McMILLEN JACOBS ASSOCIATES

Mort McMillen, PE | Principal-In-Charge

Mort McMillen is a registered Professional Engineer in the Alaska with over 32 years of experience the water resources, heavy civil, infrastructure, and hydropower markets. He has extensive experience in a variety of hydro sites in Alaska. Recent Alaskan clients in Alaska include Copper Valley Electric Association, Chugach Electric, Southeast Alaska Power Authority, Homer Electric, Cordova Electric, and the City of Sitka.

Throughout his career, Mr. McMillen has completed major modifications to existing hydroelectric dams and supporting facilities and has developed new hydroelectric facilities from 4 MW to 140 MW. Examples include Allison Creek Hydro Project, Grant Lake Hydro Project, Blue Lake Dam, Swan Lake Dam, Bonneville Dam, John Day Dam, The Dalles Dam, Cougar Dam, South Willamette, Lower Granite Dam, Lower Monumental Dam, Dworshak Dam, Hells Canyon Dam, Swan Falls Dam, Bliss Dam, Upper Salmon Falls Dam, and Lower Salmon Falls Dam.

He has led over 50 design-build projects where he assumed the overall responsibility of delivering a successful project within budget, but also intricately involved in the design and/or construction. He has and participated developing new or updating existing hydroelectric facilities with elements including powerhouse facilities, spillways, intake structures, gates, valves, diversion structures, fish ladders or barriers, trash racks/rakes, etc. He recently completed the Allison Creek Hydroelectric Design-Build Project that constructed a new $53 million, 6.7 MW facility in Alaska. He was responsible for project execution including FERC coordination, permitting, preparation of plans and specifications, equipment procurement, QA/QC, construction, and start-up.

Relevant Experience

City of Akutan, Town Creek Hydroelectric Dam Design-Build, Akutan, Alaska – Project Manager. The project was comprised of engineering and construction services for the demolition and reconstruction of two small earthen diversion dams (< 5-feet high), replacement of diversion piping, mud sluicing gates, valves and valve boxes. On the main impoundment dam, the crest was refurbished, an emergency spillway constructed, penstock piping and valves replaced and screening for both the penstock intake and spillway added. The City of Akutan constructed the hydroelectric project along with Alaska Power Systems in 1993 and was awarded grant funding from the Alaska Energy Authority to complete permitting, design, and construction for repairs and upgrades to the original project. A significant task associated with the permitting was to provide documentation and design of improvements to the main intake dam so

Education

MS, Civil Engineering, Stanford University

Experience

32 years

Registrations

Professional Engineer:

- Alaska No. 12523
- Arizona No. 43193
- California No. 79290
- Colorado No. PE.0043518
- Hawaii No. 14337
- Idaho No. P-11563
- Indiana No. PE11300432
- Nevada No. 17419
- Oregon No. 16047PE
- Washington No. 41267
- Wyoming No. PE11663
- P.Eng BC, Canada
- NCEES No. 25923

Professional Affiliations & Organizations

- Associated General Contractors of America
- National Hydropower Association
- NW Hydropower Association
- Society of American Military Engineers
- American Council of Engineering Company
- American Society of Civil Engineers

Areas of Specialty

- Technical and management skills from planning through startup and operations
- New and rehabilitation of hydro (4 to 140 MW)
- Designed and/or constructed all components of hydro facilities including penstocks, spillways, powerhouses, etc.
- Extensive Alaskan experience

that it could be permitted by the Alaska Department of Natural Resources Office of Dam Safety. After approval was received, McMillen Jacobs provided the construction services to procure the necessary equipment, install a maintenance storage facility, repair the main intake dam and the three associated diversion structures, repair the existing access road, inspect and provide maintenance to the hydro turbine, and provide the operation and maintenance manual and training for the upgraded hydropower system. *(Town Creek: $1,012,670; Oct 2009 – Nov 2012)*

City of Sitka, Blue Lake Hydroelectric Project Dam Raise, Sitka, Alaska – Project Manager (Office Engineering support during construction). Led the construction management team responsible for construction management and QA/QC for the $140 million expansion of the existing hydroelectric project. Project included an 88-foot dam raise on the existing 140-foot arch dam, new 1200-foot long intake tunnel, new concrete intake tower, new powerhouse, new 370-foot hard rock surge chamber, and modifications to the existing facilities. Responsible for management of 7 major equipment procurement contracts and management of the main general contractor. The project will replace two 3 MW generators with three 5.3 MW generators, increasing capacity to 17 MW, thereby increasing Sitka's total hydroelectric energy production by about 30%. *($5.5 Million / 2013 – Jan 2015)*

Copper Valley Electric Association, Allison Creek New Hydroelectric Progressive Design-Build Project, Valdez, AK – Design-Build Project Manager. Mr. McMillen is the Design-Build Project Manager for the permitting, design, and construction of a new hydroelectric project located near Valdez, Alaska. This new hydroelectric project consists of a new 250-foot-long by 20-foot-tall diversion structure, 7000 feet of welded steel penstock with a maximum operating static head of 1152 feet, new 725-foot-long by 16-foot-tall horseshoe hardrock tunnel, 2.5 miles of new construction access roads, new 6.5 MW powerhouse, and 3.5 miles of new transmission line. He was responsible for preparation of the final construction documents, hydraulic and hydrologic analysis, geotechnical explorations and design, and overall permit development an acquisition. He managed the construction procurement and execution through the limited 6 month construction seasons including all cost estimating, equipment procurement, and field construction. *($53M; 2012 – 2016)*

Cordova Electric Cooperative, Snyder Falls Hydroelectric Project, Cordova, Alaska – Project Manager. Feasibility cost estimate for a potential hydroelectric facility consisting 150-foot-tall dam to impound a high reservoir, a 3,600-foot-long penstock and a powerhouse located near sea level. Scope of work included a site suitability evaluation for different dam configurations, geologic and geohazard assessment, and source material assessment for the project.

SEAPA, Swan Lake Spillway Raise, Ketchikan, Alaska - Project Manager. Ketchikan Public Utilities (KPU) has seen an increasing level of diesel generation required to offset inadequate hydropower resources. During this same period, Swan Lake Dam has experienced spill conditions which if captured, would offset at least a portion of the diesel generation requirements. Mr. McMillen's team completed the initial feasibility analysis and prepared final construction documents to raise the dam spillway 15 feet to store additional water for hydropower generation. The project included developing a SAP2000 Finite Element Model for the existing 140-foot tall, 500-foot crest length thin shell concrete arch dam to determine the optimum dam raise of the existing 100-foot long ogee crest spillway. Construction of the project included a new 23-foot wide by 16-foot tall vertical roller gate with hydraulic operators, 17-foot tall steel flashboard system 78 feet long, modifications to the existing intake tower to operate at the higher reservoir levels, and complete electrical/hydraulic system upgrade. *(Swan Lake Study $50k; Design $500-$750k; Mar 2012 – 2017)*

Southeast Alaska Hydropower Site Evaluations and Planning Services – Project Manager. Primary efforts revolved in identifying potential hydroelectric projects with storage capabilities and having low risk system integration. In completing this SE Alaska region-wide work effort, our work has included hydropower

planning, regulatory, biology, constructability, environmental, and civil engineering for the hydropower assessment of this area. Scope included evaluation of over 300 potential sites and more detailed analysis on 15 sites. Based on this information, SEAPA was able to identify 3 viable sites that are currently being pursued. *(Feasibility Site Analysis; $1M+; 2013 – Ongoing)*

Soloman Gulch Dam Raise Feasibility Study, Alaska - Project Manager. Conducting a study to raise an existing 120-foot tall concrete faced rock fill dam by up to 20 feet to increase the storage capacity for hydropower generation. Currently developing alternatives for raising the dam and conventional ogee crest overflow spillway including alternatives analysis, cost estimates, constructability review, and regulatory requirements. *(Ongoing)*

Homer Electric Association, Grant Lake Hydropower Development, Moose Pass, Alaska – Design Project Manager. Kenai Hydro, LLC (KHL) was issued a preliminary permit to investigate a proposed hydropower development on Grant Creek near the outlet of Grant Lake. Mort McMillen is currently responsible for assisting with the engineering portion of the licensing, regulatory, and environmental features. Preliminary design and consulting services include Surveys and Mapping, Geotechnical Investigations, Hydrologic and Hydraulic Analysis, Operation and Generation Analysis, Alternative Development and Evaluation, Cost Estimates and Financial Analysis, Project Schedule and Construction Methodology, Preliminary Design Report, Preparation of Exhibits to Support FERC Application, Project Administration and Coordination, and Quality Control and Quality Assurance with Independent Technical Reviews. This engineering analysis will clearly develop the details of the proposed project and develop accurate estimates of the estimated project cost and generation revenue. As part of this work effort, selective withdrawal intake was developed to pull water from the upper 5 feet of the lake to meet downstream temperature standards for anadromous fish rearing within Grant Creek. The work effort included hydraulic modeling of the proposed intake structure, reservoir management, and instream temperature analysis. *($434,379; Oct 2013 – Ongoing)*

Avista Corporation, Long Lake Dam TDG Studies, Deflector Design, and Construction; Washington – Project Manager and Principal-in-Charge. Project manager responsible for the alternatives study, predesign, and final design build of modifications to the existing 210-foot Long Lake Dam spillway to reduce TDG. Led the design build team to demolish the toe of the existing spillway and construct a new reinforced concrete spillway flow deflector into the base of the dam, re-construct the left and right abutments of the spillway toe, install cofferdam and dewatering system and blasting to remove 15,000 cy of rock from the channel. Long Lake Dam is a 200-foot-tall concrete gravity dam owned and operated by Avista Corporation on the Spokane River northwest of Spokane, Washington. The dam is constructed with an overflow spillway consisting of 8 bays, which channel spill waters into a plunge pool at the base of the dam. During spill events, the plunge pool becomes supersaturated with total dissolved gases (TDG) due to the force and angle of the water entering the pool. Mr. McMillen provided civil and structural engineering during the alternatives analysis resulting in 8 options. After Avista selected the option, which added spillway deflectors on the downstream face to reduce the entry angle of spillway flows into the plunge pool, McMillen Jacobs performed the design and the construction. The two deflectors were installed in bays 3-8, and his team removed a protruding rock outcrop below bays 7 and 8. An alternative means of construction access and staging was developed and a construction cost estimate and schedule were also developed. *(Studies $171,521; Apr 2010 – Jan 2011) (Design $209,195; Mar 2014 – Nov 2014) (Construction $10,853,611; 02/16 – 12/30/16)*

Avista Utilities; Nine Mile HED Sediment Bypass System, Spokane County, Washington – Principal-in-Charge. The purpose of this project was to upgrade the inoperable existing sediment bypass system (SBS) to prevent debris from entering the turbine and causing damage. The project consisted of a Collaborative Improvement Phase where Avista and McMillen Jacobs worked together to design and evaluated improvements to the project. Based on those discussions, our team revised the existing design to improve

construction efforts, cost and schedule. Improvements included replacement of the pre-cast access bridge with a steel bridge, a new Kunz trash rake system, refurbishment of the existing powerhouse intake gates; new 10'x16' bulkhead gate, new 12'x10' roller gate with wire rope hoist, and new 50'-tall fabricated steel intake structure in the forebay. Services included design, procurement, and construction. Mort's team supplied the necessary hydraulics/hydrology assessments, geotechnical reports, and FERC packages. Challenges included short work windows with an accelerated schedule, working within the constraints of an operating facility, and working-in-the-wet with a diving team. *($9M, 12/2016 – est. October 2017)*

Gay & Robison (G&R), Olokele Hydroelectric Project, Kauai, Hawaii - Principal-In-Charge/Sr. Technical Advisor. McMillen Jacobs is currently replacing an existing 1 MW hydroelectric facility that was built in 1921. The new facility will generate approximately 7.5 MW of power, with an annual generating capacity of 20,000 MW/h. It consists of a new diversion dam, 3,000 feet of a 48-inch-diameter steel pipeline, and a new powerhouse with a 7.5 MW two-jet horizontal pelton turbine and generator. The new intake structure will be constructed on the irrigation ditch below the existing powerhouse. A new steel penstock will deliver water from the intake to the powerhouse. The new powerhouse will utilize a pre-engineered metal building, and will include a 35-ton bridge crane for servicing the equipment. In the early design stage, McMillen Jacobs provided mechanical design engineering, equipment procurement and bidding assistance, and assisted in the layout of the turbine in the powerhouse. Upon completion of that contract, McMillen Jacobs was selected by G&R to construct the new hydro design. Work is being self-performed including concrete crews, pipe, etc. Upon completion, McMillen Jacobs will assist with start-up activities. *(2017 – Ongoing)*

Rye Development, Yazoo Basin Hydroelectric Projects, Mississippi - Project Manager. Completed alternatives analysis and predesign for modifications of the four existing 100-foot tall earthfill flood storage reservoir to incorporate new hydroelectric powerhouse facilities. Worked included extensive review of existing hydrologic and facilities design, development of plan for lining the existing outlet conduits to pass 10,000 cfs, development of a geotechnical investigation plan, and evaluation of alternatives for powerhouse equipment. Developed construction cost estimates, schedule, and sequencing plans for proposed projects.

