PROPOSAL FOR

FEASIBILITY OF DEVELOPING HYDROELECTRIC GENERATION AT EXISTING PROVIDENCE WATER SUPPLY BOARD FACILITIES

Prepared for:

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FEASIBILITY OF DEVELOPING HYDROELECTRIC GENERATION AT EXISTING PROVIDENCE WATER SUPPLY BOARD FACILITIES

PROVIDENCE WATER DEPARTMENT

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PROVIDENCE WATER DEPARTMENT

1.0 INTRODUCTION

The Providence Water Supply Board has a long history of efficiently providing clean water to the residents of Providence and Kent Counties in Rhode Island and wishes to develop renewable energy sources on Providence Water's infrastructure.

1.1 PROJECT UNDERSTANDING & KEYS TO SUCCESS

The Providence Water Supply Board (PW) owns and operates several dams in the State of Rhode Island to store and supply raw water to the Philip J. Holton Treatment Plant. The largest and the farthest downstream impoundment in the system is the Gainer Dam/Scituate Reservoir, which is located near the treatment plant and the lowest impoundment in the reservoir system. PW is seeking up to 500 kW of hydroelectric generation from one or more of the sites available on PW property.

Several sites have been identified that either had previous hydroelectric generation or that have excess flow and/or energy available for hydroelectric power generation. The opportunities for development include various discharges from the Gainer Dam (including the required minimum flow discharge of 9 million gallons a day into the Pawtuxet River), four pressure reducing valves (PRVs) located along the PW distribution network, and three other historical dams or dam sites upstream of the Gainer Dam.

Currently this is no generation at any of the sites owned by PW. A powerhouse remains at the Gainer Dam that was abandoned following a failure of the turbine shaft. PW subsequently surrendered the Federal Energy Regulatory Commission (FERC) license associated with the Project. PW does not have a current license or exemption for generation. Kleinschmidt understands PW does not wish to develop projects that would require a FERC license given the potential exposure of the infrastructure owned by PW.

Keys to Success:

The keys to success for PW include:

- Developing feasible projects with regulatory efficiency;
- Minimizing civil construction capital costs;
- Providing long term generation capacity; and
- Maintaining low operation and maintenance costs.

To support PW in successful development of hydroelectric generation, Kleinschmidt proposes a phased approach that will save PW unnecessary feasibility analyses and unwarranted studies. Essential elements of Kleinschmidt's proposal include:

- Screening potential development strategies and sites for regulatory efficiencies including FERC exemption and jurisdictional constraints;
- Proposing innovative, low cost design and construction for sites meeting regulatory criteria; and
- Designing facilities geared towards low cost and ease of maintenance.

1.2 INTRODUCTION TO THE KLEINSCHMIDT TEAM

For 51 years, Kleinschmidt's focus has been on hydropower engineering and related services including licensing, regulatory, ecological, fish passage and dam safety services for hydropower owners. Kleinschmidt is known in the industry for providing practical, cost-effective, timely and high-quality services because of this long-term focus on hydropower.

Over the past 5 years, hydroelectric projects have accounted for more than 85 percent of our workload on more than 1,400 individual projects. Nearly 100 percent of our staff company-wide participates in our work with hydro clients. Our primary clients are hydro owners and operators in the United States and Canada with assets ranging in size from less than 1 megawatt (MW) to 125 MW. Our core business is design, rehabilitation and modernization of small to medium-sized assets using a client-focused approach to build mutually beneficial relationships with our clients. Kleinschmidt will bring its hydropower experience to PW with a goal of developing hydropower generation that meets PW needs at one or more of the potential sites on PW property.

To provide PW with the best possible service, Kleinschmidt proposes Andy Qua as the Project Manager. Andy has 27 years of experience and specializes in hydropower licensing. Keenan Goslin P.E. will serve as the local contact as well the engineering lead for the study. Keenan has experience in all aspects of hydropower engineering and will assist Andy with day to day

coordination of the project. They will be supported by senior engineering and regulatory staff to assure quality, as well as by technical staff to bring cost efficiency to documentation and design.

1.3 BENEFITS OF SELECTING THE TEAM

BENEFITS OF THE TEAM

Kleinschmidt's experience with similar projects will provide PW the following benefits:

- **Responsiveness.** Kleinschmidt is one of the few consulting firms in the United States that specializes in servicing the hydro industry. This long-term focus allows us to offer a depth of experience sometimes found in larger, multi-disciplined firms, while retaining project control, communication, response time, flexibility and personal attention that characterize smaller firms. For this project, we will schedule an in-person kickoff meeting shortly after receiving a notice to proceed and will hold weekly update calls with PW to ensure we are meeting your needs.

- **Creative design using proven concepts.** Kleinschmidt excels in executing projects like to the potential development of hydroelectric power at PW. The core members of Kleinschmidt's proposed team for this project are experienced in discovering creative ways to integrate new equipment into old infrastructure. The Kleinschmidt team has been performing this type of work for more than 10 years (on average) and has completed many feasibility studies and design projects with similar components as this project, including:

  > We have completed more than 75 feasibility studies and designed more than 12 hydroelectric projects over the past 15 years.

  - 1.0 MW Troy Project
  - 275 kW Equinox Project
  - 1.0 MW Timothy Lake Project
  - 1.16 MW Sherman Island Project
  - 0.6 MW West Charleston Project
  - 1.3 MW Livermore Project

  Utilizing this recent experience, we will provide PW with design concepts that effectively and creatively use the existing infrastructure to reduce the cost of development and increase the probability of proceeding with further development of a favorable alternative.

2.0 TECHNICAL APPROACH

Kleinschmidt proposes a phased approach, first identifying projects that are feasible with minimum regulatory requirements and exempt from FERC licensing requirements.

Kleinschmidt proposes a phased approach, first identifying solutions what will not require licensing by FERC. The first phase of the project will include Task 1 and Task 2. A summary of the regulatory feasibility will be provided in a memorandum following the completion of Task 2 that identifies projects Kleinschmidt feels are potentially feasible based on the understood goals of the project. Potentially feasible projects will be carried forward and evaluated through the remaining tasks. A final report will be submitted to PW summarizing all tasks of the feasibility study.

2.1 TASK 1: KICKOFF MEETING AND REVIEW AVAILABLE DOCUMENTS

Major Elements:	• Review the existing data including drawings and information for the various sites, water treatment plant, pipeline and pump station to understand the existing infrastructure • Develop a memorandum and sketches describing potential development options at each site. • Facilitate a project kick-off meeting to: o Establish expectations, establish lines of communication and review recent studies to define basic parameters for the Project o Present and discuss alternatives o Receive input from PW regarding desired or required design and operational features
Benefits of our approach to PW:	• Allows us to develop alternatives, explore tradeoffs, adapt the alternatives based on site conditions and PW input leading to the study of likely feasible options • Establishes relationships and communication to improve overall project efficiency • Establishes clear understanding of PW's expectations • Increase clarity of approach and expectations early to guide the study
Deliverables:	• Memorandum describing development options to study • Sketches showing the basic arrangement of the options • Kick-off meeting agenda • Kick-off meeting notes
Assumptions:	• No additional site visits are assumed to be required • One Kleinschmidt employee will attend the kick-off meeting at PW with all other Kleinschmidt team members attending online

Kleinschmidt will review the existing information and drawings provided by PW and develop a list of development options with brief written descriptions including tradeoffs and sketches. This will provide the framework for the investigation discussion during the kickoff meeting.

Kleinschmidt proposes a 2-hour meeting at the PW office and via Skype to kick off the Project. We believe that the meeting will promote efficiency throughout the Project by achieving the following objectives:

Relevant experience to be applied to the PW feasibility study:
During the Faraday Feasibility Study effort, Kleinschmidt facilitated a kick-off meeting with PGE staff, including bringing in draft sketches and materials and asking for input that helped to solidify and clarify PGE expectations for the Project. We will take a similar approach moving forward guiding the conversation to hear what will work for the whole PW team and building common understanding.

- confirm PW's expectations and schedule;
- establish a communication protocol (including half-hour weekly update calls with Kleinschmidt's Project Manager and local representative at a minimum);
- review the available information;
- discuss optimization of the hydraulic capacity;
- obtain PW's input for preparation of the draft conceptual designs;
- obtain PW's input on desired operational features; and
- discuss Project approach with PW (design-bid-build, design-build other).

2.2 TASK 2: REGULATORY FEASIBILITY

Major Elements:	• Identify sites with potential hydraulic energy and evaluate each option as it relates to jurisdiction by the Federal Energy Regulatory Commission (FERC) or other regulatory requirements.
Benefits of our approach to PW:	• Eliminates unneeded analyses of sites that will not meet PW's regulatory requirements • Stimulates creativity for both regulatory and engineering solutions • Focuses effort on sites that meet PW's 'success' criteria
Lessons Learned on relevant projects:	• Designs that maximize 'generation' may not meet regulatory criteria or other constraints • Business plans are critical to establishing study parameters • Just because it is feasible does not mean it is reasonable
Deliverables:	• Opportunities that meet regulatory and design constraints
Assumptions:	• Analyses only consider opportunities within 'threshold' regulatory constraints

In conjunction with our engineers, Kleinschmidt's regulatory staff will review the constraints of FERC jurisdiction, exemption or licensing for sites that meet a minimum engineering threshold. Kleinschmidt understands that PW wishes to avoid FERC jurisdiction if possible and, if necessary, seek an exemption from licensing so that further FERC involvement in the project and related infrastructure is not warranted. Through seeking unique and innovative designs and

infrastructure placement, the Kleinschmidt team will work towards solutions that reduce or eliminate federal regulatory involvement, but that meet PW's goals for energy independence. Our review will include details of the permitting, regulatory, and environmental considerations for projects that meets the engineering and regulatory thresholds for development. This includes a preliminary schedule for regulatory activities from project inception through construction.

2.3 TASK 3: ENERGY MODEL

Major Elements:	• Create an Energy Model • Identify types of equipment and major civil components
Benefits of our approach to PW:	• Provides accurate energy estimate for PW planning • Sizes new units to balance capital cost and energy output • Designs correctly sized for development that can be built economically
Assumptions:	• To calibrate an energy model, PW will provide the daily average flows and pressures at all potential PRV locations and water delivery flow data for a reasonably long period of time. • Kleinschmidt has provided time for 4 energy models

Kleinschmidt will create an energy model based on daily mean flow data and minimum flow requirements for data available from PW. We will use inflow and outflow data provided by PW to complete this model. With this energy model, we will assess energy available for generation for each development option. We have assumed that several of the options will be eliminated in Task 2, leaving up to four options for energy modeling in this task.

We understand that PW is interested in exploring the possibility of net metering the hydroelectric generation and the electrical demand of the Water Treatment Plant. We will review the treatment plant energy usage provided by PW in the RFP and consider an alternative that would be sized to net meter the plant if that option is attractive to PW. The result of this task will be described in the feasibility memorandum.

2.4 TASK 4: CONSTRUCTABILITY REVIEW

Major Elements:	• Identify major construction items for the each potentially feasible option • Evaluate red flags or potential high-risk construction items
Benefits of our approach to PW:	• The first step to reducing project risk is to identify risks, this task helps PW see risks of the project from the beginning so they can be planned for prior to construction.

Kleinschmidt will review the proposed project configuration and provide comments on the construability challenges. Common construability challenges for hydropower projects constructed at existing facilities are:

- Bypassing water around the project;
- Dewatering sections of the existing project for construction;

- Managing water during construction;
- Excavating and constructing with limited working room or near existing facilities;
- Site access challenges;
- Unknown conditions including rock surface elevations; and
- Dam safety concerns working near existing water retaining structures.

We will summarize the constructability challenges associated with the hydropower project and give recommendations on how to manage each challenge during planning, design, and construction. The constructability review will be summarized in the feasibility memorandum.

