahela River.





**Project:** Tygart Lake Dam

**Client:** Joseph B. Fay Co

**Contact:** Rich Snider

**Phone:** (304) 265-4755

**Location:** Grafton, West Virginia

**Project Description:** CTL Engineering performed materials quality control testing of concrete as well as soil and asphalt compaction in support of Joseph B. Fay Company, the contractor who was constructing the groin protection for the hydroelectric dam and a new maintenance building.

CTL also assisted in the preparation of the Contractors Quality Control plan for approval by the United States Army Corp of Engineers.

Tygart Lake Dam is located on the Tygart River in Grafton, West Virginia. The dam was being upgraded to prepare for the "500 year flood".



**Project:** Marmet Lock and Dam

**Client:** Kokosing/Fru-Con, LLC

**Location:** Marmet, West Virginia

**Project Description:** CTL Engineering provided construction observation and materials testing services for the Marmet Locks and Dam Replacement Project. The project consists of the construction of a new dam across the Kanawha River and a new 110-foot by 800-foot lock chamber. CTL's services will include material quality control testing of concrete, aggregates, and soil. The project also included laboratory materials testing of concrete, aggregate, and soils. The project includes the complete replacement of the existing lock and dam.

It includes over 3 million cubic yards of excavation and backfill and over 200,000 cubic yards of reinforced concrete.



**Project:** Lake White Dam Improvements

**Client:** Ohio Department of Natural Resources

**Contact:** Rob Doyle

**Location:** Waverly, Ohio

**Project Description:** CTL Engineering, Inc. provided quality control testing and inspection services during the rehabilitation of this dam. The project included significant work on the existing embankment, installation of Roller Compacted Concrete buttress to the face of the dam and the construction of a new bridge and concrete spillway. Over 43,000 cubic yards of embankment, 100,000 cubic yards of roller compacted concrete and 2,220 cubic yard of structural concrete. CTL provided soil compaction testing and inspection, concrete testing and roller compacted concrete testing.



**ADDENDUM ACKNOWLEDGEMENT FORM**  
**SOLICITATION NO.: AEOI DNR1800000005**

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:

*(Check the box next to each addendum received)*

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6  |
| <input type="checkbox"/> Addendum No. 2            | <input type="checkbox"/> Addendum No. 7  |
| <input type="checkbox"/> Addendum No. 3            | <input type="checkbox"/> Addendum No. 8  |
| <input type="checkbox"/> Addendum No. 4            | <input type="checkbox"/> Addendum No. 9  |
| <input type="checkbox"/> Addendum No. 5            | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

RIZZO International Inc.

Company \_\_\_\_\_

  
Authorized Signature \_\_\_\_\_

December 13, 2017

Date \_\_\_\_\_

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.



**ADDITIONAL INFORMATION**

Addendum No.01 is issued to publish and distribute the attached information to the Vendor Community.

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**Expression of Interest**

A&E Services for Modifications/Repairs of Six(6) Dams

The West Virginia Division of Natural Resources (WVDNR) is soliciting AEOI responses from qualified firms to provide architectural / engineering services contract for modifications/repairs to Upper Deckers Creek Dams #3 and #7, Fairfax Pond Dam, Rollins Lake Dams #1 and #2, and Turkey Run Dam, per the attached bid requirements, specifications and terms & conditions.

INVOICE TO		SHIP TO	
DIVISION OF NATURAL RESOURCES PARKS & RECREATION-PEM SECTION 324 4TH AVE SOUTH CHARLESTON WV25305 US		STATE OF WEST VIRGINIA JOBSITE - SEE SPECIFICATIONS No City WV 99999 US	

Line	Commodity Line Description	Qty	Unit Issue
1	Civil engineering		

Commodity Code	Manufacturer	Model #	Specification
81101500			

**Extended Description**

A/E design services and contract administration for modification and repairs to six dams.

SCHEDULE OF EVENTS		
Line	Event	Event Date
1	Technical Question Deadline 9am	2017-11-29