Puget Sound Energy; Lower Baker Powerhouse Project; Concrete, Washington – Site Selection/Cost Estimating. McMillen Jacobs provided preliminary design, construction support, and start up and commissioning support on this project. It consists of a new 30 MW powerhouse and a new 1,000-foot-long, 12-foot diameter steel power tunnel. It included the design of the underground power tunnel, powerhouse foundation, and underground connection to existing tunnel, and engineering services during construction. The tunnel design included installation of a pressure tunnel bulkhead to isolate the new tunnel excavation from the existing operating pressure tunnel. As part of an early study effort, Mr. McMillen led the design and construction team to conduct a siting study, cost estimate development, and constructability review of the proposed powerhouse. The siting study evaluated using the original Powerhouse 1 site versus a downstream site location. The selected site was downstream from the existing powerhouse to avoid unstable geotechnical areas and improve overall constructability. *($1.5M; 2009 – 2013)*

Sacramento Metropolitan Utility District (SMUD), South Fork Powerhouse & Boating Flow Release Facility (BFRF) Design-Build Project– Principal-in-Charge. McMillen Jacobs was selected as the Design-Build contractor for a new powerhouse and boating flow release facility below Slab Creek Dam as part of new Upper American River Project relicensing requirements. The purpose is to increase water releases to enhance fish habitat and recreational boating and to harvest the energy from that flow with a new powerhouse. Scope of work includes the powerhouse and transmission line, a new hydraulic connection to the existing White Rock Tunnel, the installation of a 78-inch butterfly valve, and a penstock connection to the BFRF. The Powerhouse will be connected to an existing 12 kv distribution line with a maximum output rating

of 2.978 KVA at 0.9 pf due to line capacity constraints. *($14.2M / 06/21/16 – est. end of 2018; Construction began 4/2017)*

Northern Wasco Public Utility District No., Freedom Project (The Dalles Dam) – Project Manager. Mr. McMillen is the project manager on this project which includes building a new hydropower facility with modifications to the existing intake structure. Project includes building a new powerhouse facility includes modification to the existing intake structure through The Dalles Dam, new 800 cfs intake screen, 10-foot diameter steel penstock, and new powerhouse. The project utilizes approximately 900 cfs of supplemental water used for fish passage attraction water for the north shore fish ladder system. The existing hydropower facility has been proposed to be expanded to further improve fish attraction and adult salmonid fish passage around The Dalles Dam. The additional water to the fish ladder will allow operation of a second fishway gate improving attraction and guidance of adult salmonids. Additional flows of up to 800 cfs are available for the new hydroelectric project expansion. The total combined flow of the existing and new generation facilities is approximately 1,800 cfs operating two 5.0 MW powerhouses. *($32.2M; (Phase I $575,000, Phase II $1,658,000, & Phase III $30M); 2013 – Ongoing)*

NorthWestern Energy, Hebgen Intake Cofferdam Demolition Spillway Cofferdam Design-Build, Gallatin County, Montana – Technical Oversight. McMillen Jacobs was hired by NorthWestern Energy to provide design-build services to demolish the existing cofferdam in front of the intake and build a new cofferdam to support future construction of a new spillway structure in 2016. The project was separated into two phases. In the initial phase, McMillen Jacobs demolished the existing intake cofferdam, removed and stockpiled the backfill, and disassembled and removed the steel structures. The second phase of the project required the design and construction of the new cofferdam. *($3.4M; 04/2015 – 11/2015)*

PacifiCorp Energy, Toketee Hydroelectric Project Dam Intake Tower Modifications, Roseburg, Oregon – Design-Build Project Manager. Responsible for the design build of a modifications to the existing intake tower located on the upstream side of a 100 ft tall zoned earthfill dam which is part of the existing Toketee Hydroelectric project. Project consisted of developing detailed plans and specifications for the addition of a new steel intake structure 60 ft tall, 60 ft wide, and 10 ft deep fitted with a new screen and automated trash raking system mounted on the face of the existing concrete intake tower. Conducted a finite element analysis of the existing 70 ft tall concrete intake tower with the new steel intake structure, prepared detailed plans and specifications, prepared required permits, and provided design report with calculations to FERC for approval to modify the existing structure. Responsible for the construction of the intake tower modifications including all fabrication, crane erection and lift sequence, diving team, steel fabrication, and startup/testing. This project involved a floating barge with a long reach excavator to remove 20′ of debris in front of the intake prior to the outage of the powerhouse. Once the debris was removed, the powerhouse was shut down and the existing intake screens were also removed. New modular expansion screens were installed in front of the existing intake to reduce the velocities entering the intake. All material was installed in front of the intake using a 285-ton hydraulic crane. Dive teams were utilized to remove sediment from in front of the intake and to place the pre-cast concrete block to serve as a bearing point for the underwater steel structure. *($1.8M; 01/2010 – 08/2010)*

PacifiCorp Energy, Yale Bull Trout Entrainment and Debris Net Reduction, Ariel, Washington – Design-Build Manager. This project involved the design-builder of a net system in Yale Lake to reduce entrainment of bull trout and to prevent debris from the intake ports of the intake structure. The net was over 700 feet long and 110 feet deep. A rock anchor was used to attach the left side of the net to the bank. A concrete dead man was constructed on the top of the earthfill dam. Concrete anchors were used to secure the net to the floor of the reservoir. Divers were used to install the bottom anchors. A second net was installed in front of the spillway. This net system was 400 feet long and installed in approximately 50 feet of water. The

system was designed to be raised and lowered remotely using a flotation system mounted to the top of the net and a winch system on the top of the dam. The net was installed across the reservoir in front of the spillway. McMillen Jacobs supported the permitting process, developed the design, and installed the net. Most of the work was performed from barges with extra precautions in our safety plan for working over the water. McMillen Jacobs was responsible for the design, fabrication, permitting, and construction of the net systems. *($674,280; 02/2009 – 12/2009)*

PacifiCorp, Hydroelectric Turbine Pressure Relief Valve Deflectors at Prospect Powerhouses 1 and 2 – Project Manager. During a rapid turbine shutdown, such as what occurs during lightning storms, the wicket gates shut off flow to the turbine. However, water already flowing in the penstock will maintain momentum for some time building up pressure in the unit. To relieve this pressure the flow is diverted into the Pressure Relief Valve which discharges the water to atmosphere. The Pressure Relief Valve then slowly closes, gradually slowing the flow of water and keeping the pressures within operating range. This pressure relief is quite vigorous, discharging a 4 ft diameter plume across the river and onto the far bank. This plume could pose a physical danger to boaters crossing in front of the powerhouse, direct impact from the plume could create injury, and the violent discharge could capsize a boater. The team was retained to provide design-build services for a deflector vane device or similar energy dissipating structure that would be attached to the outlet of the PRV on the face of the dam in order to dissipate energy such that the effects will not be detrimental to the safety of boaters in the proximity of the tailrace. *($327,509; 12/2009 – 10/2012)*

Ice Harbor Gate Lift Mechanism Rehabilitation Design, Walla Walla, Washington – Principal-in-Charge. Mr. McMillen was the principal-in-charge for the retrofit design of the gate lift mechanism rehabilitation for this major USACE dam on the Snake River. The technical scope of the effort included civil, structural, mechanical, architectural and electrical engineering focus. The project was executed on time and within budget and is now moving into construction support services for construction of the rehabilitation.

Monterey County Water Resources Agency, Interlake Tunnel and San Antonio Spillway Modification, Owner's Engineer for Design Build Documents, Salinas, California – Project Manager. Project Manager for development of design and preparation of design build procurement documents. Project consists of a new intake structure, 12,000-foot long by 10-foot diameter hard rock tunnel, outlet gate control structure, energy dissipater structure, and modifications to the existing San Antonio Dam spillway to convert the existing overflow crest spillway to a gated spillway. Mort is leading the preliminary design, development of final design documents, coordination with the environmental consultant, preparation of detailed cost estimates and schedule, and development of funding source. *(ongoing)*

Pend Oreille PUD; Sullivan Dam Cold Water Release System – Principal-in-Charge. The Sullivan Dam Cold Water Release System Project consisted of a new intake screen located 120 feet below the lake surface, a 54 inch diameter HDPE pipeline installed on the floor of the reservoir with concrete anchors, a downstream control gate, air burst cleaning system, and flow/temperature monitoring system downstream from the dam. The constructed system was designed to provide colder water temperatures downstream from the project to improve bull trout habitat. ($184,373; 06/2014 – 02/2015)

Idaho Power, Upper Salmon Spillway Repair – Principal-in-Charge. Mr. McMillen was the principal-in-charge on a project to repair the Upper Salmon Spillways on the Snake River near Hagerman, Idaho. McMillen Jacobs' innovative construction approach to the project provided consistent pricing, which allowed for additional piers. A floating barge was installed in the river as a work platform with an eight-ton carry deck crane staged on board. This method allowed work to be completed at each pier without any larger support equipment required. McMillen Jacobs made concrete and slide gate repairs at each location of the Upper Salmon spillway. *(Phase one: $298,413; 11/2010 – 01/2011 and Phase two: $141,843; 05/2012 – 07/2012)*

Puget Sound Energy, Electron Hydroelectric Project, Dam Replacement Study, Washington – Project Manager. Responsible for alternatives development and evaluation for replacing the existing timber crib dam with a new concrete gravity dam approximately 30 ft tall and 200 ft long. New dam will divert up to 400 cfs into a hydropower power canal and pass full flood flows over a combination of a fixed dam crest and two 16 ft wide Obermeyer spillway gates. Responsible for the analysis and preliminary design of alternative, preparation of cost estimates and construction schedule.