2.5 TASK 5: OPINION OF CAPITAL CONSTRUCTION COSTS AND ANNUAL MAINTENANCE

Major Elements:	• Opinion of Construction Cost for Hydropower Project • Opinion of Annual Maintenance Cost
Benefits of our approach to PW:	• Increase accuracy by incorporating actual construction unit costs for at least four similar design-construction projects • Increased accuracy by using published maintenance cost data for small hydropower projects

Kleinschmidt will prepare a quantity take-off and opinion of probable construction costs based on conceptual sketches. We will provide two components to create an accurate cost opinion for PW. The first is a conceptual design that is based on proven design methods and a detailed understanding of PW's objectives. Having well-developed conceptual designs will enable us to identify construction material types and quantities that do not shift significantly from concept to construction, thereby reducing the cost uncertainty for PW. The second aspect of an accurate cost opinion is having accurate construction and material costs to apply to the concept designs. We will use Kleinschmidt's cost data from prior new developments to provide a well-developed opinion of project cost. The cost opinion developed will be consistent with a Class 4 level as defined by the Association for the Advancement of Cost Engineering International classification system for the hydropower industry (Figure 2).

	Primary Characteristic	*Secondary Characteristic*		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Notes: [a] The state of technology, availability of applicable reference cost data, and many other risks affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

FIGURE 1 COST ESTIMATE CLASSIFICATION MATRIX FOR THE HYDROPOWER INDUSTRY

Kleinschmidt will also give a projected annual maintenance budget based on industry information. The cost opinions will be presented in the feasibility memorandum.

2.6 TASK 6: PHASE 1 – FEASIBILITY MEMORANDUM

Major Elements:	• List of all sites to be included in this feasibility study • Identification of potentially feasible sites based on regulatory requirements
Benefits of our approach to PW:	• Phased approach reduces unnecessary analysis for sites that are not feasible.
Lessons Learned on relevant projects:	• Regulatory costs can have significant impact on the feasibility of small hydro projects • Understanding what the regulatory agencies are looking for ahead of time and including them early provides for smoother project execution.
Deliverables:	• Draft Memorandum • Final Phase 1 Memorandum
Assumptions:	• PW will review and provide comments on memorandum within 2 weeks of submission

Kleinschmidt proposes to combine the goals, site information and regulatory investigation gathered in Tasks 1 and 2 into a cohesive and well-organized summary of feasibility memorandum. The feasibility study will summarize the assumptions, approach and results of each of the sites. The feasibility study will contain a list of potentially feasible projects to carry through into Tasks 3 through 5.

2.7 TASK 7: PHASE 2 - FINAL FEASIBILITY STUDY

Major Elements:	• Compile results of review into a draft feasibility study • Review the draft feasibility study with PW • Finalize the feasibility study
Benefits of our approach to PW:	• Provides a single presentation of the findings and results of the study • Allows for confirmation of details during PW review • Memorializes the study effort and provides information for PW evaluation of how to proceed
Deliverables:	• Draft feasibility study • Final feasibility study
Assumptions:	• PW will provide their review within 2 weeks of receiving the draft feasibility study

We have provided for a phased approach to the work scope. The deliverables will follow the phased scope with a presentation of the Phase 1 feasibility first and the detailed review for potential projects in Phase 2. The Phase 2 report will include a summary of the Phase 1 memorandum.

The tentative outline of the feasibility Memo will be as follows:

1.0 Introduction and PW Objectives
2.0 Potential Sites/Types of Development Reviewed and Rejected
3.0 Project Description
  3.1 Existing Conditions
  3.2 Initial Concept Review
  3.3 Project Concepts
4.0 Energy Analysis
  4.1 Analysis Method
  4.2 Results
5.0 Opinion of Probable Construction Cost
6.0 Overview of Permitting, Regulatory, and Environmental Considerations
7.0 Project Payback
8.0 Summary and Conclusion

We will submit a complete draft study for PW review and host a conference call to discuss PW input. Once we have received PW input we will edit the report and submit the final version.

Kleinschmidt has assumed the following will not be required and has not included in our bid:

1. Survey;
2. Additional site visits or field investigation;
3. Direct consultation with regulatory agencies;
4. Design of project components; and
5. Financial model of concept projects.

Final federal and state regulatory requirements are dependent on final design and consultation. Regulatory feasibility reporting is therefore based on Kleinschmidt's experience and our opinion.

3.0 PROJECT SCHEDULE

We understand and appreciate that the PW Project schedule is linked to your decision-making process and ultimately to the project timeline. Kleinschmidt will provide the staff needed to provide timely service and provide effective communication relative to progress during the entire Project.

Kleinschmidt is prepared to commence work immediately upon notice to proceed. Kleinschmidt will perform the Proposed Scope of Work, assuming a notice to proceed is received by August 1, 2018, as defined in Table 1.

TABLE 1 SCHEDULE

MILESTONE	COMPLETION DATE
Expected Receipt of Notice to Proceed	August 1, 2018
Kickoff Meeting	August 17, 2018
Phase 1 - Feasibility Memorandum	October 1, 2018
Phase 1 Review Meeting	October 15, 2018
Phase 2 - Draft Feasibility Study	December 1, 2018
Phase 2 - Final Feasibility Study	December 21, 2018

4.0 COSTS

Kleinschmidt is excited about the opportunity to partner with PW to discover and study creative solutions for new hydroelectric generation for PW. We propose completing the scope of work proposed for a fixed cost of $65,100.

Table 2 provides details of Kleinschmidt's fixed price cost proposal with the total cost given by phase.

TABLE 2 COST BREAKDOWN BY PHASE

Phases	Fixed Price
Phase 1	$23,100
Phase 2	$42,000
Total	**$65,100**

Kleinschmidt's Standard Terms and Conditions and Method of Payment are provided in Appendix B.

5.0 PERSONNEL QUALIFICATIONS

The Kleinschmidt Project Team's experience with similar hydropower feasibility projects is directly relevant and offers PW confidence that our feasibility study will enable you to make sound business decisions.

Andy Qua will serve as project manager and single point of contact for PW to enhance communications. Andy has 27 years of experience and specializes in hydropower project relicensing. He manages and coordinates projects and prepares licensing documents and drawings.

Andy will have access to two senior technical advisors who average 33 years of hydropower experience. These senior advisors will be used judiciously as needed during consultation on initial scoping, alternatives analysis, as well as reviewing all project deliverables.

Keenan Goslin P.E. will serve as a local contact as well engineering lead for the study. He has experience in all aspects of hydropower engineering and will assist Andy with day to day coordination of project information.

Table 2 provides a summary of our team's qualifications. Resumes are provided in Appendix A.

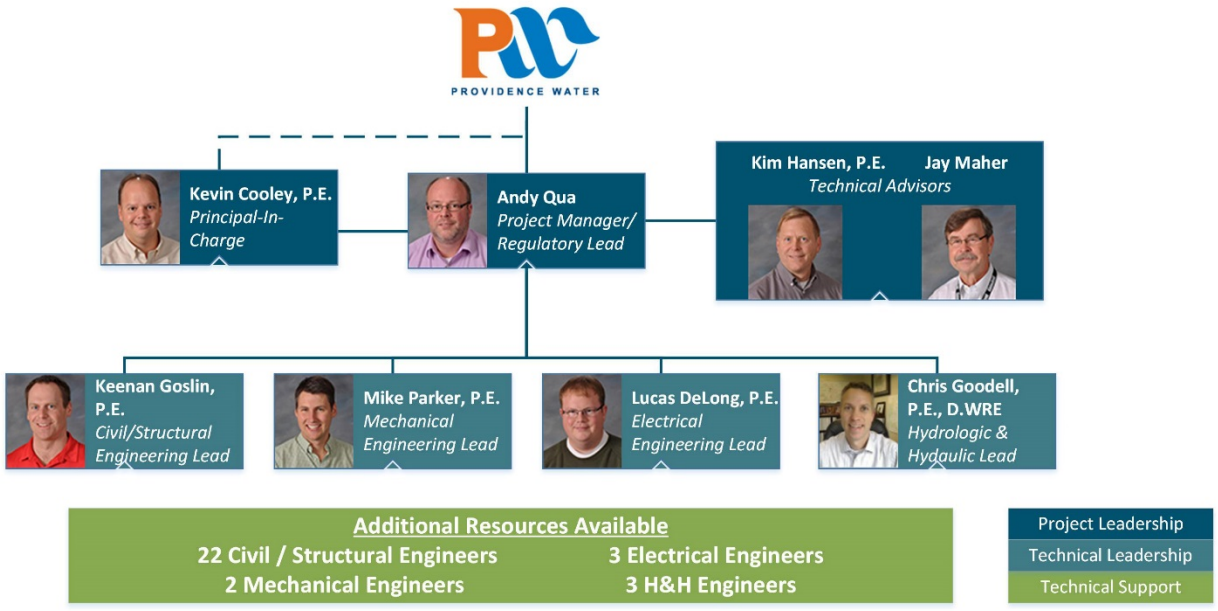


FIGURE 2 ORGANIZATION CHART

TABLE 3 SUMMARY OF PERSONNEL QUALIFICATIONS

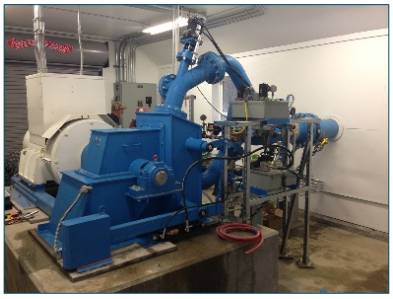
NAME / ROLE AREAS OF EXPERTISE YEARS' EXPERIENCE	RELEVANT EXPERIENCE
Andy Qua *Project Manager* • FERC Licensing/Relicensing/ Amendments • FERC Compliance Management and Implementation • Regulatory Strategic Planning • Federal and State Agency Consultation • Federal/State/Local Permitting Years at Kleinschmidt: 26 Years Total: 26	• **FERC Relicensing, Upper and Lower Barker, American Tissue, and Pumpkin Hill Projects** • **Economic Viability Analysis, Vail Project** Lyndonville Electric Department., Lyndonville, VT • **FERC Relicensing, Blenheim-Gilboa Pumped Storage Project** New York Power Authority, North Blenheim, NY
Mike Parker, P.E. *Mechanical Engineering Lead* • Hydro Feasibility Studies • Technical Assistance for Turbine Generator Equipment Selection and Procurement • Hydro Energy Analysis • Minimum Flow Units • Existing Facility and Equipment Condition Assessments • Powerhouse Design Construction Services Years at Kleinschmidt: 8 Years Total: 8	• **Pre-Feasibility Study, Seven Small Hydroelectric Projects,** Columbia Basin Hydropower, Ephrata, WA • **Pre-Feasibility Study, Banks Lake Pumped Storage Generating Project** Columbia Basin Hydropower, Ephrata, WA • **Feasibility, Procurement and Installation Assistance, Gorge 18 Turbine,** Green Mountain Power, South Burlington, VT • **Mechanical Systems Design**, Holtwood Hydroelectric Expansion Project, PPL Holtwood, Holtwood, PA
Kim Hansen, P.E. *Technical Advisor* • Dam Rehabilitation Design • Powerhouse Design • Gates and Water Control Design • Hydro Feasibility Study • FERC Part 12 Dam Safety Inspection Years at Kleinschmidt: 4 Years Total: 38	• **Spillway Upgrade Study, Rapidan Hydro**, Eagle Creek Renewable Energy, Rapidan, MN • **Stability Review and Update, Sartell Hydro**, Eagle Creek Renewable Energy, Sartell, MN • **Design of Power Canal Repairs, Sault Ste. Marie Hydro,** Cloverland Electric Cooperative, Sault Ste. Marie, MI • **Design of Auxiliary Spillway, Jackson Bluff Hydroelectric Project**, City of Tallahassee, Tallahassee, FL • **Relief Dam - Leakage Investigations**, Pacific Gas and Electric Company (PG&E), Sierra Nevada Mountains, CA

