Document Front Sheet

nalcor energy
LOWER CHURCHILL PROJECT

NE-LCP Contractor/Supplier

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REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHODS OR MATERIAL DEVELOPED AND/OR SELECTED BY THE CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTUAL OR OTHER OBLIGATIONS.

- ☐ **01 – REVIEWED AND ACCEPTED – NO COMMENTS**
- ☐ **02 – REVIEWED – INCORPORATE COMMENTS, REVISE AND RESUBMIT**
- ☐ **03 – REVIEWED - NOT ACCEPTED**
- ☐ **04 – INFORMATION ONLY**
- ☐ **05 – NOT REVIEWED**

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Prepared for

NALCOR ENERGY

INDEPENDENT ENGINEER AND OPERATING AND MAINTENANCE SERVICES
for
LOWER CHURCHILL PROJECT
AGREEMENT NO. LC-PM-082

EXECUTION PLAN

MWH
BUILDING A BETTER WORLD

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SECTION
1

Summary of Execution Plan
Phase 1 and Phase 2
Lower Churchill Project
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NALCOR ENERGY

In accordance with NALCOR Energy's request, MWH has prepared an Execution Plan for the Company's approval. The outline of the Execution Plan and the summary of the Execution Plan follows:

OUTLINE OF THE INDEPENDENT ENGINEER'S PROPOSED EXECUTION PLAN

1. Summary of Execution Plan

The role of MWH Canada during Phase 1 is to review the principal aspects of the Project engineering design, hydraulics, hydrology and power generation estimates, cost and scheduling estimates, transmission systems and converter stations, and the technical provisions in the principal Project contracts as well as the permits and licenses. The Project consists of the Muskrat Falls Generating Facility (MF) and the Labrador-Island Transmission Link Project (LITL), and the Labrador Transmission Assets Project (LTA). However, the LTA will not be included in MWH Canada's Scope of Work under this assignment for Nalcor and it's two Lender groups.

MWH Canada will identify issues uncovered during the independent engineering review, may propose an approach to address those which are within its area of expertise, and will work with NALCOR and the Client's to help resolve each issue. In general, the IE reviews work prepared by others and does not prepare original engineering design products. The work to be accomplished by the MWH team (the Independent Engineer) does not include any assessment, evaluation, review, testing, or discussion of facility security issues, including but not limited to, protection from terrorist acts, that may impact NALCOR and their facilities, systems, or human life or those of other entities with which Nalcor and the Clients have business or operation relations. The Clients will be Nalcor's Lenders and their advisors.

MWH Canada has dedicated a team of experienced engineers with many years of experience in the design and operation of hydroelectric plants, and who have performed

numerous Independent Engineering reviews for other projects during their careers. The IE organization charts included with the Execution Plan indicates the specialized fields of expertise required to process the work and include specialists to allow the work to be processes relatively more quickly by providing several specialists in each of the main categories of Work. Also included with the Execution Plan is the MWH Global Organization Chart as required by the RFP. We have included with the Execution Plan the resumes of personnel who will be dedicated to this Project during the course of the work along with the resumes of sub-consultants. The Work is outlined and discussed in Section 2, which include the Work required for Phase 1 and for Phase 2. We have attached to this Execution Plan the detailed Scope of Work to be performed under the Plan. The Detailed Scope of Work formed the basis for preparing our time estimates and budget estimates. The outline of the Scope of Work follows the Task numbering system as given in the RFP, PHASE 1: PROJECT TECHNICAL REVIEW PRIOR TO FINANCIAL CLOSE, pages 33-44, and PHASE 2: CONSTRUCTION PERIOD, Pages 45 and 46.

The Execution Plan provides a summary schedule that allows the work to be implemented in an organized manner to allow questions of NALCOR to be addressed during MWH's review of the Project documents and as complimented with discussions with the participating parties and observations made during the site visit. Notes in the Execution Plan Summary Schedule indicate where we expect the work to be accomplished and the duration of the work. We have also designated on the schedule the expected dates for submittals (reports) to NALCOR and the Client. At this time we realize that the review of our Execution Plan is subjected to approval by NALCOR and the Clients (Lenders); as such, we would expect that any revisions to the Execution Plan can be made to accommodate the needs of NALCOR, the Clients, and the Project Schedule(s).

Work required to be performed by the Independent Engineer follows the requirements to address all of the tasks as presented in the RFP which will address each subject/topic outlined therein.

2. Work to be Accomplished by the Independent Engineer

- **a.** Project Technical Review Prior to Financial Close—Phase 1
  - **i.** Detailed Scope of Work--attached
- **b.** Project Construction Period---Phase 2
  - **i.** Detailed Scope of Work---attached

3. Professional Staff to Accomplish the Work

- **a.** MWH Global Organization Chart
- **b.** Project Feature Organization Charts
  - **i.** Muskrat Falls Generating Facility
  - **ii.** Labrador-Island Transmission Link Project

c. Independent Engineer's Organization
- **i.** Project Technical Disciplines
- **ii.** Key Personnel
- **iii.** Technical Specialists
- **iv.** Resumes of Key Personnel
- **v.** Resumes of Staff Supporting Key Personnel

4. Work Schedule of Independent Engineer

a. IE Execution Plan Work Schedule

SECTION
2

Work to be Accomplished by the Independent Engineer
Phase 1 and Phase 2
Lower Churchill Project
LC-PM-0832
NALCOR ENERGY

PROJECT TECHNICAL REVIEW PRIOR TO FINANCIAL CLOSE – PHASE 1

PHASE 1: PROJECT TECHNICAL REVIEW PRIOR TO FINANCIAL CLOSE

Task 1: Initial Project Scope Meeting and Obtain Project Documentation

The purpose of the initial Project Scope Meeting is to obtain information from the Owner and its advisors as required by the RFP to allow the Independent Engineer to perform the Project assessment as outlined in the RFP in an expeditious manner such that the schedule goals established during the meeting will be achieved. In addition to items mentioned in the RFP that will be included in the discussions, we have included other material, herewith, that will aid our discussions and data gathering of germane documents needed for our perusal. We have taken the opportunity to do this at this time because we understand the necessity of keeping to an agreed-to-schedule in accomplishing the preparation of the Independent Engineer's Reports that will be used by the Clients in preparing their term sheets and agreements with the Owner. The items listed below have been mentioned in the RFP or are included, as recommended by MWH, to enhance the level of discussions and details for the first meeting. We would like to receive two (2) hard copies of the documents as well as two (2) compact discs of the data requested to aid us in our work efforts. We understand that a data room may be available to allow information to be reviewed and downloaded for our use which could supplement or replace the requested hard copies and compact discs; however, we have found we can work more efficiently if data is readily available in the forms requested.

1. List of items MWH would expect to be furnished for their review. The following items are required for our review and are listed, not necessarily in the order we would expect to receive them:

    1.1 Project Feasibility Report

    1.2 Summary of Geotechnical investigations and the Geotechnical Reports for the following: Muskrat Falls Generating Facility including the site and the switchyards; Labrador-Island Transmission Link Project including the converter stations, the transition compounds, the crossing of the Strait of Belle Isle, and

the transmission lines. Of particular interest to our civil/structural engineers and our geologists is the study associated with the treatment of the left abutment (knoll) and its geology at Muskrat Falls dam. We would also like to review the borrow area reports for sources of riprap and aggregate for concrete as well as materials for roads.

1.3 Hydrologic Reports and Studies of selected Muskrat Falls site and the Churchill River Basin

1.3.1 Basis for Power Production Estimates---Hydrology and Power Model

1.3.2 Hydrology and Power Estimates for the Planned Gull Island upstream project

1.3.3 Precipitation and Climatological Data for Site

1.3.4 Diversion and Spillway Flood Studies

1.3.5 Sedimentation Data and Reservoir Useful Life Determination for Sustainability

1.3.6 Ice Berg studies and associated design criteria

1.4 Basis of Design Report

1.5 Drawings and Specifications

1.5.1. General Civil Works

1.5.2. Major Project Features of Muskrat Falls--Dams, Power Plant, Spillway, Switchyard

1.5.3. AC/DC Converter Stations

1.5.4. Submarine Cable Crossings: Strait of Belle Isle; Bathymetry along selected route

1.5.5. Switchyards

1.5.6. Transmission Lines

1.5.7. Transition Compounds

1.6 Contract with Design Engineer (EPCM) and Contact Names/Telephone/email/FAX

1.6.1 Design Engineer's Organization Chart

1.6.2 Resumes of the Lead Design Engineers/Specialists: Civil; Geology/Geotechnical; Hydrology and Hydraulic; Mechanical; Powerhouse Mechanical; Powerhouse Electrical; Environmental; Structural; Project Manager and Deputy Project Manager; Health and Safety Specialist; Project(s) CPM scheduler; Project (s) Cost Estimator

1.6.3 Resumes of the Lead Site Engineers: Project Manager; Geologist/Geotechnical; Civil; Structural; Mechanical; Electrical; Environmental; Health and Safety Specialist; Submarine Cable Lead Engineer; and Transmission Lines

1.7 Construction Contract (EPCM)—General Provisions and Contact Names/Telephone and Fax numbers; email

1.8 Contract for Electrical and Mechanical Equipment and Contact Names/email/Telephone and Fax numbers

1.8.1 List of Equipment and Suppliers

1.8.2 Performance Criteria

1.8.3 Performance Testing Protocol

1.9 Proposed CPM Construction Schedule for the Project

1.9.1 Description of Construction Methodology

1.9.2 River Diversion and Care of Water

1.9.3 Source of Construction Materials

1.9.4 List of Critical Events and Dates

1.9.5 List of Float time for procured items and for principal construction activities

1.10 Current Construction Cost Estimate

1.10.1 Schedule of Payments to Contractor/Vendors

1.10.2 Estimate of Cost of Work Left to Complete

1.11 List of Construction Contractors and Subcontractors

1.12 Qualifications of Contractors and Principal Subcontractors and Equipment Suppliers

1.13 Permits and Licenses to Construct and Operate Project and Current Status

1.14 Power Sales Contract

1.15 Transmission and Interconnection Agreement (s)

1.16 Operation and Maintenance Agreement with EPCM Firm (SNC-Lavalin)

1.17 Projected Operation Results---Financial Pro Forma (Projection Model) with List of Assumptions and Description of Cases

1.18 Insurance Program

1.19 Safety Program

1.20 Environmental Checklist (World Bank Standards/Equator Principals)

1.21 Environmental Impact Statement and Project Handbook of Environmental Protection Measures

1.22 Emergency Action Plan for Construction, and Emergency Action Plan for Operation

1.23 Load Flow Studies Associated with the Transmission System

1.24 Health and Safety Program

1.24.1 EPCM Firm Health and Safety Program

1.24.2 Contractor's Health and Safety Program

1.24.3 Major Equipment Suppliers/Vendors Health and Safety Program

1.25 Sustainability Plan for the Project

1.26 Warehousing Plan and Tracking System

1.27 Operations and Maintenance Plans

1.28 Operations and Maintenance Budgets

1.29 Inter-connection Facilities Agreement

1.30 Water management Agreement

1.31 Water Supply and Wastewater Disposal Agreements

1.32 Fuel and Transportation Agreements

1.33 Copies of the following contracts and other contracts that are planned to be issued.

1.33.1 Procurement Contracts for Transmission Line

1.33.1.1 Insulators for AC Lines-PT0301

1.33.1.2 Conductor for AC Lines-PT0300

1.33.1.3 Tower Steel for AC Lines-PT0302

1.33.1.4 Hardware Accessories and Fittings for AC lines-PT0303

1.33.1.5 Optical Ground Wire Conductors for AC Lines-PT0304

1.33.1.6 Earthing Material for AC Lines-PT0305

1.33.1.7 Guy Wires for AC Towers-PT0306

1.33.1.8 Steel Grillage for AC Lines-PT0307

1.33.1.9 Overhead Shieldwire for AC Lines-PT0326

1.33.1.10 Rock Anchors and Anchor Bolts for AC Towers-PT0335

1.33.2 Procurement Contracts for Powerhouse

1.33.2.1 Supply of Generator Step-Up Transformer-PH0014

1.33.2.2 Supply of Isolated Phase Bus-PH0015

1.33.2.3 Supply of Generator Circuit Breakers-PH0016

1.33.2.4 Supply of Station Service Transformers-PH0035

1.33.2.5 Supply of Auxiliary Transformers-PH0036

1.33.2.6 Supply of 25kV Switchgear-PH0037

1.33.2.7 Supply of Emergency Diesel Generator-PH0038

1.33.3 Procurement Contracts for Substations

1.33.3.1 138 kV & 25 kV Circuit Breakers (Dead tank type)-PD0514

1.33.3.2 138 kV & 25kV Disconnect Switches (with & without ground switches)-PD0515

1.33.3.3 138 kV Capacitor Voltage Transformers (CVTs)-PD0518

1.33.3.4 25 kV Vacuum Interupters-PD0519

1.33.3.5 25 kV 6x4 MVAR Capacitor Banks-PD0520

1.33.3.6 Pre-fabricated Control Room Bldg.-PD0522

1.33.3.7 Substation Service Transformers-PD0523

1.33.3.8 25 kV Reclosers-PD0529

1.33.3.9 138 kV & 25 kV Surge Arresters-PD0530

1.33.3.10 MV Instrument Transformer (Combined CT & PT Unit)-PD0531

1.33.4 Construction Contracts for Intake, Dam, Powerhouse, Site Accommodations, T&G

1.33.4.1 Intake, Powerhouse, Spillway and Transitions Dams-CH0007

1.33.4.2 Accommodations Complex, Site Utilities-CH0005

1.33.4.3 Reservoir Clearing South Side-CH0023

1.33.4.4 Reservoir Clearing North Side-CH0024

1.33.4.5 Administrative Buildings-CH0003

1.33.4.6 Southside Access Road-CH0004

1.33.4.7 Bulk Excavation Works-CH0006

1.33.4.8 Accommodations Complex Buildings-CH0002

1.33.4.9 Turbines and Generators-CH0030

1.33.5 Service Contracts

1.33.5.1 Provisions of Security Services-SH0019

1.33.5.2 Provision of Medical Services-SH0020

1.33.6 Construction Contracts for Transmission

1.33.6.1 Right of Way Clearing-Sec. 1 & 2-CT0341

1.33.6.2 AC Transmission Line-CT0319

1.33.7 Construction Contract for Construction Power

1.33.7.1 Construction Contract for Construction Power-CD0512

2. MWH proposes the following Members of their team partake in the Kick Off meeting: Project Manager, Rey Hokenson, P.E. ; Principal in Charge, Nik Argirov, P.Eng.; St. John's MWH's Representative, Gerry Germain, P.Eng

3. MWH proposes that the Outline of the Independent Engineers Report we intend to use, included at the end of this Task, will form the basis for discussions pertaining to report format and content.

4. MWH would be pleased to know who the Owner intends to invited to the meeting including parties from its own staff and that of its legal advisor/contract specialist, Lead economist, insurer, pro-forma economist, and team members. Some of the following Owner's team members would are desired to participate, including the following specialists: Lead Civil Engineer; Lead Structural Engineer; Lead Hydrologist and Hydraulics Engineer; Lead Mechanical Engineer; Lead Electrical Engineer; Lead Terrestrial Transmission Engineer: Lead Substation Engineer; Lead Submarine Cable Transmission Engineer; Lead Geologist; Lead Project Scheduler; and Lead Contract Specialist.

5. MWH and the Owner and advisors will jointly discuss and proposed dates for the site visits to each of the sites mentioned in the RFP plus at least six typical sites along the transmission corridors. We initially scheduled the site visit to occur during the fifth week of the review period to allow MWH to receive and review about 90 percent of the data required to be reviewed. However, because of the very limited site work accomplished to date and insufficient contracts available for our review, we have mutually agreed to revise the schedule to accommodate a site visit in April 2013. To facilitate the field trip, we recommend that helicopters be used; therefore, scheduling for their use usually is important to consider and plan for.

6. In consultation with Nalcor we have selected the date of the first draft of the Independent Engineer's Reports to be January 31, 2013. Two IE Reports will be prepared: Muskrat Falls Generating Project; and Labrador-Island Link Project. The draft reports will not be complete because contracts scheduled for review will not be available to the IE until late in 2013 and the site visit will occur after the draft IE Report (s) are issued.

7. We originally planned to jointly select the date at which MWH can expect to receive about 90 percent of the data we have requested. This date appears to be late in the third quarter of 2013, and thus it is nearly impossible to predict what the lenders decide as the appropriate date to allow MWH to complete the reports. Our current schedule included with this Execution Plan indicates the Final Report will be delivered September 30, 2013.

8. We will develop the protocol for the submittals of the IE Reports and of receiving comments regarding the draft of the reports. We also note that lenders typically request a second draft report since they were not party to the first report's requirements; we can discuss the need to plan for this request during this meeting or subsequent meetings.

9. To enable the Kick Off meeting to be conducted with structure, MWH will propose a meeting Agenda to the Owner and the Owner will make revisions and issue the final Agenda to be followed at the Initial Project Scope Meeting. MWH will submit the Draft Meeting Agenda about 2-business-days prior to the meeting.

The following Action Items have been identified for this first Task 1 for promulgation:

1. Scope of services finalized and agreed.
2. Data and documentation required to conduct the services of the IE will be defined.
3. Proposed site visit date selected; arrangements will be made and finalized.
4. Date of draft Independent Engineer's report (s) to be issued by IE will be agreed to.
5. Format of the IE reports will be decided.
6. Procedure for submission of drafts for comment, incorporation of comments, and production of the final reports.
7. Prepare the Initial Project Scope Meeting Agenda ---DRAFT by MWH and final by Owner
8. Establish protocol for contacting Owner and then the Lender(s)
9. Owner will prepare the Meeting Notes and distribute to attendees.

Task 2: Site Visit (and MWH Proposed Office Interviews)

Selected members of the MWH team will visit the Project sites to view first-hand the geography, geology, access, and conditions of the sites. Additionally, MWH is proposing that an Office Interview and Presentations will be conducted to further gain knowledge about the project and the personnel who will be leading the teams responsible for the design and construction of the Projects. The Office interviews also serves as one of the first opportunities to personally meet some of the MWH key team members whose resumes have been included in MWH's comprehensive proposal, and which are further highlighted in MWH's Project Team

Organization Chart. The particular items to be viewed are listed below where the Independent Engineer is required to comment on the requested conditions in the Independent Engineer's Reports. The sites that were identified in the RFP to be visited include the following:

Sites to Visit:

1. Muskrat Falls Generation Facility (MF)
2. AC/DC Converter Stations
3. Switchyards
4. Sites for the crossing of Strait of Belle Isle (Forteau Point and Shoal Cove)
5. Sites along the transmission corridors (we have assumed that six) are intended to be viewed.
6. Borrow areas for the following: RCC aggregate and conventional concrete aggregate for the power station and the spillway

The purpose of the site visit is for the MWH team to become familiar with the sites; to verify and confirm whether any unusual characteristics of the sites that could present significant obstacles to successful completion of each project exist; and to make inquiries of the Owner's technical staff and that of the EPCM contractor and the main Construction Contractor. We have assumed that Lead discipline Engineers from the Design Engineer (SNC-Lavalin) will be present when the site visits are conducted and that the Construction Contractor will also have its Project Site Manager and representative Lead construction engineers present to address the MWH's team questions. MWH also requests that representatives of the turbine supplier, the generator supplier, and the AC/DC Converter Station's equipment be present in St John's for meetings either prior to the site visits or after the site visits to entertain questions and to present to the MWH team the details of their supply contracts and to discuss the contract schedules for the design, manufacturing, testing, delivery, and installation of their equipment. We also desire to listen to a presentation by the submarine cable supplier and the contractor (s) who will be responsible for the installation of the submarine cables to include discussions pertaining to the construction schedule and the safeguards to be used during inclement weather conditions. We would also expect that the Design Engineer, jointly with the Contractor, as appropriate, will make presentations to the Independent Engineer on aspects of the project that involve the following topics: river diversion and control of water; foundation treatment of the left abutment and its stabilization; RCC design and construction and protection of the upstream face of the dam from ice and debris; design of the submarine cable to protect against ice bergs, under water landslides, waves and ocean currents, geologic conditions, and ice conditions and the methods selected to monitor QA/QC during construction and deterioration occurring during its design life.

MWH also expects that the Owner and the Design Engineer (EPCM)/Contractor will have their Environmental Engineer/Permit Specialist available to present an overview of the permit status and items of work that will require monitoring during the course of the work. Additionally, the Contractor's Health and Safety Engineer would be expected to attend a meeting with the IE Team to discuss the Health and Safety Plan that will be followed during construction and the means available to administer to injured personnel and site personnel during the course of the work and during the operation and maintenance period. Since the work is spread out, we will be looking for a comprehensive and innovative way to provide for the H&S of all workers.

The IE is required to comment on the following specific items:

1. General topography, condition of ground, equipment---principal sites
2. Storage and lay-up procedures for installed and yet to be installed equipment
3. Location for storage for uninstalled equipment
4. Confirm current status of construction completion and major items to be completed
5. Access to and status of construction of off-site facilities for interconnection to electric power, water, waste disposal, fuel supply for equipment and heating

Proposed MWH Participants:

1. PM/Civil Engineer
2. Transmission line/substation engineer
3. Construction Engineer
4. Environmental Engineer
5. Geologist

ACTION ITEMS:

1. MWH Team to visit all of the sites identified herein.
2. MWH Team to gather information and take photographs of the specific items listed in the RFP and other items that are germane to the successful preparation of the Independent Engineer's Report
3. The IE will interview Owner's technical staff and that of the Design Engineer and the Construction Contractor and listen to presentations from Lead specialists.
4. The IE will listen to presentations of the principal vendors/suppliers of the hydrogenating equipment and submarine cable and interview the representatives to gain a full understanding of their supply contracts and of their design techniques.
5. The IE will attend a presentation by the Design Engineer's Environmental Engineer and Owner's Environmental Engineer/Permit specialist to understand the environmental and permit requirements of the Project.
6. The IE will attend a presentation by the Health and Safety Engineer to understand how the provisions of the Safety Plan will be implemented and monitored during construction and during the operation and maintenance period.
7. The IE will prepare germane text to be included in the Independent Engineer's Reports to memorialize the findings of the Site Visit and Office Interviews.
8. The Site Visit will occur during April 2013.
9. MWH will visit representative borrow areas, not mentioned in the RFP documents.

Task 3: Review Project Design and Projected Performance

The objective of the task is to ensure that the Independent Engineer will review all of the available Project's documents for the purpose of identifying missing, inconsistent or unresolved information. The IE will then be better able to assess the compatibility of the basis of design with the project operating requirements, site characteristics, hydrology characteristics, geologic constraints, environmental restrictions and constraints, and the off-site transportation requirements. As required by the RFP, it is important that the design review be comprehensive, and therefore, MWH has delegated a contingent of their most senior

hydropower engineers and geologic and environmental practitioner to perform these reviews to ensure that the major equipment systems and components are capable to perform as required; that the designs are robust to ensure that the equipment meets the availability and reliability requirements; and that all of the designs meet good engineering practice and meets utility prudent practice and acceptability standards. The RFP is very clear that MWH must identify equipment components that would appear to not be able to meet these given requirements, and we acknowledge this responsibility and fully support this position of the Owner.

We will include in our IE Reports comparisons from our in-house data base to assess the likelihood that the proposed equipment for Muskrat Falls Project will provide the performance guarantees that have been contracted for in the specific performance guarantees.

As required further in the RFP, "the IE will review the technical design of the Project, projected performance for compliance with generally accepted industry standards and prudent utility practices, and the ability to operate in accordance with Pro Forma projections and contract requirements." As specifically requested, MWH will perform the following services and include our responses in the Independent Engineer's Reports:

3.1. MWH will compare the projected performance to design conditions, vendor guarantees and known performance of other similar facilities. In order to do this, MWH will review the power model to ensure that appropriate efficiencies are utilized and that the headloss in the water conveyance system and at the exit of the draft tube is appropriately determined. Tailwater levels for both winter conditions where ice cover exists and during the remaining months when ice effects are not present will be reviewed to ensure ice effects are accounted for, as appropriate. If frazil ice issues are expected to occur, allowance for them in the power estimates will be examined since reduced generation during periods of heavy frazil ice loading will normally be required, with extreme events requiring the plant to be shut down.

3.2. MWH will review the hydrology of the site to ensure that the period of record is sufficient to be used in the power model; this period should be at least 30-years of record and should preferably be longer and should be daily records to use in modeling power output. Where gaps in the record have been estimated from hydrologic studies with other gages in the basin or similar basins, or with rainfall records, the basis for the derivation of the monthly and daily values will be reviewed. It is expected that the Hydrology Report will be robust and well documented, meeting industry standards for similar projects of size and complexity. Tailwater and headwater rating curve derivations will also be reviewed along with predicted models of reservoir evaporation. Sedimentation studies will be reviewed to determine if sufficient storage will be available during the design life of the project to accommodate the expected regulation rule curve live storage provision for operating the reservoir prior to the Gull Island plant being in service and after it is in service.

3.3. MWH will review the design and expected performance of the major systems of the power station to judge their compatibility with each other and their intended purpose. We also note that MWH must opine on the projected reliability and operations of the

systems under various operating conditions. The reservoir rule curve and tailwater curves will be used to establish hydraulic operating levels for the hydrogenating equipment and auxiliary systems, and the electrical requirements of the transmission system will be used to determine system restraints on the plant. Tailrace constraints and the downstream river channel will also form constraints on peaking operations and times when releases must be curtailed due to nesting of birds and fish spawning and rearing.

3.4. MWH will review if the plant, as designed, will be able to meet its operating and contractual requirements as found in the applicable agreements (power sales agreement; transmission line agreement).

3.5. MWH will review the major systems and equipment design criteria along with the expected performance to confirm 'their suitability, compatibility and completeness for the intended service of the equipment, and in particular that the design is conservative.' We will also opine as to the selection of the equipment as to its proven reliability based on historic data and use in similar plants with similar environments and operating parameters and are well within industry established parameters.

One item that is worthy of consideration which multilateral lenders and large commercial banks are normally interested in is the major equipment's suppliers reputation with respect to bribery and the subsequent banning of such firms from bidding on World Bank projects. Since there are now two leading suppliers of hydrogenating equipment that are on the World Bank's list, if the Lenders are honoring World Bank principals when it comes to not only Equator principals but ethical issues, this must be taken into consideration during the IE's review.

3.6. Coupled with our review discussed in 5., above, we will discuss the operating history of the major equipment being used in comparable applications, as well as the expected Project-specific equipment performance. We note that since hydrogenating equipment and their auxiliary systems have a very-long history of performance available for review and comparison as compared to thermal generating equipment, the concerns that are expressed in questions above are more applicable to thermal plant equipment and systems which are greatly affected by operating conditions and age of the equipment.

3.7. MWH will review the proposed electrical interconnections between each project. We will review the load flow studies to determine if there would be any reasons why the system could not perform, as designed and recommend any areas where stability issues may occur, requiring further study. We will also review the SCADA system and the control system for the transmission lines and substations and converter stations to ensure that it is robust, and that backup systems, in case of the primary system is not performing properly, will be able to control the devices or systems being employed at the Project facilities.

3.8. "Review the projected water supply, wastewater disposal systems and other applicable waste disposal plans, historical performance and projected performance;" Although we

believe this requirement is typically found to be examined for thermal generating plants during an IE review, MWH will review the proposed waste disposal system for the Muskrat Falls plant to ensure that is suitable and would meet standard Canadian codes; we will also review the cooling water supply system for the plant to determine if is suitable for a sustainable system since sediment loads, ice conditions, and woody debris issues may require relocating the intake, or even using wells to provide for plant water for cooling and lubrication.

3.9. MWH will review the various technical criteria and other provisions within the technical documents and, if available, contracts for consistency. MWH will review each of the contracts that are available to determine if the technical criteria being used in one document is the same as that being used for another contract and opine on its consistency. The MWH team will also review other provisions of the contract to determine if it is consistent between documents and if the contracts are consistent. Inconsistency appears when there are several groups of engineers and contract specialists who have worked on separate aspects of the project and have not taken the internal time to verify the consistency (some lack of quality control). The IE usually finds that projects have inconsistent documents for Owners which will require, sometimes, contract modifications after they have been accepted by both parties. Fortunately, most well-prepared contracts have provisions for making these adjustments in pricing that have already been 'spelled-out' as to how this can be accomplished, helping to expedite the corrective process. When such occurrences are found, the IE will immediately inform the Owner or Lender to allow the appropriate remedial action to occur.

3.10. MWH will review the experience and capability of the major Project participants to perform their roles in each Project and to support the successful execution and completion of the Project. To enable MWH to perform this assessment, we have requested that resumes of key individuals within the Construction Contractor's firm as well as the Design Engineer's firm to be supplied for our perusal to allow MWH to opine on the design and construction teams. We have also asked to be supplied the names of the suppliers/vendors of the major mechanical and electrical systems for the Projects and contact information to follow-up with key individuals who will be the companies' project manager and project engineer. Most of the firms that will be supplying equipment for the project are already known to MWH and possibly have worked on one of MWH's hydro projects; we therefore, bring additional experience in possibly having dealt with the company and know, first-hand, of the success and failures of their past performance. As mentions above, we will also note if any of the firms have been blacklisted (debarment) by the World Bank for further consideration by the Owner and the Lender(s).

ACTION ITEMS:

1. For each of the items listed in Task 3., MWH will review the appropriate documents with the MWH team specialists and then prepare an opinion and answer to the request for information.

2. The answers to the Task 3. questions and opinions will be included in the Independent Engineer's Reports.
3. Items of particular interest that the IE believe need immediate attention by the Owners and Lenders will be discussed via email and telephone to ensure that the appropriate action can be made to address the issue cited.
4. Usually, not all information will be available for the IE's use in a timely manner, or that it was missing from the documents being reviewed. The IE will notify the Owner in writing, usually by email followed by a telephone call, if deemed necessary to discuss the missing information to prevent a delay in the delivery schedules established between the Owner (s) and MWH.

Task 4: Review Construction Plan and Schedule

MWH will review the construction plan for each of the Projects, which include the following: Muskrat Fall Generation Project and the Labrador-Island Link Project.

4.1 EPCM Contract
MWH will review the scope of services and technical provisions of the EPCM contract and will specifically identity the following:

4.1.1 MWH will review the terms of the contract to ensure that the responsibilities of the parties are clearly define for the Owner and the EPCM Contractor. MWH will also verify that the following are clearly delineated:

4.1.2 Scope of Work, Communications and interface requirements between the EPCM Firm, Owner, and other contractors

4.1.3 Dispute resolution provisions are clearly defined

Note: "The EPCM is currently a single contract, and it is intended to be separately applicable to each Project"

4.1.4 MWH will review and report on the EPCM Contract as it is applicable to the relevant Project, and its ability to integrate each Project with the other Projects. We would expect that this will be the case since there appears to be some concern that this may not have been accomplished as desired, but we will verify that it appears to be applicable to all of the Projects and give our opinion that will be included with the Independent Engineer's Report.

4.2 Construction Contracts (other than EPCM Contract)
MWH will review the construction plan for each Project, including:

4.2.1 Review the scope of the supply and the technical provisions in the supply and construction contracts including:

4.2.1.1 MWH will review the qualifications of the contractor(s)

4.2.1.2 MWH will review the qualifications and selection of major subcontractors

4.2.1.3 MWH will review the completeness of scope of work

4.2.1.4 MWH will review the extent to which the contracts can be performed independent of other contracts and the clarity of the battery limits (scope of supply and liability provisions) of each contract

4.2.1.5 MWH will review the Contractor and Owner's responsibilities

4.2.1.6 MWH will review the provisions for guarantees, warranties and latent defect periods

4.2.1.7 MWH will review change order procedures

4.2.2 MWH will review the Transportation Plan for delivery of equipment and materials to the site(s)

4.2.3 MWH will review the logistics and storage of construction materials on and off-site (noted by MWH to be critical to this Project)

4.2.4 MWH will comment on the conformity of the proposed contracts relative to industry standards and prudent utility practice

4.2.5 MWH will review compensation terms and methods of payment relative to industry standards and loan document requirements

4.3 Guarantees and Liquidated Damages

4.3.1 MWH will review the completion and where applicable, the performance guarantees and associate liquidate damages and bonus payments, buy-down and buy-out provision, liquidate damage caps, and total liability provided by the contractors and major equipment suppliers. To enable the MWH Team to perform these services, we will need to have data, provided by the Owner, to support the fees and bonus provisions being reviewed which would mean the value of power and capacity to verify that the amounts cited in the documents would be appropriate for use in court. Additionally, we will also need other information including the computations used by the Owner to support the value (s) used in the Contracts. Only justifiable payments for the items listed above have normally been found to be appropriate when such damages or bonus payments are brought into question by one party. It is also helpfully to show sample computations in the contracts to further illustrate what is said in words to eliminate any misunderstanding that occur when two different parties make a computation without following a sample computation.

4.3.2 MWH "will review and comment on the guarantees provided by each of the construction contractors and major equipment suppliers to assess the potential for compliance with the applicable Project contracts, permits and performance expectations.

4.3.3 MWH "will also review and comment on guarantees provided by each major equipment manufacturer, to the extent that his information is available, to assess the level of support that these equipment guarantees provide to the Owner."

ACTION ITEMS

1. For each of the items listed in Task 4.3, MWH will review the appropriate documents with the MWH team specialists and then prepare an opinion and answer to the request for information.
2. The answers to the Task 4.3 questions and opinions will be included in the Independent Engineer's Reports.
3. Items of particular interest that the IE believe need immediate attention by the Owners and Lenders will be discussed via email and telephone to ensure that the appropriate action can be made to address the issue cited.
4. Usually, not all information will be available for the IE's use in a timely manner, or that it was missing from the documents being reviewed. The IE will notify the Owner in writing, usually by email followed by a telephone call, if deemed necessary to discuss the missing information to prevent a delay in the delivery schedules established between the Owner(s) and MWH.

4.4 Construction Schedule

4.4.1 MWH will review the Project schedule and each of the construction schedules designated to be reviewed by MWH and determine whether adequate provisions have been made for the design; equipment procurement; fabrication; shipment and installation; and start-up, shakedown, testing and commission of the Project. Unknown or variable elements detected by MWH in the schedule will be identified along with associated potential risks.

4.4.2 MWH will also perform the following services:

4.4.2.1 Review and assess the Project construction, engineering and procurement schedules and critical paths including any analysis prepared by the Owner of the major third party deadlines. Special attention will be paid to float-time since the numerous procurement contracts may require extra time to ensure schedules are maintained.

4.4.2.2 Comment on the likelihood of achieving Project construction milestones in accordance with the completion requirements of the Project.

4.4.2.3 Review the major equipment supply contracts designated to be reviewed by MWH with regard to performance guarantees to assess the level of support provided to the contract guarantees.

4.5 Performance Test Criteria

MWH will review the performance test criteria for each contract and major equipment supply package selected to be reviewed, as applicable, and review the performance test criteria for the Project, and also where applicable its integration with the project components, as provided by the Owner, and will comment on the following:

4.5.1 Reasonableness of the performance test criteria

4.5.2 Adequacy of the test duration

4.5.3 Ability to extrapolate test results over the expected life of the Project

4.5.4 Conformance of test procedures to established codes and standards for testing Project equipment.

4.5.5 Ability to achieve all conditions required by the EPCM Contract and by each of the individual contracts

ACTION ITEMS

1. For each of the items listed in Task 4.5, MWH will review the appropriate documents with the MWH team specialists and then prepare an opinion and answer to the request for information.
2. The answers to the Task 4.5 questions and opinions will be included in the Independent Engineer's Reports.
3. Items of particular interest that the IE believe need immediate attention by the Owners and Lenders will be discussed via email and telephone to ensure that the appropriate action can be made to address the issue cited.
4. Usually, not all information will be available for the IE's use in a timely manner, or that it was missing from the documents being reviewed. The IE will notify the Owner in writing, usually by email followed by a telephone call, if deemed necessary to discuss the missing information to prevent a delay in the delivery schedules established between the Owner (s) and MWH.

Task 5: Review Capital Budget

5.1. Total Project Cost Estimate

MWH will perform the following services with respect to the review of the Total Project Cost Estimate which will generally include the following services:

5.1.1. Review the scope of supply and corresponding cost estimate methodology for all Project costs including the following: engineering(1), procurement(3) and

construction contracts(6). The review will include project management services, spare parts, working capital and start-up costs.

5.1.2. Evaluate costs that are based on estimates and those costs based on fixed pricing. The costs of the items that are based on estimates shall be further reviewed to determine the apparent risk associated with the variables. Additionally, MWH will evaluate the level of contingency budgets compared to those of similar Projects with which MWH is familiar.

5.1.3. Review the cost estimate for any remaining facilities to assess the methodology used to develop the total Project cost estimate. MWH will review and comment on the construction scope and the cost estimate methodology used to determine the Project construction cost, including the following:

5.1.4. Project Manager and construction contractor experience, compensation and budgets.

5.1.5. Major equipment procurement costs

5.1.6. Interconnection and infrastructure completion costs

5.1.7. Spare parts

5.1.8. Contingencies

5.1.9. Start-up and commissioning costs

5.1.10. Camp costs

5.1.11. Ancillary infrastructure and services, including access and construction power, required to support the Project and furnished by the Contractor

5.1.12. Schedule of equipment delivery and work to be performed taking into account the issues associated with the site layout and location

5.1.13. Schedule of values and construction cash flow

5.1.14. Allowances for contractor performance bonuses

5.1.15. MWH will highlight critical areas of cost structure and identify high sensitivity areas for further consideration.