Puget Sound Energy, Lower Baker Dam Floodwall Design-Build – Project Manager. This project consisted of design and construction to raise the dam elevation to 460 feet at the left and right dam abutments. The purpose of the flood wall is to contain the maximum water surface elevation for an extreme flood event, and to direct potential overtopping flood flows to the center section of the dam. The full 12-foot width of the arch was raised to an elevation of 456.5 feet, with parapet walls extending the additional 3.5 feet to an elevation of 460 feet. The section of the floodwalls adjacent to the spillway bays were shaped with typical entrance curve geometry to provide a smooth flow transition in the event of overtopping during an extreme flood. Currently construction is on hold; however, design was completed. Mort's team also performed additional work on the spillway crest improvements which included a gate alternatives analysis, VE, developing a cost estimate, construction scheduling, FERC coordination, and a construction cost estimate. His responsibility included developing plans and specifications for a 17' abutment raise of the existing 286' tall thin shell concrete arch dam to accommodate eleven 22'x16' roller gates with wire rope hoists. *($4.2 Million; 11/2012 – 08/2013)*

Puget Sound Energy, Upper Baker Dam Intake Isolation Gate Inspection, Washington – Project Manager. Responsible for conducting a gate inspection and preparing report outlining the gate conditions, structural analysis, and recommended improvements in accordance with FERC guidelines for the existing 20 ft square intake isolation gate.

Puget Sound Energy, White River Diversion Dam, WA – Project Engineer. The project consists of final design and preparing construction documents for the replacement of an existing timber crib diversion dam. The new diversion dam will be 350 feet long, 15 feet high, and include 2 radial gates (35 feet and 16 feet wide), two 50-foot long by 10 feet high rubber dams, and a fixed crest section. The existing intake gates will be replaced to provide a 2000 cfs diversion to an off channel power canal. He evaluated the required modifications to the upstream migrant facilities for the ACOE fish trap and the White River Fish Hatchery.

Puget Sound Energy, White River Hydroelectric Project Dike 14/15 Inundation Analysis - Project Manager/Engineer. Responsible for completing a dam break analysis and inundation study for the existing 30 ft tall, 1500 ft long Dike 14/15 structures which form Printz Basin on the White River hydroelectric project. For this work effort, Mort lead the development of a HEC-RAS unsteady state model with dike breach option to analysis the level of inundation on downstream development in the event of dike failures. The dikes were classified as high hazard structures due to the high level of development downstream and potential for loss of life if a dike failure occurred. These dikes were the low point in the open channel conveyance system and would result in draining in excess of 50,000 acre ft of water if the dikes were to fail. Worked with PSE and their geotechnical consultant to develop remediation alternatives to stabilize the dikes. Also completed the hydraulic analysis and developed the predesign for a backflow prevention gate structure and analyzed the inundation zone with the gate structure in place. Developed report and assisted in discussions with FERC representatives and WDOE Dam Safety Program.

USACE, Cellular Cofferdams and Upstream Dewatering Bulkhead for the $35 million John Day Dam Spillway Modifications Feature Design Memorandum - Design Engineer. Project involved preparing preliminary design details for replacing two existing generator bays at John Day Dam with fish bypass spillways. Responsible for the analysis and design of the 100 ft tall temporary cellular cofferdams required to

dewater the project tailrace for construction. Also completed the hydraulic analysis and design of the new spillway structure and the sequenced demolition approach for removing the existing powerhouse structure.

USACE, Lower Granite Dam PMF Analysis, Washington - Project Manager. Responsible for development of HECRAS and HECHMS models for the entire Snake River Basin to predict the anticipated Probable Maximum Flood (PMF) event at the existing Lower Granite Dam on the Lower Snake River.

USACE, Lucky Peak Dam Outlet Tower Isolation Bulkhead Replacement, USACE, Washington - Project Engineer. Responsible for the structural analysis and preparation of plans and specifications for fabrication and installation of a new fabricated steel isolation bulkhead gate at the existing earthfill 340 ft tall Lucky Peak Dam near Boise, Idaho. Also conducted a cavitation study on the existing outlet sluice gates.

USACE, Omaha District, Big Bend Spillway Structure Chute & Basin Slab Repair – Principal-in-Charge. Mr. McMillen was the principal-in-charge on a project to repair a drain line deep under the spillway slab at Big Bend Dam on the Big Bend Spillway in Fort Thompson, SD. Due to Mr. McMillen's efforts, the project was completed a month ahead of schedule and before multiple snow fronts passed over the job. Additionally, due to a value-engineering effort, McMillen was able to save the Corps $40,000.

USFWS, Krumbo Dam Safety Inspection, USFWS, Oregon - Project Manager. Conducted the dam safety inspection in accordance with USFWS dam safety requirements for the 505 ft long, 35 ft tall zoned earthfill low hazard dam with a maximum storage volume of 5200 acre ft. Working with a certified diving team, installed an inflatable plug in the submerged intake structure, dewatered the outlet conduit and regulating gate structure, and conducted an Remote Operating Vehicle (ROV) inspection of the dewatered structure. Prepared dam safety report and submitted to USFWS dam safety program for review. Led the design-build team to complete repairs to the spillway and access bridge.

Willow Creek Dam, Heppner, Oregon - Project Engineer. Project included a 150-foot high RCC dam, outlet works, and general civil improvements including roads, utilities, fencing, and site improvements. Mort was responsible for Civil Design Components Design.

USACE, Dworshak Dam Radial Gates Design, ID - QA/QC Manager. Involved alternatives analysis and final design for rehabilitation of the existing three 12' x 9' regulating outlet (radial) gates. It included the replacement of the hydraulic operating system, upgrade of the instrumentation and electrical systems, and structural repairs to the gate and downstream conduit. Each gate has a maximum hydraulic capacity of 10,000 cfs.

Associated Ditch Companies (ADC), Rehabilitation of the Wallowa Lake Dam, Joseph, Oregon - Project Manager. Since 1996, Mort has served as the engineer of record to provide dam safety inspections and planning/design of long term improvements to the existing dam which was constructed in 1919 and raised in 1929. The existing dam is 65-foot high (measured from the dam foundation to the crest) by 200-foot long concrete gravity dam constructed on glacial till. The dam provides a storage reservoir approximately 4 miles long and 1 mile wide with a total active storage volume in excess of 50,000 acre-ft. The initial work effort in 1996 consisted of performing a dam safety inspection and developing emergency repairs to address significant dam safety issues. Mort worked closely with the Oregon State Dam Safety Engineer throughout the process to ensure the proposed strategy met the State's requirements. The second work phase consisted of conducting a feasibility study to determine the best approach to address significant dam safety issues which would require complete rehabilitation or replacement of the existing dam. The recommended alternative was to replace the existing dam with a new concrete gravity dam designed to pass the 38,000 cfs PMF with a gated spillway, conventional stilling basin, outlet tower, and new concrete irrigation flume channel. Mort has also conducted the periodic dam safety inspections in conjunction with the Oregon Dam Safety Engineer and assisted the ADC in preparing updated emergency action plans and O&M plans. *(1996)*

Donald Jarrett, PE | Project Manager and Senior Mechanical Engineer

Mr. Jarrett is a registered Professional Engineer in Alaska and has been involved in the full lifecycle of hydro facilities—from early reconnaissance, licensing/permitting, design, and procurement through start-up and commissioning and operations management. He has personally started up 4 generation projects. While an employee of an IPP, Mr. Jarrett developed business plans, and schedules, for the rehabilitation of powerhouses as well as managing operations and maintenance personnel at more than 20 operating projects. Issues addressed included O&M staff levels and utilization and the uprating of existing equipment, automation, and conversion of generating equipment.

In addition to the technical expertise to design and construct hydro facilities, Mr. Jarrett has managed multi-disciplined design teams, vendors, and stakeholders to deliver hydroelectric improvement projects within budget and schedule.

Mr. Jarret was involved with the design, manufacturing and factory testing of large centrifugal pumps (up to 100,000 HP). He has considerable experience with control systems, switchgear, protective relays, substation equipment, and transmission equipment. Specific experience includes the design, procurement and installation support of intake gates, emergency closure gates, head and tail gates, bypass gates, spillway and outlet gates, slide gates, and radial gates. In addition to gates, Mr. Jarrett has expertise in steel penstocks and bifurcations, centrifugal and mixed flow pumps, Francis, Pelton and Kaplan type hydraulic turbines, internal combustion engines, cogeneration equipment, programmable logic controllers, and associated control/ instrumentation systems. He has also designed, procured, and supported installation of gate and valve operators, as well as butterfly, spherical, polyjet, and fixed cone valves.

Education

BS, Mechanical Engineering, University of California at Berkeley

Years of Experience

40 + years

Registrations

- PE, Alaska, No. 7393
- PE, California, No. M32784
- PE, Nevada, No. 016977
- PE, Oregon, No. 09803
- PE, Washington, No. 21688
- PE, Idaho, No. P-15944

Professional Affiliations & Organizations

- American Society of Mechanical Engineers
- Past Director, Northwest Hydroelectric Association
- American Welding Society

Areas of Specialty

- Past operations and maintenance manager for multiple hydroelectric projects
- Experience with hydro projects in Alaska
- Project manager for multiple new hydro projects.
- Completed over 20 hydro condition assessment reports.

Relevant Experience

Pend Oreille Public Utility District, Box Canyon Hydro, Turbine Upgrade Project – Project Manager. In addition to providing mechanical support on the upgrade and modernization study for this 80 MW hydroelectric facility as well as engineering support during FERC relicense process, Mr. Jarrett served as the Project Manager on the turbine upgrade project. He developed turbine–generator upgrades and rehabilitation bid documents (2005) for this 4-unit powerhouse that was built in 1955. This project was awarded to Andritz Hydro in 2006 and they completed upgrade and refurbishment of the four vertical Kaplan units in 2015. As Project Manager, he led the TDG abatement program, which involved modifications to the operators (new hydraulic cylinder hoist system) of the main spillway gates. This project was awarded to Dix Company for construction in 2013 and Mr. Jarrett completed his start-up support in April of 2015. McMillen Jacobs was the Engineer-of-Record for both the turbine upgrade and TDG abatement projects and provided construction management services for both projects. He also provided engineering support for replacement of generator air coolers (2004). He developed spillway crane modernization bid documents and provided construction management services for a 100-ton gantry crane. (2004). Scope of work also included developing powerhouse

crane rehabilitation bid documents and providing construction management services for the 150-ton gantry crane (2005). *($80 M construction cost for powerhouse upgrade / $5M for TDG abatement; 2000 – 2015)*

Southeast Alaska Power Authority, Swan Lake Hydro Project Dam Raise, Ketchikan, Alaska – Lead Mechanical Engineer. Mr. Jarrett was the lead mechanical engineer for the dam raise at Swan Lake. As such he evaluated the existing generating equipment, the headgate and penstock for this dam raise. Additional he prepared procurement documents for a new spillway vertical lift gate. *(2016)*

Southeast Alaska Power Agency – Mechanical Lead. Supported McMillen Jacobs' evaluation of several hydro sites throughout southeastern Alaska. *(Ongoing)*

Avista Utilities, Cabinet Gorge Hydro Project, Washington – Project Manager. Mr. Jarrett is the Project Manager for a team of engineers developing a new design for the headgates at the Cabinet Gorge Project. The new head gates will replace the existing 1950's vintage riveted steel gates. Bid documents and installation contract documents are being prepared. *(2017-2018)*

Copper Valley Electric Cooperative, Allison Creek Hydro Project – QA/QC Mechanical. Mr. Jarrett provided internal technical review for the intake and powerhouse design of this project. *(2016 - 2017)*

Eugene Water and Electric Board, Carmen Smith Hydroelectric Project – Project Manager. Mr. Jarrett led a facility assessment consisting of the Carmen Powerhouse (two 55 MW units) and the Trail Bridge Powerhouse (single 10 MW unit for re-regulating Carmen powerhouse discharge). Initial work involved a detailed facility assessment (including dams and associated works, substation, and supporting facilities) with a team of engineers, including cost estimates for replacement and refurbishment work in 2010 and 2011. Later, he completed 60% specifications for the refurbishment of the powerhouse equipment (turbines, governors, valves, etc). *(2011 – 2013)*

Homer Electric Association, Grant Lake Hydropower Development, Moose Pass, Alaska – Mechanical Lead. McMillen Jacobs was contracted to perform feasibility engineering and develop a preliminary design package for the proposed Grant Lake Hydroelectric Project consisting of a new intake structure, conveyance tunnel, penstock, powerhouse, and tailrace. Mr. Jarrett also developed the preliminary powerhouse arrangement. *($434,379; 10/2013 – ongoing)*

USACE, Dworshak Dam – Project Manager/Lead Mechanical Engineer. Mr. Jarrett assisted in developing new hydraulic operators and hydraulic power units as well as new controls for the existing regulating outlet (RO) works tainter valves that were commissioned in 1970. McMillen Jacobs provided the Government with design, plans, and specifications for the refurbishment of these three large RO valves. *(2014 – 2016)*

Nushagak Electric Cooperative, Lake Elva Hydro Project, Dillingham, Alaska – Project Manager. Mr. Jarrett supported the feasibility studies for potential new hydro facilities.