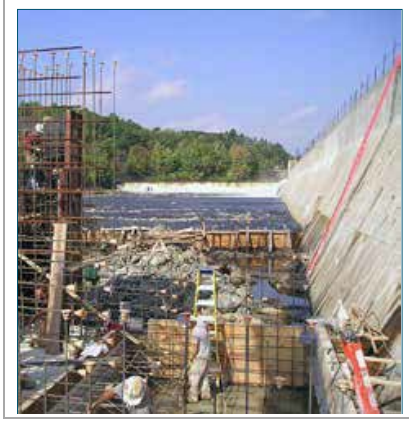
NAME / ROLE AREAS OF EXPERTISE YEARS' EXPERIENCE	RELEVANT EXPERIENCE
Jay Maher *Technical Advisor* • Regulatory Strategic Planning • FERC Licensing/Relicensing/ Amendments • Agency Consultation • Hydro Feasibility and Planning Years at Kleinschmidt: 16 Years Total: 29	• **Development of Two Hydroelectric Projects on the Illinois River**, Northern Illinois Hydro, Joliet Illinois • **Feasibility of Three Small Hydro Projects on Cambria-Somerset Water System**, Cambria-Somerset Authority, Johnstown, PA • **Feasibility -Addition of Small Hydro at a Pumped Storage Facility**, Confidential Client, Pennsylvania • **Conduit Exemption Process, Azusa Hydroelectric Plant**, Pasadena Water and Power, Azusa, California • **Feasibility of Small Hydro at Two Dams on the Mississippi River**, Confidential Clients
Lucas Delong, P.E. *Electrical Engineering Lead* • Hydro Unit and Plant Control Systems • Electrical Power and Interconnection Systems • Powerhouse Design • Years at Kleinschmidt: 11 Years Total: 11	• **Appropriation Grade Hydro Feasibility Study, Lyons Falls Project**, Kruger Energy, Lyons Falls, NY • **Hydro Turbine Upgrade Feasibility Studies, Cooke, Croton, and Tippy Stations**, Consumers Energy, Cadillac, MI • **Hydro Unit Control Systems Replacement Design**, Holtwood Hydroelectric Expansion Project, PPL Holtwood LLC, Holtwood, PA • **Powerhouse Upgrade Study**, Faraday Hydro Power Plant, Portland General Electric, Portland, OR
Keenan Goslin, P.E. *Structural Engineering* • Powerhouse Design • Dam Rehabilitation Design • Dam Safety and Structural Assessment • Gates and Water Control Design Years at Kleinschmidt: 4 Years Total: 11	• **Hydro Structural Design, Holtwood Hydroelectric Expansion Project,** PPL Holtwood, LLC, Holtwood, PA • **Powerhouse Design, Timothy Lake** Portland General Electric, Government Camp, OR • **Minimum Flow Options Review, Pierce and Monadnock Dams** Monadnock Paper Mills, Bennington, NH • **Red Blanket Dam Rehabilitation Project**, PacifiCorp, Medford, OR

6.0 RELEVANT EXPERIENCE

TABLE 4 SAMPLES OF RELEVANT EXPERIENCE

PROJECT TYPE PROJECT NAME / COMPANY NAME / PROJECT LOCATION	RELEVANT PROJECT ASPECTS
Feasibility Study and Design of new Powerhouse Troy Hydro Redevelopment Project Troy Mills Hydroelectric, Inc. Troy, VT 	• Provided civil, mechanical, electrical and structural engineering services, as well as permitting and regulatory compliance support for the new 992 kW powerstation • Participated in feasibility studies and evaluated various options for intake, powerhouse and generating equipment repairs and modifications • Designed the new facilities, assisted in procuring permits, prepared construction drawings and specifications, and provided technical support during construction • Provided energy modeling to support the receipt of state and federal grants and tax credits which helped make the redevelopment of this project economically feasible for the developer • New intake was designed and constructed during a first summer construction season and after the owner's final selection of the generation equipment, the new powerhouse was designed, constructed, and generating power in less than 8 months • Worked closely with the developer and contractor using a design-build approach to help bring the abandoned hydroelectric project back online in a cost-effective and timely manner
Feasibility Study, Design and Construction Assistance for New Powerhouse Sherman Island Minimum Flow Erie Boulevard Hydropower Moreau, NY 	• Prepared a feasibility study for adding a 1.16 MW minimum flow unit to the existing 14 MW facility • Provided design engineering and permitting services for a new minimum flow powerhouse and generation equipment • The electrical design included lighting, fire and intrusion alarms, heating, venting, three-phase power, single-phase power and 5kV power distribution equipment • Provided construction services • Construction of the minimum flow unit allowed Erie Boulevard Hydropower to meet the mandated bypass flow plus an additional 64 cubic feet per second (cfs) by redirecting and controlling flows through the minimum flow unit • Added capacity to the project to generate additional renewable electricity, annually qualifying for incentives authorized by the Energy Policy Act of 2005

PROJECT TYPE PROJECT NAME / COMPANY NAME / PROJECT LOCATION	RELEVANT PROJECT ASPECTS
Feasibility, Procurement, Design, Construction and Commissioning Assistance Mt. Equinox Hydropower Project Carthusian Foundation Arlington, VT 	• Completed a feasibility study based on site inspections and studies for rehabilitation of a 1940 vintage private off-grid electrical generation and distribution system • Evaluated energy and equipment alternatives • Developed final design of the facility modifications which included a new 275 kW twin nozzle Pelton turbine with a 615-foot design head, intake trashracks and lifting structure, penstock repairs, turbine supports, powerstation electrical and control equipment, and interconnect equipment • Provided technical specifications and bid review for purchase of the new Pelton turbine • Designed auxiliary mechanical and electrical systems including heating, ventilation and air conditions (HVAC), and service water • Provided construction coordination and commissioning services to complete project • Efficiently integrated the new station into an existing civil and electrical infrastructure to save money on the development
Powerhouse Feasibility Study and Design Timothy Lake Project Portland General Electric (PGE) Government Camp, OR 	• Conducted a feasibility assessment/alternatives analysis for a new 1-MW powerhouse on an existing dam • Considered several alternative designs, construction sequencing, powerhouse layout and arrangement, mechanical systems and electrical systems • Developing electrical and mechanical design drawings and specifications for chosen configuration • Completed feasibility study to help PGE evaluate the practicality of the options and lock in the powerhouse footprint so the substructure could be designed and constructed expeditiously, saving PGE money

PROJECT TYPE PROJECT NAME / COMPANY NAME / PROJECT LOCATION	RELEVANT PROJECT ASPECTS
Redevelopment Study, Hydro Design, Relicensing, and Construction Support West Charleston Project Great Bay Power Corporation Charleston, VT 	• Provided a feasibility assessment of six options for the project upon which Great Bay Power based its decision to redevelop the facility • Provided design services to develop and construct a new powerhouse and 675 kW generating facilities • Work included decommissioning of existing, inoperable generating equipment and a penstock and replacement of these facilities with a newly designed powerhouse, generator unit, new intakes to replace the defunct penstock, and associated electrical systems • Prepared a bid package, supported the owner during bid review and contractor selection, and served as the owner's representative during construction activities • Provided license amendment and permitting support • Kleinschmidt's creativity in the evaluation and design, coupled with early involvement with resource agencies facilitated approval and shortened the project schedule and, as a result, Great Bay Power qualified for state and federal renewable incentives making the project economically viable
Design and Construction Monitoring Livermore Falls Minimum Flow Unit International Paper Company Livermore Falls, ME 	• Provided conceptual, final design, and construction monitoring services for a 1.3 MW new minimum flow unit • The new minimum flow unit provides the flow required in the lower bypass reach. The new powerhouse houses a single vertical Kaplan turbine with a generator and required appurtenances and is located on the forebay structure upstream of the existing powerhouse. The new minimum flow unit has a design flow capacity of 450 cfs with an output capacity of 1.3 MW. The operating regime is monitored automatically by a PC-based system that receives input from water lever transponders located at the dam, the south end of the existing forebay, and the intake of the new powerhouse. • In addition to meeting the license requirements and providing flow regimes protective of the aquatic ecosystems, International Paper Company was able to displace more expensive energy used at the Androscoggin Mill with a clean and renewable energy source from the minimum flow unit. The work at Livermore Falls demonstrates Kleinschmidt's ability to work at an existing mill site with its construction limitations and fluctuating river flows.

PROJECT TYPE PROJECT NAME / COMPANY NAME / PROJECT LOCATION	RELEVANT PROJECT ASPECTS
Redevelopment Study, Hydro Design, Relicensing, and Construction Support Holtwood Project PPL Holtwood (Power Generation) Holtwood, PA 	• In 2004, because of required fish passage improvements and financial incentives associated with the new Pennsylvania Renewable Portfolio Standards, PPL regained interest in redevelopment which resulted in one of the largest new hydro power station projects in the mid-Atlantic region in decades • Retained to conduct a new redevelopment study and assist PPL in all aspects of the license amendment and final engineering design process • Final design incorporated the installation of a new power station that contains two 65 MW, vertical Kaplan units and required ancillary equipment constructed adjacent to the existing operable plant • Electrical design included automation, controls and a new substation • Other design efforts included a new skimmer wall, expansion of the existing forebay and tailrace, diversion of the discharge of the existing Unit 1 in a tunnel under the existing diversion wall into the spillway channel, replacement of the existing Unit 11 and 13 auxiliary generating units, replacement of three failed spans of Bridgestone rubber dam spans, site access bridge over the existing Norfolk Southern railroad tracks, and the relocation of a variety of buildings • Prepared bid specifications and drawings and acted as the owner's representative during construction • Provided environmental and regulatory compliance services • Kleinschmidt's focused, multi-discipline collaborative approach reduced design rework, and PPL realized project efficiencies
Redevelopment Feasibility Study Faraday Project PGE Estacada, OR 	• Facilitated a kickoff meeting to confirm PGE's requirements and preferences for the rehabilitation • Developed a calibrated energy model to predict the incremental increase in annual energy for the new powerhouse • Created drawings and scoping documents to confirm Kleinschmidt's understanding of PGE's vision for the new Faraday Powerhouse Project • Requested and obtained budgetary quotations from turbine vendors for the turbine generator equipment for the Project • Prepared a schedule and a cost opinion for the Project in collaboration with a local contractor to improve the accuracy of our scheduling and costing • Prepared a report from already reviewed and agreed to information and details so that the report required minimal review and comment from PGE • Provided additional assistance to help PGE present the Project to the Capital Committee and prepare the final design Request for Proposal

APPENDIX A

RÉSUMÉS

ANDREW D. QUA

SENIOR LICENSING COORDINATOR

Andy Qua specializes in analyzing and evaluating the balance of natural resource protection and enhancements with hydropower project economics and social values to assist in negotiating terms and conditions of new project licenses. He coordinates and manages resource effects analyses in support of FERC license applications, project scheduling and budgeting, economic modeling, and agency consultation/ negotiation. Andy has a solid working knowledge and understanding of NEPA and FERC licensing regulations including requirements governing Traditional, Alternative, and Integrated Licensing Processes and the development of Exhibit E and Applicant Prepared Environmental Assessments (APEA). He also assists clients with planning and development of document tracking databases and web sites for stakeholder outreach. In response to FERC's electronic filing and information management objectives, he assists clients in evaluating the benefits of developing web-based applications that allow for centralized data management with accessibility for users through the internet.

Andy serves as Team Leader for one of Kleinschmidt's Regulatory and Environmental Groups.

Key Expertise

- FERC Licensing/Relicensing/ Amendments
- FERC Compliance Management and Implementation
- Regulatory Strategic Planning
- Federal and State Agency Consultation
- Federal/State/Local Permitting

Professional Affiliations

National Hydropower Association

FERC Relicensing, Upper and Lower Barker, American Tissue, and Pumpkin Hill Projects
KEI (USA), Numerous Locations in ME
Project Manager responsible for coordination of document preparation, correspondence, and consultation with state and federal agencies for draft document reviews, and filing of license applications with FERC.

Economic Viability Analysis, Vail Project
Lyndonville Electric Department., Lyndonville, VT
Project Manager responsible for performing intensive economic viability analysis in order to determine the effects of relicensing associated enhancements on project profitability. Performed analysis based on techniques approved by FERC for economic viability analysis required as part of application for new project licenses. Also, prepared a report summarizing results of the analysis to provide the client with information to determine feasibility of continuing project operation.