5.1.16. MWH will provide a comparison relative to the public electrical utility industry and compare to facilities of similar size and technology taking into consideration such items as location, available infrastructure, and labor costs

5.1.17. MWH will focus on price risks, since the Projects is not being constructed under a single EPC contract.

ACTION ITEMS

1. For each of the items listed in Task 5.1, MWH will review the appropriate documents with the MWH team specialists and then prepare an opinion and answer to the request for information.
2. The answers to the Task 5.1 questions and opinions will be included in the Independent Engineer's Reports.
3. Items of particular interest that the IE believe need immediate attention by the Owners and Clients will be discussed via email and telephone to ensure that the appropriate action can be made to address the issue cited.
4. Usually, not all information will be available for the IE's use in a timely manner, or that it was missing from the documents being reviewed. The IE will notify the Owner in writing, usually by email followed by a telephone call, if deemed necessary to discuss the missing information to prevent a delay in the delivery schedules established between the Owner (s) and MWH.

5.2. Drawdown Schedules

MWH will review the drawdown schedule that will generally be appended to the contracts, or an estimated schedule, and comment on whether each monthly cash drawdown amount is consistent with the Project schedule. We will use as a basis the data to be furnished as listed in our information request, item1.10.1.

Task 6: Review Commercial Operation and Maintenance Services

6.1 Review Commercial Operation Services

MWH will perform an engineering review of the Operations and Maintenance Plan. MWH will also review contracts and agreements for operation and maintenance if these have been prepared. NOTE: MWH review will not address legal or regulatory issues associated with the Project.

6.2 Operations and Maintenance ("O&M") Plan

MWH will review the Operations and Maintenance Plan and comment of the following specific items:

6.2.1 Adequacy of the start-up and long-term operating procedures

6.2.2 Reasonableness of the annual O&M budgeting process

6.2.3 Reasonableness of the O&M fee structure and its ability to cover 'non-extraordinary' expenses

6.2.4 Proposed training program

6.2.5 Proposed preventative maintenance program

6.3 Operating and Maintenance Cost Estimate
MWH will review the list of O&M and major maintenance cost estimate components and comment on the following items:

6.3.1 Comment on the completeness of the maintenance cost estimate

6.3.2 Comment on the assumption upon which each component was calculated

6.3.3 Comment on the reasonableness of the assumptions

The review by MWH will include the following items:

6.3.4 Staffing

6.3.5 Maintenance provisions

6.3.6 Spare parts

6.3.7 Water

6.3.8 Waste disposal

6.3.9 Administrative costs

6.3.10 Management fees

6.3.11 Consumables

Task 7: Review of Project Agreements

7.1. General Requirements
MWH will review the ability of the Project, based on the design criteria, to meet the operating and technical requirements of the applicable operating agreements and the financial goals for the Project. The following items have been specifically requested to be reviewed by the Independent Engineer:

7.1.1 Power Purchase Agreements

7.1.2 Interconnection Facility Agreements

7.1.3 Water Management Agreement
7.1.4 Water Supply and Wastewater Disposal Agreements

7.1.5 Fuel supply and Transportation Agreements

7.1.6 Operation and Maintenance Agreements
MWH will comment on contract provisions to market norms with respect to the following items:

7.1.7 Term and termination

7.1.8 Budget review and control

7.1.9 Owner/Operator responsibilities

7.1.10 Operations and maintenance plans

7.1.11 Environmental compliance

7.1.12 Reporting procedures

7.1.13 Compensation and incentive bonus and penalty structure to determine cost effectiveness and compatibility with long term operations and maintenance objectives

7.1.14 Consistency amongst construction, operation and maintenance, service, (fuel?) capacity and energy sales, water management, both amongst each other and compliance with the environmental permits and requirements

7.2. Power Purchase and Interconnection Agreement(s)
MWH will review the technical aspects of the agreements to determine if the provisions are compatible with the expected output of the Project and that the design conforms to the interconnection requirements of the contracts. Specifically, MWH will perform the following reviews:

7.2.1 Review the conditions that must be satisfied to qualify for full energy and capacity payments

7.2.2 Review the conditions under which the utility can dispatch the Project or limit its power output

7.3. Water Usage Agreements
MWH will review the Water management Agreement and determine whether it allows the Project to perform to its projected capacity.

7.4. Loan Documents
MWH will review the technical aspects in the financial agreements to ensure consistency with Project contracts and performance assumptions. In particular, MWH will perform the following services:

7.4.1 Review the terms of a budget review and the approval process

7.4.2 Review the Owner/Operator reporting requirements

Task 8: Review of Permits and Licenses

8.1 General

8.1.1 MWH will assess the ability of the Projects, based on design criteria and intended modes of operation, to meet and maintain compliance with technical requirements of the applicable major permits. The review will include reviewing the conditions pertaining to reporting requirements and other operating restrictions.

8.1.2 MWH will review the schedule of permits, licenses and approvals required from authorities having jurisdiction for construction and operation and all available permits or permit applications. MWH will furthermore perform the following services:

8.1.2.1 MWH will assess the capability of the Projects as designed to meet the technical requirements and constraints specified in the Project's permits, licenses and approvals

8.1.2.2 Only at the direction of the Owner, MWH will establish contact with the appropriate provincial and federal environmental or energy regulatory agencies for the purpose of independently identifying and determining the current status of the major permits, licenses and approvals to construct and operate the Project. This work will be performed in strict compliance with the Owner's wishes and oversight and close contact with the Owner.

8.1.2.3 MWH will identify the major permits, licenses and approvals that have not been obtained and comment, from a technical perspective, on the likelihood that they may or may not be able to be obtained in a timely manner to support the Projects' schedules.

8.1.2.4 MWH will review the adequacy of budgeted amount in the capital budget to obtain and maintain compliance with the permits, licenses and approvals, including the cost of habitat compensation measures and meeting commitments made by the Owner in its application(s) for the document(s)

8.1.2.5 MWH will address technical and commercial issues arising from zoning, local municipality requirements or other agencies having jurisdiction over the Projects.

8.1.2.6 MWH will review environmental site assessment report (s) prepared by others and comment on such issues as the following ones:

8.1.2.6.1 Documentation and support for the conclusions reached in the reports

8.1.2.6.2 Unusual circumstances or locality specific issues

8.1.2.6.3 Status and cost of any required remedial activities

Task 9: Review of Pro Forma Assumptions

MWH will review and comment on the technical assumptions and data input to the Owner's Projects pro forma financial model which sets forth the projected revenue, expenses and debt service costs of the Projects. The RFP notes that because payments will be based on fixed monthly payments, extensive review of market studies by MWH is not required. MWH will not perform any market studies under this contract, but would be happy to furnish a separate proposal to do so, if the Owner and Client (Lenders) requires this to be accomplished. In particular, MWH will perform the following services for each of the two projects (MF and LIL):

9.1 Review the performance model that was used to estimate annual water usage and operating costs and annual revenues from the sale of power will be evaluated to determine if it accurately reflects the material Project contracts and expected operating environment.

9.2 MWH will determine how well the assumptions and projects made in the pro forma are supported by contract guarantee, performance testing, quality of the design and equipment, and the experience of the Project participants

9.3 MWH will verify that the following assumptions are reasonable and consistent with the design of the Project, expected operating scenarios and project agreement:

9.3.1 Project performance and reliability

9.3.2 Revenue projections

9.3.3 Facility performance degradation

9.3.4 Dispatch constraints as per the power purchase agreement including curtailments and part load operation

9.3.5 Escalation assumptions

9.3.6 Annual operating and maintenance expense inputs to the pro forma, including major maintenance and capital replacement

9.3.7 Bonus/penalty arrangements

9.3.8 Working capital requirements of the Project

9.3.9 Cost for establishing inventories

9.3.10 Adequacy of pre-operating expense budget (operator training, consumables, lubricants and testing)

9.4 MWH will propose and review a set of typical pro forma sensitivity cases. The sensitivity cases will be selected to test the impacts of variances in key operating assumptions, such as: interest rates; inflation; operating expenses. MWH usually is asked to input the following data, based on our reviews of many pro forma:

9.4.1 Average annual generation

9.4.2 Variability in annual generation (usually a rolling average for a certain number of years) – the critical factor in financing is the early years of generation while debt is being paid; for a long-term perspective, the long- term average would be appropriate

9.4.3 O&M Staffing Plan / Maintenance Program

9.4.4 Annual O&M Budget (and O&M Agreement)

9.4.5 Major Renewals and Replacement Program

9.4.6 Annual CAP EX budget

9.4.7 Valuation of power from the project

9.4.8 Any anomalies or red flags we observe

9.5 MWH will also review and comment on sensitivity cases to the base case pro forma.

Task 10: Prepare Independent Engineer's Reports

MWH will prepare a draft and final Independent Engineer's reports in a suitable format as agreed to by the Owner and the Lender Groups.

The reports will provide a brief description of the Project Facilities and key agreements and will set forth the principal assumptions, opinions, conclusions and summarized pro forma operating results. During the course of the review, MWH will bring to the Owner's and Lender's attention areas of risk that is discovered as a result of the technical review and any mitigation options to be considered by the Lender (Client) and the Owner.

A draft of the Independent Engineer's Reports setting forth preliminary opinions, conclusions and pro forma results, including discussions of any unresolved issues and associated risks identified during the review will be prepare and submitted to the Owner (the Lenders (Client) may want MWH to prepare a second draft that considers other information that has not been considered by the Owner which may involve further discussions with all parties) for review and comment. MWH will incorporate the Client's comments and Owner's comments, and present the status of each issue in the final Independent Engineer's Reports.

In keeping with our intent to communicate with the Owner as early as we can, on what MWH will be proposing, we have included with this section the outline we propose to use for the Project IE Reports:

Letter of Transmittal

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Task 11: Financial Closing Support Services

11.1 MWH will support financial close by providing information on the Project to the Lenders, prospective investors, hedge providers and the federal guarantor, either in person or via conference call.

11.2 MWH will participate in rating agency meetings and syndication presentations as requested by the Client.

11.3 MWH will prepare the typical and customary certificates required at financial closing to verify the accuracy of the information provided in its report.

11.4 MWH has assumed the following times, as given in the estimate we provide, to be reasonable. We realize that these services can vary considerably for each project; as such, we would be able to vary these times as would be provided for in our contract with the Owner.

11.5 MWH has assumed that our services will be required during the fourth quarter of 2013 and will require everification as to when they will be scheduled.

PROJECT CONSTRUCTION PERIOD –PHASE 2

Detailed Scope of Work

MWH will perform the following tasks following financial close and during the construction of the Projects:

Task 1: Attend Project Review Meetings
MWH will attend Project review meetings with the Owner and Contractor at either the Owners office or Contractor's offices to assess progress in engineering, procurement and construction activities and to review the contractors' presentation of areas of concern and change orders.
The number and frequency of meetings will be decided in consultation with the Client and the Owner. We have provided in our work break down(later), assumed times that generally are reasonable to present at this time which may vary from the times and number of meetings actually required. Our contract with the Owner is assumed to accommodate these support services that may be additional to those given herein. Following review meetings, we have assumed at one day each, visits to the project sites will be conducted allowing 2 days for these visits. We have scheduled frequent visits since the Project will require close monitoring because of its complexity and high value to protect the interest of all parties.

Task 2: Services Relating to the Engineering
MWH will review the progress of the remaining engineering for compliance with the milestone schedule. We assume this will be done on a monthly basis.

Task 3: Services Relating to Procurement
MWH will review the progress of the award of major procurement contracts and delivery commitments for conformity with the milestone schedule.

Task 4: Services Relating to Construction and Start-Up
MWH will perform the following services:

4.1 Review proposed work and quality control plans

4.2 Perform on-site visits for observation of the work in progress to determine that the Project is proceeding in general accordance with the milestone schedule and with the agreed-upon design concepts

4.3 Perform periodically reviews of the quality control reports and field laboratory test reports

4.4 Consult with the Owner and contractors in advance of scheduled major inspections, tests or the start of important work phases

4.5 Review compliance to the Project schedule (s) on a monthly basis through reports submitted by the construction contractors, and on-site observation

4.6 Review, during the on-site visits, the contractors' monthly invoice with the Owner and construction contractors to verify accuracy.

Task 5: Review Change Order(s) to the Construction Contracts

MWH will review major change orders to the construction contracts. The review will include the following:

5.1 Verification of the impact of the changes on the construction cost and schedule of the Projects and on the ability of the Projects to meet its performance guarantees.

5.2 Review of major change orders or significant changes in Project execution or budget will be performed if required by the financing agreements at Client's authorization

5.3 Review of change orders over C$ 500,000 will be performed; we have assumed a total of 8 reviews by MWH are required for change orders for the entire Project.

Task 6: Prepare Independent Engineer's Periodic Reports

MWH will prepare an Independent Engineer's Periodic Reports which will include the following topics:

6.1 General status of construction versus the milestone schedule

6.2 Status of the budget versus actual expenditures

6.3 Status of planned contract expenditures versus actual

6.4 Status of change orders or claims

6.5 Areas of concern and actions being taken of which the IE is aware.

6.6 Submittal of the report to the Client and the Owner

Task 7: Prepare Independent Engineer's Draw Certification

MWH will prepare IE draw certificates considering the following items:

7.1 Review the Client's monthly loan requisition certificate and supporting documentation

7.2 Compare the actual budget and schedule against the contract budget and schedule

7.3 Request changes or supplemental information as required to approve drawdown requests

7.4 Prepare the monthly IE's draw certification that will make a recommendation to the Client regarding the payment due

7.5 Submit the draw certificate to the Client and the Owner

Task 8: Verify Project Completion

MWH will confirm Project completion as required by the financing agreements which will include the following reviews and considerations:

8.1 Review of construction contracts' completion certificates

8.2 Monitor successful completion of each punch list item by telephone

8.3 Make final visit to the project site to verify punch list items have been completed

8.4 Sign the appropriate document and submit it to the Client and the Owner

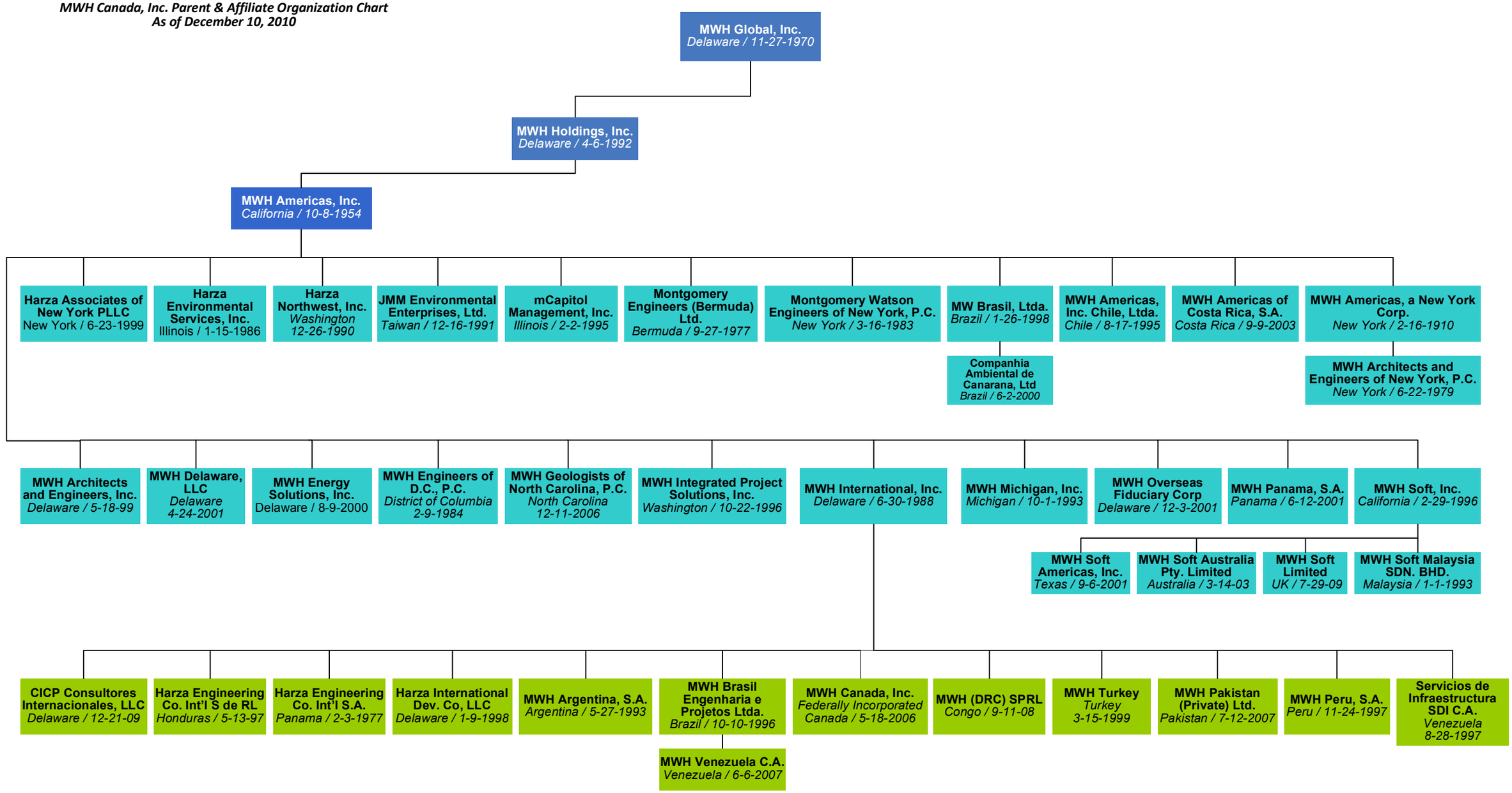
8.5 Provide certification to the Client certifying that the engineering, design, construction, testing and commissioning of the project conforms to the applicable contracts, codes, standards, good industry practice and prudent utility practice.

SECTION
3

Professional Staff to Accomplish the Work
Phase 1 and Phase 2
Lower Churchill Project
LC-PM-0832
NALCOR ENERGY

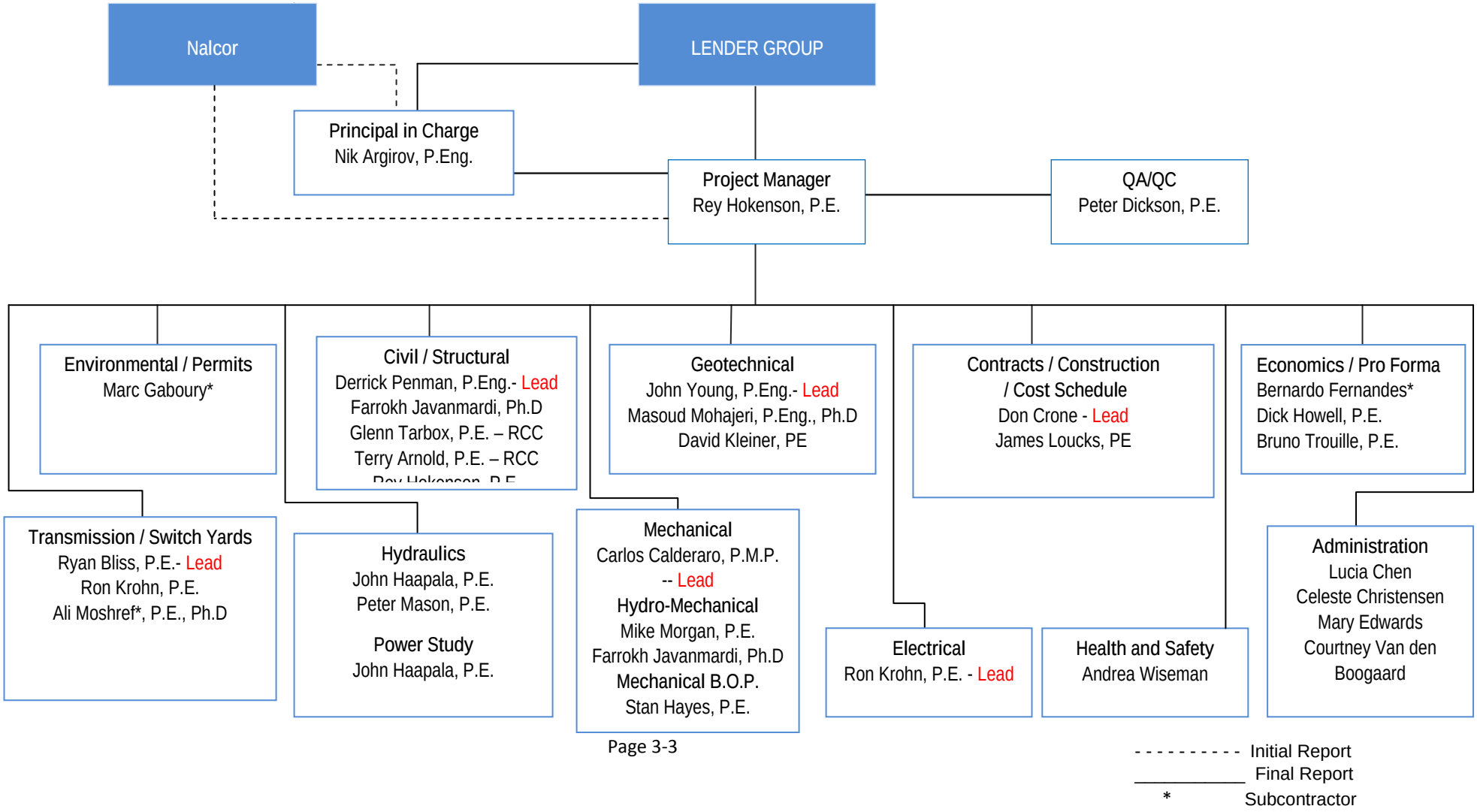
MWH CORPORATE ORGANIZATION CHART

MWH Canada, Inc. Parent & Affiliate Organization Chart
As of December 10, 2010



PROJECT FEATURE ORGANIZATION CHARTS

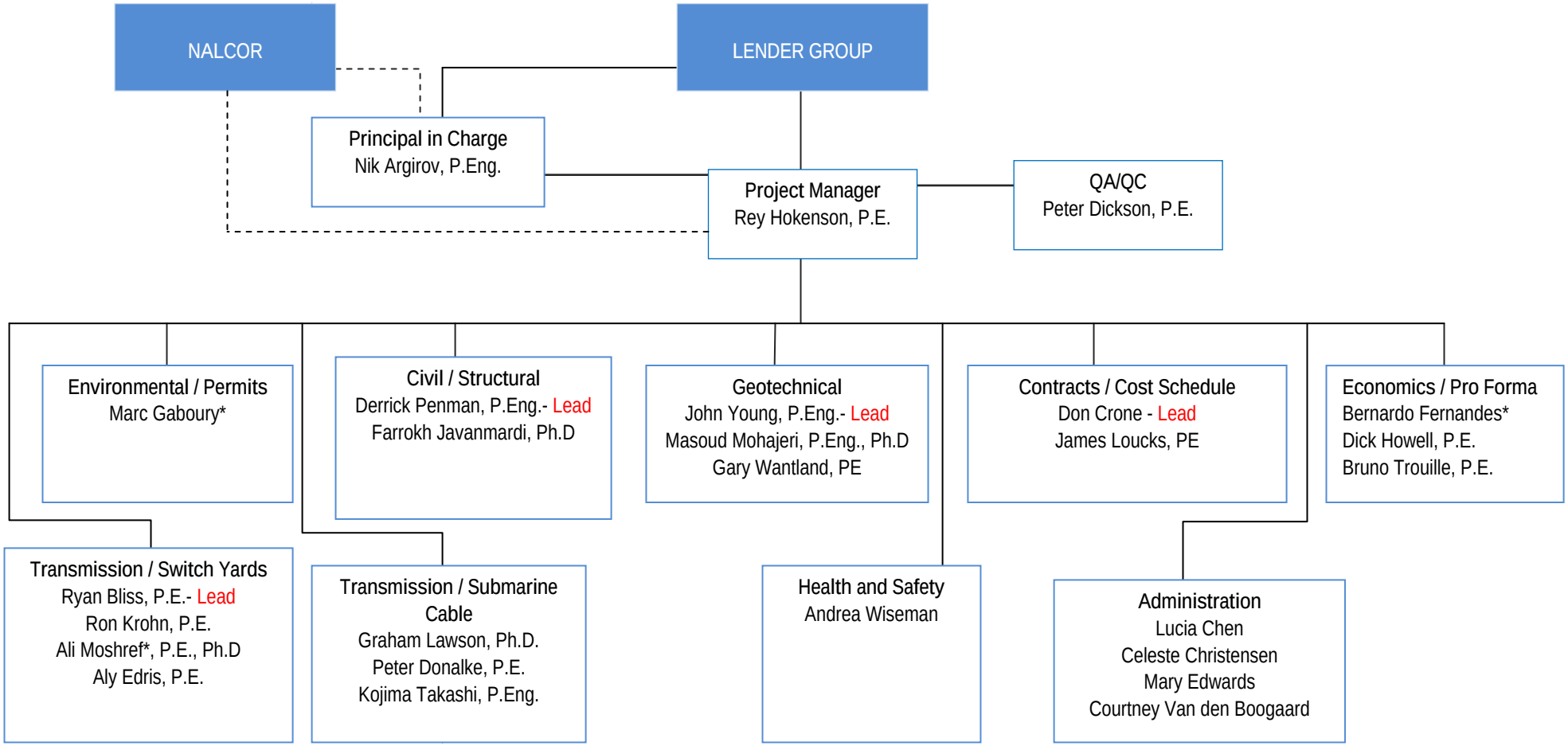
MUSKRAT FALLS GENERATING FACILITY



---------- Initial Report
_____ Final Report
* Subcontractor

Professional Staff to Accomplish Work
Phase 1 and 2
Lower Churchill Project
LC-PM-0832
Nalcor Energy

LABRADOR-ISLAND TRANSMISSION LINK



---------- Initial Report
_____Final Report
* Subcontractor

INDEPENDENT ENGINEER'S ORGANIZATION

PROJECT TECHNICAL DISCIPLINES

Key Personnel
Rey Hokenson, P.E.
Nik Argirov, P.Eng
Peter Mason
Peter Dickson, P.E.
Peter Donalek, P.E.
Glenn Tarbox, P.E.
Marc Gaboury
Derrick Penman, P.Eng
John Young, P.Eng
Don Crone
Ryan Bliss, P.E.
Stan Hayes, P.E.
Ron Krohn, P.E.
John Haapala, P.E.
Andrea Wiseman
Graham Larson, C.Eng
Bruno Trouille, P.E.
Bernardo Fernandes
Masoud Mohajeri, PhD., P.Eng
Gerry Germain, P.E.
Gary Wantland, P.E.

Technical Project Specialists

Farrokh Javanmardi, PhD	Civil and Structural Engineering
Masoud Mohajeri, PhD	Geotechnical Engineering
Jim Loucks, P.E.	Construction Engineering and Cost Estimating
Dick Howell, P.E.	Economics and Project Pro Forma
Carlos Calderaro, P.M.P.	Mechanical Engineering
Mike Morgan, P.E.	Mechanical Engineering
Steve Baughn, P.E.	Electrical Engineering
Kojima Akashi	Transmission and Submarine Cable
Terry Arnold, P.E.	Civil Engineering
Lucia Chen	Project Administration
Aty Edris, P.E.	Electrical Engineering
Ali Moshref, P.E.	Electrical Engineering
Peter Mason	Hydraulics And Sedimentation
David Kleiner	Geotechnical Engineering
Glenn Tarbox, P.E.	Concrete Dams And RCC Dams
Peter Dickson, P.E.	Foundations and QC Review
Graham Lawson, C.Eng.	Submarine Cables
Peter Donalek, P.E.	Electrical Engineering, Interconnections
Bernardo Fernandes	Contracts And Project Pro Forma
Bruno Trouille, P.E.	Economics and Pro Forma

RESUMES OF KEY PERSONNEL

REYNOLD HOKENSON, P.E.

PROJECT MANAGER

KEY QUALIFICATIONS

Mr. Hokenson has completed several FERC licensing and numerous FERC Part 12D safety inspections. He has prepared safety inspections for more than 500 water-retaining facilities and flood control projects, giving him extensive knowledge of gate types, hoists, outlet works, spillways, appurtenant gate machinery, dams, and auxiliary power systems. Rey has over 35 years of experience in hydroelectric and water resources related projects. For four years he was the Department of Energy's (DOE) designated engineer for reviewing over 40 small (less than 2,500-kW) hydroelectric projects at a pre-feasibility level. In addition to DOE projects, he has completed over 20 feasibility projects for small hydroelectric projects less than 25 MW, many of which were constructed and are now online. He has been involved in several dam removal projects, including those at Port Arthur, Elwha, Glines Canyon, Condit, and Edwards. Internationally recognized, his projects include pre-feasibility and feasibility-level studies and final designs for facilities in Panama, Columbia, Brazil, Laos, Thailand, Canada, Mexico, Peru, Nigeria, Liberia, Cameroon, Costa Rica, Nicaragua, Guyana, and the Philippines. Rey's water resources experience includes renovation design, resurfacing, post tensioning, buttressing, draining, dewatering, and placement of stabilizing beams for concrete, steel, and embankment-type structures. He has worked on several dam rehabilitation and replacement projects, new dam projects, and authored several technical papers.

EDUCATION

MS, Civil Engineering, University of Minnesota
BS, Civil Engineering, University of Minnesota

Licenses and Professional Registrations

Professional Engineer, Civil, AZ, AR, CO, CT, ID, KY, MA, MN, NH, NJ, NY, OR, PA, VT, WA, WI, WY

EXPERIENCE RECORD

Furnas Technical Evaluation

Brazil

Rey was the Project Manager and Principal Investigator/Independent Engineer to enable the Inter-American Bank to support the funding of the Furnas Investment Program, at the request of the Government of Brazil, which entails the modernization of three large hydroelectric projects (2742 MW) on the Grande River, Brazil. The modernization program involved the following upgrades: generator re-winds and exciter and voltage regulation upgrades; turbine repairs including bearings, wicket gates and runners; bearing and oil cooling systems; replacement of water and oil filtration systems; scroll case and speed ring repairs; turbine governor replacements and oil cleaning systems and containment replacement; high voltage switchgear upgrades using SF6 breakers; installation of new power transformers for the Peixoto project; upgrades to the oil containment systems for all of the plants; replacement of HVAC systems in two of the plants; reconstruction of switchyards; improvement of access to one power station; and improvements to the intakes of two projects.

Ruskin Power Plant Condition Assessment

BC Hydro

Project manager for assessing the current condition of the hydrogenerating equipment and the water conveyance system; and reviewed and confirmed the risks to better ascertain the need for component reconditioning, refurbishment, or replacement for this 105 MW station with equipment dating to 1930. Included in the evaluation

were the following components under study: intake structure; penstocks and power tunnels; powerhouse structure; switchyard; access bridge; turbines; generators; governors; exciters and excitation systems; control and protection systems; main power transformers; AC and DC station service systems; turbine inlet valves; powerhouse cranes; air, oil and water piping; draft tube and stop logs; and draft tube gate hoists. Probability of failure within 1, 5 and 10 years were assessed using mortality curve and Crow AMSAA analyses performed by BC Hydro.

John Hart Powerhouse Condition Assessment and Rehabilitation Options;
British Columbia, Canada
Project Manager responsible for assessing the current condition of the hydrogenerating equipment and the water conveyance system; and reviewed and confirmed the risks to better ascertain the need for component reconditioning, refurbishment, or replacement for this 126 MW station with equipment dating to 1945. Included in the evaluation were the following components under study: intake structure; pipelines of steel and woodstave; differential surge tanks; powerhouse structure; switchyard; access timber bridge; turbines; generators; governors; exciters and excitation systems; control and protection systems; main power transformers; AC and DC station service systems; turbine inlet valves; powerhouse cranes; air, oil and water piping; draft tube and stop logs; hoist; and service elevator. Life extensions of 15; 25; and 50+ years were reviewed and rated using mortality curve and Crow AMSAA analyses. Sustainability was of considerable importance since the station is located on a world-class salmon fishing river, and abuts the Campbell River Recreation area, requiring strict adherence to these principals and conditions.

Catawba-Wateree Project;
Duke Power Company; North and South Carolina
Project Engineer. Performed the FERC safety inspection, prepared stability analyses for water-retaining structures, and submitted a final report for the 11 separate power stations that comprised the Catawba-Wateree Project.

Upriver Dam Hydroelectric Project;
City of Spokane, WA
Prepared the FERC Part 12D safety inspection report and was involved in preparing designs to replace and stabilize piping beneath the radial-gated spillway. Mr. Hokenson was the Project Manager responsible for the design and construction management of the restoration of the Upriver Dam Hydroelectric Project and for the preparation of the FERC failure investigation report. Fast-track design efforts for five contracts, including the unique contract involving the jacking and leveling of the 11,000-ton No. 1 Powerhouse, allowed both powerhouses to be placed on-line according to schedule.

Green Lake Hydroelectric Project FERC Safety Inspection;
City and Borough of Sitka, AK
Project Manager and Principal Investigator. Performed the FERC safety inspection for this 210-foot-high concrete arch dam; 1,900-foot-long, 9-foot-diameter tunnel and penstock; and 16.5-MW powerhouse. Subsequent studies have involved special investigations concerning leaching of the grout curtain and increases in piezometric pressure in the left abutment.

Swan Lake Hydroelectric Project, FERC Safety Inspection;
Alaska Energy Authority, AK
Project Manager/Principal Investigator for the FERC safety inspection for this 174-foot-high concrete, elliptical, double-curvature arch dam; tunnel and penstock; and 22-MW powerhouse. Subsequent studies involved pseudostatic stability analysis of the abutments to evaluate their safety factor.

FERC Safety Inspections

York Haven
Hennepin Island Hydro
Buzzards Roost
Oswegatchie River Projects
Weston
Gulf Island
Brunswick-Topsham
Holcombe Hydro
Big Falls Hydro
Catawba-Wateree Project (11 stations)
Wymann
Williams
Shawmut
Deer Rips-Androscoggin

Lewiston Falls	Rock Island
Rocky Reach	Lake Chelan
Swan Lake	Green Lake
Upriver Dam	Blue Lake
Jackson Bluff	Tower and Kleber Dam
Potholes East Canal Headworks	Grand Coulee Main Canal Headworks
North Fork Stanislaus River Project	Loup River Project

John Day Fishway Auxiliary Pump P&S
USACE, Portland District
Reviewed drawings at 65 and 95 percent levels; recommended changes to the pump layout configuration to conform to industry standards.

Holyoke Hydroelectric Project
City of Holyoke Gas and Electric Department, MA
Managed the competitive re-licensing process of the Hadley Falls Hydroelectric Project. Services included management of the engineering and environmental studies; consultation with the required resource agencies under FERC's three-stage consultation process; and preparation of the draft and final license applications. The City of Holyoke Gas and Electric Department (HG&E) and the Massachusetts Municipal Wholesale Electric Company (MMWEC), a public corporation of the Commonwealth of Massachusetts, jointly filed this competing license application for FERC Project No. 2004, located on the Connecticut River in Holyoke, Massachusetts. Their joint proposal incorporates the existing Project 2004 generation, amounting to 43,156 kW of installed generating capacity, as well as an additional 15,000 kW from a new unit to be installed at the Dam. Equally important, the Joint Proposal is intended to integrate the project, a prominent feature in the City of Holyoke, with the community's other activities and to share with the City and the surrounding community the potential multi-purpose benefits the project is capable of providing. The project generally consists of the Hadley Falls Dam, a tri-level canal system and six hydroelectric generating plants -the Hadley Falls Station, the Beebe-Holbrook Station, the Skinner Station, the Boatlock Station, the Riverside Station and the Chemical Station. The largest of the six power plants is the Hadley Falls Station, which consists of two (2) vertical generating units with a plant capacity of 30,800 kW (one 15,000 kW fixed-blade propeller and one 15,800 kW adjustable Kaplan-type turbine) utilizing a gross head of 52 feet. The Hadley Falls power plant was constructed in 1950 with an initial installed capacity of 21,500 horsepower (15,800 kW adjustable Kaplan-type turbine). The second 15 MW unit was commissioned in 1984. Special environmental studies included fish and IFIM, recreation, socio-economic, water quality, and cultural resources.

Western Panama Power Supply Study
Institute of Hydraulic Resources and Electricity, Panama
Civil Engineer. Identified potential hydroelectric sites and prepared detailed layouts for more than 20 projects involving large embankment and concrete dams (100- to 150-meter-high concrete, thin-arch dams), tunnels, spillways, intake structures, diversion works, penstocks, and powerhouses, each capable of withstanding high seismic loadings (5/10 to 7/10g). Prepared cost estimates for several dam heights and tunnel and penstock diameters and installed capacities for each of the projects to allow for economic and financial evaluation and comparison. Three different plant capacity factors were assumed to allow the plant to be economically sized.