Doran Taylor Hydro, Vancouver Island, BC near Port Alberni – Project Manager. Mr. Jarrett performed a condition assessment of the existing hydro facility and provided recommendations.

Truckee Meadows Water Authority – Project Manager. Mr. Jarrett performed a condition assessment of three turn-of-the-century hydro projects (Washoe, Fleish, Verdi). He also assisted with turbine rewinds at Verdi and Fleish).

Truckee Meadows Water Authority (TMWA), Rehabilitation at Washoe, Verdi, and Fleish Hydro Projects – Project Manager and Lead Mechanical Engineer. At the Washoe and Fleish Projects, he

developed a condition assessments for the rehabilitation of facilities built in 1910. He managed the procurement for new control panels, excitation, protective relay, and neutral ground fault equipment. Engineering support to TMWA included specifications, bidding assistance, submittals review, and start-up/commissioning support. At the Verdi Project, engineering support was also provided to replace the generator shaft and rewind the generator. *(2005-2009)*

Covanta Energy, Koma Kulshan Hydro Project – Project Manager/Lead Mechanical Engineer. After Mr. Jarrett reviewed options for weld repair of the eroded Pelton runner, he developed bid documents for this 20 MW horizontal turbine and managed the procurement for the new runner. He also developed installation specifications and solicited bids for the services to install of the new runner. *(2005 – 2007)*

City of San Bernardino, Cogeneration Project - Project Manager. As a consulting engineer, he led a team to do a feasibility study reviewing options for cogeneration at the city's waste water treatment plant. As a part of that effort, he obtained a grant from the local utility for a cogeneration facility**.** As Project Manager and Lead Mechanical Engineer, he developed procurement specifications for two 1000 HP lean burn, dual gas fired, engine-generator sets with controls and switchgears (2004). Later, he led a team to develop bid documents for the installation of the cogeneration equipment and performed construction management for both contracts. *(2005 – 2007)*

Various Clients – Acquisitions/Due Diligence. Mr. Jarrett performed acquisitions due diligence on greenfield and operating hydroelectric projects in Chile (Rio Manso and most recently Baquendano), Argentina (in the late 1980's during privatization of energy projects), Brazil (in the late 1990s for Duke Engineering on an operating project, Paranapanema, 1100 MW during privatization), Guatemala (Santa Rita and San Cristobol - 2011), Costa Rica, Equador, Panama, Canada, and the United States.

Tyee Hydro, Solomon Gulch Hydro, Terror Lake Hydro and Swan Lake Hydro Project (Four Dam Pool Projects Assessment – Lead Mechanical. Mr. Jarrett reviewed several properties for acquisition by the associated cities (including Wrangel/Petersburg for the Tyee Project). *(1995)*

Summit Power, Inc., Soo River Hydro, Runner Replacement Project; Whistler, BC – Mechanical Lead. Performed condition assessment of existing facility and provided recommendations for the runner replacement and turbine refurbishment. He managed the preparation of tender documents and bidding for the replacement of two horizontal 7 MW Francis turbine runners. *(2014 – 2016)*

Hidrolelectrica Choloma SA, Candelaria and Choloma Projects, Guatemala – Mechanical Engineer. Mr. Jarrett assessed the objectives and participated in the site evaluation and planning, engineering and cost estimating. He performed mechanical design on the Candelaria Project that included a complete "water-to-wire" equipment package, including a 4.5 MW Francis turbine, generator, controls, and main step-up transformer. The Choloma, 9.5 MW high-head hydroelectric project, was only feasible due to an innovative collection of water from five small streams using new dams and diversions that were connected together into a single low head HDPE pipeline. A 40-inch-diameter steel pipeline about 10,000 feet long carried to water down about 460 meters in elevation to a new powerhouse with a 9.5 MW two-jet horizontal Pelton turbine and generator. Both projects are now operating and meeting estimated energy production goals. 2012 National ACEC Award *(06/06 $12M; 10/11 $25M Construction Cost)*

Puget Sound Energy, Lower Baker Dam Crest Improvement Project – Lead Mechanical Engineer. Participated in a Value Engineering session reviewing potential project improvements for the preliminary design of the dam crest improvement project, which includes the demolition and replacement of the existing dam deck and spillway gate equipment including 11 new fixed wheel gates. *(2016)*

Sacramento Metropolitan Utility District (SMUD), Slab Creek Powerhouse & Boating Flow Release Facility (BFRF), aka South Fork Design-Build Project – Lead Mechanical Engineer. McMillen Jacobs was selected as the Design-Build contractor for a new powerhouse and boating flow release facility below Slab Creek Dam as part of new Upper American River Project relicensing requirements. The purpose is to increase water releases to enhance fish habitat and recreational boating and to harvest the energy from that flow with a new powerhouse. Scope of work includes the powerhouse and transmission line, a new hydraulic connection to the existing White Rock Tunnel, the installation of a 78-inch butterfly valve, and a penstock connection to the BFRF. The Powerhouse will be connected to an existing 12 kv distribution line with a maximum output rating of 2.978 KVA at 0.9 pf due to line capacity constraints. Mr. Jarrett assisted with preliminary design of the powerhouse, developed turbine-generator equipment bid documents, evaluated the bids, prepared the conformed documents for the contract, and is now assisting with contract management for this equipment. Additionally, he is providing senior review for the design of the powerhouse. *($14.2M / 6/21/16 – est. end of 2018; Construction began 4/2017)*

Avista Utilities; Nine Mile Dam Sediment Bypass System, Spokane County, Washington – Mechanical Oversight. The purpose of this project was to improve the inoperable sediment bypass system to prevent debris from entering the turbine and causing damage. Improvements included replacement of the pre-cast access bridge with a steel bridge, moving the rails for the Kunz trash rake, a new bulkhead, and a new intake. Services included design, procurement, and construction. Mr. Jarrett reviewed submittals for the new bulkhead, emergency fixed wheel gate and knife gate and provided engineering support during construction for installation of this equipment. *($9M, 2016/2017)*

Gay & Robinson, Olokele Expansion Project, Kauai, Hawaii – Lead Mechanical Engineer. Included preliminary design with turbine-generator equipment sizing and preliminary powerhouse layouts. (2012). In January, 2016, Mr. Jarrett completed the bidding for the equipment procurement. Currently, he is finishing final design of powerhouse and intake, including intake gates, trashrack rake, and fish screens. *(2011 – ongoing)*

Snohomish County PUD, Youngs Creek, Sultan Washington – Lead Mechanical Engineer. Scope of work included preliminary and final design of a 7.5 MW run-of-river project in Washington State. He was responsible for the turbine-generator equipment procurement, including submittal reviews, and provided commissioning assistance in 2011. Mr. Jarrett was also responsible for powerhouse and intake mechanical systems, including HVAC, sanitary sewer, cooling water systems, fish screens and trash rack rake procurement, and selection of intake gate equipment (i.e. head gate, sluice gate, minimum flow release gate). This project received the 2012 Renewable Energy Project of the Year Award. *($30 M; 2007 – 2011)*

Snohomish County PUD, Hancock and Calligan Creeks – Lead Mechanical Engineer. Mr. Jarrett managed the design and procurement of 2 jet Pelton turbine generators (6 MW), powerhouse, intake, gates, trash rack rake, and fish screens. Work included intake gates, trash rack rake, fish screens, the development of a commissioning plan, and an O&M manual for facility. *(2011 – 2017)*

Northern Wasco Public Utility District No., Freedom Project (The Dalles Dam) & McNary Northshore Fishway Project – Lead Mechanical Engineer. This was a proposed new hydro facility with modifications to the existing intake structure through the Dalles Dam, a new 800 cfs intake screen, a 10-foot-diameter steel penstock, and a new powerhouse. Mr. Jarrett was responsible for initial design *($32.2M; 2013 – 2015)*.

Northern Wasco Public Utility District No., McNary North Shore Fishwater Project (McNary Dam) – Lead Mechanical Engineer. Project includes review of problems with existing 10 MW vertical propeller turbine. Runner has had cracking problem since commissioning. McMillen Jacobs reviewed runner repair welding procedures, obtaining budgetary turbine vendor proposals for runner replacement. McMillen Jacobs developed runner procurement specifications, and awarded a contract for a new runner. McMillen Jacobs

managed the bid process and provided construction management for installation for the new runner and rewind of the generator. The McNary unit is presently being disassembled in preparation for the installation and commissioning of the new runner. *($5M construction cost; 2013 – 2017)*

Pend Oreille PUD, Sullivan Dam Cold Water Release System –Mechanical Engineer ITR. Mr. Jarrett provided independent technical review for the cold water pipe design. This project consisted of a new intake screen located 120 feet below the lake surface, a 54-inch-diameter HDPE pipeline installed on the floor of the reservoir with concrete anchors, a downstream control gate, air burst cleaning system, and flow/temperature monitoring system downstream from the dam. The constructed system was designed to provide colder water temperatures downstream from the project to improve bull trout habitat. *($184,373, 06/2014 – 02/2015)*

US Army Corps of Engineers, Walla Walla District, Ice Harbor Lock and Dam, Hoist Machinery Replacement Project – Lead Mechanical Engineer. Prepared plans and specifications for the replacement of the lower lock gate hoist drive system. *(2014 – 2017)*

Twin Falls Hydro Associates, Twin Falls Hydro Project – Lead Mechanical. Mr. Jarrett led the preliminary design and assisted with final licensing negotiations. He was responsible for erection, commissioning, and operations management and performed vibration baseline measurements. He resolved numerous problems following project startup including control system modifications, bypass valve operation, installation of new unit draft tube water doors, bypass valve chamber concrete failure, draft tube gate failure, access tunnel rock support, HVAC, etc. Mr. Jarrett resolved a total dissolved gas problem in the tailrace which was related to the draft tube air admission system. He coordinated and implemented modifications to the control system (programmable logic controller) and provided management of velocity measurements for a submerged inclined plane, wedge wire, and fish screen system. He managed the development of an innovative air burst fish screen cleaning system, managed the installation of a partial discharge monitoring system on both units, and served as Operations Manager responsible for O&M staff, planning, compliance, and budgeting. He performed a complete vibration survey with non-contact displacement probes (including key phases) and FFT analyzer. *(1989 – 1999)*

Enel North America, Boot Hydro Project, Massachusetts – Mechanical Engineer. Mr. Jarrett provided engineering services for the replacement of the failed Kaplan hub components with a new forging. He provided construction support during fabrication, machining, and installation. *(2007)*

Lewis County Public Utility District, Cowlitz Falls Hydro Project – Consulting Engineer. He performed a review of the operations and maintenance of this 77 MW run-of-river project in 2005. He also provided assistance with the repair/replacement of the shaft seal, including weld procedures for installation of a new shaft sleeve, seal replacement vendor selection, and filed assistance during the replacement in 2007. He provided a review of Tacoma Power's fish passage facilities to be constructed at Cowlitz Falls. *(2008)*

Abitibi-Price, Iroquois Falls Hydro Projects, Ontario, Canada. While an employee of an IPP, Mr. Jarrett developed a business plan, schedule, and specifications for the rehabilitation of 3 powerhouses associated with this project in northern Ontario, Canada. Issues addressed included O&M staff levels and utilization and the uprating of existing equipment, automation, and conversion of generating equipment from 25 to 60 Hz.