FERC Relicensing, Northfield Mountain Pumped Storage and Turners Falls Project
FirstLight Hydro Generating Company, MA, NH, and VT
Project Manager for Kleinschmidt as part of a three-consultant team providing engineering, environmental, and relicensing services for the Northfield Mountain Pumped Storage Project and Turners Falls Hydroelectric Projects. The projects are located on the Connecticut River, with portions of the projects being located within three states: Massachusetts, New Hampshire, and Vermont. The projects operate as joint-use facilities, with the 67.6 MW Turner Falls Project reservoir serving as the lower reservoir for the 1,080 MW Northfield Mountain Pumped Storage Facility. Responsibilities included coordination of Pre-Application Document, development of study plan, assistance with agency outreach, oversight of numerous field studies, and development of report for aquatic and terrestrial resource areas.

FERC Relicensing and License Amendments, Otter Creek Project
Green Mountain Power Corporation, Rutland, VT
Project Manager for relicensing of the Otter Creek Project, which consisted of three developments on Otter Creek in western Vermont. Project received a new license under the Integrated Licensing Process. Assisted Green Mountain Power to complete implementation of license compliance plans.

FERC Relicensing, Williams Project
Brookfield White Pine Hydro LLC, Lewiston, ME
Project Manager responsible for coordination and oversight of project consultant team to prepare Pre-Application Document for relicensing of Brookfield's 13 MW Williams Hydroelectric Project on the Kennebec River in Maine. Worked with client and project team to develop relicensing strategy to address issues at the project associated with reregulating operations and various resources issues such as characterization of aquatic habitat and fish passage for American eel and Endangered Species Act listed Atlantic salmon. Coordinated field studies and report development. Oversaw development of the license application that was distributed for stakeholder review and filed with FERC at the end of 2015. A new FERC license was issued in 2017.

FERC Relicensing, West Buxton Project
Brookfield White Pine Hydro LLC, Lewiston, ME
Project Manager responsible for coordination and oversight of Kleinschmidt's role on project consultant team to prepare portions of Pre-Application Document for relicensing of Brookfield's 7.8 MW West Buxton Hydroelectric Project on the Saco River in Maine. Assisted client and prime consultant to analyze effects of project operations and development of the FERC license application, which was filed at the end of 2015. A new FERC license was issued in 2018.

Education
B.S. Bio-Resource Engineering Technology with a concentration in Environmental Studies, University of Maine, 1996

Years of Experience
With Kleinschmidt: 26
Total: 26

FERC Relicensing, Eastman Falls Project
Public Service of New Hampshire/Eversource, Manchester, NH
Project Manager responsible for coordination and oversight of project team to prepare Pre-Application Document for relicensing of the 6.4 MW Eastman Falls Hydroelectric Project on the Pemigewasset River. Also, responsible for agency outreach and consultation efforts to identify issues to be addressed during the relicensing process for this run-of-river project in central New Hampshire. Oversaw development of the license application that was distributed for stakeholder review and filed with FERC at the end of 2015. FERC issued a new license eight months prior to the expiration of the current license, with limited new environmental measures.

FERC Relicensing, Ellsworth Project
Black Bear Hydro Partners LLC, Lewiston, ME
Project Manager responsible for coordination and oversight of Kleinschmidt's role on project consultant team to prepare portions of licensing documents for relicensing of Brookfield's 8.9 MW Ellsworth Hydroelectric Project on the Union River in Maine. Assisted client and prime consultant to analyze effects of project operations and development of the FERC license application, which was filed at the end of 2015. FERC is currently processing the license application.

FERC Relicensing, Smith Mountain Pumped Storage Project
Appalachian Power Company, Roanoke, VA
Regulatory Advisor for relicensing of this pumped storage facility. Work consisted of providing regulatory assistance for the project relicensing and development of licensing documents.

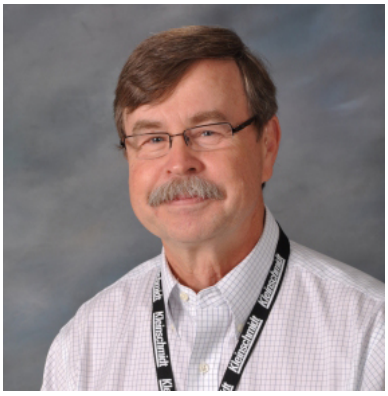
FERC Relicensing, Yards Creek Pumped Storage Project
PSEG/FirstEnergy, Blairstown, NJ
Regulatory Advisor for relicensing of this pumped storage facility. Work consisted of providing regulatory assistance for the project relicensing and development of FERC and state agency documentation.

FERC Relicensing, Blenheim-Gilboa Pumped Storage Project
New York Power Authority, North Blenheim, NY
Strategic Advisor for relicensing of this major pumped storage facility. Provided input into strategic planning; process management agency and public coordination; and study design, management, and implementation.

FERC Relicensing, Monadnock Paper Project
Monadnock Paper Mills, Bennington, NH
Responsible for project management for relicensing, using FERC's Integrated Licensing Process, of the Monadnock Project, which consists of four developments in western New Hampshire. As Project Manager, coordinated study scope development with project team, client, and stakeholders and coordinated development of license application and responses to additional information request. FERC's environmental assessment and the new license were issued, several months prior to the prior license expiration. Assisted client in developing license compliance plans through negotiation of 401 water quality certificate conditions.

JEREMIAH (JAY) L. MAHER, V.P.

PRINCIPAL CONSULTANT



Jay Maher specializes in providing strategic guidance to hydropower clients in planning for project development and operations and for relicensing existing projects. Jay's approach to projects emphasizes the strategic planning aspects that are necessary to meet business goals. This means looking at the regulatory processes from a risk management perspective, emphasizing the relationships among the regulations, engineering and operational potentials, and agency and stakeholder interactions. Jay regularly works with representatives of local, state, and federal agencies and tribes, and extensively with public stakeholders through facilitating large and small public meetings on a range of resource issues. Jay is a past board member and officer at NHA and has made many presentations at national symposia and conferences, universities, and professional organizations.

Key Expertise

- Regulatory Strategic Planning
- FERC Licensing/Relicensing/ Amendments
- Agency Consultation
- Hydro Feasibility and Planning
- Water Conveyance and Water Rights

Certification/Training

Executive Management Institute; University of Wisconsin-Madison School of Business

Cultural Resources Management Certification, Advisory Council on Historic Preservation

Education

M.A., Biology, University of South Dakota, 1981

B.A., Biology, Tarkio College, 1974

Representative Project Management for FERC processes

FERC Relicensing, Azusa Hydroelectric Project (FERC No. 1250
City of Pasadena Water and Power Department, Pasadena, CA
Senior Advisor for city of Pasadena's conversion of their 3.85 MW Azusa Hydroelectric Project license to a conduit exemption. Led the city in strategic planning and development of a pre-application document (PAD) and agency negotiations. The proposed change in project status has required additional consultations and careful process management because of multiple and overlapping regulations and changing jurisdictions.

FERC Relicensing, Townsend Water Power Project (FERC No. 3451)
Beaver Falls Municipal Authority, Beaver Falls, PA
Senior Advisor and Manager for relicensing a project on the Beaver River. Kleinschmidt is responsible for strategic planning, process management, study planning and execution. A PID was developed in 2017 followed by early agency consultations and study planning in Q1 2018.

FERC Relicensing, Kinzua Pumped Storage (FERC No. 2280)
FirstEnergy Generation Corporation, Warren, PA
Project Manager for relicensing a major pumped storage facility located in a National Forest and using a U.S. Army Corps of Engineers dam as the lower reservoir. The project affected two states and Tribal lands and involved a competitive tribal application as well as a change in ownership near the end of the process. Kleinschmidt provided complete relicensing services including strategic planning; process management; agency and public coordination; study design, management and implementation; and FERC and state agency documentation. *(Jay has been or is an advisor for relicensing five other recent pumped storage projects.)*

FERC Licensing and Project Design, Brandon Road and Dresden Island
Northern Illinois Hydropower, Will/Grundy County, IL
Project Manager responsible for completing the strategic planning, design, and licensing of two new projects at U.S. Army Corps of Engineers (USACE) facilities. The work involved every aspect of FERC licensing, state 401 processes, and USACE consultations on both regulatory and engineering design. *(Jay is directly involved with the development or redevelopment of several other projects.)*

FERC Relicensing, Lake Creek Project
Northern Lights, Inc., Troy, MT
Project Manager responsible for completing one of the first successful relicensings using the Integrated Licensing Process. A new license was effective December 2011. Kleinschmidt provided complete relicensing services including strategic planning, development of the pre-application document (PAD), study plans, and license application, conduct of the studies, as well as communications support. Kleinschmidt is now actively managing license implementation and compliance for the project.

(In addition to the above relicensings, Jay is an active strategic advisor for relicensing many other conventional and pumped-storage projects across the country. He has worked on dozens of Projects ranging from several kW microhydro installations to Projects in the thousands of MW.)

Years of Experience
With Kleinschmidt: 15
Total: 28

Representative Recent Amendments, Compliance Plans, and Project Analyses

Shoreline Management Plan, Lewis River Projects
PacifiCorp, Southwestern WA
Developed a Shoreline Management Plan (SMP) for three large projects in Washington State. The work included facilitation of public meetings, presentations to agencies, and document preparation. The SMP enables the licensee to better regulate their property and other lands within the project and recover fees for management.

Cambria Somerset Authority, PA
Engineering and regulatory feasibility for three new small conduit developments, followed by development of exemption applications.

Capacity Review/Amendment
EWEB, Eugene, OR
Review plant capacities and FERC license exhibits. Prepared a license amendment modifying the licensee's installed capacity. This work brought the license into conformance with FERC requirements and reduced the licensee's annual charges.

Confidential Client, CA
Analysis of the issues and costs related to relicensing, sale, or decommissioning of a project. The client was able to determine the most cost-effective means to manage an existing hydro project.

Confidential Client, Midwest
Develop an environmental and a regulatory considerations analysis for a potential decommissioning and prepared a preliminary opinion of cost for regulatory and environmental issues related to a potential decommissioning.

Confidential Client, Great Plains
Feasibility and regulatory analysis of a new pumped storage project.

Confidential Client, CO
Feasibility and regulatory analysis of a new, small hydro project development.

KIM HANSEN, P.E.

SENIOR ENGINEERING CONSULTANT (CIVIL/STRUCTURAL)

Kim Hansen specializes in designing small and medium sized hydro development and rehabilitation projects and performing dam safety reviews and design of dam mitigation projects. Kim conducts reconnaissance studies, due diligence, and prepares feasibility reports for hydro development at dam sites and redevelopment at existing sites in the USA and internationally. Kim conducts general project condition assessments of hydraulic turbines and turbine ancillary equipment. He designs fish passage facilities, sluice gates, and air-ballasted dewatering gates for new and existing hydro projects. He is a Federal Energy Regulatory Commission (FERC)-approved independent consultant for Part 12 dam safety inspections. Kim participates in dam evaluation studies involving timber crib, timber buttress, concrete gravity, concrete buttress, arch, inflatable, Ambursen, and labyrinth spillways, as well as earthen dams.

Key Expertise

- Hydro Feasibility Study
- Hydro Due Diligence
- Minimum Flow Units
- FERC Part 12 Dam Safety Inspection
- Powerhouse Design
- Gates and Water Control Design
- Dam Rehabilitation Design

Professional Registration

Professional Engineer, HI, IL, MD, MN, NE, NY, PA, WA, WI, and WV

Certification/Training

FERC-approved Independent Consultant
RIDM1 and 2 training

Professional Affiliations

American Society of Civil Engineers

Association of State Dam Safety Officials

Turbine Technology Evaluation & Site Layout, Buckhorn Dam Lock 31
Peterborough Utilities, Inc., Trent Severn Waterway, ON
Technical Advisor for feasibility study for development of low-head hydro power at lock and dam site. Responsibilities include turbine technology selection, energy and economic analysis, and developing recommendations regarding the site layout(s) and the feasibility of site's development.

Powerhouse Upgrade Study, Faraday Hydro Power Plant
Portland General Electric, Portland, OR
Senior Technical Advisor for the evaluation of two alternatives for the upgrade of the 48 MW Faraday Powerhouse. The study included developing conceptual layout designs, generation estimates, and opinion of cost in collaboration with Portland General Electric and a local contractor.