St. Paul River Regulation Study
World Bank, Liberia
Project Manager for the development of conceptual layouts for the step-pool (dam/reservoir) utilization of St. Paul River's hydraulic head. His responsibilities included mapping, site inspections, selection of design criteria, and project layouts relating to the construction of nine 50- to 70-meter-high concrete, earthfill, and rockfill dams. Responsible for feasibility reports and cost estimating for this 1,000-MW project. This study helped define the development of another project, the Mano-Lofa River Transbasin Diversion Project, which involved 23 miles of tunnel and penstock, and a 200-MW underground power station.

Nine Mile Hydroelectric Project
Washington Water Power Company
Project Manager responsible for the preparation of six contracts to restore this existing project and to increase its capacity from 19 to 29 MW. Value engineering exercises examined the feasibility of having six contracts for this project, which included several types of contracts, as well as near optimizing the construction schedule. The project involved upgrading two bridge cranes and intake gate hoists; upgrading two Francis quad units and installing two uprated Francis quad units; upgrading switchgear; installing new draft-tube gates; installing a new intake structure including wheeled gates, trash racks, trash rake, and piers; and refurbishing the powerhouse building. The installation of the intake structure was innovative in that caisson-type steel piers were bolted to the powerhouse, dewatered, filled with concrete, and then post-tensioned to the existing powerhouse. This construction technique saved the owner over $1 million.

Columbus and Monroe Hydroelectric Plant Rehabilitation
Loup Power District, NE
Lead Civil Engineer/QC Reviewer responsible for the civil engineering aspects of the upgrade of the Columbus and Monroe plants and review of the EPC contract documents for the unit upgrades. For each of the plants, the turbines and generators were upgraded to accommodate FERC criteria limiting the amount of installed capacity possible under the existing license and to meet economic and financial criteria established by the Owner. The Columbus plant houses three 14,000 kVA generators at 95 percent Power Factor and the Monroe plant housed three 2,750 kVA generators at 95 percent Power Factor. Of particular civil engineering interest is the apparent movement of the Columbus power station since it was commissioned in 1937. The power station is founded on firm river sands that have apparently allowed the powerhouse to displace vertically, which was accommodated in the unit upgrade designs. Responsible for preparation of the FERC license amendment, the EPC contract documents for the upgrades to the turbines, generators, and associated switchgear, the economic feasibility study to justify the capacity addition bidding assistance, and construction management services.

Elwha River Restoration Project (Removal of Glines Canyon and Elwha Dams)
Summit Technology, WA
Project Manager responsible for developing potential dam removal techniques and for addressing water quality issues and water supply restoration. Prepared the construction cost estimates for the complete dam removal and restoration program with the exception of the sediment removal program, which was performed by Summit Technology. For the first time in American history two dams are being considered expendable solely for the restoration of a fishery habitat. The two dams on the Elwha River are 100-foot-high concrete gravity dam and 210-foot-high concrete arch dam. The restoration of the Elwha River would require not only the demolition and removal of the two dams, but more importantly, the removal of an estimated 16 million cubic yards of silt, sand, gravel, and other debris accumulated in the two reservoirs. River channel restoration is paramount because if the reservoir sediments are not secured, the river could become completely uninhabitable for any salmon species. The restoration program performed by Rey included developing alternatives for new water supply sources to the nearby community of Port Angeles and two pulp mills, which rely on water diverted from the Elwha immediately downstream of the dams. The reservoirs provide effective settling ponds in which much of the fines settle out yielding water with low turbidity.

Watertown Hydroelectric Project
City of Watertown, NY
Project Manager. In obtaining a new FERC license, was responsible for preparing the initial information packet, directing a number of critical environmental and technical studies related to the project, conducting first stage and second stage consultation, and preparing and submitting a new license application to FERC. The team provided services involving IFIM studies, sizing of fish passage structures, requirements associated with low-flow releases and trash rack requirements, and whitewater kayaking provisions in the project bypass reach. Helped negotiate settlement agreements between the FERC, the client, resource agencies, and community groups concerning these issues. He wrote one of the first applicant-prepared FERC Environmental Assessments of the project for the City.

NIK ARGIROV, P.Eng

PRINCIPAL IN CHARGE / STRUCTURAL ENGINEER

KEY QUALIFICATIONS

Mr. Argirov is a Principal Engineer with over 30 years of experience in the management and design of hydroelectric projects, offshore/marine structures related work, and building construction. He is a Vice President of MWH Canada Inc. and MWH's British Columbia Regional Manager, overseeing administrative operations, professional and technical staff, client relations, and business development within the Province. Mr. Argirov is a P. Eng and a certified Project Management Professional. He has served as Project Manager, Engineering Manager, and Civil/Structural Design Engineer for numerous new construction, as well as repair/replacement projects related to dams, powerhouses and water conveyance facilities throughout Canada and internationally. His experience encompasses all phases of engineering and construction, including feasibility and conceptual studies, facility inspection, economic evaluation, specification, contract document preparation, and design.

EDUCATION

Master Certificate of Project Management, University of Victoria/York University,
MEng, Civil and Structural Engineering, Higher Institute of Architecture and Civil Engineering, Sofia, Bulgaria

Licenses and Professional Memberships

Professional Engineer – APEGBC, license #: 29031; APEGGA, license # 50801
American Society of Civil Engineers
Canadian Dam Safety Association
Project Management Institute

EXPERIENCE RECORD

Taltson Expansion Project

NWT Energy Corporation (03) Ltd

Principal-in-Charge for the Taltson Hydroelectric Expansion Project that will add a new power plant of approximately 50MW install capacity and 700km transmission lines to supply power to as many as three operating and one proposed diamond mines north of Great Slave Lake. Responsible for contract negotiations and overall project performance overview.

Chakachamna Hydroelectric Project

TDX Power

Project Manager for the preliminary engineering studies to refined feature design concepts and reservoir operations modeling for this underground hydroelectric development with estimated install capacity of 330 (MW)

PMSP

BC Hydro

Project Management Services Partnership (PMSP) provides an umbrella / program management solution for portfolio of projects with estimated total capital cost of $3,000 M CAD. The portfolio includes John Hart Replacement Project, Ruskin Project and Upper Columbia Project. As the MWH regional manager and member of the program steering committee involved in various strategic activities, meetings and presentations as well as in key technical roles during the planning/validation phase of the program. Responsibilities also include consultation and execution of contracts as well as provision of resources for the needs of the involvement.

LL Anderson Dam
Placer County Water Agency
Local team Project Manager for the modification of LL Anderson Dam spillway and radial gates. The project includes provision of engineering services and final design for complete spillway modification and replacement of radial spillway control gates. Three dimensional Finite Element Model was developed for the static and dynamic analysis and design of the radial gates and spillway piers. Project deliverables include design basis report for client and FERC review as well as final design / construction drawings and documents.

Global Gate Survey
BC Hydro
Project Manager for the study / research on the global state of the art and practice in the seismic design and analysis of radial gates.

Soda Spring Arch Dam Seismic Updates
PacificCorp Energy
Local team Project Manager for the seismic evaluation of the 130 ft high single curvature arch dam. Static, thermal, and seismic analyses were conducted utilizing 3D finite element model of dam components and foundation. The results of the 3D analyses were evaluated with respect to the acceptance criteria contained in Chapters 3 and 11 of the FERC Guidelines.

El Tablón Hydroelectric Power Project
Empresa Nacional de Energía Eléctrica
Project Manager for the preparation of general contract tender documents for this project that consists of an 80 meter high roller-compacted concrete (RCC) dam with 2x10MW vertical Francis units powerhouse. The dam/reservoir provides irrigation, flood control, and power generation.

Brilliant Expansion Project
Columbia Power Corporation and Columbia Basin Trust
Engineering Manager responsible for all engineering on this 120MW project, executed under an Engineer-Procure-Construct (EPC) contract. Responsibilities include complete detail design, value added engineering ,disciplines coordination as well as coordination of multiple contracts, reporting, review and approval of shop drawings and vendor documents including all turbine ,generator and BOP equipment drawings, installation ,commissioning and OM manuals, completion of as-built documentation, etc. The project is situated on the left reservoir/river bank at the Brilliant Dam location and consists of power intake, power tunnel, access tunnel and above ground powerhouse with single 120MW generating unit. The concrete spiral case of this vertical Kaplan turbine is considered to be one of the largest in the World.

Karebbe Hydroelectric Project
PT Inco – Indonesia
Engineering Manager and/or Lead Civil Engineer involved periodically in the design phase of the project with responsibilities ranging from civil to the overall project design. The project is located in a high seismic area and consists of a 74-meter-high roller-compacted concrete (RCC) dam, self--standing double intake tower and 132MW hydro-combine powerhouse (powerhouse located under the dam shut spillway) arrangement complete with two vertical Francis turbine generating units.

POSO 2 Hydroelectric Project
PT Antam Tbk
Lead Civil Engineer responsible for the civil part of the study and report preparation with contribution to the mechanical /electrical disciplines in terms of powerhouse equipment arrangement and evaluation of the units' rotational inertia required for stable generation and voltage and frequency control. This generation facility is proposed to supply power for the smelter operations of local mining company. The study was undertaken to evaluate current design, construction activities, project schedule and risks associated with the client's potential participation in the project. One of the major concerns is the capability of the project design to deliver quality of power satisfying the highly fluctuating load demand of smelter furnaces.

Granite Canal Hydro Electric Development
Newfoundland and Labrador Hydro
Engineering Manager responsible for project contracts strategy, development and control of project schedule, engineering management, preparation of tender documents, contractor design and drawings/documents review, contractor coordination, commissioning supervision and coordination, development of operations and maintenance manuals, and contractor claims settlement for this 42 MW Kaplan turbine development project. In addition, as a Commissioning Manager, responsible for the complete commissioning of the plant.

Penstock #1 Replacement
Deer Lake Power Company
Project Manager for replacement of the 70-year-old, 2.9-meter-ID wood stave penstock with the same size steel pipe penstock utilizing expansion joint design and on ring girder supports founded on wood piles.

Engineering Services
Tennessee Valley Authority
Project Manager responsible for preparation and submission of proposal for the provision of engineering services to be executed under a blanket agreement for a term of 5 years. Engineering support services will include the following operational areas: fossil power generation, transmission and power supply, hydro electric generation (including dams and pump-storage facilities), and nuclear power generation.

Wind Velocities and Air Pressure Differentials Study
Churchill Falls Corporation
Project Manager for the study of air velocity in the tailrace surge chamber during full or partial load rejection of the 5,000 MW capacity Churchill Falls underground powerhouse.

Feasibility Study
The Provincial Government of Newfoundland and Labrador
Project Manager for a de-inking facility feasibility study.

Project Manager , Proposal for Wind Generation Facility
Northland Contracting Inc.
Preparation of proposals for pilot project development of 25 MW wind generating facility.

Technical Advisor/Reviewer and Quality Control Specialist, Gull Island and Muskrat Falls Feasibility Studies
Churchill Falls Corporation
Technical Advisor/Reviewer and Quality Control Specialist for the final feasibility studies for 2,200 MW Gull Island and 840 MW Muskrat Falls Hydroelectric Developments. Responsible for implementing engineering solutions for significant reduction of the project capital cost and overall budget control of the joint venture. Reported directly to the Chairman of the Project Management Committee.

Avalon East School Restructuring Program
Avalon East School District
Project Engineer responsible for coordination with AESB, DWS&T and DE and managing engineering, scheduling, budget estimates, and tenders for the execution of the project.

Sheet Harbour Hydro Generating Facility Rehabilitation Feasibility Study
Nova Scotia Power
Project Manager of the feasibility study for rehabilitation of this generating facility. The cascade system includes seven reservoirs and two powerhouses with a total installed capacity of 10.5 MW. Each powerhouse consists of three-generation units. The scope of work included water management, evaluation of a third generating station, increasing capacity of water conveyance system, dam safety improvements, and improvement of the total system efficiency and output.

Project Engineer, Rose Blanche Hydroelectric Development
Newfoundland Light and Power Co. (Fortis Inc.)
Project Engineer responsibilities for final design of this 6 MW development, which included engineering management, design supervision, coordination of disciplines, design scheduling and tender preparation. The scope of work entailed design and construction support of a concrete-faced rockfill dam, concrete intake, and an excavated overflow spillway and above-ground powerhouse.

Project Engineer, Great Falls Hydro Generating Station Assessment and Alternatives Development
Noranda Inc.
Project Engineer for the assessment of existing conditions and development of rehabilitation alternatives. Responsibilities included engineering management, design supervision, and coordination of disciplines. To increase flood-handling capacity of the controlled spillway, different options were evaluated and the most feasible were selected for final tendering. The alternatives include combinations of rubber dam(s), vertical roller gates, radial or flap crest gates, and a submerged gate.

Project Engineer, Millertown Dam Rehabilitation Feasibility Study
Abitiby Consolidated, Newfoundland
Project Engineer responsible for management of engineering, development of alternatives, coordination, scheduling, estimates and report preparation. The 15-meter-high concrete dam rehabilitation feasibility study included developing the optimum alternative for handling probable maximum flood (PMF), construction schedule and final cost estimate.

Lead Inspector / Reviewer, Dam Safety Inspection and Review
Deer Lake Power Company
Lead Inspector / Reviewer responsible for inspecting several aging wood stave and steel pipe penstocks including field conditions evaluation and onsite testing and preparation of final inspection report. Also responsible for review of the main 23.5-meter-high diversion/spillway dam for the generation facility. The dam is a hollow buttressed reinforced concrete design constructed with buttresses at 5.5 m span. The review included general inspection, condition evaluation, finite elements stress analysis, preparation of final report with recommendations for monitoring and rehabilitation requirements.

Project Engineer, Fraser Dam Inspection and Rehabilitation Report
Fraser Paper Inc
Responsible for development of alternatives and coordination of disciplines. Work included evaluation of existing concrete dam conditions, recommendations for remedial work, cost estimate, and development of construction schedule.

Project Manager, Bishops Falls 14.5 MW Hydro Generating Facility Rehabilitation and Upgrade Pre-Feasibility Study
Abitibi Consolidated Inc.
Project Manager responsible for development and evaluation of alternatives, coordination of disciplines, etc. The scope of work included consideration for new installed capacity of 8- to 16-MW plus screening of alternatives for upgrading existing eight horizontal units with improved performance and conversion from 50 to 60 Hz.

Project Manager, 30 MW Turbine/Generator Unit Installation
Abitibi-Price Inc.
Project Manager for the preparation of tender documents and execution of the tender for WWES for a 30 MW turbine/generator unit supply and installation. Also managed preliminary design and feasibility study for the turbine/generator installation as a refurbishment and addition to the hydrogeneration facility.

Project Engineer, Rehabilitation of Power generation facility
Abitibi-Price Inc.
Project Engineer for the design of a power canal to replace aging forebay gravity dam/intake and more than 60 years old steel penstocks. Responsible for the engineering management, design supervision and support, design of some

major components, coordination of disciplines, etc. The project included a 10,900 m3 roller-compacted concrete (RCC) spillway, three new intakes, 15-foot and 20.5-foot ID penstock sections to existing powerhouse, gravity concrete dam and earthfill dams. The project involved complicated designs, particularly for penstock section between intake and powerhouse, and in general for the design of structures which had to be constructed in close proximity to operating systems.

Project Engineer, Star Lake 15 MW Hydroelectric Development
Abitibi-Consolidated Inc. and CHI Hydroelectric Company Inc.
Project Engineer responsible for engineering management, design supervision and development of design criteria, coordination of disciplines, coordination with the general contractor and subcontractors, construction support, and tender documents and specifications. The final project scope included 30 m high earthfill dam, 85 m long concrete overflow spillway, intake structure, 2 km buried steel penstock and powerhouse complex with vertical Francis turbine installation.

Project Engineer, No.7 penstock Replacement
Deer Lake Power Company Limited
Project Engineer responsible for complete detailed civil, structural, geotechnical, and mechanical design; erection procedures; coordination with contractors and fabricators; and construction support. Existing 2.9-meter-diameter wood stave penstock was replaced with steel pipe supported on ring girders and steel saddles over a distance of 700 meters.

Design Engineer, Victoria Lake Spillway Gate Modifications
Newfoundland and Labrador Hydro
Design and supervision of spillway gate modifications and design of spray wall during reservoir improvement construction program.

Structural Engineer, Holyrood Thermal Electric Generating Station
Newfoundland and Labrador Hydro
Feasibility design of 180 MW thermal cogeneration facilities as an extension of the existing thermal generating station. Design of new self-supporting breeching y-section spanning over 27 m for stack at the station.

PETER MASON, Ph.D.
QA/QC - HYDRAULIC

KEY QUALIFICATIONS
Technical Director for international dams and hydropower with specific expertise on dams, hydropower, canals and tunnels and associated works from conceptual through to detailed design stages, including integrated Safety, Risk and Value Engineering Opportunity Analyses, also Safety and Due Diligence Inspections and Asset Evaluations. Specific expertise on; applied hydraulics, structural analyses, concrete technology, surface and underground power stations, RCC/Hardfill dams. Named by the USBR as the state-of-the-art author on plunge pool scour downstream of dam spillways and quoted by the ASCE as authoring a "key reference" in the hydraulic design of stilling basins.

Chairman of the Board of Management (BOM) for the US$ 3.3 billion, 969 MW, Neelum Jhelum Hydro Project in Pakistan, also BOM Member for other major hydropower and irrigation developments in Pakistan, including over 350 km of major canals. Chief Civil Engineer on the 75 MW Hydropower works of the Lesotho Highlands Water Project. Project Engineer for the 122 m high Victoria Arch Dam in Sri Lanka. Responsible for feasibility studies, contract documentation and design for major hydraulic works in Asia, Africa and South America, also advice, inspection visits and asset evaluations as a Named Expert in Africa, Asia, Australia and North and South America. Advice to Contractors, Owners, Funding Agencies and Prospective Purchasers with lectures and technology transfer to Client's Engineers. Periods of residence in Africa, South America and the Middle East.

Member of various National and International Committees and of the All-Reservoirs Panel of Engineers under the UK Reservoirs Act. Author of numerous publications on named specialities.

EDUCATION

PhD, Applied Hydraulics - Scour Downstream of Dams, City University, London,
MPhil, Applied Hydraulics - Scour Downstream of Dams, City University, London
BSc, Civil Engineering, Woolwich Polytechnic,

Professional Organizations:
Fellow, Institution of Civil Engineers, 1993 to date, (Member of ICE since 1973),
All Reservoirs Panel Engineer under the UK Reservoirs Act, 1994 to date,
Chairman of British Dam Society, 2009 -2011), (Vice Chairman 2007 – 2009),
Chairman of the joint Inst of Civil Engineers and UK Gov Reservoir Safety Advisory Group, 2007 to date,
Member of ICOLD Committee on Cost Savings at dams, 2006 to 2011and earlier committees since 1993,
Member of ICOLD Committee on Hydraulics for Dams, 2011 to date

EXPERIENCE RECORD

Fasnakyle Power Station, Scotland
Condition asset inspection and review of the Fasnakyle power station. A review and assessment of remaining economic life in view of structural distress and age and condition of main Units.

Site C, Canada
Specialist advice to BC hydro of Canada on the hydraulic design of a 17,000 m^3/s capacity spillway for the proposed Site C dam on the Peace River.

Dam Safety Panel, Albania
Member of a Dam Safety Panel advising the government body KESH on remedial works to the Komeni dam
Dam Safety Inspections, Scotland and Wales
Safety Inspections and assessments of 6 major UK hydropower dams in Scotland and Wales under the UK Reservoirs Act

Damlapinar Hydropower Project, Turkey
Project Director for site inspections and review of structural, hydraulic and operational aspects of the project by others, following a major structural collapse on site.

Balmacaan and Coire Glas Pumped Storage Schemes, Scotland
Chairman of the Internal Review and Advisory Panel for feasibility studies into two major (circa 600 MW) pumped storage schemes in Scotland

New Bong Hydropower Project, Pakistan
Chairman of the Board of Management on this 84 MW hydropower development, taking irrigation flows form the existing Mangla dam and routing them through 4 No bulb turbines. The company role is as owner's engineer for design and site monitoring under an EPC design and construction.

Wimbleball dam, UK
Specialist Technical Advisor to the Client for major foundation remediation works to this major buttress dam, to address long-standing foundation seepage concerns.

Training Sessions, Uganda
Delivery of a series of training sessions in Uganda to staff of the Uganda Electricity Generating Company Limited into all aspects of dam design, construction and safety monitoring.

Panama Canal Parallel Locks
Specialist design liaison for the 55m wide by 32m high rolling lock gates and associated equipment for the new Panama Canal Locks, with particular focuses on hydraulics and aspects of seismic loading.

Vez Svoghe Hydropower Projects, Bulgaria
Specialist advice on all aspects of 9 run-of-river, small hydropower plants on the river Iskar, north of Sofia in Bulgaria and at various stages of design and construction. Typical installed capacities are around 3 MW, with heads of approx 10m and gated spillway design discharges up to 800 m^3/s

Climate Change Adaptation for Dams & Hydropower Project
Specialist inputs into two World Bank studies reviewing the possible effects of climate change on the design and operation of dams and hydropower projects

Risk Based Stability Assessments for Loyne Dam, Scotland
Carrying out USBR, event tree type risk assessments for certain stability aspects of the Loyne concrete gravity dam in Scotland as a development from a periodic inspection under the UK Reservoirs Act

Stepped Masonry Spillway Research
Leading a research project for the UK Environment Agency into the design and safe operation of stepped masonry spillways. It involves fluid dynamic testing and recommendations on the design, inspection and maintenance of such chutes

Neelum Jhelum Hydroelectric Project, Pakistan
Chairman of the Board of Management on this 970 MW hydropower development, including 32 km of 9m diameter tunnelling through the Himalayas in Northern Pakistan and a 40m high, gated, concrete gravity diversion dam with movement joint to accommodate a major foundation fault

Kafue Lower Project, Zambia
Technical advisor, dam designer and project layout specialist on the feasibility studies for this 750 MW hydropower development, as part of preparing RFQ and RFP documents for private developer selection. The probable dam will be a 120m high RCC gravity dam with overflow spillway and downstream plunge pool. Specialist studies also carried out on seismic loading and into the effects of climate change on future project yield.

Ulley Dam, UK
One of two Engineers selected by the Environment Agency to carry out a post incident inspection and report on the failure of the stepped, masonry spillway at Ulley reservoir near Rotherham in the UK

Dasu Dam & Hydroelectic Project, Pakistan
Expert advice on the structural and seismic design, hydraulic structures, overall layout and construction programme aspects for the feasibility stage of the 220m high Dasu RCC dam and 4,500 MW underground power station on the upper reaches of the river Indus in Pakistan.

UK Dam Safety Inspections and Advice - various
Statutory inspections of various dams and reservoirs under the UK Reservoirs Act including hydropower works in Scotland, major dams in the UK Midlands and five major flood storage reservoirs in Leicester and Nottingham. Also various other non-statutory inspection related work and studies.

Al Wehdah Dam, Jordan
Temporary Resident Engineer on the 100m high Al Wehdah, RCC dam on the river Jordan between Jordan and Syria

Nam Theun 1 Hydropower Project, Laos
Peer reviewer and general advisor to the EPC designer on all aspects of a 175m high arch-gravity dam and hydropower project with particular reference to hydraulic and hydraulic-structure design aspects, including re-designing the 33,000 cumec, high-head, gated spillway.

Braamhoek Pumped Storage Scheme, South Africa
Independent estimates carried out for the Client of design inputs needed for the detailed design & construction phase of the 1,000 MW Braamhoek Pumped Storage Project in South Africa.

Lurio River Hydropower Project, Mozambique
Project Manager leading design work on feasibility studies into 120 to 200 MW hydropower options on the Lower Lurio river in northern Mozambique. Included conceptual designs for various dams ranging from small concrete diversion weirs to 40m high embankments with separate major spillways.

Wadi Dayqah Dam Project, Oman
Visiting dam expert and advisor for the tender and detailed designs of two dams to form the Wadi Dayqah water supply reservoir. The main dam is a 74m high gravity RCC structure and the secondary dam is a 43m high, central cored, zoned rockfill embankment. Inputs included leading the conceptual re-design of the main RCC dam and in particular re-designing the 18,000 cumec spillway works to improve reliability and reduce costs.

Kakariki RCC/Hardfill Dam, New Zealand
Undertook site visits and feasibility designs for alternative Kakariki RCC/Hardfill dams in New Zealand in an area of very high seismicity. This included producing structural analyses, overall layouts and construction sequencing for a range of alternative dams up to 50m high

Bujagali Hydroelectric Project, Uganda
Leading an assessment, for a private developer, of all aspects of the proposed Bujagali Project in Uganda.

Longtan Hydroelectric Project, China
Member of an international advisory and inspection team to the Client during the construction phase of the Longtan Hydro Project in China. This includes the highest roller compacted concrete (RCC) dam in the world, at 216.5 m and the largest hydro-electric underground cavern in the world, housing 9 machines with a total installed capacity of 6,300 MW.

Ghazi Barotha Hydroelectric Scheme, Pakistan
Board of Management member for the design and construction supervision of the $2.2 billion Ghazi Barotha hydropower scheme in Pakistan. The scheme includes a 3 km long gated barrage across the River Indus with a

design capacity of 18,700 m3/sec and a 1,450 MW hydroelectric power station. The power canal is a particular feature. At 52 km long by 100 m wide, with a capacity of 1600 m3/s, it is one of the world's largest

Project Aqua, New Zealand
Value Engineering Manager for the feasibility study of a 540 MW hydropower project in New Zealand. The Project comprised 62 km of canal, a design flow of 340 m3/s and 6 power stations with installed capacities of 90 MW each. The works were designed for a design-and-construct "Alliance" basis, to a target price. Value Engineering and associated risk and opportunity evaluations were a key mechanism for achieving this safely.

Basha Diamer Dam & Hydropower Project, Pakistan
Expert hydropower advisor and board of management member on feasibility studies in Pakistan. This included review of 285m high rollcrete and concrete faced rockfill dams and layouts for underground hydropower caverns and associated works for an installed capacity of 4,300MW

Mangla Dam Raising, Pakistan
Expert hydropower advisor and board of management member on feasibility studies, detailed design and tender documentation stages for the raising of Mangla dam in Pakistan. This involves raising the existing 139m high earth embankment by 6.7m and all the associated intake and gated spillway works. The associated power station capacity will increase from 1,000 to 1,400MW

Kariba North Bank Power Station, Zambia
Detailed inspection in 2002 and analysis of the concrete foundations to the machines at Kariba North Bank Station, on behalf of KNBC. This was to clarify possible AAR induced present and future movements of the machine foundations in order to identify any associated refurbishment issues.

Swabi Scarp and Pehur Irrigation Schemes, Pakistan
Board of Management member for the construction supervision phases of the Swabi Scarp and Pehur Irrigation Projects in Pakistan. Together these feature over 300 km of main canal and siphons, 14 km of tunnel and all the secondary canals, control structures and drainage associated with approx. 115,000 ha of irrigated land. Much of the work involved upgrading and rehabilitation, but with a large portion of new tunnels and main canals.)

Cameroon Hydropower Asset Valuation, Cameroon
Team Leader. Pre-acquisition asset evaluation and audit of the 720 MW Cameroon Hydropower System on behalf of a prospective purchaser. Inspections, audits and liability assessments of 6 major dams and 3 hydropower complexes were carried out in country involving visits to all sites. Subsequent phases included preparing a strategic overview of future hydropower development in the country, advice on water resources and on insurance for the schemes. Subsequent phases also included the feasibility design and costing of a number of new hydropower schemes up to 200 MW and the refurbishment of existing small schemes from 0.35 to 2.54 MW. Advice was given on a separate visit on the future operation and maintenance requirements at a major hydropower station and large gated spillway, both affected by alkali aggregate reaction in the concrete

Can-Asujan Dam, Philippines
Preparation of feasibility designs and costs for a 40m high Rollcrete/Hardfill irrigation dam in the Philippines, with all work being carried out in the Clients offices in country. Subsequent advisory role during the detailed design and construction phase.

PETER DICKSON, Ph.D., P.G.

SENIOR TECHNICAL ADVISOR - GEOTECH

KEY QUALIFICATIONS

Dr. Peter Dickson has broad experience on a large variety of water resource projects in many parts of the world including dams for water supply and hydroelectric projects, power plants, penstocks, tunnels, caverns, pumping stations, and flood control structures. His experience includes project screening and ranking; design and supervision of geological, geotechnical, and hydro-geologic investigations; siting of project features and developing preliminary layouts and arrangements; dam type selection (Earth and Rock fill dams, CFRD, RCC, Gravity, Arch Dams), slope stability evaluations and slope design; landslide studies; technical training and technology transfer; and determining criteria for planning, design and construction of tunnels, caverns, and dams. His work includes assessment of risk, identification and evaluation of mitigation options and alternative project arrangements, development of project cost parameters, and constructability review. Recent work has included project development planning and has involved evaluations and assessments of existing and new projects being considered as investment opportunities. He is responsible for management of Quality Assurance and Quality Control and for risk management on high risk projects focusing on geological and geotechnical factors. He is also responsible for seismic hazard and risk evaluations and recommending seismic parameters for design of new projects and seismic safety evaluations of existing facilities.

He provides technical management of investigations, engineering, and construction work on dams and tunnels for major Water Resource Projects, Quality Management (including Quality Assurance and Quality Control), Risk Management, Technical Risk Identification/Analysis/Mitigation, and QA/QC.

As Quality Management Director he has been responsible for development and institution of quality management systems (including systems meeting ISO 9001 standards) for use in a broad range of company operations extending over many countries and five continents. His activities include implementation of continuous improvement approaches, training, conducting quality audits, as well as technical review roles. Dr. Dickson works with other MWH managers in development and training of consistent project management practices that are applied globally in all our operations. As Manager of the MWH Geotechnical Risk Management Program, he is also integrally involved in company risk management, with a special focus on high-risk projects.

As the MWH Americas leader for Technical Risk Review and Analysis, he is responsible for implementing and managing technical risk review of project pursuits that entail geotechnical risk components including dams, tunnels, geotechnical investigations, foundations and excavation design and high seismic hazard areas. Dr. Dickson has broad experience on a large variety of water resource projects; his 38-year professional history includes large civil geotechnical services provided on more than 125 projects in 33 countries.

EDUCATION

PhD, Geology University of Pittsburgh
MS/MSc, Geology University of Manchester (England)
BS/BSc, Geology University of Leeds (England

Licenses and Professional Memberships

Professional Geologist: Georgia; Virginia; Wyoming; Indiana
USSD (U.S. Committee on Large Dams), Associate Member; Geological Society of America (GSA), Associate Member; American Rock Mechanics Association (ARMA), Member; International Association of Engineering Geologists (IAEG), Associate Member; International Society of Rock Mechanics (ISRM), Member

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MWH

EXPERIENCE RECORD

Panama Canal Locks Expansion Project
Panama Canal Authority
Member of Independent Technical Review Board on development of design for design-build bid for construction of new Panama Canal locks expansion project. Lead reviewer for foundations and seismic aspects. In addition to high-level technical reviews, he was also responsible for developing and maintaining quality management system for the project. At the request of Canal Authority (Client) and prior to bidding period, he participated in peer review of seismic hazard and geologic data acquisition and interpretation, and advised client in approach to selection of seismic design criteria.

Neelum-Jhelum Hydroelectric Project
WAPDA, Pakistan
Member of senior technical review team during detailed design and construction of 950-MW hydroelectric project scheme in Himalaya foothills, Jammu-Kashmir northern Pakistan. Responsible for site visits, value engineering and technical advice to design team, technical review of underground works (28-km-long headrace and tail tunnels, underground power station complex, 300-m-high surge shaft, access tunnels), and concrete gravity dam, de-sanding chambers. Severe project challenges include major earthquake hazard (within zone of catastrophic 2005 earthquake, M=7.6), weak foundation materials, active fault crossings for tunnels, highly deformed and complex tunnel geology. Served as technical lead in evaluation of earthquake hazard using DSHA and PSHA methods for project region in northern Pakistan. Results were used for development of seismic design parameters for final design including ground motion estimates, response spectra and time histories.

Tekeze Dam
Ethiopian Electric Power Corporation
Responsible for technical review and field inspection of project works and seismic hazard on 190-high thin-arch concrete dam under construction, special focus on foundation and rock slope stability assessment, rock mechanics evaluations (including 3-D rigid block and kinematic analyses, block theory, 2-D and 3-D FEM stress and deformation analysis), rock reinforcement and anchor design, including participation in thrust-block design and left abutment remedial works (abutment replacement), review of underground works (power tunnel system and powerhouse cavern); QA of site engineering.

Cerro Corona
Goldfields
Member of independent technical review panel responsible for review of design, plans and specifications for construction of 225-m-high tailings dam and related works located in high seismic hazard region in Andes. Visited project site to conduct field inspections, participated in technical review meetings with client and design team, participated in Failure Modes and Effects Analysis of project.

Proyectos HidroAysen
HidroAysen
Served on Board of Consultants as technical expert on foundations and underground structures. Assignment involved review of five hydroelectric projects under various stages of development with total installed capacity of 2750 MW. Projects are being developed within framework of Sustainability Protocol of IHA. Review activities included site visits and detailed inspection of investigations and design with Owner and its design team.

Dasu Hydroelectric Project
WAPDA
Lead geological engineer in feasibility study and design of major hydroelectric project on Indus River (4000-MW installed capacity powerhouse, 200-m-high dam). Responsible for geotechnical investigations, development of design criteria for dam, and design of underground facilities. Also responsible for direction and review of seismic hazard and neotectonics investigations and determination of seismic parameters for design.

Al Wehdah Multipurpose Project
Jordan Valley Authority
Reviewed and evaluated foundations during construction, conducted special stability assessments (including 3-D block analyses), rock mechanics analyses, proposed design and construction modifications, reviewed foundation treatment and grouting works, attended Panel of Experts Meetings.

Pinalito Hydroelectric Project
Corporacion Delacueducto y Alcantarilla
During project development and planning, responsible for seismic hazard assessment, geological investigations, assisted in preparation and evaluation of alternative arrangements including preliminary tunnel design aspects for dam and 13-km-long headrace tunnel. During construction, responsible for senior review of contractor and engineering submittals on foundations, excavations, earthquake, construction materials, tunnel design and construction (10-km x 3.6 m dia TBM tunnel, 3-km drill/blast); conducted detailed review of contractor's tunnel progress and basis for claims; QA review and audits of site engineering during construction.

International Panel of Experts, Iraq
Ministry of Water and Energy Resources
Expert in geological engineering and seismicity serving on International Panel of Experts (POE) for Ministry of Water, provided technical review, advice, and oversight of all dam projects in operation, under design, or investigation for planning and future development.

ITR McCook Tunnel Connecting Tunnels
Client: US Army Corps of Engineers
Member of Independent Technical Review (ITR) - team responsible for design review of USACE concepts, designs, drawings, and specifications for large diameter (33 ft) connecting tunnel system and gate shaft/chamber.

El Cajon Hydrolectric Project
CFE and CIISA
Principal engineering geologist serving as Member of Dispute Resolution Board retained by Owner (CFE) and contractor consortium (CIISA) to provide expert opinion and resolve financial disputes upon completion of construction of major hydroelectric project with high concrete-faced dam, underground power station complex. Responsibilities included visit to project site, participation in meetings with Owner and Contractor, review of technical and contract information, and development of opinion on validity of claims involving changed/unanticipated geologic conditions, scheduling interferences, cost impacts. Responsibilities primarily focused on claims associated with construction of tunnels, and underground power house cavern.

Rosia Montana
S.C. Rosia Montana Gold Corporation SA
Member of independent technical review panel responsible for review of designs, plans, and specifications for construction of tailings dam and related works located in central Romania.

Spavinaw Dam Modifications
Craig & Keithline, Inc.
Project manager for structural improvement of 80-year old concrete gravity dam with overflow spillway. Work involved field visits for condition assessment, reservoir sediment survey, geotechnical investigations, stability assessments, preparation of designs, plans and specifications for repair and re-facing of concrete structures.

Karahnjukar Hydroelectric Project
Landsvirkjun
Lead geological engineer in review and finalization of seismic design for 200-m-high concrete-faced rockfill dam in Iceland, QA review of geology, foundations, and grouting. Presented findings and recommendations to independent technical review Panel of Experts.

Shandong Taian Pumped-Storage Project
Shandong Taian Pumped-Storage Power Station Co. Ltd
Consultant responsible for review and technical advice on design and construction of underground features, including power house cavern, transformer hall, water conveyance tunnels, power shafts, and surge chambers. Responsible for review of geology, tunnel design, assessment of stability of caverns and tunnels, and shafts; numerical analysis, excavation and support design of caverns, overall review of cavern design and construction methods; review and advise construction design of underground works, including review of construction procedures and specifications; check of project construction schedule, implementation plan, and construction cost estimates. Also was responsible for review and advice on geo-membrane lining system for upper reservoir.