Mathew Lawson, PE, P.Eng. | Senior Electrical Engineer / Instrumentation

Matt Lawson is a registered Professional Engineer in Alaska and has a background in power generation, plant controls, and automation, including design and construction of new and retrofit projects. He has more than 25 years in utility hydro generation design, construction, and operation; 15 years as an owner/operator of hydroelectric projects. He has extensive experience in trouble-shooting and problem-solving power system operational and control issues for a large number of hydroelectric generation facilities.

Mr. Lawson has been the responsible engineer in charge of many electrical designs—large and small. Projects include generator and plant control upgrades and retrofits, automated gate controllers, and balance-of-plant and auxiliary systems. On most of his projects, his work included electrical components of outbuildings, outdoor lighting to enhance safety, and electrical for mechanical equipment. He has designed upgrades for a wide range of generation and water facility clients including pumping stations, high-density utility and raceway designs, power delivery, automation, SCADA, and general controls. He has designed plant-wide automation systems integrating various generation and plant controllers into a central operator interface (HMI), interfacing with existing SCADA/RTU and EMS systems. Many of Mr. Lawson's projects have been remote hydroelectric facilities, with access limited by boat or float plane.

Education

BSEE, Brigham Young University, Utah

Experience

25 years

Registrations

Licensed Electrical Engineer

- PE, Alaska No. 11874
- PE, California No. 21341
- PE, Idaho No. P-13219
- PE, Oregon No. 65133PE
- PE, Utah No. 9428479-2202
- PE, Washington No. 26123
- P.Eng., British Columbia No. 154781

Professional Affiliations & Organizations

- IEEE

Areas of Specialty

- 25 years of electrical and instrumentation design, construction, and/or operations of hydro plants
- Hands on experience with field startup, commissioning, and operation of hydro plants
- 15 years of experience as owner/operator of hydro plant
- Previous experience on hydro projects in Alaska

Relevant Experience

Southeast Alaska Power Agency (SEAPA), Swan Lake Dam Raise- Lead Electrical Engineer. The existing 100-foot long Ogee spillway was filled in with an automated hydraulic fixed wheel gate and 15-foot high metal flashboard panels, allowing the reservoir elevation to be increased by approximately 15-feet. Mr. Lawson was responsible for the electrical power and control design modifications, to accommodate the dam raise. Duties included purchasing newly fabricated control panels and providing onsite support of installation and commissioning. Project access was remote, with access via by float plane or boat. *($1M; 2015- Ongoing)*

Copper Valley Electric Association (CVEA), Allison Creek Hydroelectric Project; Valdez, Alaska – Senior Electrical Engineer. On this $53 million, 6.7 MW hydro project, Mr. Lawson provided QA/QC reviews on submittals for the powerhouse, outbuildings, and controls for automated features. He also developed the electrical commissioning plan. *($53M; 09/14-2016)*

BPA-Funded Banks Lake Pumped Storage Upgrade and Operation Assessment, Grand Coulee; Lake Roosevelt, Washington - Lead Electrical Engineer. Bonneville Power Administration (BPA) as part of their wind and variable generation impact and mitigation efforts commissioned a study to evaluate the existing operation of Banks Lake Pumped Storage. Banks Lake was evaluated from a historic perspective to see if operation could have modified to improve efficiency and response time to switching between pumping

and generation, as well as improve reliability and longevity of major equipment. The study included a condition assessment of the pump-storage powerhouse and developing a cost estimate for a major upgrade in the pump-turbines and controls, estimated at $250 million. As part of the larger evaluation team, he was the lead electrical engineer and played a significant role in evaluating plant operation, major equipment assessment, and equipment upgrades cost estimates. *(2008-2009)*

Lewis County PUD, Cowlitz Falls Dam Spill Gate Upgrade, Randle, Washington - Lead Control Engineer. Cowlitz Falls Dam had four spill gates with aging actuator controls, and was mandated by FERC to address and correct deficiencies with the spill gate operations. Mr. Lawson assessment the existing facility and prepared an upgrade design on the aging system to meet FERC's requirements. Modifications included gate controls, integrating new load cells, and positioning feedback sensors. Load cells were used as added protection from overloading the actuator when raising, and preventing slack rope condition during lowering. New position sensors were necessary to replace unavailable replacement components. After completion of the design, Mr. Lawson also assisted with field installation and commissioning of the modified gate controls. *($30k; 9/2014-8/2015)*

USACE, Dworshak Dam Regulating Outlet Valves (radial gates) Equipment Upgrades - Lead Electrical Engineer. This project included replacement for 3 regulating outlet valves (radial gates). Scope included replacement of the existing hydraulic system including two 8-inch bore hydraulic cylinders and hydraulic power units for each valve. Mr. Lawson was responsible for assessment and design of power and controls including a new PLC and fiber network to link the controller to the powerhouse. *($407k; 06/15 – 05/16)*

Enduring Hydro (aka Cube Hydro), Mahoning Creek Hydro Project; New Bethlehem, Pennsylvania – Senior Electrical Design Engineer. Mr. Lawson was the lead electrical designer of a new small two-unit (6 MW total) hydroelectric facility. His duties included electrical design including control, protection, communications, SCADA, and interconnection, as well as equipment procurement, supporting construction, leading commissioning, and assisting with operational issues. Mahoning Creek is an add-on generation facility constructed on an existing U.S. Army Corps of Engineer's flood control dam. *(04/12 - 12/13, Ongoing O&M)*

Puget Sound Energy, Snoqualmie Falls Powerhouse #1 & #2; Snoqualmie Falls, Washington – Electrical Engineer/Construction Support. Mr. Lawson provided electrical construction support rebuilding and upgrading both Snoqualmie Falls underground (Powerhouse #1) and above ground (Powerhouse #2) generation facilities owned and operated by Puget Sound Energy. He provided quality control and inspection services and oversight for all electrical construction aspects of the project. His duties included interpreting engineer design drawings, preparation of installation details, and monitoring electrical subcontractor work and work processes, providing the main contractor with recommendations and documentation demonstrating contract compliance. *(02/2012-06/2014, Ongoing support)*

Ameren Osage Hydro Plant; Eldon, Missouri – Senior Electrical Engineer. responsible for the detail electrical modification design for the plant station service reconfiguration, house unit and main generator relaying protection scheme, and quality control review of the plant electrical system modeling and study. As part of this work Mr. Lawson prepared detail protection design drawings that included replacing existing electromechanical relays with modern digital relays to provide transformer, generator (both small and large), bus, line and load protection. He was also responsible for specification development for major components such as exciters, power transformers and 15-kV switchgear. The consulting services included major tasks from initial study and conceptual design to detail study and design, equipment and contractor specification and bid review, design basis documentation and finally to the operator and maintenance procedure documentation. *($500k, 2007-2009)*

Seattle City Light, Boundary Governor Replacement; Metaline Falls, Washington – Lead Electrical Engineer. Mr. Lawson was responsible for the replacement and upgrade of the six unit governors at Boundary Dam on the Pend Oreille River in northeast Washington. Mr. Lawson was responsible for preparing a technical specification for the purchase of new governor controls and lead of a team of engineers to prepare installation design and construction drawings, assisted in the construction, prepared the commissioning procedure, and lead commissioning of each of the new governors. Controls upgrade included refurbishment of the intake gate operation. *(2004-2007)*

Yakama Nation, Irrigation Drop 2 and 3 Refurbishment; Yakima, Washington – Lead Electrical Engineer. Mr. Lawson was the lead electrical engineer responsible for the electrical refurbishment of three existing irrigation drop hydroelectric generators [one 2.5 megawatt (MW), and two 680 kilowatt (kW)] at two powerhouses in Yakima, Washington. The three units were in disrepair with the generators out of service for many years. Mr. Lawson was also part of the multidisciplinary team of engineers tasked with assisting the Yakama Nation in returning the three units to service. The refurbishment effort included updating the gate and actuator controls, relaying protection scheme, revenue metering replacement, switchgear and controls inspection and testing, generator winding repair, assembly and final checkout and commissioning. *(2007-2008)*

Brookfield Renewable Energy; Northwest Pumped Storage Screening Study; Washington and Oregon – Lead Engineer. This client has a large land holdings in the states evaluated and wanted their properties to be screened for potential energy development, and then also a general site search near their property for other potential development. As the local project lead, he was responsible for coordinating and leading the various technical resources to perform the site surveys and studies. He has evaluated various land locations for topology and geologic conditions (with other technical leads), which met predetermined reservoir sizing requirements and proximity to transmission lines. Feasibility included evaluation of the interconnection requirements for each of the sites. He also developed a cost estimating template with the assistance of other engineers that allowed for a consistent, objective, and more accurate cost estimating process to be performed on each potential pumped storage site. The study included evaluating the potential size of the generator and pumping equipment and the transmission interconnection requirement. Deliverables included completed Federal Energy Regulatory Commission (FERC) Preliminary Permit Applications for seven sites deemed feasible for development. *(2007-2008)*

Fortis BC Pumped Storage Screening Study, British Columbia, Canada – Lead Electrical Engineer. Fortis BC, a utility in southern British Columbia with over 1.1 million customers, commissioned a study to evaluate potential for pumped storage in their service territory. He was the lead engineer and project assistant in performing reconnaissance of numerous potential sites. The study performed an initial desk-top screening exercise of more than a dozen locations, with further screening reducing the list to six. The short list of sites went under further evaluation and site visits, and then conception layouts, cost estimates, and economic analysis prepared for each of the short-listed locations. Client deliverables included optimized sizing of the potential project, conceptual layouts and intertie connections, and cost development for the short-listed sites. *(2007-2008)*

Pend Oreille PUD, Box Canyon Upstream Fish Ladder; Newport, Washington – Lead Control Engineer. Mr. Lawson is the lead control engineer in designing the electrical controls for the Box Canyon upstream fish passage facility. The design included PLC and motor controls for large submersible horizontal pumps, various weir slide gates, valves and auxiliary systems. The facility is used to attract targeted fish, routing through a fish ladder, collection pools, and sorting facility. It also included underwater cameras and biomarking of fish. *(09/2014-Ongoing)*

Matt Moughamian, PE | Sr. Civil Engineer

Matt Moughamian is a registered Professional Engineer in Alaska and has performed extensive work in the planning, hydraulic design, and final construction documents of many civil and pipeline designs for the hydropower industry. He has experience in process, mechanical, civil, and I&C disciplines on a variety of projects.

Penstock and piping designs have utilized a wide variety of materials from the most common materials of steel, ductile iron, and HDPE / PVC, to less common special piping applications dealing with FRP materials and reinforced concrete cylinder pipe.