Conceptual Layout for New Hydropower Facility, Tygart Hydroelectric Project
Advanced Hydro Solutions, Grafton, WV
Project Manager to optimize the conceptual layout for this 30 MW facility with two or three vertical units with a total design flow of 2,500 cubic feet a second and 150 feet of head as the selected option to meet the developer's investment criteria. This hydroelectric development at the existing U.S. Army Corps of Engineers flood control dam with a large range instream reservoir elevations. Intake design assumed in wet construction without cofferdam.

Hydroelectric Powerstation Development Study, Big Quinnesec Falls Hydroelectric Project, We Energies, Quinnesec, WI
Project Manager for feasibility study to redevelop the (old) Big Quinnesec Falls project. Study included development of four concept layouts to repair, replace, and build a new hydroelectric powerstation at an existing hydrostation. Developed opinions of probable cost for the civil mechanical and electrical work and estimated future generation revenues for economic comparisons. Supervised and reviewed report.

Spillway Upgrade Study, Rapidan Hydro
Eagle Creek Renewable Energy, Rapidan, MN
Project Manager for the conceptual design of spillway upgrades to address Category 1 Potential Failure Modes. This Ambursen spillway founded on sandstone has a history of scour along the toe and abutments. The proposed upgrades increased spillway capacity to allow permanent abandonment of abutment bays which had the highest potential for scour.

Pre-Feasibility Study, Numerous Small Hydros
Columbia Basin Hydropower, Ephrata, WA
Lead Hydropower Engineer for the evaluation of generation potential at nine existing drop structures along irrigation canals. Study included conceptual layout designs, generation estimates, and opinion of cost.

Pre-Feasibility Study, Banks Lake Pumped Storage Generating Project
Columbia Basin Hydropower, Ephrata, WA
Engineering Project Manager for the conceptual layout and construction cost opinion of a 1,000 MW pumped storage generating facility to be constructed between Banks Lake and Lake Roosevelt on the Columbia River in Washington State. The proposed project required consideration of operating limitations at lower reservoirs during fish passage seasons and operation of irrigation flows into the upper reservoir.

Pre-Feasibility Study, Big Quinnesec Falls Hydro
We Energies, Quinnesec, MI
Project Manager for the evaluation of replacement versus rehabilitation of a 61-foot-head hydro facility. The exiting 100-year-old facility requires major rehabilitation or replacement to take advantage of the entire gross head available that the site and continue reliable

Education
B.S./B.Sc. Civil Engineering, University of New Hampshire, 1979

Years of Experience
With Kleinschmidt: 4
Total: 38

operation for the next 100 years. Three redevelopment options were evaluated along with one rehabilitation option.

Prior Work Experience

opment, Three Run-of River Facilities
Confidential Client, Midwest US
Project Engineer for the evaluation of developing run-of-river hydroelectric facilities at three potential sites. Each of the sites is low head and could have installed capacities ranging from 5 to 20 MW. As project engineer, responsible for developing conceptual layouts, identifying electromechanical equipment, estimating average annual generation, and preparing cost estimates for each site in support of the economic analyses to determine their viability for development.

Feasibility Study for New Hydropower Facility, Tygart Hydroelectric Project
Advanced Hydro Solutions, Grafton, WV
Client Manager for the feasibility study which identified a 30 MW facility with two vertical Francis units for 3,000 cubic feet a second and 150 feet of head as the selected option to meet the developer's investment criteria. This hydroelectric development at the existing U.S. Army Corps of Engineers flood control dam.

Feasibility Study for Minimum Flow Unit, Black River Falls
Municipality of Black River Falls, Black River Falls, WI
Project Engineer for a feasibility study to assess the technical and economic viability of adding a 400-kW minimum flow unit at the project's spillway to increase project generation. The feasibility study included performing annual generation estimates for the low-head generating unit, developing a conceptual layout in sufficient detail to estimate construction costs, and soliciting water-to-wire electromechanical equipment budgetary quotations from suppliers.

Prefeasibility Study for Adding Power Unit to Irrigation Canal System
David Evans and Associates, Inc., Bend, OR
Project Engineer for a prefeasibility study to assess the technical and economic viability of adding a 5 MW unit in the Central Oregon Irrigation District canal system during its conversion from an open channel conveyance system to a closed pipeline conveyance system. The prefeasibility study included performing annual generation estimates for a staged-project approach involving various irrigation delivery schedules. The prefeasibility level layout featured a wye branch encased in a thrust block, a low-profile powerhouse arrangement with shut-off and by-pass valves, and two 2.5 MW Francis turbine-generator units.

Hydro Development Feasibility Study, Mississippi Lock and Dam Nos. 20, 21 and 22
Klingner and Associates, Quincy, IL
Project Engineer for feasibility study to assess the technical and economic viability of constructing hydroelectric generating facilities at three sites on the Mississippi River. Responsible for developing conceptual layouts, identifying electromechanical equipment and estimating their performance, and preparing cost estimates for each of the three sites in support of the economic analyses to determine the viability for development of each of the three sites. The generating facilities would utilize the Mississippi River flows and head created by the navigation locks and dams operated by the United States Army Corps of Engineers. The potential for hydropower development was evaluated based on site attributes, flow characteristics, and available head. The analyses showed a favorable outlook for hydropower development using new technologies that provide improved efficiencies for low-head installations.

CHRISTOPHER GOODELL, P.E., D.WRE

PRINCIPAL CONSULTANT (HYDROLOGIC AND HYDRAULIC)

Christopher Goodell specializes in water resource hydraulic engineering. He is an internationally known leader in HEC-RAS and dam breach modeling. Chris excels in finding innovative solutions to the most challenging water resources projects. He has served as instructor for HEC-RAS professional continuing education courses and taught over 100 courses throughout the United States and nine countries. He authored a user's guide to HEC-RAS and maintains the HEC-RAS blog site "The RAS Solution."

Key Expertise

- Hydrologic & Hydraulic Analysis
- Dam Breach Studies
- Inundation Mapping
- PMF Determination
- Hydrologic and Hydraulic Analysis
- Stream Channel Modeling
- Stream Channel Modification
- FEMA Flood Studies

Professional Registration

Professional Engineer, OR, WA, AK, TX, TN

Certification/Training

Diplomate, Water Resources Engineer (D. WRE)

Professional Affiliations

AAWRE Diplomate of Water Resources Engineering
ASCE
ASDSO
USSD
EWRG, Past President
SAME, Past Secretary, ACEC, Chairman, Corps Liaison Committee

Education

M.S. Hydraulic Engineering, IHE Delft Institute for Water Education, 2000

B.S. Civil Engineering, Oregon State University, 1994

Years of Experience

With Kleinschmidt: 1
Total: 23

Previous Experience

Hazard Analysis, Bear River Hydroelectric Project
PacifiCorp, Caribou and Franklin Counties, ID
Project Manager and lead hydraulic engineer responsible for for 1D-2D dam breach modeling and inundation mapping of four dams on the Bear River in Utah and Idaho.

Hazard Classification, North Umpqua Hydroelectric Project
PacifiCorp, Douglas County, OR
Project Manager and lead hydraulic engineer responsible for probabilistic 2D dam breach modeling and inundation mapping.

Hydrologic and Hydraulic Design and Analysis, Kentuck Slough Tidal Marsh Restoration, Jordan Cove LNG. Coos Bay, OR
Lead hydraulic engineer responsible for hydrologic and hydraulic design and analysis of a restored tidal marsh. Included 1D-2D HEC-RAS modeling, sediment transport, tide gate design, water quality modeling, bridge hydraulic design and scour protection, stilling basin design.

Dam Breach Analysis, Pelton Round Butte Hydroelectric Project
Portland General Electric, Madras, OR
Lead hydraulic engineer responsible for probabilistic dam breach modeling of three dams on the Deschutes River in Central Oregon. Included development of the probable maximum flood and inundation mapping.

Flood Diversion Design for New Bridge, Newton Creek on South Stewart Parkway, City of Roseburg, Roseburg, OR
Lead hydraulic engineer responsible for hydraulic design of system to divert and attenuate peak flood flows to reduce flood risk at Newton Creek Bridge. Included HEC-RAS modeling, culvert design, stilling basin design, and embankment scour protection.

System Wide Dam Breach Analysis of Dams, Columbia River
U.S. Army Corps of Engineers, WA, ID, OR
Lead hydraulic engineer responsible for developing a HEC-RAS dam breach model of all of the dams on the Columbia River from Mica Dam to Bonneville Dam. The model is used for emergency action preparedness and real time flood warning. To be effective for real-time flood forecasting, model run times were optimized to less than 10 minutes. Any or all dam are able to be failed in the model.

Probabilistic Sediment Transport Application Development
Maricopa County Flood Control District, AZ
Lead hydraulic engineer responsible for developing a software application, CSed, that automatically runs HEC-6 and 6T sediment transport models probabilistically, using a Monte Carlo analysis. The software is used in support of sand and gravel permit evaluation.

Hydraulic Modeling for Stream Restoration, Alder Creek Willamette River
Wildlands LLC, Willamette River, OR
Lead hydraulic engineer responsible for 1D-2D hydraulic modeling in support of a design of a restoration site on the south end of Sauvie Island near the mouth of the Willamette River. Included a geomorphic assessment and a FEMA No-Rise certification.

Hydraulic Modeling for Stream Restoration, Bull Run Dam
City of Portland, Bull Run, OR
Lead hydraulic engineer responsible for 2D CCHE2D modeling of the stilling basin below the Bull Run Dam No. 2 primary spillway. Hydraulic output from the model was used to

design a riprap revetment on the opposite bank from the spillway toe, to protect a potable water supply line. The design consisted of grouted riprap up to 7 ft diameter.

Hydraulic Modeling for Scour Mitigation, Independence Bridge
Oregon Department of Transportation, OR
Lead hydraulic engineer responsible for Two-dimensional RMA2 hydrodynamic modeling of a scour critical pier on the Independence Bridge over the Willamette River.

Hydraulic Modeling for Aquatic Organism Passage Design Guidance for Roadway Culverts, Federal Highway Administration, Lakewood, CO.
Lead hydraulic engineer responsible for proof of concept HEC-RAS modeling for aquatic species culvert design in support of publishing a new Hydraulic Engineering Circular for the Federal Highways Administration.

Software Development for Training SCADA Operators with Real-Time Simulations
WEST Consultants, Portland, OR
Lead hydraulic engineer responsible for developing a software application called WEST-EDI that connects a SCADA system to a virtual canal built in a HEC-RAS model. This allows operators to train on a simulated canal to train for emergency operations.

Spillway and Stilling Basin Design, Creekside Reservoirs
Cow Creek Bank of the Umpqua Tribe of Indians, Creekside, OR
Lead hydraulic engineer responsible for designing a spillway and stilling basin for a water supply reservoir in Southern Oregon.

Dam Removal and Sediment Transport Study, Milltown Dam
NorthWestern Energy, Missoula, MT
1D HEC-RAS Hydrodynamic and HEC-6 Sediment Transport Modeling in support of the removal of Milltown Dam.

Professional Presentations/Publications

Goodell, C.R., "Advanced Gate Operation Strategies in HEC-RAS 5.0", Proceedings, 6th International Symposium on Hydraulic Structures, Portland OR, June 2016.

Leon A. S., Goodell C., "Controlling HEC-RAS using MATLAB", Environmental Modelling and Software, 84 (2016), Pages 339-348, ISSN 1364-8152, http://dx.doi.org/10.1016/j.envsoft.2016.06.026.

Goodell, Christopher, *Breaking the HEC-RAS Code: A User's Guide to Automating HEC-RAS*. First Edition. Portland, Oregon: h2ls Publishing, 2014. Print.

Goodell, Christopher R., "The Effects of the Great Missoula Floods", Proceedings, 2014 World Environmental & Water Resources Congress, Portland OR, June 2014.

Goodell, Christopher R., "The Dalles Dam – An ASCE National Historic Civil Engineering Landmark", EWRI Currents Newsletter, Volume 17, Number 2, Spring 2014.