Kotli Hydropower Project
Mira Pakistan Limited
Lead geological engineer in identification and selection of preferred scheme for run-of-river hydropower project in Himalaya foothills, Jammu-Kashmir. Responsible for seismic hazard evaluation and development of earthquake design criteria in high-hazard region (recommended parameters that forecast affects of devastating earthquake that afflicted the region in 2005). Carried out field visits, development of geological investigation program, assessment of project geotechnical risks, dam foundation evaluation, design of 7-km-long tunnel system (5.5-m-dia) through weak, highly deformed Himalayan strata; tunnel construction cost estimation, and development of preliminary project layouts.

Seneca Pumped Storage Project
First Energy
Lead geologist and quality control engineer during emergency investigations, development of repair program, drawings and specifications, and implementation of repairs at lined upper reservoir of pumped storage project. Responsible for supervision and review of design components (geo-membrane system), Health and Safety Plan, Quality Control Implementation Plan, and field supervision.

Alpaslan II Project
Devlet Su Isleri
Lead geologist and geotechnical engineer for turnkey design-build team on project on the Murat River in eastern Turkey. The project involves a fill dam about 106 m high, a gated chute spillway, and a hydroelectric powerstation with an installed capacity of 200 MW. The project geology presents some important considerations including low strengths of clay shales in the foundations, swelling clays, widespread landsliding, and high earthquake hazard. Responsible for site visits and review of feasibility studies and investigations, development of additional investigations (drilling, geophysics, mapping, testing), seismic hazard analysis, and design recommendations. Supervised team of engineering geologists and geotechnical engineers during the following processes - design, seismic analysis, preparation of specifications and drawings, and the QA/QC process.

Missouri Pumped Storage Project
Confidential
Supervised team of engineers and scientists in conceptual study of proposed new pumped-storage project with a view to mitigation of environmental and visual impacts. Tasks included optimization of previously developed project configuration to establish a base scheme; modification of base scheme to account for different generation capacities (200 MW-800 MW installed capacities) as well as to mitigate environmental, real estate and aesthetics constraints; prepare cost estimates for the various schemes; identify alternative locations for the pumped storage project.

Rio Indio Water Supply Project
Panama Canal Authority
Lead geologist on a project to supply water to the Panama Canal. Responsible for site visits, development and supervision of investigation programs (including geophysical studies) for a 75-m high dam, dam type selection RCC versus CFRD dam types), appurtenant works, two small hydro plants, and a 8.5-km long inter-basin transfer tunnel; seismic hazard evaluation. Investigations carried out in remote areas requiring helicopter mobilization and support. Responsible for developing criteria for preliminary design of dam and tunnel, basic design of tunnel system, construction cost parameters and schedule. Also was responsible for geotechnical Quality Assurance on evaluation of new Lock and Canal Alignments.

PETER DONALEK, P.E.

ELECTRICAL ENGINEER, LEAD POWER SYSTEM PLANNER

KEY QUALIFICATIONS

Mr. Donalek has significant recent experience with electric utilities that are reorganizing and adopting a market approach to their services. Mr. Donalek has been involved with the organization of Open Access transmission systems that are a fundamental part of the deregulated electric utility system. He has provided engineering input to the preparation of concession bidding documents for a major transmission line in Peru, and technical engineering assistance in the privatization of two government owned bulk power transmission systems in South America. He has drafted a Technical Grid Code for the power system of Pakistan. On projects in the United States, he is involved in the analysis of power transmission requirements for Non Utility Generators and the evaluation of distribution system planning and reliability. He has submitted comments to the Federal Energy Regulatory Commission (FERC) on the early draft of FERC rule 888 regarding the definition of Available Transmission Capacity. Mr. Donalek has significant recent experience with electric utilities that are reorganizing and adopting a market approach to their services. Mr. Donalek has been involved with the organization of Open Access transmission systems that are a fundamental part of the deregulated electric utility system. He has provided engineering input to the preparation of concession bidding documents for a major transmission line in Peru, and technical engineering assistance in the privatization of two government owned bulk power transmission systems in South America. He has drafted a Technical Grid Code for the power system of Pakistan. On projects in the United States, he is involved in the analysis of power transmission requirements for Non Utility Generators and the evaluation of distribution system planning and reliability. He has submitted comments to the Federal Energy Regulatory Commission (FERC) on the early draft of FERC rule 888 regarding the definition of Available Transmission Capacity. For several nationwide and regional utilities carried out an assessment of the condition of bulk power transmission system and substation facilities as part of program to privatize the system. These efforts included the formulation of due diligence, field inspections, review of design criteria, evaluation of maintenance programs, control centers and system operating practices. Prepared several region-wide and national transmission planning studies, including load-flow, short-circuit and transient stability analysis. Provided transmission expansion plan schedules and cost estimates. Carried out assessments of combined generation expansion plans with associated transmission expansion plans. Developed transmission connection studies, developed connection alternatives, evaluated costs, evaluated reliability issues, provided input to applications for public need and necessity for new generation facilities. Assignments were carried out for hydro, pumped storage and thermal generation plants. Mr. Donalek contentiously continues to expand his knowledge base by engaging in numerous professional development activities. Since 1975 he has attended either the winter or summer meeting, and some years both meetings, of the Institute of Electrical and Electronics Engineers - Power Engineering Society (IEEE-PES). At these meetings he attends paper sessions, presides as chairman of technical sessions, participates in meetings of Task Forces, Working Groups, Subcommittees and Main Committees. Mr. Donalek is an electrical engineer with specific and relevant experience related to evaluation and modernization of pumped storage projects. His experience includes nine pumped storage projects. He has carried out plant electrical equipment design as well as more recent experience with the application of adjustable speed machines to pumped storage projects. He has conducted a research assignment for the Electric Power Research Institute on the application of adjustable speed machines in conventional and pumped storage hydro plants. He has published several technical articles related to pumped storage projects and adjustable speed pumped storage projects. In addition to his experience with pumped storage plants he also has experience with the transmission system connection requirements for generating plants under the FERC rule 888. He has formulated system study plans and directed the preparation of system studies for new and upgraded generating plants.

EDUCATION

MA, Mathematics University of Toledo

MS/MSc, Electrical Engineering University of Pennsylvania

BS/BSc, Electrical Engineering University of Illinois (Urbana-Champaign), 1961

Professional Registration: Professional Engineer, 062-025529, Illinois, 1966

Professional Organizations: Seminar Chairman, Chicago Section, Chairman, 1981 expires 1982; IEEE-PES System Dynamic Performance Committee, Member, 1985; Mathematical Association of America, Member, 1972; Institute of Electrical and Electronics Engineers (IEEE), Senior Member, 1981; International Conference on Large High Voltage Electric Systems (CIGRE), Member, 1997; Task Force on Discrete Supplemental Controls for Stability, Chairman, 1975 expires 1981; American Power Conference , Program Committee, 1984 expires 1992; IEEE-PES Working Group on Renewable Technologies, Member, 1998

EXPERIENCE RECORD

Taltson Hydroelectric Expansion Project
NWT Energy Corporation (03) Ltd.
Prepared scope of services for power system studies for the 161 kV transmission system and reviewed transmission line designs prepared by sub consultant.

JRSP Jordan River Pipeline Project
Jordan
Prepared preliminary transmssion plan for the connection of pumping stations and energy recovery hydro generators to the 400/132 kV bulk power transmssion system of Jordan.

Lake Powell Pipeline Project
State of Utah; natural resources Division of Water Resources
Prepared plans for the interconnection of booster pump stations, in-line hydro generators and pumped storage hydro plant to electric power transmisison grid in southern Utah. Worked with local transmisson owners to identify interconnnection points. Prepared costs estimates for transmission lines and substations. Worked with transmission owners to prepare power system studies.

AMP Hydroelectric Projects (Ohio River Run-of-river Hydroelectric Projects)/Cannelton, Smithland, Willow Island, and Meldahl Hydroelectric Projects
Client: American Municipal Power (AMP Ohio)
Prepared transmisison interconnection applications to Mid West ISO for Smithland and Cannelton Projects. Prepared transmisison interconnection application to PJM for Willow Island Project. Plants will have bulb turbine driven generators. Prepared preliminary transmission line designs for Smithland (161 kV), Cannelton (138 kV) and Willow Island (138 kV). Peter has participated in the Cannelton Hydroelectric Project, which will be located on the left descending bank at Cannelton locks and dam, near Cannelton, IN. Gross head at the Cannelton site is about 25 ft. The new facilities will include a three-unit powerhouse with an estimated capacity of 84 MW. The project is expected to generate an average of 390,000 MWh annually. (Ongoing) (2007 – Present)

SDCWA-Lake Hodges Pumped Storage -61004
San Diego County Water Authority
Developed transmission connection options for proposed pumped storage hydro project. Prepared plant and machine data required by Cal ISO for Transmission Connection and System Impact Study. Reviewed and advised client on the Electric System Impact Study Agreement. Prepared substation planning report.

Mangla Dam Raising, Water and Power Development Authority
Indus Basin, Pakistan
Peter participated in this project, where the main objective of the Mangla Dam Raising was to regain the storage capacity lost due to sedimentation in the reservoir. The project involved raising the main and ancillary dams by 30 feet; modification of the headwork and orifices of the main spillway; and construction of a control weir upstream of the emergency spillway. The Mangla reservoir is primarily operated to meet irrigation requirements, with power generation as a secondary objective. The main benefits of the project included additional average annual water availability and additional average annual generation of 644 GWh.

San Francisco Transmission Project (HVDC Cable)
San Francisco Public Utility Commission
Prepared electric power system section of pre-feasibility study and report. Prepared description of power system configuration for a base plan and three variants. Described relevant HVDC converter/inverter technology as well as conventional alternating current power system facilities. Established voltages, major equipment ratings and representative costs. Project is based on 30 mile HVDC undersea cable to transmit approximatly 400 MW of hydro generation from the Newark substation to load centers in the city of San Franscisco and Alameda.

Technical Analysis of Pump Storage and Integration with Wind Power in the Pacific Northwest
U.S. Army Corps of Engineer NW Dividsion HDC and Bonneville Power Administation
Prepared engineering description of conventional pump storage and adjustable speed pump storage. Described benerfits and explained how adjustable speed pump storage can be used to integrate wind powered and solar generation into interconnected system operation. Suggested how pump storage wtih adjustable speed machines can participate in Wide Angle Measurement System and Wide Area stability and voltage Control System.

Beltzville Hydroelectric project
Borough of Lehighton
Prepared application to PJM for interconnection of the 2.8 MW Beltzville hydro electric power project to the Allegheny Power Services Corp. Provided electrical characteristics and models for use in Generation Interconnection Feasibility Study.

NERC/WECC Compliance Monitoring and Reporting
California Departmetn of Water Resources
For CalDWR assisted in the preparation of software to monitor and accumulate information needed for reliability audits by WECC as part of the NERC Compliance Monitoring Project.

Supplementary Feasibility Study of the Proposed Steelpoort Pumped Storage Scheme
ESKOM Holdings Ltd
Prepared study and report of the applicability of 380 MVA adjustable speed machines in the Steelpoort Pumped Storage project. Evaluated technology, identified benefits, described operating condtions and recommended adjustable speed machines.

Characteristics of Pumped Storage Hydro Units with Adjustable Speed Capabilities - Hawaii
Hawaiian Electric company, Inc
Conducted study and prepared report on the capability of adjustable speed machines in pumped storage plants. Study was based on two pumped storage sites each with 2 x 25 MVA machines. Study evaluated the operating benefits and recommended that pumped storage machines with adjustable speed capability can proide power and frequency regulation in systems with high penitration of wind powered generation.

Bujagali Falls Hydro
Sithe Global
Reviewed existing transmission plan and specification for 220 kV and 132 kV transmission lines and substations. Reviewed Uganda Grid code. Recommended changes to the specifications reflecting changes in line of ownership between plant facilities and national transmission system.

Dana Point Desalination Facility Power Delivery Study
Municipal Water District of Orange County, CA
Conducted a study and prepared a report recommending a 138 kV transmission connection along with a preliminary design of the 13.8 kV plant distribution system. Study included evaluation of overhead vs. underground 138 kV transmission and the use of a SF6 gas insulated substation. The plant would contain twelve 2.2 MGD reverse osmosis trains and includes a energy recovery turbine.

New Zealand 400 kV Transmission System
Transpower
Provided technical input and review of site selection reports for the nation wide 400 kV grid development.

USAID Central Asia Water-Energy Nexus
United States Agency for International Development
Visited the four countries interviewed more than 60 government officials, utility managers and international donors. Prepared an evaluation of the technical programs in the energy sector and recommended programs in the transmission and energy sector to be funded by USAID for the next five years.

Kajakai & Darunta Assistance
Advanced Engineering Associates, Intl.
Reconstruction of bulk power transmission system of Afghanistan. As a subconsultant to Advanced Engineering Associates International (AEAI) reviewed various transmission planning and design reports and provided recommendations for follow-on projects and connection to Central Asia grid.

Generation Investment Study
MWH sa/nv (Belgium)
Reviewed volume on transmission system issues for the Southeast Europe Generation Investment Study. The study determined the optimal timing, size and location of future generating capacity and associated bulk power transmission in the region over the next 15 years (2005 to 2020). GTMax and PSS/E were used to perform detailed models of the interconnected transmission grid for the Southeast Europe Regional Electricity Market.

Hill Air Force Base Relay Coordination Study
US Air Force
Senior Electrical Engineer for the relay coordination study of the Hill Air Force base 44 kV and 12.47 kV distribution systems. Selected relay coordination software. Developed data collection and establishment of an electronic database, established case study list, recommend fuse ratings, revised relay settings and reviewed draft and final reports.

SDCWA-LH Pump Stn & I/O -61006
San Diego County Water Authority
Designed 69 kV transmission connection and switchyard for a two-unit pumped storage plant in San Diego California. Plant is connected to the San Diego Gas & Electric bulk power system according to standards of the California Independent System Operator. Prepared equipment, material and construction specifications for two 69 kV circuits, 69kV switchyard and connection to SDG&E bulk power transmission system.

Oroville Sp-E3-04/Oroville Thermalito Power
Harza/Edaw Joint Venture
Department of Water Resources State of California. FERC Re Licensing Study for the Oroville-Thermalito Power Complex. Evaluated the application of adjustable speed generator/motor turbine/pump units on 40 MW Units 2, 3 and 4 in the Thermalito plant. Study examined technical aspects and included preliminary layout design, cost estimates and evaluation of cost/benefit analysis.

Mendota Hills Wind Farm
Navitas Energy
Organized study program, devleoped study case list, coordinated data collection, evaluated study results, recomended type and capacity rating for reactive power controller, contacted equipment manufacturers, prepared cost estimate and drafted report.

Upper Indus Transmission Plan for Basha Dam
Water and Power Development Authority
Developed several transmission expansion plans for study. Plans were based on the use of HVDC, 765 kV and 500 kV transmission technologies.

USAID Role of Hydro in Southeast Europe Regional Electricity Market
USAID
Project Manager for the USAID funded technical assistance program to the countries of South East Europe. Purpose of the plan is to provide necessary analysis and technical assistance to define the role of hydro generation in a regional electricity market.

GLENN TARBOX, P.E.

QUALITY ASSURANCE / QUALITY CONTROL

KEY QUALIFICTIONS

Mr. Tarbox has 41 years of experience as a civil/structural engineer in all facets of water resource project development and management. He offers expertise in planning, design, management and construction of dams, hydroelectric plants, transmission lines, tunnels and other major civil works projects. His early career developed as a dam design and construction engineer and Assistant Chief, Dams Branch with the U.S. Bureau of Reclamation; the past 22 years have been spent with the private sector. Glenn has served as Design Engineer or Project Manager on more than 23 major domestic and international dams and is often called upon to serve as a dam expert on consulting boards for new or upgraded projects, a FERC certified Part 12 Independent Safety Consultant and as an expert forensics witness related to dams.

EDUCATION

BS/BSc, Civil Engineering, University of Maryland
BS/BSc, Mathematics and Operations Research, University of Colorado (School of Mines)
BS/BSc, Hydraulics, University of Colorado (School of Mines)
BS/BSc, Structures, University of Colorado (School of Mines)
MS/MSc, Master of Science Academic Requirements, University of Colorado

Licenses and Professional Memberships

Professional Engineer, Alaska, 4871
Professional Engineer, Arizona, 16736
Professional Engineer, Colorado, 9311
Professional Engineer, Georgia, 18035
Professional Engineer, Illinois, 062-044980
Professional Engineer, Montana, 8292PE
Professional Engineer, Texas, 59105
Professional Engineer, Utah, 167339-2202
Professional Engineer, Wyoming, 4759
Professional Engineer, Washington, 2201
Professional Engineer, Idaho, 11113
Professional Engineer - Civil, L3458 - New Brunswick

EXPERIENCE RECORD

Seismic Assessment Study for Gene Wash Dam/Reservoir and Copper Basin Dam/Reservoir

Providing evaluation phase oversight of two thin arch dams. Upstream deformation and cracking was observed at both dams immediately after reservoir filling. Studies confirmed the dam concrete was undergoing alkali-aggregate reaction (AAR) contributing to the deformation. Evaluated overall dam performance for earthquake-induced vertical and horizontal deformations based on the Maximum Credible Earthquake. Used three dimensional finite element analyses and a material properties parametric evaluation that considered a substantial reduction in the concrete normal tensile strength due to AAR.

Romaine 1, 2, 3, and 4 Hydroelectric Projects
Member Board of Review to review designs and construction management of the 640MW Romaine 2 Hydroelectric Project as part of the 4 Power Plant Romaine River Developments (1,550MW total installed capacity).

Eastmain 1A & La Sarcelle Hydroelectric Projects
Member Board of Review to review designs and construction management of the 768MW Eastmain 1A and 150MW La Sarcelle Hydroelectric Projects as part of the Rupert Diversion.

Upper San Joaquin River Basin Storage Investigation
QA/QC Manager providing oversight for intake structures, tunnel, and powerhouse features for new dam and reservoir on the San Joaquin River. CONTRACT: IDIQ for Water Resources Planning and Engineering (01CS20210B and BRPS/06CS204097B)

San Vicente Dam Raise
Mr. Tarbox was task leader and principal structural engineer overseeing the design of a 337-ft-high RCC gravity dam (a 117-ft raise from the original height of 220-ft to 337-ft when completed), including RCC mix designs, optimization of raised design cross-section, FEM static and dynamic stress analyses, thermal studies, instrumentation design, facing systems, galleries and saddle dam. The project featured two tunnels, a 9-foot-diameter penetration through the existing dam into a submerged cofferdam at the upstream face, and a 17-foot tunnel and shaft beneath the raised dam while maintaining reservoir levels.

Tekeze Arch Dam & Hydroelectric Project
As Senior Advisor & Principal Structural Engineer, responsible for technical review and field inspection of project works, quarry development, aggregate processing, concrete mix designs, consolidation grouting of foundation and finite element seismic stress analysis for a 190-m-high, thin-arch concrete dam. He reviewed and recommended special foundation shaping studies including rock slope stability assessment, rock reinforcement and anchor design, and design of a combined shaping and thrust block structure to reconstitute left abutment ground contours.

Karahjnukar Dam and Hydroelectric Project
Senior Advisor, Principal Structural Engineer and reviewer for a 200-m-high, concrete-face rockfill dam (CFRD) in Iceland He provided quality assurance (QA) review of foundations; instrumentation; design and analysis of a special 40-m-high concrete gravity toe wall to resist tectonic displacements of faults existing in the foundation; RCC mix design; and PVC water-proofing membrane.

Columbia River Off-Stream Storage Study
Project Manager for the Columbia River Off-Stream Storage Study to identify off-stream versus on-stream reservoir sites of 300,000 feet or larger for pumped storage and/or modification of existing facilities to allow for additional storage.

Santa Anita Dam Re-Analysis
Principal-in-Charge for re-analysis of Santa Anita Dam, a 225-foot high concrete arch dam built in 1924-27. The primary issues of concern include Alkali-Aggregate Reaction (AAR) within the dam concrete, seismic stability to withstand the current Maximum Credible Earthquake (MCE), and hydraulic adequacy of the existing spillway to handle updated Probable Maximum Flood (PMF). Performed an engineering/safety inspection and investigation of the dam. Cores were obtained to assess the existing condition of the concrete (including petrographic analysis). Design earthquakes were developed using actual ground motion records scaled to spectrally match a target spectrum. Linear-elastic and non-linear finite element analyses were performed to assess the seismic stability of the dam. Updated hydrologic analyses were performed to develop inflow hydrology for evaluation of the existing spillway.

Baise Multipurpose Dam Project
Project Manager for the review of designs, operating policy, environmental impact assessment, economic and financial analysis and alternative flood protection possibilities for the $500 million Baise multipurpose Project that includes a 130-m-high (430 ft), 2 million cubic meter, RCC dam, two rockfill dams and a 540-MW underground powerplant

Big Tujunga Dam Stability Evaluation/Big Tujunga Dam Seismic Rehabilitation and Spillway Modification Project
As Principal-in-Charge, provided oversight of the final design and stability evaluation of a 251-foot-high concrete arch dam. He performed a seismic dynamic finite element analyses of the dam using ground motion records modified to spectrally match a target spectrum. He developed six general rehabilitation concepts and analyzed each concept using the finite element method. The selected concept consisted of placing RCC on the existing dam's downstream side to transform it from a thin to a thick arch dam, to achieve seismic strengthening and spillway modifications for hydraulic rehabilitation. (1999 - Present). Big Tujunga Seismic Rehabilitation and Spillway Modification Project received the National Rehabilitation Project of the Year Award, Association of State Dam Safety Officials (ASDSO), 2011. The 244-foot-high, variable radius thin-arch Big Tujunga Dam required modifications to strengthen the dam for seismic events and to create additional spillway capacity. (Ongoing)

Mactaquac Generating Station
Member Board of Review for annual review and evaluation of monitoring and mitigation programs conducted by NB Power dealing with severe autogenous growth problems in the concrete of the head works dam, spillways and powerhouse structures due to AAR (Alkali Aggregate Reactivity). Unprecedented expansion due to AAR has resulted in NB Power adopting a range of measures to combat the ongoing expansion including a regular program of saw-cutting monolith blocks in the head works adjacent to the spillway, between generation bays in the powerhouse, and in spillway access bridge slabs, excising portions of six penstock encasements and replacement with expansion couplings and a program of continuous realignment of the turbine and generator shafts to accommodate out-of-round and out-of-plumbness of the units due to the AAR expansion.

Olivenhain RCC Dam
Project Manager overseeing the detailed design of this 318-foot-high, 1.4 million cubic yard RCC gravity dam with a six-level selective withdrawal I/O tower and a stair-stepped cascade spillway on the dam's downstream face. The dam will create an offstream reservoir to provide emergency water supply to 3.5 million San Diego County residents in the event an earthquake severs the region's water delivery aqueducts and pipelines. The $140 million dam is part of the $850 billion Emergency Storage Project and will be the highest RCC dam in North America and the first new RCC dam constructed in California. The design included the Lake Hodges Portal, tunnel stub, and shaft for the future Lake Hodges Pumped Storage Project. The Team prepared specifications, drawings and contract documents for four separate construction contracts and is providing engineering services to the Authority during construction. (1998-Present) Olivenhain Dam received the ASCE Opal Award of Merit, 2005 and Milestone RCC Project 1987-2007, 5th International Symposium on RCC Dams, Guiyang, China, 2007

Xiaolangdi Multipurpose Dam Project
Served on the Xiaolangdi Dam Consulting Board. The Xiaolangdi Dam, on the Yellow River in Henan Province, consists of a 505-foot-high earth and rockfill dam, 15 outlet and power tunnels, an intake structure, an 1800 MW underground powerhouse and a concrete-lined plunge pool stilling basin. The intake structure consists of ten towers with a height of 367 feet and a total volume of more than 4.4 million cubic yards of concrete. There were three 60-foot diameter, 3,600-foot long diversion tunnels, six 25-foot diameter power tunnels and three 39-foot wide by 62-foot high by 2,950-foot long tailrace tunnels. There are also six 21-foot diameter post-tensioned pre-stressed tunnels for sluicing of sediment.

Served on the Xiaolangdi Dam Consulting Board, the Xiaolangdi Dam on the Yellow River in Henan Province, consisting of a 505-ft-high earth and rockfill dam, 15 outlet & power tunnels, an intake structure, an 1800-MW underground powerhouse and a concrete-lined plunge pool stilling basin. The intake structure consisted of ten towers with a height of 367-ft & a total volume of more than 4.4 million cubic yards of concrete. There were three 60-ft-dia, 3600-ft long diversion tunnels, six 25-ft diameter power tunnels & three 39-ft wide by 62-ft high by 2,950 ft long tailrace tunnels. There are also six 21-ft dia post tensioned pre-stressed tunnels for sluicing of sediment.

Bear River Risk Assessment
Project Manager for the risk assessment of a series of dams on the Bear River. The study demonstrated an Incremental Consequence Assessment (ICA) for the four dams: Soda Point, Grace, Oneida and Cutler. The results were presented to the Federal Energy Regulatory Commission (FERC) by the Owner to illustrate the threat posed to downstream dams by upstream dams in a cascading failure scenario in probabilistic, economic and safety terms. The Owner's proposals for upgrading the dams were based on the results of the risk assessment and were accepted by the FERC.

Rocky Mountain Hydroelectric Project
Responsibilities as chief engineer included an overall QA/QC program for the Rocky Mountain Hydroelectric Project. He was Vice President of Engineering during project design, which included an upper reservoir ring embankment dam, eight lower reservoir dams and a 750-MW pumped storage power station.

Feasibility Investigation and Design Study
Dwaar Kill Reservoir
Senior staff member responsible for conceptual designs and overall quality control for a feasibility investigation and design study of a water supply project that involved a 267-meter-long embankment dam and a 256-meter-long roller compacted concrete dam designed to impound a 16-million-cubic-meter reservoir. (1988-1990)

Upper San Joaquin River Basin Storage Project, Reclamation
Served on a team that suggested alternative ideas and solutions to perform functions, consistent with identified criteria, at a lower cost or increase in long-term value. They evaluated, analyzed, and prioritized ideas. The best ideas were developed to a level suitable for comparison, decision making, and adoption. The total dollar value of all alternative ideas represented an estimated reduction in costs of approximately $650M of the estimated $2B project feasibility cost estimate. MWH provides engineering design, cost estimating, environmental compliance, modeling, planning, cultural resource studies, economic evaluations, and stakeholder/public outreach services to Reclamation for the Upper San Joaquin River Basin Storage Investigation (USJRBSI) project. (Ongoing)

DERRICK PENMAN, P.Eng.

PRINCIPAL CIVIL / STRUCTURAL ENGINEER

KEY QUALIFICATIONS

Mr. Penman is a Hydropower Engineer with experience in the layout and design of hydroelectric plants at prefeasibility, feasibility and detailed design levels both in Canada and internationally. He has also been involved in dam safety assessments and due diligence assessments of hydroelectric projects for financial institutions. His most recent experience includes ranking and feasibility studies, tender design through to construction, review of design concepts, due diligence work, and construction supervision.

EDUCATION

BS/BSc, Civil Engineering, Heriot-Watt University,

Licenses and Professional Memberships

Professional Engineer, Ontario, Newfoundland and Labrador,- Canada
Institution of Civil Engineers, UK
Order of Engineers of Quebec, Canada

EXPERIENCE RECORD

White River Hydro Project

Regional Power Opco, Inc.

Project Manager for the White River Hydroelectric Project. White River project consists of two hydroelectric projects located approximately 30 km northwest of White River, Ontario, consisting of (i) Gitchi Animki Bezhig facility (the "Upper White River Project") being located approximately 3.2 km downstream of the existing MNR-operated White Lake Dam, and (ii) Gitchi Animki Niizh facility (the "Lower White River Project") being located approximately 1.6 km downstream of Chicagonce Falls. The two sites are situated approximately 12 km apart on the river. MWH is involving in Preliminary/Detail/Final design as well as Support during construction and commissioning.

Taltson Expansion Project

NWT Energy Corporation (03) Ltd

Project Manager for the Taltson Hydroelectric Expansion Project that will add a new power plant of approximately 50MW install capacity and 700km transmission lines to supply power to as many as three operating and one proposed diamond mines north of Great Slave Lake.

Waneta Expansion Project

Peter Kiewit & Sons, British Columbia

Responsible for the coordination between the various engineering disciplines in the preparation of the design of the 335MW expansion to the existing Waneta Hydroelectric Project on the Pend d'Oreille river in British Columbia for an EPC bid submitted by Peter Kiewit & Sons a major North American civil engineering contractor. The Waneta Expansion project is located on the right abutment of the existing facility. The layout comprised two separate power intakes, located adjacent to the existing north closure wall, two lined tunnels with a diameter of 10m for the concrete section and 8.3m for the steel lined portion upstream of the powerhouse and a powerhouse located some 80m downstream of the existing dam containing two vertical axis Francis units. Water is conveyed from the existing reservoir to the power intakes through a 185m long unlined channel excavated in rock and overburden. The inlet to the approach channel is located approximately 40m upstream of the existing intake.

Tekeze Hydropower Project
Ethiopian Electric Power Corporation
As Chief Design Engineer, responsible for supervision of the design activities at site including re-design of elements of the project where site conditions vary from those assumed during the initial design phase, review of contractor's shop drawings, review of method statements, temporary works designs, and other technical submissions from the Contractor. The project comprises a 185-m-high double curvature arch dam containing 4 orifice type outlets to handle a flood of 4500 m³/sec after routing through the reservoir. Power flows are conveyed to a 4 unit underground powerhouse with an installed capacity of 300 MW through a f 7.25 m 320-m-long concrete lined headrace tunnel, a f 6.75 m pressure shaft leading to a concrete lined manifold which branches to 4 steel lined tunnels f 4.0 m varying in length from 76 m to 52 m. Flows are discharged to the river through 55-m-long concrete lined D-shaped tunnels with an equivalent diameter of 5.0 m.

Karun III Hydroelectric Project, Iran
Iran Water and Power Development Corporation (IWPC))
Responsible for providing advisory services to the joint venture of Acres and their local Iranian partner Mahab Godss on the construction supervision of the Karun III Hydroelectric Project in a joint role as Design Manager and Area Engineer for the Plunge Pool and Underground Power Complex. The project comprises a 205 m high concrete arch dam, spillway facilities to handle flows of 21,440 m3/sec and underground works, which comprise an 8 unit underground powerhouse (installed capacity 2,000 MW), and an underground transformer gallery. Flows for power generation are conveyed through penstock tunnels approximately 700-m-long and varying in size from 12.6 m to 5 m in diameter. As Design Manager responsible for managing and coordinating the efforts of the design team, which reviewed design changes proposed by the contractors, temporary works designs, and other technical submissions. An area engineer for the plunge pool and underground works coordinating the construction supervision.

Supplementary Studies for the Upper Karnali Hydroelectric Project, Nepal
Acres International (funded by the World Bank)
Project Manager for the supplementary studies for the 300 MW Upper Karnali Hydroelectric Project in Nepal carried out in preparation for construction approval submissions. The feasibility study was initially carried out by Acres under the Medium Hydro Study Project funded by the World Bank. The supplementary studies involved the EIA and cadastral surveys for 100 km of 220 kV transmission line, EIA and cadastral survey for 22 km of access road between the intake and powerhouse, Glacial Lake Outburst Flood (GLOF) studies, investigation of new headworks layout and supplementary hydraulic studies for the lower reaches of the Karnali River to determine the effect on aquatic habitat. This work was suspended in the initial stages due to political problems in the country.

Misema Hydroelectric Project, Canada
Green Energy Developers, Toronto, Canada
Project manager for the 3 MW Misema Hydroelectric Project, near New Liskeard Ontario during the preparation of the final engineer's estimate, application documents for construction approval and the preparation of the bid documents for the procurement of the electromechanical equipment. The project layout comprised a low concrete weir to divert water into an intake and power waterway through a ridge to develop the available head at a series of rapids in the Misema River. The project was located in an area of deep unstable sands prevalent along the banks of the Misema river and after studying various options the f 0.9 steel penstock was located below the sand in a f 2.6 tunnel constructed through the underlying rock and the intake adapted to a dropshaft type. The surface powerhouse contained 2-horizontal Francis units.

High Falls Hydroelectric Project, Canada
Beaver Power Company
Project Manager for the studies carried out for the rehabilitation of the 3MW High Falls Hydroelectric Project, north of Thunder Bay, Ontario. The project comprised some 30m of woodstave penstock leading from a power intake at the head of a set of rapids in the High Falls River to a single horizontal axis Kaplan unit. The project had flooded during the spring freshet some years before. The remedial measures included: redesign of flood protection walls; design of access walkways inside; rehabilitation of the generator and controls damaged during the flood; and preparation of a budget cost estimate for the Client.

El Canada Hydroelectric Project, Costa Rica
Energía Global, USA Private Developer
Provided engineering support on the detailed design of the 60MW El Canada Hydroelectric Project in Costa Rica. The project comprised a small weir intake and desilting structure located immediately downstream from an existing concrete gravity dam, the storage for which had become depleted due to siltation.
The spill from the upstream dam was diverted into an 800-m-long f 1.2 m low-pressure buried steel pipeline, which led to a storage reservoir excavated in volcanic tuff and lined with a PVC liner. The storage tank was connected by another intake and surface penstock to a surface powerhouse, housing 3-Francis turbines.

Brilliant Dam Expansion Studies, British Columbia, Canada
Columbia Power Corporation
Project Engineer responsible for the conceptual studies for the 100 MW Brilliant Dam Expansion Studies on the Kootenay River in British Columbia. The conceptual studies formed the basic technical information to be included with EPC documents. The work involved preparation of layouts and cost estimates for surface and underground options for the addition of a new powerhouse, with a single Kaplan turbine to capture spill flows at an existing dam and power installation. The work included investigations of options for disposal of spoil from the excavations to satisfy strict environmental regulations on what was an important salmon river in British Columbia.

Ethiopia Long-Range Generation Plant
Ethiopian Electric Power Corporation (EEPCO)
Hydroelectric Specialist on the Ethiopia Long-Range Generation Plan for EEPCO funded by the African Development Bank. Responsible for bringing cost estimates for candidate projects at different levels of study to a common base for input into the planning model. Projects included the Chemoga Yeda, Beles and Halele Werabasa projects, which are currently in the design stage.

Dona Francisca Hydroelectric Project
Inter-American Development Bank
Project Manager for the Independent Engineer Review for the design and construction of the 125-MW Dona Francisca Project on the Jacui River in the state of Rio Grande do Sul in the South of Brazil. The project comprised a 58-m-high, 610-m-long gravity dam constructed of RCC, a free overflow spillway constructed of RCC and conventional concrete, and a surface powerhouse, housing two Francis units.

Alto Cachapoal Project
Bechtel, USA & Andrade Gutierez, Brazil (Project Developers)
Project Manager for a supplementary design phase of the 180-MW Alto Cachapoal Project in Chile, with the objective of reducing the capital cost of the project. The project comprised a number of small intakes and desilting structures diverting water from small catchments, adjoining the main Cachapoal catchment to a central reservoir and intake, which lead to a power tunnel and underground powerhouse. This phase of the work involved revisions to the project layouts to include basic low-cost, high-maintenance structures. This culminated in a three-day value engineering exercise by specialized consultants to identify the lowest cost alternative.

Screening and Ranking of Medium Hydropower Study Project
NEA (Nepal Electricity Authority)
Project Manager for the feasibility studies and Project Engineer for the screening and ranking phase of the Medium Hydropower Study project, Nepal. The first phase of the project involved the screening and ranking of 138 projects defined as medium-scale in the Nepal context to lie in the range from 10 MW to 300 MW. From the 138 projects seven projects were selected for full feasibility study and environmental impact assessment study, through a coarse and fine screening process, using both environmental and technical parameters. The MHSP team carried out three of the studies, namely 300-MW Upper Karnali, 300-MW Dudh Koshi and 100-MW Tamur-Mewa. Local consultants under the supervision of the MHSP team carried out the remaining four in the 10-MW to 50-MW range, namely Rahughat, Likhu, Budhi Ganga and Kabeli A. The Upper Karnali Project comprises a gated barrage type intake (3-12m high by 12m wide gates) and large desanding structure (190m3/sec flow), approximately 2km of power tunnels ranging in diameter from 11m for the unlined headrace tunnel to 8.0m and 6.0m for the concrete lined and steel lined respectively, an underground surge shaft and underground powerhouse with 4-Francis units. The Dudh Kosi Project features a 180m high zoned fill dam and approximately 11km of power tunnels with a range of

diameters of 11m to 6.0m depending on the lining condition and an underground powerhouse housing 4 -Francis units. The remaining projects have similar layouts comprising a free overflow concrete weir, desanding structures power tunnels and underground powerhouses.

Jebba Hydroelectric Project
NEA (Employer:Montreal Engineering Company Ltd.)
Provided engineering support to the field staff during construction, reviewing contractor's designs and diversion schemes, for the 560-MW Jebba Hydroelectric Project in Nigeria. Also responsible for the detailed design and preparation of construction drawings for a 15,000-m3/s underflow spillway and a 200-m-long, 12-m-wide, 30-m-tall lift navigation lock for the project.

Addalam Hydropower Project
ConWest Exploration Co. Ltd. of Canada
Modifications to the layouts and preliminary design of component structures for a build-operate-transfer (BOT) bid on the 46-MW Addalam hydropower project in the Philippines.