He also has years of experience planning and design of water and wastewater disinfection systems, for wastewater treatment and drinking water treatment facilities. He also has designed numerous water reuse and treatment systems to conserve/improve limited water supplies and reduce energy consumption.

Relevant Experience

Copper Valley Electric Authority (CVEA), Allison Creek Hydroelectric Development Project, Valdez, Alaska – Design Engineer. Mr. Moughamian served as lead design for the 7,000-foot-long steel penstock design for this new 6.7 MW hydropower project. The penstock consisted of 40-inch and 36-inch buried steel pipe in a single-bevel butt-weld joint design. Penstock designs on grades of up to 60% were achieved with a total vertical fall of nearly 1,200 feet from the intake to the powerhouse. Design included special vertical drilled rock anchors on inverted elbows along with penstock embedment through a 700-foot-long tunnel. Mr. Moughamian developed the design of all the penstock anchoring, thrust blocks, air-release stations, vacuum relief, complete pipeline and joints, including lining and coating systems. *($53M; 2013 – 2016)*

Avista Utilities; Nine Mile Dam Sediment Bypass System, Spokane County, Washington – Civil/Pipe Valves. The purpose of this project was to improve the inoperable sediment bypass system to prevent debris from entering the turbine and causing damage. The project consisted of a Collaborative Improvement Phase where Avista and McMillen Jacobs analyzed and evaluated improvements to the construction project. Based on those discussions, our team revised the existing drawings to prepare for construction. Improvements included replacement of the pre-cast access bridge with a steel bridge, moving the rails for the Kunz trash rake, a new bulkhead, and a new intake. Services included design, procurement, and construction. *($9M, 12/2016 – est. 12/2017)*

Rye Development, Yazoo Hydroelectric Project – Lead Pipeline Engineer. In coordination with USACE Vicksburg, MI District and Rye Development, McMillen Jacobs and Mr. Moughamian assessed the existing conditions at four different earthen dam projects, and designed a solution including new steel liners inside the existing ovoid and circular concrete conduits. The new steel liners ranged in diameter from 11 feet to 15.5

Education

MS, Civil Engineering, Massachusetts Institute of Technology

BS, Civil Engineering, University of Notre Dame

Experience

30 years

Registrations

- NCEES, No. 52769
- Alaska, No. 13953
- Arizona, No. 59069
- Idaho, No. P-6590
- Montana, No.PEL-PE-LIC-28853
- Oklahoma, No. 27110
- Utah, No. 6523096-2202
- Wyoming, No. 12816

Professional Affiliations & Organizations

- American Water Works Association
- International Ozone Association
- International UV Association
- Lifewater International

Areas of Expertise

- 30 years of experience with design and construction of hydraulic structures, gates, valves, and penstocks
- Extensive experience in Alaska with hydro projects

feet, and were analyzed for a number of project conditions including structural and thrust loading, internal hydraulic pressure, mitigation for lack of waterstop at some of the concrete joints in the conduits, bifurcation wye design, transportation issues, and constructability and joint welding design. Analysis was also provided on the hydraulic flow capacity impacts of the new steel liners on the existing concrete conduits to help the USACE provide the best solutions possible to line these 60-year-old flow conduits. Flows ranged from about 1,000 cfs up to 6,000 cfs. *($198k; 09/15 – 08/16)*

Sacramento Metropolitan Utility District (SMUD), Slab Creek Powerhouse & Boating Flow Release Facility (BFRF), aka South Fork Design-Build Project – Lead Civil Engineer. Scope of work includes a powerhouse, a connection to the existing White Rock Tunnel, the installation of a 78-inch butterfly valve, and a 400-foot-long penstock connection to the boat flow release facility. The penstock and fixed-cone bypass valve are being designed to meet the maximum instream flow release and recreational flow release required under the FERC License. He was responsible for senior engineering oversight of the assessment and design of the new 78-inch-diameter penstock, penstock bifurcations, the new 54-inch-diameter penstock, and a TIV valve at the powerhouse. *($14.2M; 6/16 – 2018 est.)*

City & Borough of Sitka, (CBS), Takatz Lake Hydropower Assessment Study, Baranof Island, Alaska – Lead Design Engineer. McMillen Jacobs civil, structural, and environmental permitting staff served as sub-consultants to Current Consulting on this concept design and assessment of the potential for a 30 MW hydropower project from Takatz Lake on the east side of Baranof Island. The project considered the viability and concept design and estimated capital cost of a new lake tap tunnel bored under and into Takatz Lake, some 190 ft below current lake levels. Mr. Moughamian served as the lead design PE for civil and project arrangement drawings developing approximately 20 drawings of the lake-tap, unlined tunnel alignments and profile, powerhouse and electrical switchyard site arrangement options, and maintenance building and access road alignments. Powerhouse layout options were developed for use of two, vertical axis Pelton impulse units each designed for a maximum flow of ~250 cfs at a maximum head of ~960 ft (417 psi). Portions of the project include the use of 72-inch steel penstock inside the lined tunnel where rock cover is insufficient to resist hydrostatic pressures. Mr. Moughamian was responsible for coordinating the production of a 200-pg assessment report titled Takatz Lake Hydroelectric Project Appraisal Study, 2014. The study was successfully completed for CBS in spring of 2014. *(2013 – 2014)*

PacifiCorp, Lemolo No. 2 Discharge Reroute to Toketee Lake Project, Toketee Lake, Oregon – Lead Civil Engineer. Mr. Moughamian served as both PM and lead PE for this $5M tailrace barrier project to reroute up to 700 cfs of the Lemolo 2 Hydropower effluent water through a ¾-mile long pipeline to Toketee Lake. This project included all predesign, design, and bid assistance services for the construction of a new tailrace diversion / intake structure, a 700 cfs concrete intake structure, and ¾ mile of 9-ft and 8-ft diameter Reinforced Concrete Pipe (RCP – ASTM C76) conveying water directly to Toketee Lake. Responsibilities included coordinating all design and project management efforts for the design team and to provide bid-assistance and CM services to the Owner. *(2009 – 2010)*

Pend Oreille PUD, Sullivan Cold Water Intake Design and CM, Oreille County, Washington – Senior Civil Engineer. Mr. Moughamian provided the hydraulic analysis and pipeline and fish screen design for the Sullivan Cold Water project. McMillen Jacobs was contracted to assist in developing a solution for mitigating downstream elevated water temperatures at Sullivan Lake Dam in northeastern Washington. In order to improve fish habitat and development, the PUD was required to install a cold water release structure that would lower the creek temperatures during the summer months below Sullivan Lake Dam. The selected approach for solving this problem was the installation of a low-level cold water release system. The system consists of an intake with twin stainless steel NOAA criteria tee screens located approximately 900-ft from the dam at a water depth of roughly 130 feet. The project included a 900-ft of 54" HDPE pipeline from the intake to the dam; a steel conduit and bulkhead assembly that passes through one of the existing low-level

outlets within the dam; and a slide gate on the end of the pipeline to control the release of cold water. Instrumentation and controls required to operate the system were also designed by Mr. Moughamian. *(2013-2014)*

Navajo Gallup Water Supply Project – QA/QC. McMillen Jacob's scope of work was to install 4 miles of 42-inch-diameter water supply pipeline and appurtenant facilities. Technical aspects included using hydraulic hammers to break apart and excavate portions of the pipe alignment where hard sandstone and claystone where found, navigating all the unmarked utilities in the right-of-way as well as coordinating work activities around the monsoon season. Installation of the 42-inch steel pipeline required excavation depths up to 20 feet as the pipeline crossed several county roads, existing buried utility lines, and numerous arroyos or washes on the site. The pipeline was installed in 2 steep grades with slopes exceeding 80%. Mr. Moughamian performed independent technical reviews on the design. *($12.6M; 2012 – 2013)*

US Army Corps of Engineers (USACE), Walla Walla District, McNary Dam Water System Upgrade, Umatilla, Oregon – Project Manager. Mr. Moughamian served as PM and lead PE for the complete planning and design to provide upgrades to the 50-year old water supply, storage and transmission system to McNary Dam. Upgrades included a new 0.5 MG dual-cell water storage tank, automation of an existing chlorination system, and design of 1.5 miles of new 8-inch to 12-inch diameter distribution piping (AWWA C900 PVC) for supply of potable water to dam yard support buildings and also to the complete powerhouse facility. Mr. Moughamian coordinated all disciplines of design and also self-performed the civil, process mechanical, and controls engineering design for the facility upgrades. *(2011- 2012)*

PacifiCorp Energy, JC Boyle Dam Instream Flow Augmentation Project, Klamath County, WA – Design Engineer. Mr. Moughamian served as lead design PE for the new 24-inch diameter steel bypass pipeline to provide up to 50 cfs instream flow augmentation to the Klamath River. The new project required design of a new 18-inch diameter V-port knife gate valve for flow control purposes to throttle the system flows along with orifice plate design as well. The knife gate was designed with metal seat systems to resist high bypass pipeline velocities along with electric actuation and controls. *(2011)*

Kauai Island Utilities Cooperative (KIUC), Upper & Lower Waiahi Hydropower Penstock Replacement Projects – Lead Design Engineer and Project Manager. Mr. Moughamian designed a new 37-inch-diameter, 500-foot-long, above-ground, steel penstock for two powerhouses in this remote area of Hawaii. He also developed an optional steel joint design to compare costs. The projects were successfully constructed and tested in 2014. *(2014)*

Kevin Jensen, P.E., P.Eng. | Civil /Hydraulics Engineer

Kevin Jensen is a registered professional engineer in several states and in Canada and offers a depth and breadth of engineering experience that covers planning, civil design, hydraulic design, hydrologic and hydraulic modeling, development of operational procedures for dams, and a variety of investigations and analyses related to the potential impacts and benefits from water resources-related infrastructure.

Mr. Jensen brings expertise in the design of hydraulic structures, and has worked on a number of water-related design projects. These projects have allowed Mr. Jensen to integrate his skills through the iterative process of analysis-design-simulation, enabling him and his team to develop the best solutions practicable.

Mr. Jensen has experience managing field work, databases, and proprietary programs in the service of modeling pursuits. In the past three years, he has steered the development of several large-scale hydrologic and hydraulic models in both the public and private sectors and at the local, state, and federal levels.

His numerical modeling experience includes computational fluid dynamics (CFD), 1- and 2-dimensional mobile bed hydraulic models, rainfall-runoff hydrologic models, and groundwater flow and transport models. CFD model experience includes proficiency in STAR-CCM+ and FLOW-3D, two industry-standard numerical codes used in the water resources industry. Through graduate courses in CFD at the University of Idaho, Mr. Jensen has also become proficient in the use of Fluent, another industry-standard CFD code. Other hydraulic modeling experience includes the following codes: HEC-RAS, FESWMS-2DH, MD-SWMS, RMA2, FLO-2D, and RiverFLO-2D, along with the habitat suitability model River2D and the fish passage program FishXing. Hydrologic modeling experience includes the following codes: HEC-HMS, HEC-SSP, WinTR-20 and SITES. Groundwater modeling experience includes the following codes: MODFLOW, FEFLOW, SUTRA, HST3D, and MTD3MS. Other computer experience includes GIS, spreadsheets, and programming in FORTRAN, Java, VB, Python and C++.