Goodell, Christopher R., "Moving Towards Risk-Based Dam Breach Modeling", Proceedings, Dam Safety 2013 Conference, Providence, Rhode Island, September, 2013.

Goodell, C.R., "A Probabilistic Approach to Dam Breach Modeling", Proceedings of the 2nd European Conference on Flood Risk Management FLOODrisk2012, Rotterdam, The Netherlands, 19-23 November, 2012.

Goodell, Christopher R.; Froehlich, David C., "Comparison of Reservoir Routing Methods Used to Calculate Dam Breach Outflows", Presentation, World Environmental & Water Resources Congress (EWRI) 2012, Albuquerque, New Mexico, May 2012.

KEENAN M. GOSLIN, P.E.

SENIOR ENGINEER (CIVIL/STRUCTURAL)

Keenan Goslin specializes in designing dam and hydroelectric project structures including powerhouses, penstocks, intakes and gates. He completes field assessments of existing structures and develops and leads the development of project designs and specifications. Prior to coming to Kleinschmidt Keenan worked for 7 years at the University of Maine's Advanced Structures and Composites Center where he worked as a project engineer and project manager for innovative bridge analysis and rehabilitation projects as well as a $1.4M composite bridge research program. Keenan is proficient in Microsoft Project, RISA-3D, MathCad, AutoCad, and SAP2000.

Key Expertise

- Powerhouse Design
- Penstock Investigation and Design
- Gates and Water Control Design
- FRP Composite Structural Product Development
- Materials Testing
- Live Load Testing and Load Rating of Bridges and Other Large Structures

Professional Registration

Professional Engineer, AK, CT, MA, ME, and RI

Certification/Training

SPRAT Level 1 Rope Access Technician.

Education

Graduate Studies in Bridge Engineering, Experimental Mechanics, and Business Administration, University of Maine

M.S. Civil Engineering with structural focus, University of Maine, 2007

B.S. Civil Engineering with structural focus, University of Maine, 2005

Dam Inspection and Powerhouse Development, Albion and Ashton Developments
New England Hydropower Company, Lincoln, RI
Project Engineer for dam inspection, stability analyses and preliminary site and powerhouse design of two sites on existing non-powered dams. Designs incorporate Archimedes Screw Turbines for low head conditions.

Structural Assessment, Lyons Falls Redevelopment Project
Kruger Energy, Inc., Lyons Falls, NY
Lead Structural Engineer responsible for performing a structural assessment of a partially demolished mill building abutting operating powerhouse and feasibility of completing demolition without impacting powerhouse operations.

Opinion of Probable Construction Cost, Faraday Redevelopment Project
Portland General Electric Company, Portland, OR
Structural Engineering Lead for Feasibility Study including Opinion of Probable Construction Costs for the redevelopment of a six-unit hydroelectric station including new penstocks, turbines, powerhouse and site work.

Bull's Bridge Cemetery Pond Embankment Repairs, Bull's Bridge Hydroelectric Project, FirstLight Power, Kent, CT
Project Manager for the design of repairs and modifications of earthen embankment to meet modern stability requirements. Work includes coordination of internal and client personnel for design, permitting and construction activities.

Powerhouse Design, Timothy Lake
Portland General Electric, Government Camp, OR
Structural Engineer for the redevelopment of a new 1 MW powerhouse on an existing dam. The design included the consideration of several alternatives, construction sequencing, powerhouse layout and arrangement, mechanical systems design, and electrical systems design.

Overflow Drain Gate Replacement, #2 Overflow Holyoke Canals
Holyoke Gas & Electric, Holyoke, MA
Project Manager for the design and bidding documents for two new slide gates replacing quarter turn butterfly gates at the Holyoke #2 Overflow.

Dam Rehabilitation, Red Blanket Dam Project
PacifiCorp, Medford, OR
Structural engineering including stability design of the concrete spillway, concrete abutments design, and re-supporting specifications for concrete low flow structure.

Hydro Structural Design, Holtwood Hydroelectric Expansion Project
PPL Holtwood, LLC, Holtwood, PA
Staff Engineer for structural design of concrete and steel members for a $440M, 130 MW hydroelectric project expansion.

Caribou Penstock Anchor Block 6 Evaluation
Pacific Gas and Electric, Caribou, CA
Structural engineer for the evaluation of a penstock anchor block on a hillside that is in a slow landslide. The project includes working with the owner to estimate loads and define analysis scenarios, completing the analysis, and presenting the results in a report.

Minimum Flow Options Review, Pierce and Monadnock Dams
Monadnock Paper Mills, Bennington, NH
Project Engineer for development and evaluation of minimum flow options for two dams and subsequent design of slide gate and corresponding civil work. Generation and

Years of Experience
With Kleinschmidt: 4
Total: 11

coordination of bid documents for stainless steel slide gate and development of record drawings.

Emergency Spillway Rehabilitation, Middle Fork Irrigation District Hydroelectric Project (Clear Branch Dam), Middle Fork Irrigation District, Parkdale, OR
Senior Structural Engineer who assisted in the response to excessive seepage issues and movement of the spillway concrete slabs at the earthen embankment. Designed structural rehabilitations to the cast-in-place concrete emergency spillway and provided an Opinion of Probable Construction Cost.

Valuation Analysis, Various Hydroelectric Facilities
Eagle Creek Renewable Energy, Various Locations
Project Engineer responsible for performing detailed civil structural quantity take off calculations and valuations for several hydroelectric facilities in the United States.

Penstock Inspection, Beebe Lake Dam
Cornell University, Ithaca, NY
Structural Engineer for inspection and evaluation of Cornell University's 5-foot-diameter, 1,650-foot-long penstock. The system is a mix of precast concrete piping, cast-in-place pipe, and riveted steel penstock, all constructed in 1904, and with a static head of 135 feet. The 30-degree slope of the steel penstock section required rope access to inspect the interior. After inspection, the penstock was evaluated for internal and external pressure capacities, and a report submitted to the client.

Spillway Gate Replacement Design, Willamette Falls Hydroelectric Station
Portland General Electric, Portland, Oregon
Structural Engineer for the design of supports and site civil/structural modifications for Obermeyer Inflatable Flashboard system to replace existing wooden flashboards.

Canal Leakage Assessment and Repairs Design, Monadnock Mill Power Canal
Monadnock Paper Mills, Bennington, NH
Project Manager and Lead Engineer for site assessment and evaluation of sources of leakage in the power canal to the mill and powerhouse and subsequent design of repairs to the concrete power canal walls and intake structure.

Spillway Gate Installation, River Mills Hydro Power Plant
Portland General Electric, Portland, OR
Structural Engineer responsible for design and specification of new steel crest control gates.

Design of Concrete Repairs, Scotland Hydroelectric Project
FirstLight Power Resources, Scotland, CT
Project manager and structural engineer for designing concrete repairs and a grouting program to the right abutment. Leakage was found through the abutment with historically poor concrete. Led the team to design chemical and cementitious grout placement in the concrete wall and in the earthen embankment behind the abutment to cut off leakage. Concrete repairs were designed and inspected to ensure quality repairs where the radial gate trunnions were anchored.

Penstock Replacement Options Evaluation, Indian Orchard Hydroelectric Project
Essential Power Company, Springfield, MA
Structural Engineer for the evaluation of options for the rehabilitation of 2 buried, 16-foot diameter riveted steel penstocks, approximately 1000 feet long each, including opinion of costs and technical feasibility of HDPE, steel and composite pipe options.

MICHAEL S. PARKER, P.E.

SENIOR ENGINEER (MECHANICAL)

Mike Parker specializes in hydropower project design, feasibility studies, station rehabilitation, design of auxiliary mechanical systems, and energy modeling. He manages and coordinates projects, prepares mechanical designs and specifications for mechanical components and systems, coordinates bidding processes, conducts bid reviews, provides construction coordination, completes energy models, creates conceptual designs, and inspects power stations and turbines.

Key Expertise

- Powerhouse Design
- Minimum Flow Units
- Existing Facility and Equipment Condition Assessments
- Hydro Feasibility and Planning
- Hydro Energy Analysis
- Penstock Investigation & Design
- Hydro Economic Incentives

Professional Registration
Professional Engineer, ME

Education
B.S. Mechanical Engineering, University of Maine, 2010

Years of Experience
With Kleinschmidt: 8
Total: 8

Trail Bridge Micro Hydro Feasibility Study
Eugene Water and Electric Board, Blue River, OR
Project Manager and Engineer for a study to evaluate the addition of a micro hydro unit as a pressure reducing valve for fish passage attraction flow. The project included creating a list of twelve options with an evaluation matrix to refine to three options. A feasibility study report was written for the three preferred options that included conceptual drawings, energy production estimates, cost opinions, and system descriptions.

Chalk Creek Hydro Feasibility Study
Truckee Meadows Water Authority, Reno, NV
Project Manager for a feasibility study for the development of a small hydro project at a water treatment plant. The study involved a site visit, concept development, energy estimate, cost estimate, and summary report.

Washoe Hydro Redevelopment Feasibility Study
Truckee Meadows Water Authority, Reno, NV
Project Manager for a feasibility study for the redevelopment of a small hydropower plant originally built in the early 1900s. The study involved a site visit, concept development, energy estimate, cost estimate, and summary report.

Supplemental Storage Feasibility Study, Clear Branch Dam
Middle Fork Irrigation District, Parkdale, OR
Project Engineer for the evaluation of the cost for three alternatives to increase storage at the dam. Included development of alternatives, conceptual designs, cost opinions, and a feasibility report.

Runner Replacement Feasibility Study, Pelton Dam
Portland General Electric, Madras, OR
Project Manager for a feasibility study to determine the benefits of replacing one or more runners at the dam. The study included a site visit, requesting vendor quotes for replacement runners, development of an energy model, and a report on the results and preferred option.

Pre-Feasibility Study, Seven Small Hydroelectric Projects
Columbia Basin Hydropower, Ephrata, WA
Project Engineer for the evaluation of generation potential at nine existing drop structures along irrigation canals. Study included conceptual layout designs, generation estimates, and opinion of cost.

Pre-Feasibility Study, Banks Lake Pumped Storage Generating Project
Columbia Basin Hydropower, Ephrata, WA
Project Engineer for the conceptual layout and construction cost opinion of a 1,000 MW pumped storage generating facility to be constructed between Banks Lake and Lake Roosevelt on the Columbia River. The proposed project required consideration of operating limitations at lower reservoirs during fish passage seasons and operation of irrigation flows into the upper reservoir.

Appropriation Grade Hydro Feasibility Study, Lyons Falls Project
Kruger Energy, Lyons Falls, NY
Mechanical Engineer for an appropriation grade, thirty-percent design, feasibility study on an 11.2 MW site redevelopment. Responsibilities include assisting with turbine selection, energy analysis, and auxiliary mechanical systems.

Minimum Flow Turbine Selection Procurement Assistance, Scotland Dam Powerplant
FirstLight Power Resources, Windham, CT
Project Engineer on project that included conducting site visit and review of previous feasibility studies and recommending a more economical turbine option. Created turbine specification and preliminary drawings for minimum flow unit to be used for procurement.

Minimum Flow Feasibility Study, Moore Station
TransCanada, Littleton, NH
Project Manager in Training for conducting a feasibility study for a new minimum flow unit either in a new power station or in the basement of the existing power station. The project included a site visit and evaluation of alternatives, turbine selection, powerhouse layout, and cost opinion.

Feasibility Study, Quemahoning, Hinckston Run, and Peggy's Run Hydroelectric Projects, Cambria Somerset Authority, Johnstown, PA
Project Engineer responsible for developing powerhouse layouts and obtaining turbine budgetary pricing for three new small hydroelectric projects.

Feasibility, Procurement, Design, Construction and Commissioning Assistance,
Mt. Equinox Hydropower Project, Carthusian Foundation, Arlington, VT
Project Manager in Training on a project that included completing a feasibility study based on site inspections and studies for a rehabilitation of a small privately owned hydroelectric system to replace outdated and failed equipment optimizing for total cost of energy. Provided technical specifications and bid review for purchase of a new Pelton turbine. Provided design for installation of the new unit and construction coordination services to complete project.