Rehabilitation of Big Eddy Dam
Inco Sudbury, Canada
Coordinator for the rehabilitation study of the 159-ft-high Big Eddy Dam, near Sudbury, Ontario. The work included evaluation of structural stability, review of construction methodology and preparation of a detailed cost estimate.

Birr and Koga Irrigation Project, Ethiopia
Ministry of Water Resources, Ethiopia
Preparation of layouts and preliminary design of hydraulic structures for the 320,000-ha Birr and Koga Irrigation project in Ethiopia. The project included two assignments of two and a half months between 1994 and 1995.

Trishuli Devighat Hydroelectric Complex
Nepal Electricity Authority (NEA)
Supervision of detailed design and preparation of construction drawings for the 31.5-MW Trishuli Devighat hydroelectric complex, Nepal. Four short-term assignments of two months and a four-month assignment on the construction site.

Aleltu Hydroelectric Project
Ethiopian Electric Power Corporation (EEPCO)
Civil design coordinator responsible for layout and design of civil works including the underground powerhouse and related works for the feasibility study of the 300-MW Aleltu hydroelectric project. Two 2-month assignments in Ethiopia and completion of design work in Canada.

JOHN YOUNG, P.Eng.

PRINCIPAL GEOTECHNICAL ENGINEER

KEY QUALIFICATIONS

John Young is an experienced geological engineer with over 30 years experience in the geotechnical and geological engineering aspects of major hydroelectric projects in Canada and overseas. Main responsibilities include geological investigations, geotechnical design and construction supervision for dams, tunnels and underground powerhouses, grouting design and supervision. Project highlights include:

Resident Geotechnical Engineer during construction of the 200-m-high arch dam and 2000 MW underground powerhouse of the Karun 3 project in Iran during 1997 to 2005;

Senior Rock Mechanics Reviewer for the Shuibuya hydroelectric project in China during 2002 and 2003;

Principal Geotechnical Engineer for the Lesotho Highlands Development Authority in Lesotho in 1996. Responsible for various consultants' activities on the Katse arch dam, the water transfer tunnels, the Mohale dam and powerhouse, and the Matsuko diversion project;

Senior Geotechnical Specialist for British Columbia Hydro during investigations and remedial works to repair sinkholes in the 200-m-high rockfill Bennett Dam in 1996;

Geotechnical Liaison Engineer during a major program of trial excavations, in-situ rock mechanics testing, trial grout tests and grout curtain construction for the planned Conawapa Generating Station in Manitoba, Canada;

Geotechnical Coordinator for detailed site investigations and rock mechanics design work for over 30 km of tunnels and an underground powerhouse in 1994 and 1995 at the Alto Cachepoal Project in Chile; and

Design and construction supervision for embankment dams in Canada and the United States.

EDUCATION

BS/BSc, Geology Memorial University of Newfoundland, Canada
MS/MSc, Engineering Geology and Geotechnics University of Leeds, UK

Licenses and Professional Memberships
Professional Engineers of Ontario and Newfoundland and Labrador,

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EXPERIENCE RECORD

Ladore Falls Dam Geotechnical Services
BC Hydro and Power Authority
Provide studies and derive geotechnical parameters for stability analyses of the bedrock foundation of the Dam.

WAC Bennett Dam –Dam Safety Review
BC Hydro and Power Authority
Project Engineer to identify performance expectations, including flood and earthquake criteria, based on the BC Hydro Dam Safety Management Manual and 1007 CDA Guidelines; Review available documents for evidence of conformance with dam safety requirements; Determine the dam's conformance with the set of dam safety expectations; Identify any additional dam safety requirements to enhance risk management and to incorporate appropriate international practices.

White River Hydro Project
Regional Power Opco, Inc.
Project Engineer for the White River Hydroelectric Project. White River project consists of two hydroelectric projects located approximately 30 km northwest of White River, Ontario, consisting of (i) Gitchi Animki Bezhig facility (the "Upper White River Project") being located approximately 3.2 km downstream of the existing MNR-operated White Lake Dam, and (ii) Gitchi Animki Niizh facility (the "Lower White River Project") being located approximately 1.6 km downstream of Chicagonce Falls. The two sites are situated approximately 12 km apart on the river. MWH is involving in Preliminary/Detail/Final design as well as Support during construction and commissioning.

Kalai II Hydroelectric Project
Larsen and Toubro
Senior Geotechnical Engineer for feasibility investigations and geotechnical design a 160 m dam, alternative surface and underground powerhouses and associated tunnels for the 1200 MW hydroelectric project in northern India.

Susitna-Watana Hydroelectric Project
Alaska Energy Authority
Provide review of site conditions and geotechnical design criteria review.

Oskan and Berkman Hydroelectric Projects
AEI Services LLC
Lead Geotechnical Engineer to perform due diligence services for the Oskan and Berkman Hydroelectric Projects on the Ceyhan River, in southern Turkey. This project is at an advanced stage of construction and consists of two nearly identical hydroelectric developments that consist of 25 to 30 m high embankment dams, concrete gate structures and surface powerhouses of 25 and 35 MW capacity. Visited the site and reviewed and the design documents of the facilities. Carried out a number of limit equilibrium and finite element analyses to verify various project designs. The work included assessments of the embankment dams which are founded on thick alluvium at both sites, bedrock foundations of the concrete spillways and powerhouses, grout curtain designs, seismicity parameters and the stability of the100 m high excavated rock slope at the Oskan site.

Panama Canal,Third Set of Locks Project
Impregilo
Senior Geotechnical Reviewer for ongoing design work for excavation for the locks and lock chambers on the Pacific and Atlantic ends of the Panama Canal. The Lock excavations will be 20 to 40 m deep and will be cut into overburden and bedrock in an area subject to intense earthquake activity

Huanza Hydroelectric Project
Empresa de Generación Huanza S.A (Minera Buenaventura)
Senior Geotechnical Engineer for geotechnical evaluations and design of a 90 MW surface powerhouse, 10 km long and 4 m wide power tunnel and a 25-m-high RCC dam of the Huanza Hydroelectric Project in the Andes Mountains of central Peru. Developed and monitored a program of geological mapping, geology compilation work, structural interpretations and geo-mechanical assessments in a sequence of folded and faulted andesite, pyroclastic and sedimentary rocks. Carried out geotechnical assessments and developed geotechnical design parameters for surface and underground works. Currently working on final geotechnical designs and construction drawings. Construction of the project will commence in early 2010.

La Higuera Hydroelectric Project
Pacific Hydro
Senior Geotechnical Engineer for due diligence review and design studies to assess squeezing rock problems and remedial designs for 16 km long and 5.9 m wide power tunnel. The tunnel is constructed in non-durable argillaceous tuffs that are susceptible to time dependant squeezing deformations.

Chicayes Hydroelectric Project
Astaldi
Senior geotechnical engineer for geotechnical assessment and design work for design-build contract design of 8 km long power tunnels, 10 km long canal and a 150 MW surface powerhouse in the Andes Mountains of central Chile. Actively involved in geotechnical design and construction aspects of this ongoing EPC contract.

Singoli Bhatwari Project
Larsen and Toubro
Senior Geotechnical Engineer for design and construction review of the 90 MW surface powerhouse, 10 km long power tunnel and a 10-m-high concrete dam of the Singoli Bhatwari hydroelectric project in northern India.Carried site inspections, data assessment, detailed geotechnical designs and reviews of all geotechnical design aspects of the project. Ensured that the geotechnical aspects of the projects complied with internationally accepted standards.

Waneta Hydroelectric Project
Client: Kiewit
Senior geotechnical engineer for geotechnical assessment and design work for design-build contract design of twin power tunnels and a 400 MW surface powerhouse in southern British Columbia.Assessed the engineering geology and geotechnical design of the existing gravity dam and power facilities. Directed additional field investigations for the planned new power facilities.Produced geotechnical designs for underground works, surface excavations, cofferdams and related facilities.

Cachapoal Hydroelectric Project
Client: Pacific Hydro
Senior geological engineer in charge of geological mapping, drilling and geotechnical laboratory testing in the Andes Mountains of Chile. The planned project consists of four tunnels with a combined length of over 30 kilometres, four river diversion structures and an underground powerhouse with a planned capacity of 300MW.Supervised geological mapping, geology compilation work, structural interpretations and geo-mechanical assessments in a sequence of complexly folded and faulted andesite, pyroclastic and sedimentary rocks. Carried out a geological hazard risk assessment of the project. Produced regional and local geological maps and profiles for the various underground and surface structures.Participated in value engineering work with the owner?s design engineers and the lending bank?s review engineers to optimize all aspects of project design, excavation methodology and rock mechanics measures

Dasu Hydropower Project
Client: Water and Power Development Authority
Chief Geotechnical Engineer. Responsible for feasibility investigations and geotechnical design of the dams and underground powerhouse structures in the Himalayan Mountains of the Northwest Frontier Province of Pakistan.?The project concept consists of 235-m-high concrete-faced rockfill dam (CFRD) and 105-m-long reservoir. The spillway will have six radial gates, each 20 m^2, and design flood capacity 23,000 m^3/s. The project has a 25 m wide, 400 m long, 60 m high underground powerhouse and five 10 m diameter tailrace tunnels that will be 5 to 7 km long. Total installed capacity of the power facilities will be 2,700-MW with 10 units.?Carried out walkover field assessments of the various alternative dam and powerhouse sites during the Phase 1 site selection studies. Participated in site comparison studies and the selection of a final scheme that was studied to full feasibility level. Supervised a comprehensive site investigation program that included regional and detailed geological mapping, drilling of 25 boreholes, construction of two exploratory adits, materials testing and geophysical studies. Carried out geotechnical assessments of the investigations results, rock mechanics design of the dam, surface excavations and underground structures. Supervised all limit equilibrium and finite element stability studies for the slopes, tunnels and underground powerhouse.

Jinping Project Technical Review
Client: ERTAN
Senior Geotechnical Engineer. This project includes the world?s highest arch dam, which is 230 m high, and underground powerhouse constructed in Sichuan Province. Participated in two missions, one-month duration each, to the Jinping project site in China.?Responsible for review and revision of rock mechanics designs for the arch dam. Carried out a series of finite element and a limit equilibrium analyses to verify project designs and geotechnical parameters.

Dniester Pumped Storage Project
Client: EDF/World Bank
Lead Geotechnical Engineer to perform due diligence services for the proposed World Bank investment program to complete the first phase (3 units, each 350 MW, out of a potential 7 units) of the Dniester pumped storage project. Visited the site and worked with the local Design Institute and Hydro Company to review and assess the design of the facilities. Carried out a number of limit equilibrium and finite element analyses to verify various project designs. The project consists of an artificial upper reservoir created by means of a 7 km long ring earth fill dam 26 m high; a water intake structure joining 7 separate intakes; vertical shafts (depth around 100 m and 7.5-m diameter), inclined penstocks (400-m length and 7.5-m diameter); individual pit powerhouses; and downstream inclined tunnels (120 to 150-m length and 8.2-m diameter 8.2 m). Served as lead geotechnical engineer to perform due diligence services for the proposed World Bank investment program to complete the first phase (three units, each 350 MW, out of a potential seven units) of the Dniester pumped storage project. Carried out site inspections and worked with the local Design Institute and Hydro Company to review and assess the design of the surface and underground facilities. The findings of this work were included in the World Bank assessment of the viability of this project.

Slave River Project
Client: Trans Canada Pipeline
Senior geotechnical engineer for hydroelectric planning and feasibility studies on the Slave River in Northern Alberta. Carried out geotechnical feasibility level design works and assessments for the 2 km long, 45 m high planned Slave River Dam and 1200 MW surface powerhouse. This site is characterized by granitic riverbed foundation and glacio-fluvial riverbank deposits.

Karcham Wangtoo Project, India
Client: Jaiprakash Associates Limited (Employer:Hatch Acres Ltd)
Senior Geotechnical Engineer for a due diligence review of the 100 MW underground powerhouse, 17 km long power tunnel and a 40-m-high concrete dam of the Karcham Wangtoo hydroelectric project in northern India. Acting as lender's engineer, carried out a site inspection and a detailed geotechnical review of all geotechnical design aspects of the project.

Khazir Gomel Project
Client: Ministry of Water Resources, Republic of Iraq
?Assessed the engineering geology and geotechnical design of the planned 105 m high Bakerman damsite. ?Reviewed geotechnical criteria for arch dam and RCC alternative designs. Established geotechnical design parameters for the new RCC dam design.. Produced design drawings and contributed to schedules and cost estimating for this project.

Albany River Project
Client: OPG
Senior geotechnical engineer for geotechnical design for hydroelectric planning and pre-feasibility studies on the Albany River in Northern Ontario. Carried out geotechnical prefeasibility level design works and assessments for the Chard and Hat Island damsites. These sites are characterized by karstic limestone and weak shales foundations. The final dam will be a 25 to 35 m embankment structure with a surface powerhouse.

Dniester Pumped Storage Project
Client: EDF/World Bank
The project consists of an artificial upper reservoir created by means of a ring earth fill dam 26 metres high and 7,35 kilometres long; a water intake structure joining seven separate intakes; vertical shafts (depth around 100 metres and 7.5-metres diametre), inclined penstocks (400-meters length and 7.5-meter diametre); individual pit powerhouses; and downstream inclined tunnels (120 to 150 metres in length and 8.2-metre diameter). Served as lead geotechnical engineer to perform due diligence services for the proposed World Bank investment program to complete the first phase (three units, each 350 MW, out of a potential seven units) of the Dniester pumped storage project. Carried out site inspections and worked with the local Design Institute and Hydro Company to review and assess the design of the surface and undergorund facilities. The findings of this work were included in the World Bank assessment of the viability of this project.

DON CRONE, P.E.

LEAD CONSTRUCTION / COST SCHEDULER

KEY QUALIFICATIONS

Mr. Crone has over 35 years of experience in the engineering and construction industry. His extensive experience includes project planning, estimating, contracts, and allocation of labor and equipment resources, scheduling, budgeting and overall project execution. Mr. Crone's process for cost estimation includes site visits, reviewing local labor rates, developing equipment rates, and obtaining material prices and subcontractor quotes. The estimate is then developed by crew base estimating by performing quantity takeoffs and applying reasonable production rates for the crews. The estimates are prepared with direct cost and indirect cost with markup and appropriate contingencies added. These estimates are prepared to an AACE Class 2 estimate level. Mr. Crone's process for developing project schedules entails applying the correct predecessors and successors to work activities to accomplish the project. The work activities are assigned durations from the cost estimating process. During this process the plan and specification reviews are accomplished to Quality Control the final plans and specifications. Mr. Crone has progressed from surveyor, office engineer, field engineer, project engineer, estimator, project manager, operations manager to Vice President of Operations of a top 10 ENR construction company.

EDUCATION

BS Civil Engineering, Tri State University

Licenses and Professional Memberships

Professional Engineer – WY, MD, KY

EXPERIENCE RECORD

Ruskin Powerhouse Rehabilitation

BC Hydro

Cost Estimator. Identification Phase work (detailed feasibility studies) to develop a preferred alternative for comprehensive rehabilitation, modernization, and improvements to the Ruskin powerhouse, a 1930 vintage plant housing three vertical-shaft, 35 MW Francis-type turbines and generators. Overall scope is to support BC Hydro in developing a preferred alternative for comprehensive rehabilitation, modernization, and improvements to the Project intakes, generating unit water conveyances, generating units, plant auxiliary equipment and systems, and powerhouse structure.

Lower Baker Floating Surface Collector

Performed cost estimates for Puget Sound Energy's Lower Baker floating surface collector (FSC). Estimated costs for the FSC hull and floatation structure, on-board fisheries facilities, net transition structure, guide nets, mooring lines and winches, and the shoreside facilities including buried and submarine power feeds, piers, docks and fish handling facilities.

Blue Diamond Pump Storage Project

Las Vegas, Nevada

A joint venture with PKS (Peter Kewit & Sons. Performed cost estimates for the construction of a 300 Million Design Build Pump Storage project. The project consisted of an upper and lower reservoir, intake shaft, power tunnel, underground power house, and tailrace tunnel and outlet.

Bakun Hydropower Project

Ahmad Zaki Sdn Bhd, Malaysia

Senior estimator and construction specialist assisting the contractor with construction planning and preparation of cost estimates for construction of the spillway and power intake works for the Bakun Hydropower Project in Malaysia. Construction involves 500,000 cubic meters of concrete placement with a completion period of about two years

Karahnjukar Dam and Hydropower Project
Landsvirkjun, Iceland
As a Construction Specialist, assistance was provided to the Owner with cost analysis, change order negotiations, and schedule impacts with the contractor on site. Construction involved 8,500,000 cubic meters of rock fill dam that is 650 ft high with a concrete face slab. The project also has diversion tunnels, access tunnels and grouting tunnels. The concrete toe wall has approximately 60,000 cubic yards of concrete.

Al Wehdah Dam
Performed an AACE class 2 cost estimate and schedule for the construction of a 1,300,000 cubic yard, RCC dam that is 70 meters high, requiring the development of a quarry, intake towers, and steel conduits to a discharge structure.

Portugues Dam
U. S. Army Corps of Engineers
Principal Estimator. Performed an AACE class 2 construction estimates for construction of the spillway and power intake works. This dam is a double curvature arch dam with a height of 220 feet and a crest length of 1317 feet that contains 200,000 cubic yards of concrete, also performed an alternate class 2 estimate for the construction of a RCC dam.

Folsom Dam Spillway Project
Joint Federal Project: U. S. Army Corps of Engineers, Department of Interior Bureau of Reclamation
Performed scheduling and phasing tasks for the spillway construction and recommendations on construction work packages and staging considerations The project consists of civil work including mass excavation and construction of a new control structure and new spillway at Folsom Dam in Folsom, CA. The concrete spillway will be constructed to control flows associated with 100-200 year flood events. Six submerged Tainter gates will be installed at the control structure to accomplish this. The project is value at $875 M and will extend to the year 2016.

Broomfield Dam & Reservoir Project
City of Broomfield
Cost estimator and scheduler for this project, which the project consists of the construction of a 3,000,000 cubic yard earthen dam embankment with a height of 90 feet and a crest length of 4700 feet. A grout curtain will be constructed extending from the central core trench to the underlying impervious foundation zone. Water deliveries to a water treatment plant from the reservoir will be from new welded steel piping. Structures on the project are a pumping plant, outlet tower, spillway outfall structure, drainage structures and pipelines.

Iowa Hill Hydropower Project
Sacramento Municipal Utility District (SMUD)
Performed a feasibility estimate for a pump storage project consisting of a 2100 acre foot to a 6500 acre foot upper reservoir, intake shaft, power tunnel, under-ground powerhouse and tailrace tunnels. The power generation was comprised of combinations different size upper reservoirs and power generation from two 125MW Units to two 200MW Units.

Lake Mead Intake No. 3 Pumping Station
Southern Nevada Water Authority, Henderson
Cost estimator and scheduler for this project, which consisted of civil work including mass excavation and grading of the new pump station with 22,390-foot pumps, surge chamber and a 50-foot diameter surge tank, site and yard, site utilities, access road, and view beams. Underground civil work included a 26-foot inside diameter concrete lined shaft 390 feet deep, and construction of a fore bay cavern. Tunneling consisted of approximately 2,200 feet of modified horseshoe tunnel 14 feet wide by 16 feet high, including tunnels connecting to the fore bay and 300 feet of connector tunnel. Pumping station work consisted of vertical turbine pumps and motors, ancillary systems such a HVAC and plumbing, the pumping station building, and raw-water 84-inch discharge pipelines.

Lake Mead Intake No. 2 Connection and Modifications
Southern Nevada Water Authority, Henderson
Provided cost estimating and scheduling for the Lake Mead Intake No. 2 Connection and Modification. The project consisted of the construction of a 22-foot-diameter concrete-lined shaft, 377 vertical feet, with the installation of a gate and electrical driven gate hoist, electrical equipment, and controls. Tunneling consisted of 536 lineal feet of modified horseshoe tunnel 14 feet wide by 16 feet high. Chemical feed lines installed in IPS-2 existing tunnel and shaft and installation of electrical and control systems.

Calaveras Dam Replacement
San Francisco Public Utilities Commission
Responsible for providing cost estimating and scheduling. Project involves the replacement of the existing Calaveras Dam with a new earth fill dam consisting of 4,000,000 cubic yards of zoned embankment to be constructed from borrow sources and project excavations. Excavations involve dam foundation, 1,800,000 cubic yards and 2,300,000 cubic yards of spillway excavation. The project also will consist of the construction of a new outlet works and a concrete spillway with 49,000 cubic yards of concrete

San Joaquin Pipeline System
San Francisco Public Utilities Commission
Provided cost estimating and scheduling. The project consists of the installation of 55,000 feet of 92-inch welded steel pipeline and valve vaults. The project also included four trench-less crossings involving large-diameter micro-tunnels.

Crystal Springs/San Andreas Transmission System Upgrade
San Francisco Public Utilities Commission
Provided cost estimating and scheduling for the construction of a new pump station consisting of a building 165 feet by 55 feet with four 2500HP pumps. The modifications of four outlet towers, all towers require under water demolition and construction of multilevel outlets at each tower, while maintaining water service with the existing pump station and pipelines. The project also includes the rehab and new construction of a 60in steel pipeline, and reconstruction of inlets and outlets at Crystal Springs Dam.

Olivenhain–Hodges ESP/Pumped Storage Projects
San Diego County Water Authority
Prepared the project cost through feasibility to 65 percent planning phase. Major features of the pumped storage project consist of a 5,700-foot-long pressure tunnel in very hard rock that will connect to the existing inlet/outlet structure in the Olivenhain Reservoir; a two-unit 40-MW pump house with reversible Francis pump-turbines; and a tailrace tunnel and inlet/outlet structure in Lake Hodges.

Bakun Hydropower Project
Ahmad Zaki Sdn Bhd
Senior Estimator and Construction Specialist assisting the contractor with construction planning and preparation of cost estimates for construction of the spillway and power intake works for the Bakun Hydropower Project in Malaysia. Construction involves 500,000 cubic meters of concrete placement with a completion period of about two years.

RYAN BLISS, P.E.

ELECTRICAL ENGINEER

KEY QUALIFICATIONS

Mr. Bliss is an accomplished Transmission Line Engineer, Engineering Project Manager and Engineering Team Manager. Mr. Bliss is an experienced and accomplished user of the PowerLine Systems, PLS suite of software programs.

EDUCATION

BS/BSc, Civil Engineering University of Utah
ME/MEng, Civil Engineering University of Utah, 2005

Licenses and Professional Memberships

Professional Engineer, Structural, 2797329, Utah, 2008; Professional Engineer, 38968, Wisconsin, 2007; Professional Engineer, 19764, New Mexico, 2009; Professional Engineer - Civil, 50707, Arizona, 2010; Professional Engineer, 43715, Colorado, 2009
American Society of Civil Engineers (ASCE)

EXPERIENCE RECORD

Double Circuit 34.5 kV Fox River Crossing
Kaukauna Utilities
Engineering Project Manager for the Double Circuit 34.5 kV Fox River Crossing Project, responsibilities included the design of a double-circuit steel monopole and accompanying reinforced concrete foundations. The project utilized unique structure framing and high-temperature, high-strength conductor in order to meet long span, 1500 feet and future load requirement needs of the project. Responsibilities also included oversight and assistance of the construction bid process as well managing the procurement of all project material and construction support. (2009 – 2011)

Iron Horse to Salvador 230/138 kV Transmission Line
La Plata Electric Association
Engineering Project Manager for the design of the 138 kV transmission line loop to feed the new Iron Horse substation and a new double circuit 230/138 kV transmission line to feed the new Salvador substation. The line incorporated the design of steel tangent, angle and dead-end structures. All steel structures also had accompanying reinforced foundations designed. (2009 – 2011)

Pre-Certification - Monroe County to Council Creek 161/69 kV Double Circuit TSP
American Transmission Company
Engineering Project Manager for the development and preliminary design of a 17 mile 161/69 kV double-circuit transmission line. The preliminary design for this project consisted of structure design configuration for use in areas of limited ROW width, T2 conductor, multiple switch and substation interconnections which included the analysis of difficult routing and structure spotting. Many unique and specialized structure designs were also developed in-order to accommodate existing obstacles of the selected line route. Preliminary activities also included the development of project cost estimates, EMF analysis, FAA analysis, and satisfying the design requirement of four distinct entities. (2009 – 2011)

TRTP - Segment 6 - 500 kV LST & TSP
Southern California Edison
Responsibilities as Segment Design Lead / Project Manager for this 500 kV rebuild project included steel monopole, multi-pole and lattice tower analysis and evaluation, leg extension selection and design of reinforced concrete

foundations for all structure types. This line posed many challenges for structure and leg extensions selection as it traversed through the mountains of the Angeles National Forest for its entire 32 mile length. Design of long spans, many in excess of 2500 feet, was necessary for the majority of the project as spotted structure locations were limited due to terrain and environmental constraints. (2008 – 2011)

TRTP Segment 7 - 500 kV LST & TSP
Southern California Edison
Responsibilities included supporting the design teams during design and Engineering. Lead for the detailed design of all foundation systems for both segments, which included both Lattice and steel pole construction. Design?s included incorporating specialty foundations (Micro-Pile) for the most difficult locations. (2008 – 2011)

TRTP Segment 11 - 500 kV LST & TSP
Southern California Edison
Responsibilities included supporting the design teams during design and Engineering. Lead for the detailed design of all foundation systems for both segments, which included both Lattice and steel pole construction. Design?s included incorporating specialty foundations (Micro-Pile) for the most difficult locations. (2008 – 2011)

LiDar Post Processing, PLS Modeling & Rating Analysis
American Transmission Company
Numerous projects over several years involving Post Processing of LiDar Survey data, PLS modeling of processed LiDar Data and Line Rating Analysis for more than 2500 miles of transmission lines. Responsibilities included managing a team environment focused on transmission line rating services and value added engineering solutions for line uprating recommendations. Rating reports include capacity analysis, methodology, thermal rating results, clearance diagrams and recommended upgrading solutions. (2001 – 2011)

Arden Substation Buildout - 230 kV Quad Circuit TSP
Nevada Power Company
Engineering Project Manager for the transmission structures associated with a major substation expansion. Project consisted of twelve double and quad circuit 230 kV and 138 kV dead-ends on self-supporting steel reinforced concrete foundations along with two tangent structures. Responsibilities included managing a team environment focusing on electrical transmission line design, PLS-CADD Modeling & QC, Developing & checking loads, clearances, drawings and designs. Responsible for the Scoping, Estimating, Budget Adherence, Schedule Adherence, and Quality Control of the construction documents, specifications and drawing packages. (2006 – 2007)

LiDar Post Processing, PLS Modeling & Rating Analysis
Nevada Power Company
Numerous projects over several years involving Post Processing of LiDar Survey data, PLS modeling of processed LiDar Data and Line Rating Analysis for more than 2000 miles of transmission lines. Responsibilities included managing a team environment focused on transmission line rating services and value added engineering solutions for line uprating recommendations. Rating reports include capacity analysis, methodology, thermal rating results, clearance diagrams, span violation descriptions and recommended upgrading solutions. (2001 – 2004)

STAN HAYES, P.E.

MECHANICAL B.O.P ENGINEER

KEY QUALIFICATIONS

A mechanical engineer with more than 30 years of professional experience, Mr. Hayes is skilled in the management and design and/or refurbishment of water resources projects, including all mechanical elements. He has been responsible for the study, selection, design coordination, installation and testing of a wide range of new and rehabilitated equipment for hydroelectric facilities and hydraulic structures. His expertise includes project management, cost estimating, preparation of design memoranda and contract documents, analysis of bids, review of suppliers' drawings, shop inspection, and start-up and testing of equipment. He routinely investigates and resolves technical problems during the selection, design, manufacture, installation, testing and operation of equipment and projects. Mr. Hayes has also conducted planning studies and prepared cost estimates related to water resources projects, including specifically hydraulic machinery and/or mechanical equipment for more than 50 projects.

EDUCATION

BS/BSC, Mechanical Engineering, University of Illinois (Urbana-Champaign), 1976

Professional Registration: Professional Engineer, 062-040776, Illinois, 1982

EXPERIENCE RECORD

Ruskin Powerhouse Improvements Project

BC Hydro

Project manager and lead mechanical engineer for Identification Phase work (detailed feasibility studies) to develop a preferred alternative for comprehensive rehabilitation, modernization, and improvements to the Ruskin powerhouse, a 1930 vintage plant housing three vertical-shaft, 35 MW Francis-type turbines and generators. Overall scope is to support BC Hydro in developing a preferred alternative for comprehensive rehabilitation, modernization, and improvements to the Project intakes, generating unit water conveyances, generating units, plant auxiliary equipment and systems, and powerhouse structure. Work includes review of operation and maintenance records and previous studies and reports; detailed physical examination of features, structures, equipment, and systems, in-depth interviews with plant, project, and management staff; development of User Requirements and Working Design Bases; development and evaluation of alternatives, selection/development of a preferred alternative, and development of plans for Definition and Implementation Phase work. All work will incorporate Safety by Design principles and practices.

Boundary Hydroelectric Project

Seattle City Light

Mr. Hayes was the project manager for design services for rehabilitation and improvements of the Project Access Roads for the 1,051-MW Boundary Hydroelectric Project in Pend Oreille County, Washington.

Alice Falls Project

Long Lake Energy Corporation

In charge of preparing specifications and bidding documents for a 2.5 MW s-type unit. He also analyzed the bids for the equipment.

Cowlitz Falls Project
Lewis County Public Utilities District
Mr. Hayes was project manager of a multi-disciplinary team of MWH engineers acting as the Independent Engineer providing a triennial review of Lewis County PUD's Cowlitz Falls Project on the Cowlitz River in eastern Lewis County, Washington.

Humpback Creek
Cordova Electric Cooperative
Lead Mechanical Engineer responsible for preparation of specifications and bidding documents for hydraulic machinery including a 1MW Francis unit. Responsible for reviewing the manufacturer's submittals, providing technical support and coordination, and preparing designs, specifications, drawings, and bidding documents for the general mechanical systems, including piping, pumps, HVAC and cranes.

Due Diligence Review Services
Various Clients Nationwide
Responsible for the mechanical engineering aspects of due diligence reviews and analyses for a number of hydroelectric projects. His responsibilities included review of contract documents and bids, review of shop drawings, site inspections, review of quality control plans and documentation, review of staffing, review of project budgets and/or witnessing of plant start-up and testing. Performed work for the financing agencies involved with the projects. The projects include: (1986-Present)Upper Sterling Dam, IL (two 1MW pit units)Hannibal Lock and Dam, WV (two 18MW bulb units)Guilman Amorim Project, Brazil (four 35-MW Francis units)Pichi Picun Leufu Project, Argentina (three 80-MW Kaplan units)Chivor Project, Columbia (eight 125-MW Pelton units)Betania Project, Columbia (three 180-MW Francis units)Sidney S. Murray Hydroelectric Project, LA (eight 24MW pit units.)

Leaburg and Walterville Hydroelectric Plant Rehabilitation
Eugene Water and Electric Board
Project manager for plant upgrades and unit overhauls, including runner replacements and upgrades, generator rewinding, and plant automation. The turbine overhaul work includes two 9,500 Hp Francis turbines and a single 11,000 Hp Kaplan turbine. The turbine work primarily related to runner and seal ring replacements, governor replacements/modifications, wicket gate and guide bearing upgrades/refurbishments, and overall reconditioning of the units. Plant automation included PLC based controls for automating the turbine-generators, canal headgates, dam roller gates, and other control points.

Facilities Condition Assessment
Seattle City Light
Mr. Hayes was responsible for mechanical engineering aspects of this independent review of Seattle City Light's (SCL) Capital Improvement Program. Mr. Hayes performed independent assessments of the condition of selected water resource development, generation, transmission and distribution facilities, including five dams and associated hydroelectric generating facilities: Cedar Falls, Boundary, Ross, Diablo, and Gorge. The assessment included physical observations and inspection of each project's dam and spillways, water intakes and conveyance structures, generating equipment, auxiliary equipment and systems, powerhouse structure, and switchyard as well as interviews with each plant's operating and maintenance personnel, and review of inspection, maintenance, and availability/reliability data. The resulting report provided SCL with an independent opinion as to the state of its water resources infrastructure, including water control equipment and hydroelectric facilities.

Lower Saranac Project
Long Lake Energy Corporation
Responsible for preparing specifications and bidding documents for the hydraulic machinery at this facility. Equipment included two 3.5 MW s-type units.

East Canyon Dam,
City of Bountiful
Responsibilities as Lead Mechanical Engineer included the preparation of specifications and bidding documents for one 2.1MW Francis-type unit. Prepared designs, specifications, drawings, and bidding documents for associated mechanical systems, including large valves, piping, pumps, cranes and HVAC.

Abiquiu Dam Outlet Works Gates
U.S. Bureau of Reclamation
Mr. Hayes served as Project manager, responsible for the design of two high-pressure bonnetted slide gates, hydraulic operating cylinders, and hydraulic power operating system, to be installed in an existing underground gate chamber at the Abiquiu Dam in New Mexico.

Cordova Tidal Power Study
Tidal Electric
power applications using a unique development scheme developed by Tidal Electric, the use of a ring dike in a tidal pool area to impound water for hydroelectric generation. Mr. Hayes is the lead mechanical engineer, providing support in the areas of overall project layout, generating equipment selection and sizing, energy production estimates, and project cost estimates.

High Falls Project
Long Lake Energy Corporation
Prepared the necessary specifications and bidding documents for a 250-kW Francis-type unit.

Olivenhain Dam Design
San Diego County Water Authority
Provided guidance and technical review and oversight of a multi-port Inlet/Outlet Tower, downstream control facilities to provide maximum flexibility in routing water into and out of the reservoir from/to multiple locations, and equipment to provide emergency drawdown of the reservoir. Provided design and procurement support for piping, valves, operating systems, instrumentation and controls, and miscellaneous mechanical systems (HVAC, piping, and drainage). Overall design included three major iterations/revisions to arrive at final design. Provided overall oversight of mechanical and electrical design team of 5 engineers of an important off-source 24,000 acre-foot water storage dam. The final design reduced costs over 25% compared with the initial final design concept. Project has operated successfully since 2003, providing flexible storage and water routing to multiple end users.

Bonneville Dam Emergency Relief Gate
Portland District, Corps of Engineers
Project Manager/Lead Mechanical Engineer, Bonneville Project Fish Passage Gate. Site constraints limited room and resulted in high bearing loads. Researched and applied state-of-the-art self lubricating materials specifically designed for high bearing pressures. Managed design of a flap-type gate that provides emergency flow relief to fish passage facilities at the Bonneville Dam on the Columbia River. Supervised structural engineer, mechanical engineer, and CAD operator. The gate was fabricated and installed and operates well and reliably.Project Manager/Lead Mechanical Engineer, Bonneville Project Spillway Gate Automation Study. Evaluated site constraints, developed and sketched alternative physical operators and gate control technologies, performed an evaluation and rating of each alternative, and detailed the recommended alternative. Managed feasibility study evaluating ways to automate exiting vertical-lift spillway gate to meet demanding and highly varying spillway flow requirements. The final recommendations included new, semi-fixed wire type hoists and a PLC-based control system to automate operation of a total of 16 of the 18 spillway gates. The installed systems allow the project to meet varying spillway flow requirements under normal operation and flood events. IDIQ for Hydroelectric Power and Pumping Plant Engineering Design and Analysis Services - Hydroelectric Design Center, USACE, Portland District.

Kangneung Project,
Korea Electric Power Corporation
As Senior Mechanical Engineer Mr. Hayes was responsible for the preparation of specifications and bidding documents for two 43.5MW Pelton turbines and the associated spherical inlet valves and governing systems.

Green River Headworks Modifications
City of Tacoma
Provided technical review and oversight of all mechanical design work for modifications to the City of Tacoma's primary water source on the Green River, which involved raising an existing diversion dam eight feet, providing fish screens, and reorienting the intake structure. Mechanical elements included the design of the intake structure, new slide gates and stop logs for service closure and maintenance of gates and other structures.

Serra da Mesa Project
Nacional Energetica
Assisted Nacional Energetica (NE) with evaluation of equipment vendor qualifications and evaluation and ranking of proposals for supply and installation of hydraulic turbines, generators, and all major mechanical and electrical equipment and systems for this 1,200 MW hydroelectric project. Reviewed the Terms and Conditions for the subsequent Contract.

Cerron Grande Project
Comision Ejecutiva del Rio Lempa
Mr. Hayes reviewed manufacturers' submittals and witnessed index and load-rejection tests for two 69.3MW Francis turbines for the Cerron Grande Project.

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification Project
Los Angeles County Department of Public Works
Guided and approved design concepts developed during alternatives analysis; functioned as technical resource during design; performed formal review at designated design points. Provided technical guidance during design development and performed QA review at established review points. Project produced an integrated and optimal design to store flood flows and manage releases over a wide range of reservoir levels and inflow conditions.