Relevant Experience

Southeast Alaska Power Agency, Various Hydro Sites, Alaska – Project Engineer. Mr. Jensen assisted McMillen Jacobs' team in the evaluation of potential hydroelectric sites in Southeast Alaska. He developed site evaluation approaches, conducted hydrologic and power evaluations, and created generation simulations to determine the most feasible hydro sites. He assisted in the evaluation of each site and supported construction cost estimates. *(Aug 2017 – Ongoing)*

Education

MS, Water Resources Engineering, University of Idaho (coursework complete)

BS, Environmental Resources Engineering, Humboldt State University

BA, English and Philosophy, University of San Francisco

Experience

8 years

Registrations

- P.E., Washington, No. 54576
- P.E., Idaho, No. P-16248
- P.E., Utah, No. 9512870-2202
- P.Eng., British Columbia, No. 169843

Professional Affiliations

- American Association of Dam Safety Officials (ASDSO)
- Canadian Dam Association (CDA)
- U.S. Society of Dams (USSD)

Boards and Committees

National Reservoir Sedimentation and Sustainability Team

Areas of Specialty

- Assessments of existing facilities
- 15 years of experience with hydraulic and hydrologic analysis supporting hydro projects
- Supported the analysis and preliminary design of over 20 hydro studies
- Experience in Alaska
- Dam Safety

Copper Valley Electric Association, Allison Creek Hydro Project, Hydraulic Lead. Mr. Jensen provided hydraulic and hydrologic modeling for this $53M design-build hydro project in a remote area of Alaska. This new hydroelectric project consists of a new 250-foot-long by 20-foot-tall diversion structure, 7000 feet of welded steel penstock with a maximum operating static head of 1152 feet, new 725-foot-long by 16-foot-tall horseshoe hardrock tunnel, 2.5 miles of new construction access roads, new 6.5 MW powerhouse, and 3.5 miles of new transmission line. *($53M, 2016 – 2017)*

Confidential Client, Optimization of Relief Well Placement, Confidential Dam Seepage Abatement Project, British Columbia, Canada – Hydraulic Modeler. The dam in this project is one of the largest earthen dams in the world. As such, the integrity of the dam is a high priority for the client, who owns and operates the facility. As part of a seepage abatement project for the dam, Mr. Jensen developed a 3-dimensional groundwater flow model of the site in order to introduce several wells along the face of the dam to relieve pressure in the core and reduce the potential for seepage. As part of this task, Mr. Jensen determined the optimal number and configuration of wells to achieve the client's goals while minimizing project costs.

Avista Corporation, Nine Mile Sediment Bypass System – Hydraulics QA/QC. Assessments on existing facility. Reviewed methodology and calculations for estimating potential scour depth below the outfall of a 5-foot diameter sediment bypass conduit. Supported the design and construction for repairs and upgrades.

Utah Associated Municipal Power Systems, Freedom Project, CFD Design Support, The Dalles, Oregon – Hydraulic Modeler. The Freedom Project is a hydropower design project at The Dalles Dam (Columbia River) intended to increase hydropower production for UAMPS while improving fish passage conditions at the north shore fish passage facility. The design analyzed several alternative weir operation configurations in order to evaluate the best possible hydraulic scenario for fish passage. For this project, an existing USACE-developed model was updated, and upgraded from STAR-CD to STAR-CCM+. The new STAR-CCM+ model of the fishway and tailrace area was validated against earlier model results, which themselves were validated against a physical model developed at ERDC.

Yurok Tribe, Small Hydro Feasibility Study for Two Tributaries of the Klamath River, CA – Researcher. The Yurok Tribe of Northern California hired the Schatz Energy Research Center to conduct a small hydropower feasibility study of two tributaries along the Klamath River. As part of this study, Kevin was tasked with determining the energy resource available at each site. This required developing hydrologic rating curves and conducting hydraulic analyses of each tributary, so that results could be introduced to an engineering cost-benefit analysis to determine which, if any of the streams should be developed for power generation.

Pend Oreille County PUD, Box Canyon Dam FERC Part 12D – Project Engineer. Mr. Jensen completed the Supporting Technical Information (STI) document as part of the FERC Part 12D Independent Consultant's Inspection of Box Canyon Dam, located on the Pend Oreille River. The dam is a run-of-river hydropower facility that has had recent modifications to the spillway gates, and that has planned upgrades for fish passage.

Pend Oreille County PUD, Sullivan Lake Canyon Dam FERC Part 12D – Project Engineer. Completed the Supporting Technical Information (STI) document as part of the FERC Part 12D Independent Consultant's Inspection of Sullivan Lake Canyon Dam, located near Metaline, Washington. The dam is used to regulate water surface elevations in the lake for recreational and diversion purposes. Recent upgrades have included the installation of a cold water intake, automated gate controls, and a SCADA system to relay data to the operating room at Box Canyon Dam.

Rye Development, Yazoo Hydroelectric Project – Project Engineer. With close coordination with USACE Vicksburg District and Rye Development, McMillen Jacobs designed a new steel liner inside the existing

ovoid and circular concrete conduits that range in diameter from 11 feet to 18 feet at 4 different earthen dam projects. Scope of work included a variety of analysis and design issues from structural and thrust loading, to hydraulic pressurization concerns, mitigation for lack of waterstop at some of the concrete joints in the conduits, and effects on hydraulic flow capacity of the conduits to help the USACE provide the best solutions possible to line these 60-year-old flow conduits. Flows at these 4 facilities range from about 1,000 cfs up to 6,000 cfs. *($198k; 09/2015 – 08/2016)*

Sacramento Municipal Utility District, Slab Creek Powerhouse and Boating Release Facility, CFD Task Manager. Oversight, including guidance and quality control, of a FLOW-3D model simulating flow through a tunnel-adit bifurcation transitioning into a new 54"-diameter penstock. Efforts included developing alternative geometries to minimize hydraulic losses and cavitation potential through the transition.

Pacific Gas & Electric, Pit 6 Temporary Construction Emergency Action Plan and Water Management Plan – Project Engineer. Developed a TCEAP and WMS for a hydropower facility along the Pit River, California undergoing modification and repairs to a stilling basin. Included back-up dewatering strategies, evacuation routes, lockout-tagout protocols, and emergency notification systems.

TransAlta, Upper Mamquam Facility Inundation Study – Project Engineer. Mr. Jensen conducted an inundation study of the Upper Mamquam Hydropower Facility in order to review and update the consequence classification of the dam, define the Inflow Design Flood (IDF), and determine the population at risk (PAR) and potential Loss of Life (LOL) during a dam failure. Project deliverables included inundation maps of the breach extents, a study report with the incremental potential economic, social and environmental losses from the resulting dam failure and corresponding consequence re-classification.

USACE, Walla Walla District, Columbia River Treaty Unsteady Flow Model of Columbia River between Ice Harbor and McNary Dams – Project Engineer. As part of the 2014/2024 review of the Columbia River Treaty, McMillen Jacobs was hired to develop a calibrated and validated HEC-RAS model of the Columbia River, from Ice Harbor Dam to McNary Dam. Mr. Jensen managed to closely calibrate results to measured values, in order to simulate more critical events with greater confidence and provide the client with accurate inundation maps of the area.

USACE, Walla Walla District, Conceptual Modifications to Mill Creek Diversion Dam for Passage of the Standard Project Flood – Hydraulic Modeler. The Mill Creek Project is a flood control project located in Walla Walla County, Washington and operated and maintained by USACE, Walla Walla District. The project provides flood protection for the city of Walla Walla and other developed areas within the Mill Creek floodplain. In 2008, USACE revised the Standard Project Flood (SPF) for the Mill Creek Project, which is now higher than the previous SPF. The purpose of this project was to evaluate modification alternatives to the Mill Creek diversion dam in order for it to safely pass the updated SPF. To this end, Mr. Jensen developed a GIS-based unsteady HEC-RAS model using 1-meter LiDAR. The model was calibrated before being modified with design alternatives. From this analysis, the best optimal alternative was recommended to the client.

USACE, Walla Walla District, Hydraulic Modeling, and Floodplain Delineation of Lucky Peak Dam Failure, Boise, Idaho – Project Engineer. As an essential component of the Army Corps' endeavors to create an Emergency Action Plan for Lucky Peak Dam, located just upstream of Boise, Idaho, USACE hired McMillen Jacobs to conduct an extensive dam breach analysis of the dam, along with detailed inundation maps of two failure scenarios. This project entailed a single integrated HEC-RAS model spanning over 150 miles, containing over 1,000 LiDAR-derived cross sections, multiple canals and drains, storage areas, diversions, weirs, split flow, combined flow, and supercritical breach velocities of up to 50 fps.

BC Hydro, Site C Fish Passage Design, CFD Technical Input, British Columbia, Canada – Hydraulic Modeler. The Site C Clean Energy Project is a proposed dam and hydropower facility along the Peace River in central British Columbia, Canada. As part of the project design, both temporary (construction-term) and permanent fish passage facilities are planned for the dam site. Because the hydraulics at the tailrace of a dam can be quite complicated, BC Hydro retained McMillen Jacobs to simulate the hydrodynamics of the fish passage design using the CFD program Flow 3D. Mr. Jensen was responsible for modeling the permanent fish passage facility at various scales using the CFD software in order to single out the optimal design and to provide recommendations.

Orchard Irrigation District, Emergency Action Plan and Dam Inundation Study of Pole Creek and Willow Creek #3 Dams – Project Engineer. Orchard Irrigation District owns and operates several small dams in Eastern Oregon. Because of the proximity of these dams to population centers and/or critical infrastructure, many of them have high-hazard classifications. Consequently, Emergency Action Plans (EAPs) are essential to the safe operation and maintenance of these dams. For this project, Mr. Jensen developed dam breach models of both dams, as well as concomitant inundation maps, in order to aid in the development of an EAP for each dam. He then collaborated with the client and McMillen Jacobs management to develop a customized EAP for each dam that was both thorough and intuitive for the end-user.

NRCS, New Mexico, Santa Cruz Watershed Inundation Studies – Project Engineer. The scope of this project included evaluating several possible severe storm events and developing stability design and freeboard hydrographs for seven different dams within the Santa Cruz River watershed using the SITES program. Hydrographs were then included in a HEC-RAS dam breach model for each dam, and the resulting flood inundation was mapped using ArcGIS.

NRCS, Utah, Green River Diversion Dam Rehabilitation Concept Design – Project Lead. Mr. Jensen was responsible for developing the concept design for a dilapidated diversion structure along the Green River, near Green River, UT. The structure diverts water for irrigation purposes, as well as for municipal and hydropower uses. The rehabilitation design included a new dam alignment, and features to allow for sediment sluicing, debris passage, boat passage, and upstream and downstream fish passage with PIT detection. Mr. Jensen also contributed to the development of a Draft EIS for this project.

NRCS, Utah, Ivins Dams and Debris Basins – Project Engineer. Mr. Jensen was responsible for developing rehabilitation alternatives for six dams located in southern Utah. The effort included evaluation of the existing structures against federal and state design criteria, development of design drawings, hydraulic and hydrologic analysis, analysis of sedimentation rates into the basin, coordination with project stakeholders, evaluation of the existing structure against federal and state design criteria, cost-benefit analysis of proposed alternatives, holding public meetings, and ensuring that the design process met NEPA requirements.

NRCS, Utah, Sand "H" Dam and Debris Basin – Project Engineer. Mr. Jensen was responsible for developing rehabilitation alternatives for this aging structure. The effort included evaluation of the existing structure against federal and state design criteria, development of design drawings, hydraulic and hydrologic analysis, analysis of sedimentation rates into the basin, coordination with project stakeholders, evaluation of the existing structure against federal and state design criteria, cost-benefit analysis of proposed alternatives, holding public meetings, and ensuring that the design process met NEPA requirements.