Mechanical Auxiliary System Design, Brandon Island/Dresden Road Powerhouse
Northern Illinois Hydro, Joliet and Morris, IL
Assistant Project Engineer responsible for coordination of eight engineers and four drafters. Designed two new power stations on existing U.S. Army Corps of Engineers lock and dam facilities. Designed auxiliary systems including cooling water and sump and dewatering. Created specifications for major purchased equipment including overhead crane and head gates.

Feasibility, Procurement and Installation Assistance, Gorge 18 Turbine
Green Mountain Power, South Burlington, VT
Project Engineer responsible for completing a Kaplan conversion project to upgrade a single unit plant including runner replacement, generator rewind, switchgear replacement, new controls system, and the installation of an inflatable flashboard system. Completed feasibility study. Created mechanical specifications and designs used for bidding each component of the project to multiple contractors. Provided bidding assistance through running pre-bid meetings and providing bid comparisons. Provided construction support including technical assistance, requests for information responses, shop visits, and submittal reviews to multiple contractors on-site.

Minimum Flow Feasibility Study, Leesville Development Discharge Study
American Power Company, Altavista, VA
Project Engineer responsible for preparing a report and drawings detailing the feasibility of a minimum flow unit for a station that operated on an hourly pulsing regime. Created an energy model to determine benefits of minimum flow unit and conceptual designs to estimate cost of installation.

Mechanical Systems Design, Holtwood Hydroelectric Expansion Project
PPL Holtwood, Holtwood, PA
Project Engineer responsible for designing and specifying HVAC, compressed air piping, cooling water, and service water systems for a new 130 MW hydropower station.

LUCAS J. DELONG, P.E.

SENIOR ENGINEER (ELECTRICAL)

Lucas DeLong specializes in designing electrical control systems for hydropower facilities. He designs and prepares cost projections for electrical equipment including switchgear, motor control centers, protective relays, synchronizing equipment, transformers, generators, and various custom control panels. Lucas models and designs power distribution systems including generator step-up transformer and equipment interconnections. He works with drafters to create a complete electrical drawing package for construction and maintenance, reviews contractor submittals, and provides support during construction. Lucas also determines opportunities and needs for equipment upgrades at hydro stations by analyzing existing electrical test data, evaluating adequacy of existing switchgear and transformers for existing and future generation and loads, evaluating existing protective relaying, and providing recommendations for maintenance and equipment upgrades.

Key Expertise

- Hydro Unit and Plant Control Systems
- Electrical Power and Interconnection Systems
- Powerhouse Design

Professional Registration

Professional Engineer, CA, CT, MA, MD, ME, MI, MT, NY, PA, VT, WI, AL, and OR

Certification/Training

National Electrical Code, provided by Eastern Maine Community College

Basic Ladder Logic Programming and PID Loop Development and Tuning Provided by Rockwell Automation

Unit and Plant Control System Commissioning Assistance, Rainbow Falls Hydro Station, New York State Electric & Gas (Avangrid), Keeseville, NY

Senior Electrical Engineer responsible for testing and commissioning the unit and plant control system. The control system was designed by others who were unable to complete commissioning or PLC program and HMI development. Picked up where the designer left off, assisting NYSEG with testing from instrumentation to SCADA connections as well as developing PLC program logic and HMI graphics for control of the generating units and auxiliary equipment.

Turbine Technology Evaluation & Site Layout, Buckhorn Dam Lock 31
Peterborough Utilities, Inc., Trent Severn Waterway, ON

Senior Electrical Engineer responsible for electrical aspects of a feasibility study for development of low-head hydro power at a lock and dam site. Responsibilities include developing recommendations regarding the site and power station layouts and the feasibility of the site's development.

Powerhouse Upgrade Study, Faraday Hydro Power Plant
Portland General Electric, Portland, OR

Senior Electrical Engineer responsible for the evaluation of electrical aspects of two alternatives for the upgrade of the 48 MW Faraday Powerhouse. The study included developing conceptual layout designs, generation estimates, and opinion of cost in collaboration with Portland General Electric and a local contractor.

Mechanical and Electrical Condition Assessment, Tinker Generating Station
Algonquin Hydro, Aroostook Junction, NB

Electrical Engineer responsible for completing a comprehensive site assessment for a five unit, 36 MW project in New Brunswick. This included an investigation of the power station and examination of plant conditions and recommendations for future upgrades and improvements.

Generator Rehab and Relay Protection Upgrade, Pine Hydroelectric Station
We Energies, Florence, WI

Engineer of record for protective relay upgrade design. Provided generator rewind specification. Designed new protective relay sub-panel and integrated new voltage regulator into existing controls, modifying existing controls as needed. Reviewed technical submittals from generator rewind vendor and voltage regulator vendor. Developed generator protection settings files for Schweitzer protective relay.

Appropriation Grade Hydro Feasibility Study, Lyons Falls Project
Kruger Energy, Lyons Falls, NY

Electrical Engineer responsible for electrical aspects of an appropriation grade, thirty-percent design, and feasibility study on an 11.2 MW site redevelopment. Responsibilities include design checking and preparation of the electrical interconnection application.

Station Electrical Rehab, Big Quinnesec Falls Hydroelectric Station
We Energies, Iron Mountain, MI

Engineer of record for electrical rehabilitation design of the Big Quinnesec original hydroelectric plant. Provided generator rewind specification and replacement transformer procurement specification. Developed demolition plan and construction specifications. Designed new protective relaying, metering, and control panels and integrated a new voltage regulator (Basler DECS 250). Developed protection settings files for Schweitzer protective relays and provided configuration files for the new Basler DECS AVR. Reviewed technical submittals from generator rewind vendor and control panel builder. Modified Modicon PLC program to add automation of new exciter and protection.

Generation Station Protection (PROT-413) provided by Schweitzer Engineering Laboratories

Professional Affiliations
Institute of Electrical and Electronic Engineers
National Society of Professional Engineers
Illuminating Engineering Society

Education
B.S. Electrical Engineering, University of Maine, 2007

Years of Experience
With Kleinschmidt: 11
Total: 11

Hydro Unit Control Systems Replacement Design, Holtwood Hydroelectric Expansion Project, PPL Holtwood LLC, Holtwood, PA
Electrical Engineer responsible for unit control system design and plant integration. This project replaced two abandoned direct current hydro-turbine-generator units with two new alternating current units with all new control system and protective relaying. Contributed to design of control and protective relaying systems, integrating them into the existing plant's control and relaying schemes and integrating the physical equipment into the plant's existing control and relay boards. Worked with drafters to create a complete electrical drawing package for construction and maintenance. Reviewed contractor submittals and answered questions during construction. Helped to program the unit's control system consisting of Allen Bradley Controllogix Programmable Logic Controller, Panelview Human Machine Interfaces (HMI), and PC HMIs including implementation of data logging and alarm and event recording. Helped to test, troubleshoot, and commission the two units over a total of two months' work in the plant.

Hydro Unit and Plant Control System Design and Commissioning, Holtwood Hydroelectric Expansion Project, PPL Holtwood LLC, Holtwood, PA
Electrical Engineer responsible for designing indoor and outdoor lighting, exterior underground power and controls duct banks, public address and telephone system, fire alarm system, conduit and cable tray layout, and standby generator remote controls. Contributed to design of 480V, 4000A, main-tie-main station-service power distribution system including motor control centers, power panels, transformers, and lighting panels. Reviewed turbine-generator and control system vendor's technical submittals. Led drafters and junior engineers to complete the integration of vendor-provided component schematics into complete system wiring diagrams and ultimately a complete electrical drawing package. Adapted technical construction specifications and contributed to contract documents defining contractor scope. Assisted in commissioning the new plant as the automation commissioning lead directing programmers, electricians, and instrument and control technicians to plan and complete automation and controls related startup and testing of hydro-turbine-generator (HTG) unit and plant control systems over the course of a year at the plant.

New Hydro Control Systems Design, Sherman Island Unit 1 Installation
Brookfield Renewable Power, Warren and Saratoga Counties, NY
Staff Electrical Engineer responsible for supporting design for installation of a new hydro-turbine generator unit in existing unused water passage. Integrated controls equipment designed by others. Specified cables and created interconnect drawings to integrate the turbine, generator, switchgear, and control system. Created motor elementaries, and reviewed vendor submittals.

Hydro Turbine Generator Installation, Abenaki Generator #6
Madison Paper Industries, Madison, ME
Staff Electrical Engineer responsible for supporting design for installation of a new 3.3MW synchronous hydro-turbine generator unit in existing unused water passage. Helped design the unit control system based on an Allen Bradley ControlLogix Programmable Logic Controller (programming by others) and developed a package of wiring diagrams and schematics for installation.

Design of Minimum Flow Unit, Sherman Island Dam
Brookfield Renewable Power, Warren and Saratoga Counties, NY
Staff Electrical engineer responsible for providing quality control review of design for minimum flow unit powerhouse having 1.2 MW capacity at existing hydroelectric project. This included design for lighting, fire and intrusion alarms, heating, venting, three-phase power, single-phase power, and 5 kV power distribution equipment. Services included equipment specifications preparation, equipment installation design, equipment integration/interconnection design, power distribution line design, protective relaying design, bid package development, contractor bid reviews, and construction support.

APPENDIX B

TERMS AND CONDITIONS AND METHOD OF PAYMENT

KLEINSCHMIDT ASSOCIATES
(A MAINE CORPORATION)
STANDARD TERMS AND CONDITIONS

1. **Purpose**: These Standard Terms and Conditions when combined with a Proposal are intended to form a complete Agreement between Kleinschmidt Associates (Kleinschmidt) and the Client to whom the Proposal is addressed. When Kleinschmidt's signed Proposal has been accepted by the Client, the resulting Agreement shall take the place of all other agreements and representations concerning the subject of the Proposal. This Agreement may be amended only by a writing signed by both parties. Terms and Conditions of any purchase order issued by Client shall not be part of this Agreement unless separately signed by Kleinschmidt.

2. **Payment**: In consideration for Kleinschmidt's performance of the proposed work, Client shall pay Kleinschmidt as stated in the Proposal. Client agrees to pay promptly Kleinschmidt's fees and expenses as submitted on monthly invoices. If any balance remains unpaid thirty days from the date of the invoice, Client shall pay interest on the unpaid balance at the rate of one and one-half percent per month from said thirtieth day and shall, in addition, pay Kleinschmidt's costs of collection including reasonable legal fees.

3. **Client's Duties**: At no cost to Kleinschmidt, Client shall:

   Promptly provide to Kleinschmidt the information required by Kleinschmidt for performance of its services.

   Provide Kleinschmidt personnel with access to the work site so that they may perform their work without interference.

   Designate a Client's representative with authority to transmit instructions, receive information, and define Client's polices concerning this Agreement.

   Promptly notify Kleinschmidt of any defect in Kleinschmidt's services as soon as Client becomes aware of it.

   Prior to commencement of Kleinschmidt's work, furnish Kleinschmidt with any special design or construction standards, which Client may require Kleinschmidt to follow.

4. **Kleinschmidt's Liability**: Kleinschmidt's services will be performed with that degree of reasonable care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances.

   The total liability by Kleinschmidt and its agents for all claims relating to the work outlined in the Proposal shall not exceed the compensation received by Kleinschmidt or $50,000, whichever is greater.

   Kleinschmidt shall not be liable for any losses resulting from deficiencies in its services if those deficiencies arise from a cause beyond Kleinschmidt's reasonable control.

5. **Betterment**: If Kleinschmidt omits a required element of the project, Kleinschmidt shall not be responsible for paying the cost to add such item to the extent that it would have been necessary to the project or otherwise adds value or betterment. Kleinschmidt will not be responsible for any added cost or expense that provides betterment, upgrade or enhancement of the project.

6. **Shop Drawing Review**: When authorized by Client, Kleinschmidt shall review contractor submittals, such as shop drawings, product descriptions, samples, and other data, but only for determining that it conforms to the design concept and that it appears consistent with the contract documents. This shall not include checking the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination of the work with other trades, or construction safety issues, all of which are the sole responsibility of the Contractor.