San Vicente Dam Raise
San Diego County Water Authority
Led initial design development (to 15%), and then oversaw design development through final design. Provided guidance and technical review and oversight of a multi-port Inlet/Outlet Tower, downstream piping and valves to provide for routing of water into the reservoir and out of the reservoir from/to several sources/end locations. Also included piping and valves to provide emergency drawdown of the reservoir. Provided design support for piping, valves, operating systems, instrumentation and controls. Final design, which is just being completed, meets all project objectives at minimum cost.

Castaic Powerplant Condition Assessment and Modernization Project
Client: Los Angeles Department of Water and Power
Mr. Hayes, as project manager, is providing Owner's Engineering services for refurbishment of this 1,200 MW pumped storage project. Work at the project will include turbine refurbishment including runner replacement, inlet valve rehabilitation, motor/generator rewinds, updating of automation and controls to a state-of the art distributed control system, and refurbishment of balance of plant systems. Montgomery Watson Harza (MWH) services will include contract development, independent review of Contractor's condition assessment and optimization studies, review of final designs, witness inspections including physical model testing and major components, and support throughout filed work, including commissioning and field performance testing.

RON KROHN, P.E.

PRINCIPAL ELECTRICAL ENGINEER

KEY QUALIFICATIONS

Experienced in preparation of specifications, design review, field supervision of erection, field monitoring of quality control, preparation of plans for Engineer quality assurance program, participation in and/or direction of field commissioning activities, direction and/or performing of generator performance tests, and analysis test results. For new units, plan powerhouse development to include the requirements of potential generator vendors. Work with field teams to establish roundness and centering control to achieve specification and/or CEA tolerances for field stacked cores and field constructed rotors. Work with turbine designers to develop overall unit schedule when generator and turbine rehabilitation are combined. Maintain Project schedule and quality control through review of Contractor design drawings and procedures submitted in addition to monitoring work in progress. Utilize electronic drawings (CAD) and electronic documents (text) submittal, review and commenting to expedite the submittal process. Experienced in both conventional hydroelectric plant and pumped storage applications for design of units and peripherals. Experienced in design of variable speed units to take advantage of efficiency gains in pumped storage applications or conventional turbines applications with extreme head ranges.

EDUCATION

BS/BSc, Electrical Engineering University of Missouri

Professional Registration:

Professional Engineer: Nebraska, Alaska

EXPERIENCE RECORD

Rocky Mountain

Oglethorpe Power Corporation

Preparation of specifications for rehabilitation of generator/motors, specifically upgrading the field winding insulation system to allow the units to be operated continuously at 80 degrees C.

Basha Diamer Dam, Feasibility Report

WAPDA

Prepared feasibility level study for 4500 MW development of 12 x 375MW or 10 x 450MW in two underground powerhouses. Design details provided to establish underground excavation requirements and functional arrangement. System required use of 18 kV generators, SF6 generator circuit breakers, underground transformer yard, underground gas insulated substation (planned as 765 kV, but later determined impossible). Price estimates obtained for all major features, and concepts and layouts all provided as CAD files. Due to a high range of head fluctuation (~2:1), consideration to variable speed generators is given. Details on price, design and how to fit into powerhouse also provided

Basha Daimer Dam, Transmission Study

WAPDA

The planning had left the option of 765 kV and 550 kV because no vendors had provided data on 765 kV GIS. The study works were expanded to clearly show that there are some 16 GW of generation to connect to Pakistan, and that to do so with 550 kV along is not possible, due to the narrow transmission corridor. Either 765 kV or HVDC is needed to accomplish the job. To attract GIS vendors to the 765 kV portion of the work, details of the 2025 vision of the Government of Pakistan were released to prospective suppliers. Unfortunately, the response was not in the affirmative for supply of 765 kV GIS. Issue is still not resolved.

MWH

Lake Chelan Powerhouse Rehab Feasibility Study
Chelan County PUD
Worked with lead turbine engineer and clients team to produce a feasibility study concerning how to proceed with rehabilitation of the 75+ year old Lake Chelan Powerhouse. The original study was conceived as a turbine study, that evolved to include CFD analysis of the turbines, showing economic benefit to runner replacement, the economic need to replace the generator stators and field poles, upgrade the governors, and provided a list of items to the client for consideration in modernization of the balance of the station. Recommendations were to provide combined unit replacements to take advantage of a single disassembly of the unit, to avoid allowing the generator to fail in service for economic reasons, and a list of other suggested improvements for the balance of plant.

Bear Hydro Project, British Columbia
Regional Power Inc.
QA/QC for Hydrotechnical aspects. MWH is the Owner's engineer for this project which consisting of two hydropower facilities; Upper Bear and Lower Bear.

Malakand III Project, Package I & II review and Contract Negotiations
Shydo
81 MW hydroelectric project, 3 units, 500 rpm. Provided review comments to Packages I and II before issue of tenders in summer of 2002. In July 2003, traveled to Lahore for evaluation of tenders. Preliminary evaluation listings completed by local partners at Pakistan Engineering Services (PES). Final evaluation report compiled and issued while in Pakistan. Traveled to Peshawar to present report to Shydo and answer any questions they might pose. Successful tenderers for both packages are Chinese. Requested to return to Pakistan in January 2004 for contract negotiations. Led negotiation team and prepared Memorandum of Understanding for Package I and II. Principal negotiation issues for both packages were for contractor financing. Technical terms were successfully negotiated

Rocky Reach Generators Units C1-7
Chelan County PUD
Provide technical review of electronic design drawings and other technical documents for rehabilitation of generators. Information transmitted via an FTP site. Comments were coordinated between site team members, and documents issued to Contractor. Assisted in maintaining record of document reviews. Generator rehab included new stator frames, cores, stator windings, new rotor, new field poles, radially keyed soleplates, control of "large" hydroelectric generator air gap to +/-5% of the air gap, factory and lab visits to witness fabrication and design tests on stator bars, and all site testing associated with the new unit.

Rock Island Dam, Major Electrical Works Replacement Study
Chelan County PUD
Scope of work was to study transformer T1 and T2 replacement, and determine best method and size for replacement. Also study medium voltage cables and circuit breakers for generator voltage system and assess condition and need for upgrading and replacement. Study was started by subcontractor, and rejected by client. Study reviewed and redrafted into logical sections to create document that can be understood by readers. Short circuit study data and load flow data updated and presented in form that can be read by knowledgeable readers, identifying by highlight all conditions not within ratings. Study analyzed system between generator terminals and 115 kV McKenzie Switchyard. Revised study accepted by client.

Lake Chelan Static Excitation Systems
Chelan County PUD
Project was to replace the existing rotating exciters with new static excitation. As a preventative measure, a motor generator set was made active as a standby excitation system should a rotating exciter fail. Specifications were prepared for the system, reviewed by the PUD and issued. Bids were received and evaluated by the PUD. When the job was returned to my control, e-mail record file was established, drawing procedures were established to do drawing approvals electronically. All information was stored on a PUD server. Installation contractor was simultaneously working to supply its data for approval. Site location, erection, single lines, three lines, control drawings, and wiring drawings were all prepared in multi-color format. On site testing was directed to enable initial start. Liased with manufacturers commissioning engineer to ensure proper equipment calibration and operation. Worked with supplier to establish PUD training sessions and to obtain WEC models for the excitation and power system stabilizer

Kali Gandaki Project, Transmission Lines
Nepal Electricity Authority
Work consisted of one single circuit and one double circuit transmission line across some of the most undulating mountainside terrain imaginable. Led evaluation team for transmission line contract consisting of myself, IVO/Finland, and local seconded staff. In the interim between evaluation and award, rerouted the northern end to a different substation location than originally planned. Award to Tata Projects, India. In supervising the work, out the discovered a 40 degree surveying error that could have resulted in many bad real estate transactions. Negotiated a Variation Order with the Contractor to provide more of the largest tower sizes. Scope of work to contractor included determination of real estate requirements, permitting for right-of-way clearing, tree cutting and recovery of the timber, hand excavation or foundations, manual hauling of materials, manual concrete mixing and placement, manual erection of towers, controlled tension stringing, variation order for OPGW (fiber optic earth wire) and its installation.

Kali Gandaki Project, Resident Electrical Engineer
Nepal Electricity Authority
Negotiated for and obtained satellite communications system for project, and supervised installation of system, along with local telecommunication engineers. Installed PABX from Kathmandu office at jobsite to make a functional system that served for 3 years with minimal problem. Supervised seconded staff from client at jobsite for electrical works. Trained entire project site staff (>70 people) in AutoCAD over a course lasting approximately 6 weeks. Designed station earthing systems from field office using seconded Engineering staff and AutoCAD based drawings. Monitored construction of permanent electrical equipment and systems. Dealt with daily problems of construction activities on site. Analyzed and prepared variation orders for electrical works. Issued field orders as required for minor works resolution. Coordinated Electrical construction efforts with contracts for headworks structures, powerhouse civil works, headworks hydraulic steelworks, powerhouse turbines and mechanical equipment, and transmission lines and remote substations. Assumed additional responsibilities of resident civil engineer for last 8 months after departure of resident civil engineer, preparing civil field orders as needed for construction, preparing necessary civil designs, and handling unit price pay statement unit approvals

Line Relaying Upgrade, Wenatchee Substation
Chelan County PUD
Prepared design drawings for upgrade of line relaying for two 115 kV transmission lines from electro/mechanical type to digital relays with fiber optic interface for telecommunications. One of the two lines is a three terminal line. Schemes revised and updated to agree with master scheme later devised for the PUD McKenzie Switchyard.

McKenzie Switchyard, Line Relaying conversion to rack mounting
Chelan County PUD
MWH design previously prepared and approved was requested to be revised to utilize rack mounted equipment to facilitate a revised plan for field installation. Worked side by side with PUD wiremen to develop revised design. Design for all rack mounts was standardized to utilize a standard set of I/O so that digital relay programming could also be standardized. Engineering for the first line was completed within one week. New drawings issued for entire substation within 6 weeks. No delays were added to scheduled outages. Information from the design revision was fed back into ongoing designs for other line relaying packages to make all use a similar formatted design and standardization of I/O from the relays.

Kali Gandaki Project, Electrical Works
Nepal Electricity Authority
Scope of contract work was supply of powerhouse and other site required electrical equipment including 1) 132 kV gas insulated substation (Hyundai), 132/13.8 kV main transformers (Koncar), 13.8 kV generator to transformer bus (Indian), hydro generators (Toshiba), excitation (Alstom), 400 volt switchboards and motor control centers (Siemens-India), station computer system (Alstom), communications equipment (Alstom), station dc system (French), and an 11 kV power line from powerhouse to headworks. I handled final technical negotiations leading to award of Contract for electrical works. Performed submittal review for electrical works equipment, including vendor approvals, equipment approvals, equipment arrangement and incorporation into powerhouse design, control diagram approvals, lighting, cabling, raceways, and wiring and connection diagram approvals. Supervised seconded staff from client for electrical works. Major variations to the contract work included: 1) change from power line carrier to fiber optic based communications via OPGW, 2) non-metallic (teflon coated) thrust bearing shoes for the generators, 3) changing

on-site communications to be via fiber optics. Significant accomplishments included: 1) site stacked stators controlled to +/- 3% of air gap. Assumed responsibilities of resident civil engineer for last 8 months after departure of resident civil engineer, preparing field orders as needed for construction, preparing necessary civil designs, and handling unit price pay statement unit approvals. Participated in mechanical and electrical commissioning activities.

Illinois Creek Gold Mine
USMX
Served as electrical field engineer at the Illinois Creek Gold mine, enabling fast track construction to proceed. Assisted client out of trouble issues backlog. Ordered materials as required for continuing the work. Troubleshot design problems with gold elution process equipment and made systems functional. Worked with and simplified the process control and provided cad documentation of the same. Provided load calculations for total site diesel generation. Provided professional engineer sealed drawings to meet state law for electrical work.

115 kV Line Replacement
City of Seward, Alaska
Construction Manager for replacement of 115kV powerline on the same corridor. Inspected foundation preparation, wood pole line materials erection, helicopter setting of transmission poles, stringing and sagging of conductors, and coordination of switching for clearances for client. Assisted client at end of project in defense of a large claim by the Contractor against the foundations and anchors.

Diesel Generator Plant
City of Seward, Alaska
During transmission line outages, the City of Seward's diesel generating plant proved to be unstable when two units were paralleled. After researching the problem on the drawings, then searching for deviations from the drawings, located current transformers that were short circuited in a normally inaccessible bus location. Removal of the short circuits, probably left over from shipment to the site 25 years before, allowed the units to be operated in parallel as required.

Macagua II, Generator Erection
EDELCA
Review of Macagua Unit 8 erection revealed that the erection tolerances were not met. Further research showed that comments to design submittals on the erection manuals were neither responded to nor action taken by the contractor to remedy the situation. The summation of the erection tolerances for the parts exceeded the tolerance of the final product. The tolerance issue was remedied for future units, and unit 8 was studied further and determined that the tolerance excedance was on a very small area, and therefore of little impact to the generators. Working language was Spanish.

Macagua II, Construction Drawings
EDELCA
Worked with local engineers and sub-consultants to produce construction drawings that incorporated design data from suppliers, purchased materials, and engineering data from the National Electrical Code to produce functional installation drawings based on the latest available information. Various drawing sets were produced during my tenure. All drawings were in Spanish language, and Spanish was the working language of the offices.

JOHN HAAPALA, P.E.

HYDRAULICS / POWER STUDY

KEY QUALIFICATIONS

Mr. Haapala has 35 years of specialized experience in hydrology, hydraulics, reservoir operation and power studies, engineering economics and fisheries issues with an emphasis on computer applications. He is adept at the usage and adaptation of many existing standard hydrologic and hydraulic computer programs, and has developed a number of new application programs. He has been lead hydrologist on numerous hydrology and hydraulics studies for hydroelectric power developments worldwide.

He has performed power and operation studies of more than 100 reservoirs and powerplants including complex multi-reservoir, multi-use systems. The studies were performed to determine firm water supply yield, hydroelectric generation, benefits of component sizing and the effects of alternative instream flow requirements.
His hydrologic experience has included stochastic hydrology, the development of long-term monthly and daily flow records at many sites using correlation, and watershed simulation techniques. He has derived flood hydrographs from storms for various flood frequencies up to the Probable Maximum Flood (PMF) in several states, and prepared statistical analyses of flood data. His hydrologic and hydraulic analysis experience also includes reservoir and channel flood routing, spillway sizing, gated spillway flood operations, freeboard analysis and riprap sizing for shore protection.

EDUCATION

MS/MSc, Civil Engineering University of Washington
BS/BSc, Civil Engineering University of Washington

Licenses and Memberships
Professional Engineer, 27907, California, 1977; Professional Engineer, 19661, Washington
American Society of Civil Engineers (ASCE)
United States Society on Dams (USSD)
Association of State Dam Safety Officials (ASDSO)

EXPERIENCE RECORD

Portugues Dam
U.S. Army COE - Jacksonville
Portugues Dam is a new dam in the design phase that will provide flood control and water supply for Ponce, Puerto Rico. As a member of the Board of Consultants for the dam, Mr. Haapala reviewed the spillway and stilling basin design and the hydraulics of the low-level outlet.

Eweb Carmen-Smith Eng. Support
Eugene Water & Electric Board
A power study and reservoir operation model was developed in support of FERC relicensing of the 120-MW Carmen-Smith project. The model included development of 42-years of daily natural inflows to three reservoirs, the diversion of water between reservoirs, the hourly peaking operation, the reregulation reservoir operation, and all project operating constraints and objectives. Economics were included in the model to account for the production of energy, capacity, and ancillary benefits.

Chugach-CooperLake Relicensing
Chugach Electric Association, Inc.
An operation study model was developed to simulate the effects of a hydroelectric peaking operation on the receiving lake. Reverse routing of the recorded lake outflows was used to develop the natural inflows to the lake. The operation model was used to compare the fluctuation in lake levels both with and without the hydroelectric project.

Santa Anita Dam
Los Angeles Department of Public Works
Santa Anita Dam is a 225-foot high concrete arch dam near Los Angeles built in the 1920's for flood control. Investigations were conducted to determine the adequacy of the existing spillways. Rating curves were developed for the existing spillways and routing of flood hydrographs through the reservoir was performed. The trajectory of spill and the downstream impact points were determined.

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification Project
Los Angeles Department of Public Works
John investigated several alternative spillway types and configurations for Big Tujunga Dam, a 251-foot-high concrete arch dam near Los Angeles built in the 1930s for flood control. Performed flood routings with HEC-1 modeling to determine the maximum reservoir level during PMF passage for this $88M project. Performed detailed hydraulic analysis of the proposed emergency spillway including both stepped spillway and flip bucket alternatives. Estimated erosion potential below the spillway for the spillway alternatives. The final design met client needs, was accepted by the California Division of Safety of Dams and is under construction.

Bart Lake FERC License Application
Alaska Electric Light and Power
Bart Lake is a new 14 MW hydroelectric project that would supply the City of Juneau. Alternative power study runs were performed to determine the effects of component sizing on the available energy generation. Appropriate tables and figures on the hydrology and energy output of the project were developed for inclusion in the FERC license application.

Bart Lake Hydroelectric Project
Alaska Electric Light and Power
An operation study model was developed to determine the generation available from a range of turbine installed capacities and conduit hydraulic capacities. Simulation of the upstream storage reservoir operations was included in the model. Firm and average generation results were presented for a matrix of turbine and conduit sizes.

Gillespie Dam Litigation
Mesch, Clark & Rothschild, P.C.
Expert witness support was provided for the defendant in a lawsuit resulting from a dam breach. Technical support included mathematical modeling of the dam-break to determine the downstream effects of breach formation. To assist in determining the cause of the dam failure, a detailed 2-dimensional mathematical hydraulic model was developed for about one mile of river upstream from the dam.

Lake Dorothy Hydroelectric Project
Alaska Electric Light and Power
The available hydrologic data was reviewed and extended by correlation after an evaluation of alternative methods of data extension. A reservoir operation model was developed to simulate operation of the storage reservoir, the tunnel and conduit system, and the powerhouse for a period of 65 years. A series of operation model runs were performed to determine the effects of alternative installed capacities and alternative reservoir operation modes.

Upper San Joaquin River Basin Storage Investigation Feasibility Study and Environmental Impact Study/Report
USBR - Mid-Pacific Region
Reviewed model development and provided alternative ideas for model development based on extensive modeling experience. Additional improved methods were incorporated into the model.IDIQ for Water Resources Planning and Engineering - Bureau of Reclamation, Mid-Pacific Region (01CS20210B and BRPS/06CS204097B).John also

participated in a hydropower workshop to develop a daily hydropower model for use in the feasibility phase of the USJRBSI to assess water storage increase alternatives. He assisted in creating model concepts that would best address the unique hydropower challenges of the project, while maintaining flexibility to adapt to potential changes in project alternatives. He advised the MWH Team during model development, and performed a quality assurance/ quality control review of the daily hydropower model. He is currently assisting the integration of daily reservoir operations and hydropower models to better maximize benefits of the USJRBSI.

L L Anderson Dam Raise and Spillway Modification
Placer County Water Agency
The rock channel spillway with gated ogee crest needed to be modified to pass the revised and increased Probable Maximum Flood (PMF). Served as lead hydraulic/hydrologic engineer for spillway expansion at this 230-foot-high dam that impounds 136,000 acre-feet of storage. Evaluated alternatives for increasing the spillway capacity including increasing the spillway channel and gated crest width, raising the allowable maximum pool level, and changing the slope and energy dissipation characteristics of the channel. Provided gated spillway sizing and rating curve development, approach and downstream channel hydraulic analysis, and oversight of a physical hydraulic model of the spillway. Determined best solution was a widened channel and gate structure with a long stilling basin cut into the rock channel for increased spillway capacity, energy dissipation and acceptable channel velocities. Supervised two engineers on hydraulic design. A physical hydraulic model study confirmed the validity of the spillway design. The increased capacity spillway design and crest structure was approved by the California Division of Safety of Dams and the Federal Energy Regulatory Commission

Site-Specific Waste Water Treatment Plant Design and Standard Design for Water Plants in Iraq
AFCEE (4PAE)
Reviewed 100-year flood flow and water-level determination. Assembled information from multiple sources to compensate for scarce information in Iraq. Information obtained from alternative sources served as check on the limited study information that was initially provided. The client was given a better basis to evaluate flood risks.

Comprehensive Everglades Restoration Plan (CERP)/Acceler8
South Florida Water Management District
Reviewer of 15 environmental restoration projects to be constructed within an 8-year expedited schedule period. Projects consist of large storage reservoirs, natural stormwater treatment areas, spreader canals to rehydrate wetlands, major pump stations and water control structures, and other water impoundments. Original author of the Design Criteria Memorandums to be applied to all new dams for dam hazard potential classification, wind and precipitation design criteria for freeboard, and spillway capacity design criteria. Hydrology and Hydraulics Reviewer for several of the new reservoir basis of design reports.

Peace River Reservoir Expansion
Southwest Florida Water Management District
Developed extensive hydrologic computer model (AdICPR) for the above ground, water supply reservoir which required compensatory mitigation for wetland impacts. He was also responsible for a continuous simulation model, which used site specific rainfall data to predict runoff and ponding characteristics once ditch blocks were in place. Preliminary designs and model results were provided to the Southwest Florida Water Management District and Florida Department of Environmental Protection engineers for review early in the project design. The models included over 140 wetland basins and the design of 40 hardened control structures. Mr. Haapala demonstrated through modeling that historic wetland hydrology could be restored to the existing wetlands

Broadwater Power Project ? Dam Break Study
Montana Department of Natural Resources and Conservation
Dam-break studies were performed for wet and dry weather breaches of the main dam gravity blocks, for the embankment section near the abutments, and for a rapid deflation of the spillway rubber dam. Dam-break flows were routed downstream to the point where they would no longer pose a hazard. The BOSS DAMBRK model was calibrated using available downstream rating curves. Sufficient dam break model runs were performed to determine a hazard potential classification for the dam. A dam break study report complete with inundation mapping was prepared.

Cowlitz River Hydroelectric Project Dam-Break Studies
Tacoma Power
Dam-break studies were performed for a breach of the 606-foot high Mossyrock Dam. The study was a revision of a dam breach study previously performed by Tacoma Power. The use of more accurate topography at critical cross-sections and different hydraulic routing methods resulted in a substantially inundation map.

Peace River Reservoir Expansion - Dambreak
Peace River/Manasota Regional Water Supply Authority
A new off-stream water supply reservoir was being constructed on nearly flat ground in Florida. The reservoir would be formed by an encircling embankment dam. Dambreak studies were performed using the 2-dimensional hydraulics program FLO-2D. Inundation maps were performed for assumed breaches in different parts of the dam.

Depression Lake Dike Dam-Break Study/Engineering Services for Baker River Projects
Puget Sound Energy
A dam-break study was performed for Depression Lake Dike, which impounds seepage water from Baker Lake for later pump-back to Baker Reservoir. Depression Lake has an area of about 50 acres and a storage volume of about 700 acre-feet. Sinkholes in the vicinity of the dike have raised some concerns about the potential impacts of a dam-break flood on a campground area that is downstream from the dike. Dam-break floods were routed from Depression Lake Dike to Baker River and an inundation map was prepared.John developed a spillway rating curve for the multi-gated spillway. Because of dam overtopping potential during the PMF, he determined the over-topping spill trajectory and impact areas. He also performed a dam-break study for Depression Lake Dike, which impounds seepage water from Baker Lake for later pump-back to Baker Reservoir. John routed dam-break floods from Depression Lake Dike to Baker River and prepared an inundation map. MWH is performing this project to provide dam seismic rehabilitation and spillway modification.

Santa Clara Reservoir Dam-Break Study
City of Eugene, Oregon
Santa Clara Reservoir was a drinking water supply reservoir located to the northwest of the Eugene city limits. The reservoir had an area of 5.5 acres and a maximum depth of 14.75 feet. Since construction of the reservoir, surrounding housing developments were constructed, with the closest house being about 80 feet from the reservoir embankment. A dam-break study was performed to support a determination of hazard potential. The BOSS dam-break model was used to route potential dam-break floods through the residential areas. Dam-break flow rates and maximum velocities and depths were determined at a number of cross-sections. Results were summarized in a letter report.

San Vicente Dam Raise
San Diego County Water Authority
Mr. Haapala was the Lead Hydraulic Engineer for the San Vicente Dam Raise project. He performed the spillway hydraulic design for a 280-foot-high stepped spillway with an ogee crest and a flip bucket at the spillway terminus. Mr. Haapala also developed a HEC-RAS river backwater profile and scour analysis downstream from the spillway.

Report on Pacific Northwest Pumped Storage and Wind Energy Integration
USACE Portland District
Supervised 11 staff and wrote report sections for a $106,000 pumped storage and wind integration study. Rapid recent and planned installation of several thousand MW of wind power in a limited area near the Columbia River posed a number of challenges for intermittent power integration into the existing transmission system. Evaluated several benefits and the approximate costs of developing pumped storage hydroelectric plants to facilitate the integration. Study was completed on time on a very aggressive, 4-week start-to-finish schedule with full client satisfaction. USACE formal performance evaluation was very good or exceptional in all categories. ?MWH did an impressive job on a formidable task in a very short time frame. Exceptional Service!?IDIQ for Hydroelectric Power and Pumping Plant Engineering Design and Analysis Services - Hydroelectric Design Center, USACE, Portland District

ANDREA WISEMAN, Dipl. Chem. Tech., Dipl. Env. Tech., EPt

CANADA SAFETY ADVISOR, ENVIRONMENTAL TECHNOLOGIST

KEY QUALIFICATIONS

Andrea has diplomas in Chemical Technology and Environmental Technology from the Southern Alberta Institute of Technology. She has 11 years experience in quality, health, safety and environment (QHSE) for the mining, chemical and oil and gas industries. With a background in chemical technology Andrea has experience of the analytical requirements of the environmental industry. She also has experience in health and safety and has assisted in developing Best Practices for the calcium carbonate mining industry. As the Canada Safety Advisor, Andrea coordinates and updates the Canadian Health and Safety Program to maintain compliance for MWH Canada expansion and growth. She has experience with QHSE Audits, Environmental Field Reports, Detailed Site Assessments, Phase I and II Environmental Site Assessments, Reclamation Certificate Applications, Conservation and Reclamation Plans, Government Approval Programs, groundwater monitoring and pre and post water well testing for seismic programs. Andrea also manages a portion of the Indian Oil and Gas (IOGC) Environmental Audit program. Andrea is a member of the Environmental Careers Organization (ECO) Canada as an Environmental Professional-in-Training since February 2007.

EDUCATION

Environmental Technology, Southern Alberta Institute of Technology, 2003
Chemical Technology, Southern Alberta Institute of Technology, 2001

Licenses and Professional Memberships

Environmental Careers Organization (ECO) Canada – Environmental Professional in Training (EPt)
Member of the Advisory Board for the Environmental Technology Program at the Southern Alberta Institute of Technology (SAIT), Calgary, Alberta

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EXPERIENCE RECORD

- 2010 – present Canada Safety Advisor, MWH Canada, Inc.
- 2008 – present Environmental Technologist, MWH Canada, Inc.
- 2007 – 2008 Environmental Technologist, Northern EnviroSearch Ltd.
- 2005 - 2007 Environmental Technician, Northern EnviroSearch Ltd.
- 2004 - 2005 Customer Service Team Leader, QA/QC Assistant, Laboratory Analyst, Kaizen Environmental Services Inc.
- 2002 - 2003 HSE Consultant, Graymont Western Canada Inc.
- 2000 Co-op Lab Technologist, NOVA Chemicals Technology Center

PROJECT ACTIVITIES

- Development and management of the IOGC Environmental Audit Program.
- QHSE Audits for Acquisition/Divestiture Programs.
- Completion of Alberta and Saskatchewan Detailed Site Assessments, Phase I and II Environmental Assessments and Reclamation Certificate Applications.
- Completion of Conservation and Reclamation Plans, including Environmental Protection Plans, for Class I Pipeline Applications.
- Management of Post-Construction Pipeline Inspections.
- Completion of Indian Oil and Gas Canada Environmental Assessments and Audits.
- Completion of Acquisition/Divestiture Audits and Phase I Assessments.
- Completion of commercial and municipal Phase I and Phase II Environmental Assessments.

- Completion of Soil and Groundwater Monitoring as per Alberta Environment Approvals.
- Development and monitoring reclamation projects.
- Evaluation of laboratory analytical results and research into analytical reporting anomalies.
- Initiating line locates, landowner consultations and government inquires.
- Performed water quality testing, sampling and chemistry results comparisons.
- Consulted with clients on a multitude of environmental and health issues and assisted with Quality Assurance and Quality Control in an Environmental Lab.
- Performed chemical, microbiological and toxicological analyses on a wide range of environmental, chemical and plastic samples.
- Designed and performed modified air quality test of stacks.
- Performed and analyzed noise dosimetry of high risk areas and high risk activities.
- Development and Coordination of Safety Manuals, Safe Work Procedures, New Task Training Program, Confined Space Policy, Violence Prevention Policy, Emergency Response Plans, Ground Disturbance procedures, and Crisis Management Procedures.
- Management and designing assistance of on-line database system for analytical reporting.

OTHER QUALIFICATIONS (COURSES/CERTIFICATION)

- Hazard Assessment (Enform 2012)
- Incident and Accident Investigation (Enform 2012)
- Canadian Registered Safety Professional (CRSP) Exam Preparation (IQSEM 2011)
- Safety Program Development (Enform 2011)
- Ground Disturbance II™ (2009)
- H_2S Alive (2009)
- Petroleum Safety Training – Industry Recommended Practice (IRP) 16 – Administrator (2009)
- Red Cross - Standard First Aid / CPR (2009)
- Environmental Field Report Workshop (Enform)
- Reclamation Criteria for Wellsites and Associated Facilities (Enform)
- Alberta/Canada Safety Council ATV Rider Course (2006)
- TDG/WHMIS (2007)
- AutoCAD Level 1 (2004)
- Environmental Practitioner Certificate, SAIT (2002)

BRUNO TROUILLE. P.E.

ECONOMICS / PRO FORMA
SR. PROJECT MANAGER

KEY QUALIFICATIONS

Mr. Trouille has been the Lead Economic and Financial Consultant on a number of water resources and energy projects. He developed pro-forma financial spreadsheet models to analyze both public and private project financing. He worked closely with World Bank teams and private developers to develop short-term investment programs and detailed financial analyses of water, wastewater and hydro projects. He wrote papers on hydropower financing and economic trade-offs between power and non-power benefits.

He serves as Senior Project Manager on water resources and energy projects (master plans, feasibility studies, due diligence), irrigation and flood control projects, water supply and power system expansion studies, regional market analyses, water supply, and hydrologic studies. He supervises and coordinates other engineers, scientists, and subcontractors involved in complex water resources and energy projects. He has led many master plans, feasibility studies, and (re)licensing studies of small run-of-river hydro facilities to very large multi-purpose projects. For a master plan study of the Jordan Rift Valley between Jordan and Israel, he prepared Project Profiles for a wind farm, a solar power plant, and a regional energy center. He is Chair of MWH Committee on renewable energy.

Mr. Trouille has directed training and transfer of technology programs on most of the overseas projects he has been responsible for. These programs included on-the-job training of counterpart personnel in their native countries and various internships, tours, seminars and workshops in the US.

EDUCATION

MS/MSc, Industrial Relations, Loyola University
MS/MSc, Civil Engineering, Institut Catholique des Arts et Métiers (Lille)
BS/BSc, Mechanical Engineering, Institut Catholique des Arts et Métiers (Lille)

EXPERIENCE RECORD

Belesar-Peares III Pumped Storage Project
Led a team of Senior Experts to provide an overall due diligence and fatal flaw analysis of the proposed layouts of a 200-MW pumped storage project, as well as a more detailed analysis of the hydraulic transients. The major technical tasks included review of geology, geotechnical aspects, general layout, unit size, tunnel design criteria, cavern design, intake submergence, and selection of electromechanical and hydro-mechanical equipment. A team of 7 Engineers came from Spain and spent one week in the Chicago office.

Moraca Hydro Projects
Montenegro
Assisted the IFC Team in reviewing the proposed projects (up to 4 projects with a total installed capacity of 235 MW) and preparing draft concession agreements for private developers/investors, project technical specifications and Instructions to Bidders. Participated in meetings with the 4 short listed bidders during the bidding phase.

Inver Small Hydro Scheme
Provided general Quality Control of the feasibility studies. Reviewed hydrology analysis, reservoir operation studies, and project economics. The project would have an installed capacity of 1 or 2 MW.

Pumped Storage and Integration with Wind Power in the Pacific Northwest
Led the preparation of a white paper which provides an overview of pumped storage hydropower, focusing on the technical and operational aspects, characteristics and benefits of pumped storage for integrating large quantities of wind power development into the Pacific Northwest power grid. Analysis of adjustable speed technologies was also included.

Kafue Gorge Lower Hydropower
Project Manager for the feasibility study of a 750-MW hydro power project, and preparation of RFQ and RFP documents to select a private developer/investor for the project. Various sites were first investigated to recommend final project location and overall layout. Alternative CFRD and RCC options were examined for the 120-m-high dam. A 5-unit underground powerhouse was selected. Additional aerial and seismic surveys were done. Climate change impacts on river hydrology was investigated. A Strategic Options Report was prepared for the Government of Zambia to describe alternative private and Public Private Partnership options to develop and finance the $1.5 billion project. Selection criteria for the RFQ and RFP phases were presented in the report. A detailed technical and economic feasibility study was prepared.

Mt. Elbert Pumped Storage Plant, Reclamation
Lead Project Economist for the condition assessment of Mt. Elbert. Tasks included a risk assessment of major electrical and mechanical equipment, development of improvement options, economic evaluation of opportunities, and development of investment scenarios. The main objective of the study was to provide the Bureau and its partners with a cost effective investment strategy that will result in maintaining the reliability and availability of the Mt. Elbert pumped storage plant, as well as safety for the personnel and the public, for the next thirty or more years. The second objective was to identify and assess viable plant opportunities such as improved efficiencies, improved range of operation and ancillary services, and reduced cost of operations and maintenance.

Renewable Energy Credits
As a Senior Advisor, provided input and comments to develop a strategy to successfully assist the City of Peru, IL obtain Renewable Energy Credits (RECs) for its 8-MW hydro facility that generates, on average, 40,000 MWH annually. In both 2008 and 2009, we assisted the City of Peru respond to RFPs issued by the two large Illinois utilities to purchase RECs. Tasks included confirming the eligibility of the hydropower facility, setting up an account with a REC Tracking System, identifying the requirements in each RFP, and strategizing on a bid approach for the City of Peru. The City of Peru was awarded all its REC bids made, and has been receiving significant additional revenues from their existing hydropower facility.

Amaila Falls Hydroelectric Project
Project Manager for the review and update of the feasibility study that was done in 2001, and preparation of a Project Brief and EPC tender documents. The Project is located at the confluence of the Kuribrung and Amaila Rivers, just above Amaila Falls, approximately 250 kilometers from Georgetown, Guyana The Project would divert about 33 m3/sec through a low pressure headrace tunnel, a vertical shaft, a pressure tunnel and a penstock for a distance of about 3 km, leading to a surface powerhouse located below Amaila Falls, utilizing the available gross head of approximately 360 m for electricity production. The installed capacity was increased from 100 to 140 MW. The original cost estimate was updated to reflect current market conditions. An alternative dam and spillway configuration (RCC versus CFRD) was analyzed, as well as an increased dam height of 2 to 8 meters. Power system studies were also conducted to analyze how the hydro project would be integrated into the total power system of Guyana. Assistance was also provided to the Client in promoting the project to potential EPC Contractors.

Amman Wastewater Master Plan
Performed an economic evaluation of investment and O&M costs for various alternative development plans over the period 2007-2035. Developed funding scenarios (public, private, public-private partnership) to finance the recommended treatment plant and related conveyance systems (a total investment cost of about $160 million).

Lima Pumped Storage Feasibility Study
MWH Project Manager for the site selection studies, feasibility studies and preparation of tender documents of a 1,500-MW pumped storage project in South Africa. Four alternative locations were analyzed with heads ranging from 550 to 850 meters. A detailed feasibility study, construction schedule and cost estimate were performed for the selected alignment. Cost estimates were updated. Besides a reference cost estimate, low and high cost estimates were developed to reflect variations of key commodities and equipment prices. A Risk Register was developed and each risk was assessed according to the severity of the potential impact and the probability of occurrence. Tender design, specifications and documents for the Main Access and Cable tunnels were prepared.

Water and Hydropower Development
Project Manager for Reconnaissance and Pre-Feasibility studies to evaluate investment opportunities in water supply and hydropower facilities to serve the Federal Capital of Nigeria. Hydropower projects range from 10 to 150 MW. Water supply projects range from 1 to 3 cubic meter per second. Visited the project area and worked very closely with two Nigerian engineering companies. Assisted our Client, a Nigerian-US investor, during various oral presentations to the Minister of Power and other High-Level Representatives from the Federal and State Governments.

Dnister Pumped Storage Project
Economic and Financial Analyst to review and assess the viability of completing the construction of the first 3 units. An analysis of the Ukrainian existing and forecasted electricity demand and supply was performed as well as the integration of the proposed project into the hourly dispatch of power system. The first 3 units have a total installed capacity of 1,050 MW. The analysis was part of a due diligence study performed for the World Bank that is interested in investing as much as $200 million to complete construction of the first 3 units (Phase 1).