NRCS, Utah, Stucki Dam and Debris Basin – Project Engineer. Mr. Jensen was responsible for developing rehabilitation alternatives for this dam located in southern Utah. The effort included evaluation of the existing structure against federal and state design criteria, development of design drawings, hydraulic and hydrologic analysis, analysis of sedimentation rates into the basin, coordination with project stakeholders, evaluation of the existing structure against federal and state design criteria, cost-benefit analysis of proposed alternatives, holding public meetings, and ensuring that the design process met NEPA requirements.

McMILLEN JACOBS ASSOCIATES

Heidi A. Wahto, MPA | Regulatory/Permitting Lead

Heidi Wahto is a Senior Regulatory and Licensing Consultant with 20 years of experience providing a range of legislative, policy, regulatory, and environmental services in both the public and private sectors. She specializes in analyzing requirements for and advising clients in licensing, permitting, and developing compliance programs for hydropower projects. Ms. Wahto has extensive experience managing Federal Energy Regulatory Commission (FERC) regulated Environmental Assessments (EA) and National Environmental Policy Act (NEPA) processes; statistical and economic analyses; public organization, budget, and compliance considerations; and environmental due diligence for a variety of engineering and environmental projects. In addition, she has supported various committees and task forces, and facilitated several multi-stakeholder processes. Ms. Wahto has several years of experience in legislative and regulatory affairs at the federal level, including support to a U.S. Senator.

She has participated in several FERC Part 12 Dam Safety inspections as Potential Failure Modes Analysis (PFMA) workshop consultant, technical recorder, and editor. She coordinated the preparation, review, and production of PFMA workshops, safety inspections, and engineering reports, including Emergency Action Plans. Clients included Grant County PUD and Tacoma Power in Washington and Copper Valley Electric Association, Petersburg Municipal Power & Light, Alaska Energy Authority, Ketchikan Public Utilities, Kodiak Electric Association, and the Southeast Alaska Power Agency in Alaska. She developed and produced Supporting Technical Information (STI) documents for Petersburg Municipal Power & Light in Alaska and the City of Ashland, Oregon.

Relevant Experience

Petersburg Municipal Power & Light, Blind Slough Hydropower Project, Southeast Alaska – Relicensing Support*. Supported the relicensing process. Responsible for preparation, production, and filing of the license application and environmental assessment. Conducted land use evaluation, economic analysis, and review of agency comments on the environmental assessment, and negotiated with permitting and resource agencies and FERC.

Alaska Electric Light & Power, Salmon & Annex Creek Hydro Projects, Juneau, Alaska – Relicensing Lead. Currently leading relicensing effort for the combined 3.675 MW Annex Creek and 6.9 MW Salmon Creek Projects. Developed draft and final license applications and environmental management plans. Managed study reporting and agency consultation. Prepared license amendment

Education

B.A., International Relations and Asian Studies (Chinese), Colgate University, Hamilton, New York

Master of Public Administration, Evans School of Public Policy and Governance, University of Washington, Seattle, Washington

Presidential Management Fellowship, Washington, DC, Finalist

Experience

20 years

Professional Affiliations & Organizations

- National Hydropower Association (NHA), Regulatory Committee Chair
- Northwest Hydropower Association (NWHA), Member
- HydroVision Steering Committee

Certifications

- Environmental Management Certificate

Areas of Specialty

- Native of Juneau, Alaska, bringing hands-on experience in Southeast Alaska
- Lead or supported several FERC licensings/relicensings in Alaska
- Completed full range of State /Federal permitting for multiple hydro projects in Alaska
- FERC and NEPA Specialist
- Compliance and Permitting
- Analyses and assessments of existing hydro projects
- Dam Safety and PFMA Analysis

applications supporting modifications to stream gaging program and project boundary. Providing continued support through FERC's licensing process including responses to requests for information, review and responses to scoping documents and agency comments, and review of FERC's EA document and final license. *($477k; 2015 - Ongoing)*

Copper Valley Electric Association, Allison Creek Hydro Project, Valdez, Alaska – Licensing and Compliance Lead. Led FERC license application process for the new 6.7 MW hydro project and license implementation and compliance through construction, including environmental monitoring and mitigation. Managed a multi-disciplinary team and led the preparation of license application and EA document; associated state permitting processes; development of 15 environmental management plans; and consultation with agencies and stakeholders. Prepared license amendment applications for modifications to project design and construction methods. Oversight of environmental monitoring and reporting during construction (completed 2016). Continuing to support environmental monitoring and final land owner negotiations. *($53M; 2009 – Ongoing)*

Cordova Electric Cooperative, Crater Lake Water & Power Project, Cordova, Alaska – Regulatory Lead. Permitting and environmental support for the feasibility analysis of a new combined water supply and hydropower project. Identified required permits, coordinating with USACE, agencies, and land owners. *($98k; 2015 – Ongoing)*

Absaroka Energy, Gordon Butte Pumped Storage Hydroelectric Project – FERC License Coordinator. FERC License Application process for the proposed 400-MW Gordon Butte closed loop pumped storage project in western Montana. Activities included conducting due diligence collection of existing information; preparing a Pre-Application Document and a request to use the TLP; consulting with FERC staff; planning for the joint meeting and site visit; and supporting public outreach. License application filed October 2015 and FERC license issued December 2016. *($390k; 2013 – Ongoing)*

City of Sitka, Takatz Lake Hydroelectric Project, Sitka, Alaska – Environmental Lead. Authored environmental portions of project appraisal study report for greenfield 25-MW hydro project on Baranof Island in southeast Alaska. Analyzed environmental issues, compiled multi-disciplinary technical sections, developed draft FERC exhibits, and managed document production. *($185k, 05/12 – 01/15)*

Ketchikan Public Utilities, Whitman Hydro Project, Southeast Alaska - Regulatory Coordinator*. Coordinator for the design and construction of this project. Managed team of four environmental subconsultants developing environmental monitoring and mitigation plans for the new 4.6-MW hydroelectric plant at an existing dam. Conducted agency and stakeholder consultation. Prepared application for a Special Use Authorization to the U.S. Forest Service for use of public lands. Provided grant funding research and application support. Coordinated project communication, scheduling, and administration among engineering, regulatory, and environmental teams.

Ketchikan Public Utilities, Ketchikan Hydro Plant Upgrade Project, Southeast Alaska – Consultant*. Participated in consultations with federal and state agencies and developed filings to secure required permits and approvals. Prepared Clean Renewable Energy Bond (CREB) applications for upgrade project; successfully secured $1.2 million CREB.

Cordova Electric Cooperative, Humpback Creek Hydro Repair Project – FERC Support*. Coordinated the development and submission of permits and plans. Supported FERC license amendment process and application as permitting liaison between engineering team, environmental consultants, and client.

Sacramento Municipal Utility District, South Fork Boating Flow Release Facility & Powerhouse – Regulatory Compliance Lead. McMillen Jacobs is the Design-Build contractor for a new powerhouse and

boating flow release valve that will enhance fish habitat and recreational boating while harvesting energy from required water releases below Slab Creek Dam. Ms. Wahto led the team's adherence to the FERC license and managed the coordination, assembly, and delivery of permitting documents, environmental management plans, and associated supporting engineering information for SMUD, agencies, and FERC license amendment compliance and construction approval. Permit compliance and/or agency coordination included CWA 401 certification and amendment, CDFG 1600, USFS SUA, and CEQA MND. *($14.2M / 6/16 – est. end of 2018; Construction began 4/2017)*

Rye Development, Overton, Williams, Yazoo and Lock and Dam No. 11 Hydroelectric Projects, IN, KY, LA and MS – Regulatory Support. Supporting FERC compliance activities throughout licensing and license implementation of various hydropower projects. Activities include developing environmental management plans, preparing exhibits, coordinating efforts with construction and operations staff, and strategic planning and compliance support. *($373,280; 2015 - Ongoing)*

Grand River Dam Authority, Pensacola and Salina Hydroelectric Projects, Vinita, Oklahoma – Regulatory Support. Supported FERC variance request development and process and initial license amendment preparation for permanent variance requests. Ms. Wahto also supported license compliance and exhibit requirements. *(Salina $268,118; complete, and Pensacola $67,101; 01/13 – Ongoing)*

Avista, Long Lake Hydro Project, Washington – Permitting Support. In support of spillway modifications, development of SEPA checklist, JARPA permit, BMPs, and environmental management plans. *($12M; 2015 - 2016)*

City of Hyrum, Hyrum Hydro Project, Hyrum, Utah – Regulatory Advisor. Alternatives analysis for repair/removal of a 400-kW hydroelectric project in Utah and associated compliance with FERC license surrender and dam safety requirements.

Pend Oreille PUD, Sullivan Lake Hydroelectric Project, Metaline Falls, Washington – Environmental Management. Development of an Operations Compliance Monitoring Plan for the lake level monitoring of Sullivan Lake. *($5.1 M cost; $184,373 contract; 06/14 – 02/15)*

City of Hastings, Lock & Dam No. 2 Hydropower Project, Minnesota - Regulatory Lead*. Project Manager of the FERC License Amendment process for the approval, installation, and compliance of hydrokinetic turbine technology at the City of Hastings' Lock & Dam No. 2 hydropower project on the Mississippi River in Minnesota. Coordinated agency consultation, and assembly and submission of amendment application drawings and documents. Managed post-license compliance activities, studies, and implementation of plans.

Cowlitz County PUD's Swift No. 2 Hydropower Project, Washington State – FERC Support*. Supervised the development of engineering exhibits for the relicensing process. Reviewed land use requirements and ensured compliance of engineering drawings and exhibits with FERC relicensing and security requirements.

Withrow Wind Project, Douglas County, Washington – Regulatory Coordinator*. Coordinated the permitting and regulatory approvals for data acquisition phase of this proposed 160-MW hydro project. Consultation with Federal Aviation Administration and application for FAA approval of meteorological tower. Managed communication among engineering, environmental assessment, and survey/access road teams. Performed assessment of SEPA scoping, wind turbine and access road siting, transportation requirements, and construction and building codes and permits.

Avista Utilities, Cabinet Gorge Bypass Tunnel Project – Regulatory Support*. Provided regulatory support to the engineering design and supported Avista in establishing agreement with the regulatory agencies so that the project design and construction complies with the terms of the license and the settlement agreement. Assembled drawings and documentation in support of permitting and regulatory filings.

Due Diligence Reviews, Various Power Plants and Locations – Environmental Consultant*. Performed environmental and regulatory due diligence reviews and related risk assessments in support of the purchase, sale, or refinancing of power plants. Activities involved reviewing records for compliance with applicable regulations and permit conditions, including FERC licenses. Projects included a combined cycle power plant in Washington State and hydroelectric plants in Montana, Oregon, the Northeast US, Panama, and Mexico.

New York Power Authority, Lake Erie Ice Boom – Study Support*. Conducted a study to identify alternative storage sites for the Lake Erie Ice Boom. Consulted with federal, state, and local agencies and planning offices. Negotiated with private land owners and other users of the Buffalo waterfront. Performed a cost-benefit analysis of the selected sites including environmental, engineering, economic, and social costs and benefits.

Hydro Ottawa Limited, Asset Management Support*. Provided assessment and analysis of regulatory, environmental, economic, and organizational concerns for Asset Management Framework Report for Hydro Ottawa Limited. Responsible for conducting interviews, reviewing corporate documentation, and implementing integration of concerns into asset management process.

PacifiCorp Hydroelectric Projects – Analyst*. Responsible for economic and statistical analyses of operational data using MS Access for risk analysis project for PacifiCorp's hydro generation facilities.

* *Work completed prior to employment with McMillen Jacobs.*