   Kleinschmidt's review shall be conducted with reasonable promptness while allowing sufficient time to permit a review that is adequate in Kleinschmidt's judgment. Review of a specific item does not mean that Kleinschmidt has reviewed the entire assembly of which the item is a part.

   Kleinschmidt shall not be responsible for any deviation from the contract documents unless the deviation is brought specifically to Kleinschmidt's attention by the Contractor in writing. Kleinschmidt shall not be required to review partial submissions or those for which correlated items have not been received.

7. **Ownership of Documents**: Any drawings, specifications, or reports prepared by Kleinschmidt under this Agreement shall be the property of Client; however, Kleinschmidt shall have the unlimited right to use such drawings, specifications, and reports and the intellectual property therein. Client's use of such drawings, specifications, and reports shall be limited to the project or purpose for which they were prepared. Any use other than that purpose will be at Client's sole risk and without liability to Kleinschmidt and Client shall indemnify and hold harmless Kleinschmidt from all claims, damages, losses, and expenses resulting therefrom.

8. **Opinions of Probable Cost**: Opinions of Probable Cost prepared by Kleinschmidt are merely expressions of Kleinschmidt's judgment based on its experience as a design professional familiar with the industry. Kleinschmidt has no control over market prices, construction methods, or competitive conditions and therefore cannot represent that actual bids or negotiated prices will not vary from Kleinschmidt's Opinions of Probable Cost.

9. **Patents**: Kleinschmidt's work under this Agreement shall not include patent or copyright searches; and Kleinschmidt assumes no responsibility for any patent or copyright searches; and Kleinschmidt assumes no responsibility for any patent or copyright infringement that may arise from its work. Kleinschmidt makes no representation that anything made, used, or sold in connection with its services will be free from such infringement.

10. **Termination or Suspension**: Either party may terminate this Agreement upon reasonable notice to the other. Kleinschmidt shall be paid for the services provided and expenses incurred through the date of termination.

    If the Agreement is terminated by the Client without breach by Kleinschmidt or if Kleinschmidt terminates for Client's breach, Kleinschmidt shall also be paid its reasonable and necessary termination costs which may include layoff and demobilization expenses as well as costs of terminating contracts, leases, and other obligations incurred by Kleinschmidt in reliance upon this Agreement. If Client suspends the work, Kleinschmidt shall be reimbursed by Client for such added fees and costs which arise from the suspension and remobilization.

    Kleinschmidt shall not be liable to Client for losses resulting from Kleinschmidt's termination or suspension caused by Client's non-payment or other material breach of this Agreement.

11. **Assignment**: Neither party shall assign its rights, interests, or obligations under this Agreement without prior written consent from the other party; but such consent shall not unreasonably be withheld.

12. **No Waiver**: The failure of either party to enforce a provision of this Agreement shall not prevent that party from later enforcing it or from pursuing the remedies that may be available for breach of the provision.

13. **Indemnification**: Within its limit of liability Kleinschmidt shall indemnify and hold harmless the Client and its agents from any and all claims and losses caused solely by the negligent acts or omissions of Kleinschmidt or its agents in the performance of services under this Agreement.

    Client shall indemnify and hold harmless Kleinschmidt and its agents from any and all claims and losses caused solely by the negligent acts or omissions of Client or its agents with respect to this Agreement.

14. **Governing Law**: This Agreement shall be governed by the laws of the State of Maine, provided that nothing contained in the Agreement shall be interpreted in such a way as to render the Agreement unenforceable under any law of the United States or the law of the place in which the Client is located.

15. **Time for Acceptance**: Kleinschmidt's proposal shall remain firm for no longer than 60 days unless another period is specified in the proposal or the time is specifically extended by Kleinschmidt.

KLEINSCHMIDT ASSOCIATES
METHOD OF PAYMENT

1. Client may pay Kleinschmidt either on a negotiated Lump Sum basis or Hourly Rate basis, as defined in the Work Authorization and agreed by the *Client* and Kleinschmidt in writing.
2. Client agrees to pay Kleinschmidt for Services the amounts quoted in the Proposal or Work Authorization, in accordance with the compensation terms laid out in the contract. Kleinschmidt agrees not to exceed the estimated consulting costs as stated in the proposal without explaining the need to the Client and obtaining the Client's authorization to proceed.
3. For Lump Sum projects, Kleinschmidt will invoice monthly as a percent complete of the project or Work Authorization, unless otherwise defined in the Work Authorization.
4. For Time and Materials, or Hourly Rate projects, Kleinschmidt will invoice monthly for all employee time at the hourly billing rate currently in effect, times a number of hours worked on the project plus subconsultant fees and expenses as described below. Client agrees to pay for expert testimony and direct preparation for testimony in any litigation, arbitration, or other legal or administrative proceeding at 150% of the standard billing rates with a minimum daily charge based upon an 8-hour day, plus Reimbursable Expenses.
5. For any projects where expenses are invoiced separately from labor, the following apply:
    a. Client agrees to pay Kleinschmidt a 15% markup for subconsultant services.
    b. Client agrees to pay 3% of labor costs for telecommunications (e.g., phone, data transmission and storage, fax, conference and video conference, data security).
    c. Client agrees to pay for specialized computer programs, field equipment, and other unit charges (e.g., photocopies, mileage, photos, drawing reproductions, CD preparation, Sharepoint hosting) according to the current rates in effect.
    d. Client agrees to pay any other reimbursable expenses actually incurred by Kleinschmidt at cost.

APPENDIX C

BID FORMS

BOARD OF CONTRACT AND SUPPLY
CITY OF PROVIDENCE, RHODE ISLAND

BID FORM 1: Bidders Blank

1. Bids must meet the attached specifications. Any exceptions or modifications must be noted and fully explained.
2. Bidder's responses must be in ink or typewritten, and all blanks on the bid form should be completed.
3. The price or prices proposed should be stated both in **WRITING** and in **FIGURES**, and any proposal not so stated may be rejected. **Contracts exceeding twelve months must specify annual costs for each year.**
4. Bids **SHOULD BE TOTALED** so that the final cost is clearly stated (unless submitting a unit price bid), however **each item should be priced individually**. Do not group items. Awards may be made on the basis of ***total*** bid or by ***individual items***.
5. All bids **MUST BE SIGNED IN INK**.

Name of Bidder (Firm or Individual): Kleinschmidt Associates

Contact Name: Andy Qua

Business Address: 141 Main Street, Pittsfield, ME 04967

Business Phone #: _____

Agrees to bid on (Items(s) to be bid): Renewable Energy Projects

If company is based in a state *other than Rhode Island*, list name and contact information for a local agent for service of process: _____

Please visit http://www.naics.com/search/ and identify the NAICS Code(s) for items being bid on. Enter the NAICS code(s) here or in parentheses next to each item listed immediately above: 541330

Delivery Date (when applicable): June 25, 2018

Name of Surety Company (if applicable): _____

Total Amount in Writing*: Sixty-five thousand one hundred dollars

Total Amount in Figures*: $65,100

If you are submitting a unit price bid please insert "Unit Price Bid."

Use additional pages if necessary for additional bidding details.

Signature of Representative

Vice President

Title

BOARD OF CONTRACT AND SUPPLY
CITY OF PROVIDENCE, RHODE ISLAND

BID FORM 2: Certification of Bidder
(Non-Discrimination/Hiring)

Upon behalf of Kleinschmidt Associates (Firm or Individual Bidding),

I, Kevin Cooley (Name of Person Making Certification),

being its Vice President (Title or "Self"), hereby certify that:

1. Bidder does not unlawfully discriminate on the basis of race, color, national origin, gender, sexual orientation and/or religion in its business and hiring practices.
2. All of Bidder's employees have been hired in compliance with all applicable federal, state and local laws, rules and regulations.

I affirm by signing below that I am duly authorized on behalf of Bidder, on this 22 day of June 2018.

Signature of Representative

Kevin Cooley
Printed Name

BOARD OF CONTRACT AND SUPPLY
CITY OF PROVIDENCE, RHODE ISLAND

Certificate Regarding Public Records

Upon behalf of Kleinschmidt Associates (Firm or Individual Bidding),

I, Kevin Cooley (Name of Person Making Certification),

being its Vice President (Title or "Self"), hereby certify an

understanding that:

1. All bids submitted in response to Requests for Proposals (RFP's) and Requests for Qualification (RFQ's), documents contained within, and the details outlined on those documents become public record upon receipt by the City Clerk's office and opening at the corresponding Board of Contract and Supply (BOCS) meeting.
2. The Purchasing Department and the issuing department for this RFP/RFQ have made a conscious effort to request that sensitive/personal information be submitted directly to the issuing department and only at request if verification of specific details is critical the evaluation of a vendor's bid.
3. The requested supplemental information may be crucial to evaluating bids. Failure to provide such details may result in disqualification, or an inability to appropriately evaluate bids.
4. If sensitive information that has not been requested is enclosed or if a bidder opts to enclose the defined supplemental information prior to the issuing department's request in the bidding packet submitted to the City Clerk, the City of Providence has no obligation to redact those details and bears no liability associated with the information becoming public record.
5. The City of Providence observes a public and transparent bidding process. Information required in the bidding packet may not be submitted directly to the issuing department at the discretion of the bidder in order to protect other information, such as pricing terms, from becoming public. Bidders who make such an attempt will be disqualified.

I affirm by signing below that I am duly authorized on behalf of Bidder, on

this 22 day of June 20 18.

Signature of Representative

Kevin Cooley

Printed Name

From:	Keenan Goslin
To:	"gdiaz@providenceri.gov"
Cc:	"Gary Marino"
Subject:	FW: Minority/Womens Owned Business Waiver
Date:	Tuesday, June 19, 2018 9:39:00 AM
Attachments:	WMBE Waiver signed.pdf PVD18-155 RENEWABLE ENERGY PROJECTS.pdf

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Good morning Grace,
Kleinschmidt will be submitting a bid on Monday (6/25) for the hydro portion of Providence Water Renewable Energy RFP (attached). We're requesting a waiver of the MBE/WBE Participation requirement and our Waiver Form is also attached. Will the City of Providence need a hard copy of this or is this electronic version acceptable?

Best,
Keenan

Keenan Goslin P.E.
Senior Engineer
Kleinschmidt
860.581.5883 direct office
207.949.0973 cell
www.KleinschmidtGroup.com
*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

APPENDIX D

2018 STANDARD RATES

KLEINSCHMIDT ASSOCIATES
2018 RATES (USD)

LABOR CATEGORY	HOURLY BILLING RATE
SENIOR CONSULTANTS	
Principal Consultant F1	$215.00
Senior Manager M1G	$200.00
Section Manager M1T	$172.00
ENGINEERS	
Senior Engineering Consultant E6	$187.00
Senior Engineer E5	$156.00
Project Engineer E4	$140.00
Engineer E3	$130.00
Staff Engineer E2	$120.00
Engineer Technician E1	$90.00
LICENSING COORDINATORS/PLANNERS	
Senior Regulatory/Planner Advisor L/P7	$200.00
Senior Licensing Coordinator/Planner L/P6	$161.00
Project Licensing Coordinator/Planner L/P5	$135.00
Licensing Coordinator/Planner L/P4	$120.00
Staff Licensing Coordinator/Planner L/P3	$104.00
Associate Licensing Coordinator/Planner L/P2	$88.00
Licensing Coordinator/Planner Technician L/P1	$71.00
SCIENTISTS	
Senior Science Advisor S7	$204.00
Senior Scientist S6	$161.00
Project Scientist S5	$133.00
Scientist S4	$118.00
Staff Scientist S3	$99.00
Associate Scientist S2	$80.00
Scientist Technician S1	$70.00
PROJECT AND PROGRAM MANAGEMENT	
Program Director PD	$210.00
Senior Project Manager PM2	$205.00
Project Manager PM1	$175.00
Project Controller A6	$115.00
Senior Project Coordinator/Accountant A5	$105.00
Project Coordinator/Accountant A4	$95.00
Administrative Staff A3	$83.00
Associate Administrative Staff A2	$70.00
Office Assistant A1	$64.00
DESIGNERS/DRAFTERS	
Senior Designer D4	$120.00
Designer D3	$105.00
Senior Drafter D2	$90.00
Drafter D1	$80.00