Development of HOGK Strategy and Investment Program
Assisted HOGK Executive Board of Directors and Senior Management in developing a 3-year strategy for the new company created from RAO UES, the Russian national electric power company. Assets of the new company include 22,000 MW of existing hydro facilities as well as about 10,000 MW under construction. Study focused on the ownership, organizational structure and management of the new company, development of a priority investment program in rehabilitation and upgrade, completion of new projects and start up of new ventures.

Site Selection Studies for Kafue Gorge Lower
In collaboration with ZESCO staff, carried out a reservoir operation study, updated cost estimates, and benefit-cost analysis to determine the most appropriate site to locate the dam for the proposed 750-MW Kafue Lower Project. A detailed hourly optimization model was created to simulate the operation of both the existing Kafue Upper (900 and up to 1500 MW) and Kafue Lower projects. Construction cost estimates were updated for the three dam location alternatives that were under review.

Generation and Transmission Investment Study
The main objective of the proposed study was to assist the European Commission, International Financing Institutions (World Bank, EBRD, EIB) and donors in identifying an indicative priority list of investments in power generation and related regional transmission interconnections from the regional perspective and in line with the objectives of South East Europe Regional Electricity Market. Led a team of experts to develop 20-year expansion plans for each country and for the region as a whole, taking into account constraints in transmission interconnections. Run various computer models including WASP, GTMax and PSS/E and computed hourly marginal costs under various hydrological conditions. Developed specific recommendations and short-term priority actions.

Finchaa-Amerti-Neshe (FAN) Multipurpose Project
Development of hydropower and irrigation potential of the Neshe River with respect to the optimum allocation of water resources, existing infrastructure in the area (2 existing reservoirs, 130 MW Finchaa hydropower station and 7,000 Ha Finchaa Sugar Estate). The hydro project consist of a 22-m-high dam, a 0.4-km low-pressure pipe, a 180-m vertical shaft, a 1.1-km tunnel, a 1.2-km surface penstock, and a 2-unit Pelton powerhouse. Project Manager and Financial Analyst for the feasibility study of a 100-MW hydro project and a 35-km transmission line. Performed all the economic and financial analyses.

Russian Power Sector Restructuring Project
Consultant to the Russian Ministry of Energy who assisted with the restructuring and liberalization of the Russian Power Sector. More specifically, developed a program of State incentives for new investments into the power sector, which are to be integrated into State policies for the restructuring effort. As part of this assignment, identified and analyzed investment risks, recommended options to lower risk, developed sample models for investment projects (BOT, BOOT, BOO, etc.), recommended optimal financial structures, developed tax, tariff, and

Assessment of a 330-kV Transmission Line for Two New Mines
Project Manager for the preparation of a bankable document to build the 190-km 330-kV line between the existing Luano substation and a new mining development in Kansanshi (80 MW0 and Lumwana (45 MW) in the northern province. A feasibility report, environmental impact assessment and tender documents were prepared. The country power sector was reviewed to analyze future demand and supply for electricity and cost of production over the next 15 years. Financing options for the construction of the line were discussed with the power utility, representatives of the Ministry and the mining developers.

Water & Wastewater Systems Environmental Audit
MWH was retained to conduct an environmental audit of the City of Bucharest's Water and Sewerage System to identify the nature and importance of environmental hazards and liabilities resulting from past and present operations. Mr. Trouille served as the lead corporate contact for the client. In this capacity he was responsible for selecting local subcontractors, preparing a proposal, overseeing project scheduling and maintaining communications with the client.

Trans-Balkan Power Line Project
The objective of the study was to analyze the technical/environmental feasibility and financial viability of constructing two new transmission interconnections to improve the power transfer capabilities between Albania, Bulgaria and the Former Yugoslav Republic of Macedonia. The first line is a 400-kV line connecting Radomir in Bulgaria and Dubrovo in the Former Yugoslav Republic of Macedonia. The second line is a 220-kV line connecting Vrutok in the Former Yugoslav Republic of Macedonia and Burrel in Albania. In addition, the legal and institutional framework in each country was assessed to identify any legal, regulatory, political or other institutional problems or constraints that might be imposed on the participation of the private sector in these two projects.

Least Cost Expansion Program
Project Manager for the 20-year development of the recommended least-cost expansion program. Three scenarios of future energy and electricity demand were developed for the period (2000-2020) using the MAED model. Existing thermal and hydro powerplants were assessed, along with new generation options (gas-fired, nuclear, and renewables). The least cost capacity expansion plan was developed in association with Argonne National Laboratory, using the VALORAGUA and WASP models.

Macedonia Power Distribution System
Prepared the economic analysis and ranking of a 5-year investment program for each of the 28 electric distribution companies. Benefits included reduction in energy distribution and transmission losses due to improved networks, reduction in energy not served due to less frequent forced outages, and reduction in energy not sold due to the replacement of old equipment and investment to serve new customers.

Masoud Mohajeri, PH.D., P.Eng

Project Manager/Principal Geotechnical Engineer

EDUCATION

Ph.D. Geotechnical Engineering, University of Tokyo
M.A.Sc. Civil Engineering, Tehran University

PROFESSIONAL REGISTRATIONS

Professional Engineer – APEGBC, NAPEG, APEGS

SUMMARY

Masoud Mohajeri is a principal geotechnical engineer with 20 years of experience in research and engineering projects. His experience includes land-based and marine geotechnical investigations, site characterization, undisturbed soil sampling, static and cyclic laboratory testing, large scale shake table and scaled centrifuge testing, slope stability analysis for static and dynamic loads, seepage analysis, seismic site specific ground response analysis, liquefaction triggering assessment, deformation and settlement assessment, stress-strain Finite Element and Finite Difference analysis, geotechnical design of embankment dams and construction material, design of mechanically stabilized retaining walls, excavation and shoring design, shallow and deep foundation design, geotechnical risk assessment and preparation of geotechnical design specifications and baseline reports for design-build projects. Mr. Mohajeri has extensive knowledge and experience in soil dynamics, earthquake engineering, soil-structure interaction and seismic analysis and design of foundations. He has lectured foundation engineering and soil dynamics courses for undergraduate and graduate programs and has published several peer-reviewed papers and technical reports. Mr. Mohajeri's project management experience covers scope, schedule, cost, quality, communications, human resource, procurement, risk and integration management. In addition to his several years of project management experience, he has successfully completed MWH Global project management training course and is a qualified MWH project manager.

PROJECT EXPERIENCE

Dams and tunnels

South Fork Dam, *City of Nanaimo, B.C., Canada (2011-2012)*
Role: Deputy Project Manager and Principal Geotechnical Engineer
Scope of Work: Conceptual design of three new 50 – 75 m high embankment dams and preliminary design of raising an existing embankment dam by 10 m in a high seismic area on Vancouver Island.

White River Hydroelectric Project, *Regional Power, ON, Canada (2011-2012)*
Role: Principal Geotechnical Engineer
Scope of Work: Preliminary and detail design of two 20 m high embankment dams and powerhouses, transmission lines and substations.

Ruskin Intake Seismic Upgrade Project, *BC Hydro, B.C., Canada (2011)*
Role: Principal Geotechnical Engineer
Scope of Work: Field and laboratory investigations to assess stability of rock mass and joint characteristics behind an existing intake structure.

John Hart Redevelopment Project, *BC Hydro, B.C., Canada (2008-2011)*
Role: Geotechnical Workpackage Manager
Scope of Work: Conceptual and preliminary design studies for replacement of an existing hydroelectric powerhouse and a 2.0 km long tunnel and a new intake structure on a high seismic area on Vancouver Island. The studies included extensive field and laboratory investigations and design of excavation, shoring, groundwater management, site specific seismic response analysis, liquefaction assessment, foundation design, slope stability analysis, deformation and settlement assessment, soil improvement, preparation of design-build specifications and geotechnical baseline report and geotechnical and environmental risk assessments.

Strong Motion Accelerograph Replacement Project in British Columbia, *BC Hydro, B.C., Canada (2008-2010)*
Role: Geotechnical Workpackage Manager
Scope of Work: Dam safety review for replacement and installation of strong motion accelerographs at Allouette, Seton, Ladore, John Hart, Strathcona, Lajoie, Jordan, Wahleach, Cheakamus, Ruskin, Stave Falls, Aberfeldie, Hugh hugh Keenleyside, Duncan and Terzaghi Dams in British Columbia.

John Hart Seismic Upgrade Project, *BC Hydro, B.C., Canada (2011)*
Role: Geotechnical Workpackage Manager
Scope of Work: Marine geotechnical field and laboratory investigations; seismic upgrade design of an existing 45 m high embankment dam in a high seismic area on Vancouver Island.

Agchai Hydro Project, *West Azerbaijan Water Authority, Iran (1997 – 1998)*
Role: Geotechnical Project Engineer and Project Manager
Scope of Work: Preliminary and detail design of a 108 m high earthfill located near an active fault. The dam is currently under construction.

Karkheh Hydroelectric Project, *Ministry of Energy, Iran (1994 – 1998)*
Role: Geotechnical Project engineer
Scope of Work: Detail design and construction supervision of a 127 m high earthfill dam, a 78 m deep cut-off wall, and a 400 MW underground powerhouse in a high seismic area. The dam is currently in operation.

Tehran Sewage Tunnel, *Tehran Metropolitan Authority, Iran (1997-1998)*
Role: Geotechnical Project Engineer
Scope of Work: Geotechnical field investigations, site characterization and design of a 20 km sewage tunnel along densely populated areas including cut and cover and soft ground tunnelling.

Ilam Hydro Project, *Garb Water Authority, Iran (1996)*
Role: Geotechnical Project Engineer
Scope of Work: Preliminary and detail design of a 65 m high rockfill dam in a high seismic area. The dam is currently in operation.

Ramin Hydro Project, *Zanjan Water Authority, Iran (1995)*
Role: Geotechnical Project Engineer
Scope of Work: Feasibility studies of a 46 m high earthfill dam in a cold and high seismic area. The studies suggested that a Roller Compacted Concrete dam is a preferred option and the latter option is currently under construction.

Tabarak Abad Hydro Project, *Korasan Water Authority, Iran (1994)*
Role: Geotechnical Project Engineer
Scope of Work: Preliminary and detail design of a 74 m high rockfill dam in a cold and high seismic area. The dam is currently in operation.

Taham Hydro Project, *Zanjan Water Authority, Iran (1993)*
Role: Geotechnical Project Engineer
Scope of Work: Preliminary and detail design of a 124 m high earth fill dam in a cold and high seismic area. The dam is currently in operation.

Dez Hydroelectric Project, *Ministry of Energy, Iran (1991 – 1993)*
Role: Geotechnical Project Engineer
Scope of Work: Site reconnaissance and conceptual design of three 150 to 180 m high earth and rockfill dams located in very remote and high seismic areas.

Karoun Hydroelectric Project, *Ministry of Energy, Iran (1991 – 1993)*
Role: Geotechnical Project Engineer
Scope of Work: Site reconnaissance and conceptual design of four 153 to 200 m high earth and rockfill dams located in very remote and high seismic areas.

Bridges, Pipelines, Port and Airport

No. 3 Road, Abbotsford, City of Abbotsford, B.C., Canada (2009)
Role: Geotechnical Project Engineer
Scope of Work: Field investigation program, in-situ soil testing (CPT), design of deep foundations (comparison of wood, steel and concrete piles) for a proposed bridge replacement.

Kansai Airport Terminal II Bridge Seismic Performance Design, *Port and Airport Research Institute, Japan (2002)*
Role: Research Engineer
Scope of Work: Physical modelling of a proposed floating bridge between terminal I and II at Kansai Airport using a six degree of freedom underwater shake table to verify the seismic performance design.

Seismic Performance Design of Quaywall Breakwaters, *Port and Airport Research Institute, Japan (2001)*
Role: Research Engineer
Scope of Work: Physical and numerical modelling of quaywalls using a six degree of freedom underwater shake table to verify seismic performance of the breakwaters and supporting mound.

Seismic Performance Design of buried Gaslines in Tokyo Metropolitan Area, *Tokyo Gas, Japan (2000)*
Role: Senior Research Engineer
Scope of Work: Scaled physical modelling of a buried gas line along a slope using shake table under 50 g centrifugal gravity to verify the seismic performance design of buried gaslines along the slopes.

Seismic Performance of piles and Sheetpiles, *National Research Institute for Disaster Prevention, Japan (2002-2005)*
Role: Senior Research Engineer
Scope of Work: Full-scale physical modelling and numerical simulation of piles in liquefiable soil behind sheetpile using the largest shake table in the world to verify seismic performance design of the piles.

Slopes Stability and Retaining Walls

Slope stability analysis and design of mechanically stabilized retaining walls for more than 30 residential and industrial projects in Metro Vancouver (2005-2008) and Tokyo residential area (1998-2001) including:

Post-Earthquake Deformation Assessment of River Dykes in Tokyo, Tokyo Metropolitan Government, Japan
Role: Research Engineer
Scope of Work: Post-Earthquake deformation evaluation of river dykes in Tokyo Metropolitan area using Swedish Penetration Test and Geophyisical survey results using modified Newmark approach.

Buildings

Shallow and deep foundation, soil improvement and excavation shoring design, site specific seismic response analysis, liquefaction assessment, deformation and settlement assessment for more than 50 residential and industrial buildings in Metro Vancouver area (2005 – 2008) , including:

1321 Richards Street, Vancouver, *BC Housing, B.C. Canada*
Role: Geotechnical Project Engineer
Scope of Work: Numerical modelling (FLAC), design, supervision during construction and monitoring the instrumentation after installation of micropiles under a high-rise residential development, temporary shoring and underpinning design and supervision during construction.

South Terminal Vancouver Airport, *London Aviation, B.C. Canada*
Role: Geotechnical Project Engineer
Scope of Work: Field investigations and in-situ testing (CPT), site characterization, site specific analysis in site class F (liquefiable soil) according to BC Building Code, numerical modelling of the liquefiable soil and soil improvement using FLAC, design recommendations for foundations.

PUBLICATIONS

M. Mohajeri, M. Ghafgazi (2012): Ground Sampling and Laboratory Testing on a Low Plasticity Clay, 15th World Conference on Earthquake Engineering, September 2012, Portugal.

M. Mohajeri, K. Ichii and T. Tamura (2004): Experimental Study on Sliding Block Concept for Caisson Walls, Journal of Waterway, Port, Coastal, and Ocean Engineering, ASCE, Vol. 130, No. 3, pp. 134-142.

I. Towhata, A. Ghalandarzadeh, H. Shahnazari, M. Mohajeri and A. Shafiee (2004): Seismic Behavior of Local Soil and Foundations in Bam City during the 2003 Earthquake in Iran, Bulletin of Earthquake Research Institute, University of Tokyo, Vol. 79, pp. 69-80.

M. Sato, M. Mohajeri and Y. Taji (2004): Dynamic Centrifuge Tests on Failure of Slopes with Buried Pipes, Proc. 11 ICSDEE & 3 ICEGE, UC Berkeley, USA, pp. 628-635.

M. Mohajeri and I. Towhata (2004): Practical Method for Prediction of Deformation in Earth Fills Subject to Cyclic Loading, Proc. 11 ICSDEE & 3 ICEGE, UC Berkeley, USA, pp. 307-315.

M. Sato, A. Abe and M. Mohajeri (2004): Ultra Large Laminar Box Design and Sample Preparation Plan for Tests on the Largest Shake Table in the World, 11 ICSDEE & 3 ICEGE, UC Berkeley, 718-725.

M. Mohajeri, Y. Kobayashi, K. Kawaguchi and M. Sato (2004): Numerical Study on Lateral Spreading of Liquefied Ground Behind a Sheet Pile Model in a Large Scale Shake Table Test, 13WCEE, Canada.

M. Sato, M. Mohajeri, A. Abe (2004): Large Scale Shake Table Test on Lateral Spreading of Liquefied Sand behind a Sheet Pile Wall Model, Proc. of the 13WCE, Canada.

T. Inoue, M. Sato, M. Mohajeri, Y. Mohri and K. Izumi (2004): Three Dimensional Analysis of Soil-Pile-Structure Model in a Shake Table Test, Proc. of the 13WCE, Canada.

A. Abe, J. F. Meneses, M. Sato, M. Mohajeri (2004): Near-Full Scale Testing and Analysis of Saturated Sand-Pile Interaction under Earthquake Condition, Proc., 13WCE, Canada.

J. F Meneses. , M. Mohajeri, T.Kagawa (2004): Feasibility of Numerical Simulation of Dynamic Interaction between Solid Particles and Moving Pore Fluid for Liquefaction Analysis of Sandy Soils, Proc. 17th Engineering Mechanics Conference of ASCE – EM2004, University of Delaware.

M. Mohajeri and I. Towhata (2003): Stress-Strain Behavior of Compacted Sandy Material under Cyclic Simple Shear, Journal of Soils and Foundations, Vol. 43, No. 6, pp. 75-90.

M. Mohajeri and I. Towhata (2003): Shake table tests on residual deformation of sandy slopes due to cyclic loading, Journal of Soils and Foundations, Vol. 43, No. 6, pp. 91-106.

M. Mohajeri and I. Towhata (2002): Residual Deformation of Slopes due to Cyclic Loading, Proc. 12th European Conference on Earthquake Engineering, London, Elsevier Publications, Paper No. 785.

M. Mohajeri and I. Towhata (2002): An Experiment Based Model for Deformation Analysis of Slopes Subjected to Cyclic Loading, Proc. 5th European Conf. on Numerical Methods in Geotech Eng., Paris.

M. Mohajeri and I. Towhata (2002): An Introduction to a Simple Model to Predict the Residual Deformation of Sandy Material due to Cyclic Loading, 37th National Conf., JGS, pp. 1877-1878.

M. Mohajeri, K. Ichii and T. Tamura (2002): Modification of Sliding Block Concept for Caisson Walls, Proc. of the 11th Japan Earthquake Engineering Symposium, Paper No. 191.

M. Mohajeri, (2001), Residual Deformation of Silty Sand under Cyclic Loading, Ph.D. Dissertation, The University of Tokyo.

M. Mohajeri, Y. Horie, I. Towhata (2001), Shake Table Tests on Prediction of Earthquake Induced Deformation of Earth Structure, 36th National Conference, JGS, pp. 1341-2.

M. Mohajeri, Y. Horie and I. Towhata (2001): Time Effects on the Stress Strain Behavior of Geomaterials under Cyclic Simple Shear, 56th Conf., JSCE, Vol. 1, pp. 122-123.

M. Mohajeri, and I. Towhata (2001): Residual Deformation Characteristics of Sandy Soils under Cyclic Simple Shear, Proc. of the 54th Canadian Geotechnical Conf., Calgary, Canada, Vol. II, pp. 1008-1015.

M. Mohajeri, and I. Towhata (2001): Effects of Number and Amplitude of Cyclic Loading on Residual Deformation of Sandy Soils under Cyclic Simple Shear, 3rd Int. Summer Symp., JSCE, pp. 189-192.

M. Mohajeri, and I. Towhata (2001): Shear Deformation of Silty Sand under Cyclic Simple Shear, The 14th Southeast Asian Geotechnical Conference, Hong Kong, Balkema Publications, Vol. I, pp. 559-565.

M. Mohajeri and I. Towhata (2000): Stress Strain Behavior of Silty Sands, Proceedings of the 35th National Conference, Japan Geotechnical Society (JGS), Vol. 2, pp. 1657- 58.

MWH

GARY M. WANTLAND, P.E.

Principal Engineer

YEARS OF EXPERIENCE:

33

EDUCATION:

University of Houston: M.S., Civil Engineering, 1979

Florida Institute of Technology: B.S., Ocean Engineering, 1976

ACTIVE REGISTRATION:

Registered Civil Engineer, Florida, #44614, Aug. 1991 (expires Feb. 2013)

Registered Civil Engineer, South Carolina, #17833, Oct 1996 (expires Jun 2012)

Registered Civil Engineer, Tennessee, #103619, Aug 1997 (expires Aug 2013)

Registered Civil Engineer, Illinois, #62-055513, Mar 2002 (expires Nov 2013)

Registered Civil Engineer, Alabama, #21532, Jan 1997 (expires Dec. 2012)

Registered Civil Engineer, Ohio, #75007, June 2010 (expires Dec. 2013)

Registered Civil Engineer, Texas (obtained in 1983) and Georgia (obtained in 1996) – not current

PROFESSIONAL HISTORY

Mr. Wantland is a Principal Engineer with MWH Americas, Inc. He has over 33 years of planning, consulting, engineering, design and construction experience. In his career he has worked on hundreds of civil and environmental engineering projects in a wide range of geologic environments. Mr. Wantland has provided civil and geotechnical engineering services to the U.S. Army Corps of Engineers, the Florida Department of Environmental Protection (FDEP), local water management districts as well as numerous private sector clients in the oil production, mining, electric power, chemical, waste disposal, and forest products industries.

Mr. Wantland's experience includes on-shore and off-shore site investigations, characterization of subsurface conditions, engineering analyses, conceptual and detailed design, management of construction activities and monitoring of performance. This experience includes development of design criteria and the basis of design, preparation of plans and specifications, generation of construction cost estimates, construction engineering, and project management.

Mr. Wantland's foundation experience includes investigation, evaluation and design recommendations for shallow and deep foundations for offshore structures as well as for facilities located within a wide range of geologic environments onshore. This experience includes on-shore, shore-front and off-shore structures. His deep foundation experience includes both driven piles and drilled shafts founded within soils and rock strata.

Mr. Wantland's background also includes extensive experience in evaluation of geohazards related to pipeline alignments and characterization of potential loading conditions. This experience includes geohazard analysis of alternate alignments and an evaluation of potential river crossings using HDD techniques for a proposed pipeline in Central Florida as well as an evaluation of potential loading conditions for proposed offshore pipelines in the Gulf of Mexico. The analysis for the land-based pipeline was based on evaluating geologic conditions and the potential occurrence of a sinkhole or other geohazard on the alignment. In the areas of high geohazard risk potential, statistical analyses were performed to assess potential development. The evaluation of the offshore pipelines was focused on lateral loading due to landslides and underwater sloughing.

His experience also includes geotechnical evaluation of three major river crossings where HDD pipeline installation techniques were under consideration. These investigations evaluated geotechnical conditions at the HDD sites and delineated the preferred "envelope" in which the HDD drilling should occur.

RELEVANT PROJECT EXPERIENCE

PORTS, HARBORS AND WATERFRONT STRUCTURES

AMP Ohio, Willow Island Lock and Dam Conversion, Ohio, - Engineering support and Senior Review of geotechnical calculations and analysis for settlement, stability and seepage of proposed modifications to the existing lock and dam structure with the addition of a low head in-stream power house.

Panama Canal Expansion, Third Set of Locks Project, Groupo Unidos Por el Canal, Panama City, Panama – Intra-disciplinary reviewer of geotechnical design calculations and work products for bearing capacity, deformation and seepage of the proposed lock expansion project. Technical reviewer of excavation design packages addressing seepage and stability of the proposed canal expansion excavations. These technical reviews included both the Atlantic and Pacific lock structures.

Confidential Client, Reservoir Evaluation, Florida Panhandle – Project manager and lead investigator for the evaluation of potential vulnerability of an existing water supply reservoir to contamination due to salt water intrusion via wave overtopping and structural failure of the sheet pile dam. The scope of services includes evaluation of the existing dam and reservoir, assessment of potential vulnerability to contamination, evaluation of the existing water supply infrastructure and potential alternative infrastructure options as well as assessments of the potential extent of and estimates of recovery time for the reservoir in the event of a catastrophic storm damaging the structure.

GATX Slope Failure, Galena Park Facility, Galena Park, Texas – Lead geotechnical engineer responsible for the evaluation and design of repair measures for a 1000 foot wide slope failure adjacent to a high capacity dock located on the Houston Ship Channel. Characterization of the cause of failure included back calculations of shear strength and measurements of pore pressure and lateral movement on the failure surface. Information

obtained during the investigation of the failure was used to design repairs to the slope. Remedial measures were successfully implemented over a year's time without taking the dock out of service. Services performed included construction oversight of the repairs to the slope.

Project Engineer, GATX Dock and Seawall Investigation and Repair, Houston, Texas – Lead geotechnical engineering responsible for the investigation and design of repair measures for a sheet pile bulkhead and concrete docking facility. Engineering analyses and design services included evaluation of the impacts the slope failure on existing foundations as well as design of replacement systems. Scope of the repairs included installation of over 50 cast-in-place concrete pier foundations and *20* driven pipe piles used to support site pipeline dock access ramps and appurtenant infrastructure. Services performed included oversight of construction activities.

Project Engineer, Shell Oil Offshore Foundation Investigation, Houston, Texas – Geotechnical engineer responsible for performing the field investigation, calculations and engineering analyses for lateral and vertical pile capacity for four offshore platform sites in the Gulf of Mexico. Services performed included development of the final evaluation reports.

Project Engineer, Tellupson Construction Slip Widening, Houston, Texas – Project engineer responsible for site investigation and engineering analyses of lateral loads imposed on a proposed sheet pile wall installed for a proposed slip widening in an area off the Houston Ship Channel. The scope of this evaluation included slope stability calculations to assess the global stability of the proposed construction.

Prinos Desulferization Plant Offshore Foundation Investigation, Aegaen Sea – Project engineer responsible for subsurface characterization, pile capacity and foundation design calculations for a proposed off shore industrial facility.

Petrobras, Usina Nuclear, Foundation Construction, Angra dos Reis, Brazil – Responsible for inspection of drilled shaft rock sockets and calculation of pile capacity. Responsibilities included oversight of six reverse circulation drill rigs working 24 hours a day. Approximately 100 piers were evaluated, approved and released for concrete placement.

PIPELINES

Florida Progress Anclote / Bartow Pipeline Replacement, Tampa. Florida -Progress Energy determined that loads from a proposed earth fill overpass would risk the integrity of the Bartow / Anclote petroleum Pipeline such that it must be removed from service and replaced before the proposed loads were applied. Replacement of this pipeline involved installation of approximately 1100 feet of new pipe with up to 600 feet of a horizontal directionally drill (HDD) under US 19. As part of this scope of work approximately 1100 feet of existing pipeline will be removed from service and backfilled with grout. The scope of work for this project included design of the proposed replacement pipeline, development of detailed construction drawings for installation of

the new pipe and removal of the existing pipe, permit drawing and construction specifications. Development of a contractor bidding package and support during bidding was also provided.

Gulfstream HDD Installation Design, Tampa Bay, Florida - Geotechnical investigation and design services for a 20-inch lateral natural gas pipeline from Port Manatee to the Progress Energy Bartow Plant for Gulfstream Natural Gas Systems. The investigation was performed on-board barges at five channel crossings within Tampa Bay. Drilling was completed using a rotary wash and wire-line drilling technologies. Collected samples were transported to our geotechnical testing laboratory for identification of engineering characteristics and detailed evaluation. The scope of work included design of the five HDD installations ranging in length from 1500 to 4000 feet. These crossings included water-to-water and water-to-land installations and also included evaluation of pipeline stresses during installation and operation of the line. HDD installation locations were selected based on characteristics of the subsurface materials and to avoid environmentally sensitive areas within Tampa Bay.

Williams Gas Pipeline (Transco), Central Florida – Project Manager responsible for an evaluation of several river crossings in Central Florida for the proposed Buccaneer pipeline. This study involved evaluation of Horizontal Directional Drilling (HDD) techniques to establish the viability of the approach and the appropriate depth for pipeline installation.

Williams Gas Pipeline (Transco), Central Florida – Project Manager responsible for a karst geohazard routing and siting evaluation for the proposed Buccaneer pipeline Central Florida crossing. This study involved evaluation of the probability of sinkhole development along the proposed pipeline alignment. This evaluation addressed the integrity and safety of the pipeline and identified mitigation measures to reduce the potential impacts.

Williams Gas Pipeline (Transco), Tarpon Springs, FL. – Project Manager responsible for engineering and design services to in support of Transco's development of the Anclote Water Separation Facility for the proposed Buccaneer pipeline in Central Florida. These services included geotechnical evaluations for foundations, bridge concept development, and architectural landscaping and site development / permitting support.

Gulfstream Natural Gas Pipeline, LLP, Hillsborough County, FL. – Project Principal responsible for construction monitoring of offshore segment of 36-inch diameter gas pipeline in the near shore waters of the Gulf of Mexico and in Tampa Bay. Project staff performed water quality sampling during installation of the pipeline to ensure permit requirements for turbidity were maintained. Water quality monitoring services were also performed for restoration work performed in sensitive areas of the Bay.

Gulfstream Natural Gas Pipeline, LLP, Hillsborough County, FL. – Project Principal responsible for construction monitoring of on shore segment of 36 inch diameter gas pipeline in Central and West-Central Florida. Project staff were performing water quality

sampling during installation of the pipeline at all river crossings and near all wetlands to ensure permit requirements for turbidity were maintained. Water quality monitoring services were also performed for restoration work performed in sensitive areas along the pipeline route. Additional services included installation of site restoration measures, design recommendations for compression station foundations and miscellaneous support during construction.

SLOPE FAILURE EVALUATION AND REPAIR

Gulf Coast Waste Disposal Facility, Texas City, TX. – Evaluation and design of repair measures for a slope failure within an active below grade industrial waste landfill. Insitu measurements of pore pressure and back calculated values of shear strength were used to design the repairs for this cell. Reconstruction of the slope included the use of dewatering and selective excavation of failed soils to restore the storage capacity of the cell.

Amoco Chocolate Bayou, Texas City, TX. – Evaluation of slope failure within a stormwater surface impoundment. Piezometers installed in the failed slope were used to identify the phreatic surface for post failure conditions. Information gathered was used to design repair measures for the slope.

Engelhard Phase II Nitrate Landfill Slope Failure Attapulgus, GA. - Investigation and reconstruction of a failed compacted nitrate-waste fill slope. This investigation included characterization of the phreatic surface within the slope and back calculations of stability to estimate compacted fill shear strength on the failure surface. The selected strength values were used to design the stabilization measures for the reconstructed slope.

duPont Beaumont Works, Beaumont, TX.- Failure of the embankment for a waste effluent disposal pond occurred during a raise of the dike. Very soft subsurface clays required the failure be repaired by replacing the earth berm with light-weight concrete U-sections to reduce the applied stresses on the foundation soils. Project engineer for the investigation and design of repairs to the levee.

PROFESSIONAL HISTORY

MWH Americas, Inc, Principal Engineer; Tampa FL.; 2006 - Present

URS, Principal and Vice President; Tampa FL; 1998-2006

Woodward-Clyde Consultants; Senior Associate and Vice President; Tallahassee, FL; 1990-1998

Woodward-Clyde Consultants; Staff Engineer to Associate; Houston TX; 1979-1990

D'Appolonia Consulting Engineers; Staff Engineer; Houston, TX; 1978

University of Houston; Houston, TX; Teaching Assistant; 1976-1977

MWH

SHORT COURSES AND PRESENTATIONS

"Project Risk Management, Large AE firm Perspective", ASCE West Coast Branch GeoInstitute, Professional Practice Series on Project Risk Management, January 2012.

"Dam Safety and Emergency Action Training Programs, Peace River Reservoir #2 Facility" presented to facility staff and surrounding county Emergency Response Personnel, 2010 and 2011.

Quality Management Short Course, Session Chair, SAME Jacksonville Post, Doing Business with the Government Seminar, October 2012.

"Project Management Fundamentals", Professionalism and Engineering Ethics Course, University of South Florida, March 2011.

"Peace River Reservoir #2 Construction and Start-up", Florida Engineering Society, West Coast Branch Chapter; April 2010.

Soil Cement for Erosion Protection, USACE Jacksonville District, Geotechnical Division; February 2010.

"Instrumentation for Monitoring Embankment Performance", South Florida Water Management District, September 2005.

Seepage and Piping for Dams, Florida Department of Environmental Protection; Dam Safety Technical Workshop, August 2001.

Solid Waste Issues in Florida, Woodward-Clyde Consultants, Organizer and Presenter, June 1993

"Surface Impoundments", Woodward-Clyde Consultants RCRA/SARA Seminar, September 1988

"Test Fill Programs", Texas Chemical Council, Test Fill Subcommittee, Symposium, April 1988

"Design of Hazardous Waste Landfills", Central Symposium on Case Histories, Woodward-Clyde Consultants In-House Seminar, October 1986.

PUBLICATIONS

Wantland, Gary M., and Coates, Michael, "Reservoir Development to Achieve Raw Water Supply for a Sustainable Future", Louisiana Water Environmental Association 2011 Technical Conference, May 2011.

Rothfuss, Cara and Wantland, Gary M., "Siting Infrastructure for Alternative Water Supply", Florida Section, American Water Works Association, Fall Annual Conference, November 28 – December 2, 2010.

Rothfuss, Cara and Wantland, Gary M., “Siting Infrastructure for Alternative Water Supply”, Florida Section, American Water Works Association, Alternative Water Supply Conference, May, 2010.

Wantland, Gary M., “The Peace River Project – Construction and Start-up of an Off-line Raw Water Supply Reservoir”, Geotechnical and Materials Engineers Council Annual Conference, Florida Engineering Society, May 2010

Wantland, Gary M., and Cara Rothfuss, “Using An Expert Evaluation Process And GIS Tools For Identification Of An Off-Line Reservoir Site In West Central And Southwest Florida”, American Water Resources Association (AWRA) 2010 Spring Specialty Conference GIS & Water Resources VI - Orlando, Florida, March 29 – 31, 2010.

Wantland, Gary M., William Weber and Mike Coates, “Site Evaluation Study For Potential Raw-Water Off-Line Regional Reservoir Storage Facility”, Charlotte Harbor National Estuary Program Workshop, Watershed Reservoirs: Locations, Purposes, Effects and Solutions, April 13-14, 2009.

Wantland, Gary M., Deedra Allen and T. Anderson, “Performance Evaluation of Phosphatic Clay Settling Area Dam,” Tailing Dams 2002, Association of State Dam Safety Officials / U.S. Society on Dams, Las Vegas Nevada, April 29 – May 1, 2002.

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RESUMES OF STAFF SUPPORTING KEY PERSONNEL

Lucia Chen

Senior Project Coordinator/Financial Analysis/ Office Manager

EDUCATION

Bachelor of Art in Business Administration, Northeast Missouri State University, Kirksville, M.O., U.S.A.
Certificate in Business Management, Ming Chuan College, Taipei, Taiwan, R.O.C.

SUMMARY

Ms. Chen was in retail management for over 15 years before joining MWH in 2008. She was the sole Admin/project support person for the Vancouver office until end of 2011. She was involved in all office operation related tasks including office management, marketing support, AR/AP, Human Resources and IT. Her Project related tasks including supporting the project teams in contract review, project set-up, invoicing, report formatting; she also helped project managers preparing monthly project reviews, tracking expenditure and assisting resolving project revenue/cost issues. Ms. Chen is currently working as the Financial Analysis / Office Manager for the Vancouver Office, she also work as the senior project coordinator supporting two junior staff members. Ms. Chen is fluent in spoken and written both English and Chinese (Mandarin).

RELEVANT PROJECT EXPERIENCE

MWH Canada, Inc., Vancouver BC, Canada, *Senior Project Coordinator / Financial Analyst / Office Manager / Marketing Support*

- Supporting junior project coordinators on project related tasks.
- Reviewing office financial reports and resolving revenue related issues. Preparing annual budget.
- Managing office operations.
- Supporting marketing pursuit, reviewing opportunities and coordinating in RFP preparation: compiling information, editing, printing and submitting proposals. Conference booth set-up

MWH Canada, Inc., Vancouver BC, Canada, *Office Administrator/Project and Marketing Support*

- Supported project managers in project financial controls; preparing monthly EACs; resolving project revenue and cost related issues; reviewing/processing invoices; contract reviews; Change Order processing and project report formatting.
- Reviewed weekly and monthly financial reports.
- In charge of office operation such as resolving facility related issues; meeting arrangement; supply and equipment ordering; and other operation related tasks.
- Supported marketing pursuit, reviewing opportunities and participating in RFP preparation, printing and submittal.

Winners Merchants International LP, Burnaby, BC, Canada, *Assistant Manager, Merchandising and Operation*

- Oversaw the daily operation of the store.
- Responsible for the processing of the merchandise, promotion set-ups, recruiting and training employees, developing new supervisors and setting a high standard of customer services.

HOLA Home Furnishing Company Ltd., Taipei, Taiwan, *Buyer, Dinnerware Department, Head Office*

- Responsible for vendor and product administrations for a yearly sales NT$17 Million department.
- Prepared merchandizing guidelines; outlined product changeover plans.
- Prepared annual promotion calendars; developed promotion strategies.
- Assisted store personnel in resolving problems and improving sales revenue.
- Executed detailed planning for direct import from Mikasa® Dinnerware, U.S.A. Handled all communications and followed up with tracking, shipping and bill paying details.

HOLA Home Furnishing Company Ltd., Taipei, Taiwan, *Department Manager, Bath Product Department, Flagship Store*

- Managed daily operations of a weekly sales NT$200,000 Department.
- Assisted the lunch of the New High-End Bathroom Fixture department.
- Supervised seven sales associates; developed internal training programs to achieve maximum efficiency and optimal customer service levels.

The Home Depot North Hollywood store, **C.A.**, *Count Auditor*

- Executed daily price changes; located, counted merchandise, input the counts and replaced price labels.
- Handled data entry tasks; maintained computer and cash register equipment.
- Provided clerical supports for managerial team members.
- Helped customers on sales floors; run cash registers.
- Held on-job training classes and new employee orientation classes.

The Home Depot Glendale store, C.A., *Assistant Manager*

- Supervised Electrical and Lighting departments with a combined sales of USD$250,000 a week.
- Teamed up with other supervising staffs in managing daily operations of a weekly sales USD$1.3 Million store.
- Handled customer and vendor related issues.
- Assisted Loss Prevention Supervisor in store security and safety control.

The Home Depot Santa Clarita store, C.A, *Head Cashier/Department Supervisor*

- Responsible for a single merchandising department with weekly sales ranging from USD$70,000 at Lighting
- Department to USD$200,000 at Paint Department; trained, motivated and evaluated up to fourteen associates.
- Led, trained, motivated thirty-seven full and part time cashiers; developed two line supervisors.
- Led the cashier team winning the District Operation Department Gold Cup in 1993.

The Home Depot Glendale store, C.A., *Associate Manager*

- Trained and worked in varies departments of the store; familiarized with Stander Operation Procedures in both Operation and Merchandising Departments.

Mary Edwards

Administrative Project Coordinator

EDUCATION

Hon. Bachelor of Arts Degree, University of Toronto

SUMMARY

Ms. Edwards has 4 years of administrative experience and an Honours Bachelor of Arts Degree. Her background includes working in government, finance, property management and freelance writing. She manages administrative tasks and supports project coordination. She is fluent in English and Swedish.

RELEVANT PROJECT EXPERIENCE

Lower Churchill Independent Engineer, *Nalcor Energy*

- Provide document control and word processing
- Administrate subcontracts
- Support Project Coordinator

White River Preliminary Design, *Regional Power, Inc.*

- Format specifications, reports and memos
- Prepare transmittals, track correspondence, and process invoices

Bear Hydro, *Regional Power Inc.*

- Record correspondence; format documents

Horseshoe and Kananaskis Redevelopment, *TransAlta*

- Support opening project budget, administrate contracts
- Format reports, process invoices

South Fork Dam II, *City of Nanaimo*

- Support opening project budget, administrate contracts
- Format reports, process invoices, and arrange meetings

Ruskin Powerhouse, *BC Hydro*

- Process invoices

Bennett Dam Safety Review, *BC Hydro*

- Print final report and format pdf version of report for submittal

PREVIOUS EXPERIENCE:

Receptionist, *various contracts through Adecco Employment Services*

- Screened job candidates, answered all incoming calls on 10-line phone system, greeted in-person clients, and updated spreadsheets

Office Manager, *Dragonwood Enterprises*

- Administrated contracts and files for new tenants, maintained record-keeping system, and supported Executives
- Marketed commercial spaces for rent, liaised with tenants and potential clients

Office Clerk, *Manulife Financial*

- Generated 300 cheques bi-weekly using Accpac, liaised with client managers, investigated and solved discrepancies in commission payments
- Formatted sales reports, charged credit cards in Moneris, and trained new employee

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Courtney van den Boogaard

17403 60A Avenue, Surrey BC, V3S 6X9 ☎ 778-887-1777 courtney.vandenboogaard@us.mwhglobal.com

PROFILE

A focused, diligent employee with experience in roles as an assistant project manager, project coordinator, and office administrator who brings a professional level of order and efficiency to ensure projects are completed with proper and accurate processes and controls.

SKILLS AND STRENGTHS

- Relationship Management
- Organization & Attention to Detail
- Self-directed
- Systems and Procedures
- Flexible & Approachable

EDUCATION

Diploma of Business Administration
Kwantlen University College
Surrey, BC

COMPUTER SKILLS

- MS Office 2010
- MS Project
- MS Visio
- Citrix
- Adobe Acrobat
- Type 70 wpm

VOLUNTEER EXPERIENCE

- Mentoring of Moms
- Beckley Farm Lodge
- CIBC Run for the Cure
- Children's Hospital Foundation

PERSONAL INTERESTS/ACTIVITIES

Running, Skiing, Beach Volleyball, Yoga, Travel, Reading, Internet Research, Music

RELEVANT EMPLOYMENT EXPERIENCE

MWH Canada — **2012 - Present**

Project Controls Coordinator

- Assisting project Engineers with monitoring invoicing, project progress, document controls and develop tracking data
- Monitor and process routine administrative items such as accounts payable, expense reports and set meetings
- Help maintain project files, library files, records and report database

Ruskin Construction Ltd. — **2010 - 2012**

Port Mann Hwy 1 Foundations – $10 million

Project Coordinator

- Project management: track and manage progress of multiple jobs
- Submit monthly billings, create/compile force accounts, create claims database
- Prepare arguments and documentation regarding claims and represent the company at meetings with owner representatives
- Manage office logistics, and train site administrators and others

Ruskin Construction Ltd. — **2011 - 2012**

BNSF Timber Bridge Replacement - $3 million

Assistant Project Manager

- Company representative with owner for project cost accounting
- Assist in project estimating: process tender documents and pre-qualifications
- Invoice for the contract and cost plus portions of the contract/claims
- Oversee material ordering, and logistical coordination
- Audit and maintain safety documentation

Ruskin Construction Ltd. — **2009 - 2010**

Deh Cho Bridge North West Territories – $180 million

Project Coordinator

- Site logistics: maintain/coordinate camp of 20 employees, arrange accommodations and flights for 50+ staff and contractors
- Manage expenses, time entries, create/maintain crew files and other documentation
- Project coordination: organize transportation of equipment and materials to a remote site on an extremely time sensitive job
- Reporting: notify owner representatives and local government of daily progress, and attend and document weekly meetings with engineers and management

Ruskin Construction Ltd. — **2008 - 2009**

BNSF Bridge No. 140.8 – 4.5 million

Site Administrator

- Monitor project schedule and budget, file and retrieve site documentation, liaise with site owner representatives and engineers, complete purchasing entries, confirm materials and supplies were delivered, and ensure site safety compliance and monthly safety report submission

Canadian Imperial Bank of Commerce — **2005 - 2008**

Financial Service Representative

- Facilitate a wide variety of consumer products for bank clients
- Create costumer relations with clients by ensuring they are comfortable and informed regarding the various products, and that their needs are identified and accounted for

Celeste Christensen

Project Coordinator/Network Coordinator

SUMMARY

Celeste Christensen has 25+ years in assisting upper management in project tasks, document production, and data management, including 8 years in general administration and financial services. Prior to joining MWH in late 2007, Ms. Christensen was a contractor working for Sph3r3, LLC, an IT consulting company who provided services to BP. As a consultant to BP, Ms. Christensen provided project support, including financial and status reporting. Her final assignment was as Regional Project Manager for the installation of wireless networks in several BP offices. Earlier in her career, Ms. Christensen worked in various positions, including lower management, in the printing industry.

PROJECT EXPERIENCE

MWH Americas, *Monsanto (several projects)*

- Assists in estimates and budget preparation
- Reviews, verifies and approves project expenditures
- Document production including formatting of the document and providing both electronic and hard copies to various agencies
- Assists in preparation of client invoicing
- Assists in subcontractor set up
- Sets up, organizes and updates project ftp and SharePoint sites

MWH Americas, *City of Anacortes*

- Reviews, verifies and approves project expenditures
- Assists in preparation of client invoicing
- Assists in subcontractor set up
- Keeps files on server up to date

MWH Americas, *Chelan County PUD*

- Reviews, verifies and approves project expenditures
- Assists in preparation of client invoicing
- Assists in subcontractor set up
- Keeps files on server up to date

MWH Americas, *Associated Engineering (B.C.), LTD*

- Reviews project expenditures
- Assists in preparation of client invoicing
- Assists with ICA set up and invoicing
- Keeps files on server up to date

MWH Americas, *PUD No. 1 of Douglas County*

- Reviewed, verified and approved project expenditures
- Assisted in preparation of client invoicing

MWH Americas, *USACE (several projects)*

- Assisted in preparation of client invoicing

Sph3r3, LLC, *BP – North America Regional Project Manager for Wireless Network Installations*

- Managed schedule and budget for wireless deployments throughout North America
- Developed scope for new deployments
- Reviewed contracts and provided input for contract negotiations
- Obtained quotes and ordered equipment and services
- Compiled and submitted all Americas weekly and monthly financial and project status reports

- Tracked all P.O.s and orders as well as verified all invoices to ensure expenditures were complete and accurate
- Compiled year end accruals
- Updated project database
- Assisted with global project closeout documentation

Sph3r3, LLC, *BP – Next Generation Networks – Americas Program Office Manager*

- Managed program office for ten different projects
- Gathered, compiled and submitted weekly and monthly status reports
- Ensured Project Managers completed required project documentation
- Indexed and maintained all project documentation on SharePoint
- Organized team meetings
- Set up subcontracts
- Verified invoices
- Reconciled actuals to forecasts

Impression Printing, *Pre-Press Manager*

- Scheduled pre-press production
- Monitored schedules and costs on pending work and staff hours
- Provided estimates
- Provided in-house daily status reports as well as customer status reports when required
- Technical lead for all desktop software
- Researched new software and made purchase recommendations
- Maintained archives

Art Foto Typography, *Day Shift Manager*

- Determined daily production schedule and assigned projects to staff
- Assisted with project estimates and reconciliation of project overruns
- Interfaced with clients to assist with job preparation and/or completion
- Provided status reports to business owner
- Technical lead for most desktop software
- Maintained archives

EDUCATION

Bachelor of Arts – History and Sociology, University of Northern Iowa, Cedar Falls, Iowa

PROFESSIONAL ASSOCIATIONS

PMI – Member 2005 through 2011

PROFESSIONAL DEVELOPMENT

Managing Projects – ESI
Risk Management – ESI
Understanding Network Fundamentals; Internet and Network Communications – Global Knowledge
Beginning Excel, Intermediate Excel, Advanced Excel – South Seattle Community College
Introduction to MS Access, Intermediate MS Access – South Seattle Community College
Introduction to MS Visio – South Seattle Community College
Capital Value Process for Digital and Communications Technology (DCT); Excellence in Project Delivery - BP

SUB-CONSULTANTS/SUB-CONTRACTORS

Bernardo Ferandes---Economics, Contracts, and Project Pro Forma
Graham Larson, PhD---Submarine Cable
Marc Gaboury---Environmental, Permits and Licenses
Ali Mashref, P.E., PhD---Transmission
Kojima Takashi, P.Eng---Transmission and Switchyards, Submarine Cable
Gerry Germain, P.Eng---Contracts

RESUMES OF SUB-CONSULTANTS/SUB-CONTRACTORS

BERNARDO T. FERNANDES
Managing Partner
18 Winthrop Ave
Marblehead, MA 01945
tel: (781) 631 5025
btfernandes@enventurepartners.com

PROFILE

Bernardo Fernandes, founding and managing partner of **ENVENTURE LLC** and **ENVENTURE BRASIL**, is a specialist in the electrical power industry, with over 38 years of practice in various regions of the world. In both companies, Mr. Fernandes is responsible for business and project development activities.

His strong credentials and qualifications in the non-utility (IPP) power field were gathered during the last two decades, following the development, in 1985, of his first private cogeneration project in the United States, at the Massachusetts Institute of Technology (M.I.T.), and through creative ventures in several privatized electrical sectors of Europe and Latin America. In the process, he has become well versed in project financing, and served often in the past as an advisor to major commercial and investment banks, discharging on their behalf a wide range of duties, including contract negotiations, risk assessment, economic analyses and financial structuring. The portfolio on financial closings where he has taken a lead role is in excess of US$8,000 million dollars.

Previously, he worked for major engineering firms, as a senior director, and as a consultant, building and demonstrating sound technical design and planning expertise on most generation technologies. His contributions include global business development and marketing activities, and extensive involvement in legal, regulatory and contractual matters. Another important facet of his distinguished career involves the training of other professionals accomplished through assignments as a university lecturer, seminar instructor and speaker at business conferences.

EDUCATION

Instituto Superior Técnico (Universidade de Lisboa, Portugal)
Mechanical Engineering (B.Sc) (1970)
Imperial College University of London, England
Thermal Power (M.Sc.) (1973)
Diploma in Thermal Power Engineering (1973)

CULTURAL AND LANGUAGE

Mr. Fernandes has translated numerous technical publications in the Portuguese, English, Spanish and French languages and, while a student, he was a part-time technical translator for Derwent Publications (London). Excellent command of, and fluency on, these languages,
allied to his working and living experience in several countries, affords him a rare broad cultural perspective and serves him well in promoting and expanding **ENVENTURE**'s international energy ventures.

GLOBAL PRACTICE

Mr. Fernandes has worked in the energy sector and projects in over 25 countries, where he has developed generation projects, advised equity investors and financial institutions, performed engineering and been responsible for construction.

- **EUROPE**

PORTUGAL	ENGLAND	NORTHERN IRELAND	
HOLLAND	SWITZERLAND	SPAIN	

- **AFRICA & MIDDLE EAST**

GHANA	JORDAN	KUWAIT	IVORY COAST
SAUDI ARABIA	MOZAMBIQUE	TANZANIA	TUNISIA

- **AMERICAS**

BOLIVIA	CANADA	ARGENTINA	GUAYANA
BRAZIL	COLOMBIA	GUATEMALA	HONDURAS
UNITED STATES	VENZUELA	MEXICO	CHILE

EXPERIENCE

Mr. Fernandes' professional record is comprehensive and diversified. He has worked with all commercial generation technologies, from nuclear to solar; performed conceptual and detailed engineering; undertaken planning studies; led complex studies and analyses; developed software applications; participated in turbo-machinery research and lectured on thermodynamics; contributed to the privatization of electrical sectors in several countries; played leading roles in project finance; and, developed many projects.

The following is a partial list that exemplifies the breadth of his work.

IPP PROJECT FINANCING (Attachment 1)

Since the late 80's, Mr. Fernandes has focused his professional activities in Project Financing of independent power and other infrastructure facilities, rendering advisory services to a wide range of international financial institutions, from commercial banks to multilateral agencies, from investment funds to private developers.

He has contributed, mostly as the lead technical advisor towards numerous financial closings, in excess of US$8 billion, of both domestic and international projects.

Mr. Fernandes works closely with owners and financial advisors in structuring private power projects, and has reviewed, negotiated and drafted power purchase (PPA), construction (EPC), energy sales and operation and maintenance (O&M) contracts.

The vast array of responsibilities he has discharged in financing many energy projects has gained Mr. Fernandes considerable and diversified experience and made him a well known expert in both the U.S. and international energy business. In recognition, various industry participants call upon him to opine on diverse matters and train bankers, engineers and other professionals.

COMBINED-CYCLE GAS FIRED PROJECT EXPERIENCE (Attachment 2)

In the last twenty-five years, Mr. Fernandes has participated in, and contributed to, the development and financing of combined-cycle plants, with and without co-generation, in the U.S., Europe, Africa and Latin America. He has played an instrumental role in the growth of the gas-fired, combined-cycle, and co-generation business

His role as lead developer or advisor to the multilateral agencies and major international financial institutions encompasses more than 10,000 MW on close to fifty plants using combustion turbine technology.

ENGINEERING

In his role as a consulting engineer, Mr. Fernandes worked in a wide variety of projects, including power generation in off-shore oil exploration platforms, three different nuclear facilities, and several very large thermal utility plants, including large coal-fired plants.

LECTURES, PRESENTATIONS, SPEAKING ENGAGEMENTS

Mr. Fernandes has lectured, instructed, and trained in the fields of power engineering and energy economics at college and professional levels, people with backgrounds as diverse as Chinese (People's Republic of China), South American (Brazil) and African (Mozambique).

Mr. Fernandes has been a guest speaker at industry conferences and business seminars in Europe, North and South America, and Africa. He has also sponsored and organized the first Project Finance conferences in Portugal and Brazil.

RESEARCH AND REPORTS

Author - Mr. Fernandes prepared a White Paper on the technical, commercial, and environmental aspects of burning oil for private power projects. The document was used by a major natural gas supplier in its executive planning decisions.

During his tenure as university lecturer and in subsequent years, Mr. Fernandes conducted research in fluid mechanics and turbine/compressor design and performance. His published thesis is entitled "Centrifugal Compressor Performance Prediction."

PRIVATIZATIONS

Mr. Fernandes has contributed directly to the privatization of the electrical sector in Colombia, Northern Ireland, Portugal, England, Guatemala and Brazil, by advising local government agencies, assisting with the development of legislation and participating in sales of assets. He also worked as a consultant in the preparation and evaluation of several bidding processes in various regions of the world.

NORTHERN IRELAND ELECTRICITY EXPANSION/PLANNING STUDIES

Northern Ireland Electricity (NIE)

Generation expansion and corporate planning studies were conducted for this European utility in anticipation of its privatization. Mr. Fernandes' contribution included a technical assessment of existing power plants, identification of the type and size of future units, and their integration into the system. Mr. Fernandes was responsible for studying and advising NIE on the various contracting methods for future projects.

AFRICAN DEVELOPMENT BANK

Mr. Fernandes was a consultant and advisor to this international agency on the financing of the rehabilitation of the Zanzibar (Tanzania) Electrical Power System. Amongst other responsibilities, Mr. Fernandes was charged with the preparation of the Terms of Reference, bid analyses and selection of contractors.

IPP PROJECT DEVELOPMENT (Attachment 3)

Mr. Fernandes has developed several power and cogeneration projects. In this capacity he has been involved with most technical, financial, legal and regulatory aspects of an independent venture and performed feasibility studies, developed pro forma models, completed economic analysis, negotiated contracts (PPA's, fuel supply, O&M, etc.) and negotiated debt and equity participations. Some of the projects include:

- El Cerrejon 40 Mw simple-cycle generator (Colombia)
- Acquisition of a 17 Mw gas turbine cogeneration; conversion to natural gas and refurbishment and re-powering to 35 Mw - Brazil
- Combined-cycle cogeneration (80 Mw, with GE Frame 6FA) - Brazil
- MIT campus cogeneration facility (20 Mw), Cambridge, MA
- S. Paulo 6 Mw diesel fired IPP in Portugal
- Heavy-oil fired 85 MW in Manaus, Brazil
- 150 MW hydro project in Guyana
- Windfarm of 25 MW installed capacity, Ceará, Brazil

CONTRACT NEGOTIATIONS

Mr. Fernandes has reviewed and negotiated a very large number of contracts supporting project finance (EPC, PPA's, O&M, Fuel Supply, etc.) and has been responsible for the negotiation and draft of many others in several countries, including, as examples:

- Power Purchase Agreements (in Spanish) of CORELCA (Colombia)
- Contracts (in French) for a wood-fire, 20 Mw power plant in Quebec, Canada
- EPC Contract (in Portuguese) for Campos Novos, 880MW hydro in Brazil
- Negotiated the EPC contract for the 250 Mw Alto Cachapoal (Chile) project
- Responsible for all contract negotiations on the 80Mw c.c. plant at Tibras , Brazil
- Transmission line and sub-station contracts in Mexico

- O&M negotiations for a 150 MW oil-fired plant (La Laguna, Guatemala)
- Acquisition of a 60 Mw oil-fired plant, and responsible for operating contracts
- In charge of all contracts for 85 MW Manaus oil/gas project

FEASIBILITY STUDIES AND PLANNING (International)

KUWAIT THERMAL RECIRCULATION STUDY

For this Thermal Recirculation Study for a site in Kuwait combining 4,800 MW of power generating units with 200 MIGPD of desalination capability, Mr. Fernandes was responsible for comparing twelve different site layouts, and developing a cost/benefit analysis used to select plant final configuration

KUWAIT AZ ZOUR NORTH PROJECT

For the 2,400 MW Az Zour North power station in Kuwait, with a 100 MIGPD MSF desalination plant, Mr. Fernandes was in charge and responsible for all feasibility studies involving:

Economic criteria System planning/unit sizing Cogeneration cycle optimization
Selection of number and type of desalination units Selection of major equipment

A similar scope of work was performed for the twin plant at Az Zour South.

TRANSFER OF TECHNOLOGY/TRAINING PROGRAM

People's Republic of China

Mr. Fernandes participated in the organization, layout, and scheduling of the program, and was responsible for conducting lectures covering all feasibility studies, heat balances, and economics, including theory, cost-benefit, and financial analysis.

SYSTEM PLANING STUDIES

Saudi Arabia

Mr. Fernandes engaged in Systems Planning Studies for the development of several alternative sites in Saudi Arabia; he conceived a generic method, including a graphic solution, to assess and price fuel delivery schemes. He created a monogram, integrating capital and operating costs versus distances and mode of transportation for quick reference.

JORDAN ELECTRICITY AUTHORITY PROJECT

Jordan - Electricity Authority

For the 2-unit, 130 MW power station for the Jordan Electricity Authority, Mr. Fernandes was in charge of all feasibility studies, including:

System planning and unit size selection Condenser selection Power cycle optimization
Fuel selection, transportation future conversion to coal Desalination plant type and size

Tender Documentation / Bid evaluation on Turbine, Boiler, Switchyard, and Civil Works

Verification of guarantees Operating (Performance) cost evaluation
Financial analysis - developed micro-computer program to handle source of financing (governmental loans and World Bank Credits) Participated in loan negotiations

SABIYA STATION STUDY
Kuwait Ministry of Electricity and Water

Mr. Fernandes was responsible for the unit size/design selection, thermal cycle, and condenser studies of the proposed Sabiya 2,400 MW oil-fired power station for the Kuwait Ministry of Electricity and Water. He developed the economic criteria and respective evaluators for the Project, and prepared a comparative analysis of desalination plant sizes and types (MSF versus Reverse Osmosis).

RABIGH POWER STATION ANALYSIS/DESIGN
Saudi Arabia

For the 1,000 MW Rabigh oil-fired electric generating station, Mr. Fernandes was responsible for the economical analysis, cycle configuration and parameter selection, and circulating water system design. He also wrote part of its specification, guarantee terms, and performance criteria. In addition, Mr. Fernandes studied the supply of fuel oil and investigated the feasibility of burning natural gas as an alternative energy source. An in-depth pipeline study was performed to optimize number and size of lines, pumping stations, and pipe location. A report covering technical and economic aspects was prepared to substantiate recommendations.

Domestic IPP Projects (Partial List – Attachment 4)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (M.I.T.)
Cambridge, Massachusetts

Developed the M.I.T. campus 20 MW gas-fired cogeneration plant, and was responsible for all the feasibility studies, financial analyses, power sales contract negotiations, and equipment selection.

POLAROID
New Bedford, Massachusetts

Technical and economic feasibility of installing a coal-fired power station at this site.

TAUNTON MUNICIPAL LIGHTING PLANT
Taunton, Massachusetts

Project review and bid evaluation of a 100 MW coal-fired power plant using a single circulating fluidized bed (CFB) boiler and one condensing steam turbine.

UNIVERSITY OF MASSACHUSETTS
Amherst, Massachusetts

Conducted a comprehensive feasibility study of a cogeneration project for this academic institution. Various project options and alternative approaches to ownership, design, construction and operation of the facility were studied.

SALT CITY COGENERATION
Syracuse, New York

Responsible for a coal-fired cogeneration plant rated at 80 MW net and maximum steam extraction of 200,000 lb/hr. The project, developed by HYDRA-Co, consisted of the rehabilitation of an existing plant fitted with eight boilers.

MULTITRADE - HURT SMALL POWER PROJECT
Hurt, Virginia

Evaluation of a dispatchable, 80 MW wood/coal facility. Fuel procurement reliability, costs, and unit ability to cycle under utility dispatch were among the major issues addressed.

FORT ORANGE COGENERATION
Castleton-on-Hudson, New York

Due diligence on a topping-cycle cogeneration facility consisting of a steam-injected, natural-gas-fired GE Frame 6 gas turbine. This combined-cycle plant produces 62 MW (net) of electrical power while supplying an average of 35,000 lb/hr.

EMPIRE ENERGY - Niagara
Lockport, New York

Technical and economic assessment of a proposed 170 MW net cogeneration plant with a combined-cycle configuration based on three GE Frame 6 gas turbines coupled with three heat recovery steam generators. Steam is used for NO_x control and for export to an adjacent General Motors plant to maintain QF status.

AETNA COGENERATION
Windsor, Connecticut

Evaluated the project feasibility for a 3 MW cogeneration plant. Alternative use of gas turbines or reciprocating engines was investigated and agreements with purchasing utility reviewed.

RICHMOND POWER ENTERPRISE LP
Richmond, Virginia

Independent Engineering Review for a 250 MW dual-fired combined-cycle plant using two ABB Type II combustion turbines, selling power to VEPCO under a long-term contract and steam to a paper processing facility. At a later date, assisted in the negotiations for facility re-sale.

MORGANTOWN ENERGY ASSOCIATES
Morgantown, West Virginia

Mr. Fernandes provided contract review for a cogeneration plant consisting of a coal and coal waste-fired atmospheric circulating fluidized bed boiler with a gross design capacity of 69 MW.

CPC LOWELL AND ARROWEAD PROJECTS
Lowell, Massachusetts and Georgia, Vermont

Consolidated Power Company of Connecticut developed the Lowell combined-cycle plant around a GE LM 2500 gas turbine and a HRSG with a total output of 27 MW of electrical power and 50,000 lb/hr process steam. Mr. Fernandes conducted a preliminary assessment of the proposed replication of this concept at the Georgia site, with special focus on environmental and contractual aspects.

MID-CONTINENT POWER COMPANY
Pryor, Oklahoma

This gas-fired 150 MW cogeneration facility was developed through an extensive renovation and expansion of an existing utility-grade power plant. Incorporation of three used Pratt & Whitney GG 4-A7 gas turbines, three used Deltak HRSG's and a new GE Frame 6 GT required comprehensive inspection of the equipment and, in the absence of a turnkey construction contract, creative structuring of performance guarantees and liquidated damage provisions. Mr. Fernandes managed the project review and implementation on behalf of the Lenders.

LONE STAR NATURAL GAS STORAGE FACILITY
North Dayton, Texas

The project facility stores 4.8 BCF of natural gas in a salt dome, and can deliver up to 500 MM SCFD to Houston Light & Power. Mr. Fernandes directed the due diligence review of the design, construction and operation of this storage complex.

SUNNYSIDE COGENERATION
Sunnyside, Utah

Mine-mouth cogeneration facility using coal waste to fuel a circulating fluidized bed boiler. The steam turbine plant generates 45 MW (net) and supplies thermal energy to an adjacent tomato greenhouse. Mr. Fernandes conducted a technical and contractual project evaluation, as an advisor to a potential equity participant.

FIRESTONE COGENERATION
Salinas, California

For a 48-MW, simple-cycle plant based on a GE LM 5000 gas turbine, conducted an Independent Engineering Review and contract negotiations.

SPRECKLES COGENERATION
Salinas, California

Mr. Fernandes was also responsible for work done for a replica of the Firestone project, located within the same Industrial Business Park, involving a similar scope of work.

COGENERATION BRIEFING REPORT

In charge of a comprehensive study of the U.S. Independent Power Production (IPP) industry, which was prepared to assist a financial institution in its executive decision to participate in the IPP market. Technical, regulatory, and risk assessment issues were among those addressed.

STERLING POWER PARTNERS, L.P.
Oneida, New York

Mr. Fernandes managed the independent review required prior to the financial closing of a 52 MW net combined-cycle cogeneration plant. The consistency of all documentation and the technical, contractual, financial, and legal structure of the deal were assessed. After the closing, Mr. Fernandes was also called upon to advise the project's new gas supplier on the project's merits and risks.

SELKIRK COGEN PARTNERS, L.P.

Along with his duties as project manager for the Lender's due diligence activities, Mr. Fernandes actively participated in the construction contract negotiations of this 79.9 MW gas-fired combined-cycle plant, and was responsible for all aspects of the review.

LOCKPORT ENERGY ASSOCIATES, L.P.
Lockport, New York

Manged all technical evaluations, contract reviews and financial analyses that constituted the scope of services rendered to the Lenders for the third-party financing of this combined-cycle cogeneration project.

COGENTRIX OF RICHMOND
Richmond, Virginia

Mr. Fernandes was requested by one of the Lending Banks to review the construction contract on this 210 MW coal-fired station. The risks associated with the lack of a turnkey contract were assessed, the project financial structure analyzed, and risk-mitigating strategies proposed.

NEVADA SUN-PEAK
Clark County, Nevada

Reviewed the Power Sales and Operating and Maintenance Contracts for this 210 MW gas-turbine peaking plant, one of the first IPP projects in the U.S., for Nevada Sun-Peak, a project lender.

OTHER REPRESENTATIVE DOMESTIC PROJECTS

COAL-FIRED POWER PLANT INVESTIGATION
Mr. Fernandes participated in the investigation of a continuous malfunction of two 560 MW coal-fired units. He assessed, to support legal action, all cost damages through review of design and contractual documentation, and by simulating several system dispatching scenarios. He also evaluated the impact of major design deficiencies on the utility's financing and planning activities.

MASSACHUSETTS DEPARTMENT OF PUBLIC UTILITIES

Mr. Fernandes defined the scope of services provided to utilities for power plant performance and energy audit programs to be implemented in compliance with the Department of Public Utility's requirements. He integrated hardware/software resources and technical expertise into a comprehensive "Performance Enhancement Program" to achieve the desired higher availability, capacity and overall efficiency objectives.

POWER STATION ASSESSMENT

Mr. Fernandes performed a technical and economic assessment of air handling/chilled water coils vs. small air handling/local fan coils air-conditioned systems for an eight-unit, 2,400 MW power station complex. Both alternatives were sized and priced based on meteorological conditions, cooling loads, power consumptions and various indoor ambient conditions.

LIGNITE-FIRED POWER STATION

Mr. Fernandes sized the evaporative cooling pond for the heat rejection system for a three-unit, 1,500 MW lignite-fired power station.

FUEL CELL DEMONSTRATOR PLANT

Mr. Fernandes conducted an investigation on ways to recover the waste heat from the glycol water coolant system of the DC module on a 4.8 MW Fuel Cell Demonstrator Plant. He recommended plant and site modifications to improve overall plant efficiency.

SEAWATER DESALINATION PLANT STUDY

Mr. Fernandes was responsible for the feasibility study of a seawater desalination plant comprising 16 distillation units of 6 million Imperial GPD; the effort included technical and economical assessment of alternative processes and sites.

EXPERIENCE SUMMARY OF Dr. W. GRAHAM LAWSON

B.Sc., Ph.D., C.Eng., Fellow I.E.T., Sen. Mem. I.E.E.E.

Energy Cables Consulting Engineer with:

- **20 Years RD&E Experience in the Energy Cable Industry**

Plus:

- **15 Years International Experience as a Consulting Engineer in the Field of Underground and Submarine Cables**

Date: January, 2012

KEY QUALIFICATIONS:

Dr. Lawson's career in Research, Development and Engineering (RD&E) with Pirelli (now Prysmian) involved extended periods in Italy, Brazil, U.K. and in North America where he held the position of Vice President RD&E. In 1992 he joined Power Technologies, Inc. (now Siemens PTI, Inc.) of Schenectady, New York as Manager of the Underground/Submarine Cables Group. In 1997 he founded Energy Cable Consultants, Inc. a small business corporation registered in New York State. Since 1992 Dr. Lawson has provided consulting services in the field of underground and submarine cables to a worldwide client base. Among his most recent U.S. activities Dr. Lawson has provided consulting services for the Neptune^{RTS} Project, the 500 kVDC, 660 MW submarine cable link between New Jersey and Long Island, NY and the 3-core 138 kV, 300 MVA Connecticut to Long Island submarine cable link which replaced the 1969 SCFF submarine cable circuits.

EDUCATION:

Dr. Lawson graduated with a B.Sc. (Hons. Physics) from Edinburgh University and a Ph.D. (Electrical Engineering) from the University of Southampton ,(UK).

EXPERIENCE RECORD:

Since founding Energy Cable Consultants, Inc. Dr. Lawson has provided consulting services for the following clients:

ABB High Voltage Cables AB - Karlskrona, Sweden.
Advanced Power Solutions, Sdn. Bhd. Shah Alam, Selangor, Malaysia.
Atlantic Energy Partners LLC, Pittsfield, Maine, United States
Baltimore Gas & Electric Company - Baltimore Maryland.
Black & Veatch Corporation, Overland Park, KS.
Consolidated Edison Company of New York - New York City NY.
Electric Power Research Institute (EPRI) - Palo Alto CA.
Energy Initiatives Group, LLC, Sutton, MA.
Fichtner Consulting Engineers International - Stuttgart, Germany.
Harza Engineering Co., Bellevue, WA.
Lahmayer International, Bad Videl (Frankfurt), Germany.
Nexant, Inc., Second Street, San Francisco CA 94105.
Northern Ireland Electricity plc - Belfast, Northern Ireland.
Northeastern Utilities Service Company (NUSCO), Berlin, CT.
Siemens-PTI, Schenectady, NY.
Southern California Edison - Oakland CA.
Stantec Consulting Ltd. 10160-112 St. Edmonton AB T5K 2L6
Tasmania Hydro, Australia.
Teshmont Consultants LP, Winnipeg, Manitoba R3T 0P4.
Underground Systems, Inc. USA.
Vector Electricity, Newmarket, Auckland, New Zealand.

Brief details of Dr. Lawson's more recent submarine and underground cable consulting activities are summarized in the following Sections A and B, respectively:

A: SUBMARINE CABLE ACTIVITIES

- **San Francisco Bay Project (2011):** is currently working with Black & Veatch on planning of a short 230 kV, 400 MVA submarine cable link between PG&E's Potrero and Embarcadero Substations. Dr. Lawson has carried has prepared (at the time of writing) a draft Design Report and provisional Technical Specifications for the Project.

- **PREPA- VIWAPA Project (2010 – 2011):** Dr. Lawson is currently working with Siemens PTI on the Feasibility of Interconnecting the Caribbean Islands of Puerto Rico and the USVI / BVI by means of HVDC Light/Plus and HVAC submarine power cable types.

- **NORGER Project (2009 – 2011):** Dr. Lawson worked as a Subcontractor to Fichtner (Stuttgart) on this ± 500 kVDC, 1400 MW Interconnection between Norway and Germany, a distance of ~ 600 km, which is due to be commissioned in 2014. Consulting activities included HVDC submarine cable technology review, selection of cable type, detailed cable design and budgetary pricing, and review of marine survey data.

- **SEATRAC Project (2009-2010):** Dr. Lawson carried out studies and prepared budgetary costs and technical specifications for the supply and installation of a 500 kVdc, 1600 MW submarine cable link between East and West Malaysia, a distance on 670 km across the South China Sea (the new Bakun project now called SEATRAC). The submarine cable component of the project will cost on the region of EURO 2 billion (2.8 billion USD). The lead consultant for the Project is Fichtner (Stuttgart, Germany). The Project is currently on-hold.

- **CRESS Project - Caribbean Regional Energy Strategy Study (2009- 2010):** Dr. Lawson worked as a subcontractor to Nexant of San Francisco in this World Bank financed study, being responsible for furnishing advice on submarine transmission cable technologies and assessing viable interconnections among the islands to minimize generation and transmission investments to meet future power demand.

- **San Francisco Bay Submarine Cable Feasibility Study (2009):** Dr. Lawson worked as a subcontractor to Power Delivery Consultants, Inc. and was responsible for developing technically feasible and economic HVAC and HVDC submarine cable designs for the proposed 400 MW submarine power cable link between Newark Substation at the southern end of San Francisco Bay and San Francisco City at the northern end, a distance of some 30 miles (50 km). The lead consultant was MHW (San Francisco) and the client was San Francisco Public Utilities Commission.

- **British Columbia / California Renewable Power Transmission Study (2007):** Dr. Lawson was retained by EIG, LLC to participate as the submarine cable expert in a feasibility study concerned with all aspects of a proposed HVDC submarine cable interconnection between British Columbia (Canada) and Northern California (USA).

- **West Bay Project: Doha Qatar (2007- 2009):** Dr. Lawson worked with Lahmeyer International (Frankfurt, Germany) on KahraMaa's 220 kV, 1030 MW XLPE submarine

cable connection across the West Bay, Doha. Consulting services include provisional assessment of the cable route, provisional cable design, power transmission capacity, developing budgetary costs and the preparation of Technical Specifications and Bid Evaluation.

- **Bakun HVDC Project: (2007).** Dr. Lawson teamed with Advanced Power Solutions and Syme Darby on the proposed 700 km long 500 kVdc, 1000 MW submarine cable interconnection across the South China Sea between East and West Malaysia. Consulting services included technical and commercial evaluation of Submarine Cable Options.

- **The Neptune Project (2003-2007):** Dr. Lawson provided consulting services to the Neptune Team/Energy Initiatives Group for the 500 kVDC, 660 MW Neptune RTS^{TM} HVDC submarine cable link between New Jersey and Long Island, New York. Involvement in design studies on HVdc and HVac cables and witnessing of Type Test in 2005 and Factory Acceptance Testing of the HVDC MI and MVDC-XLPE submarine and underground cables, and 345 kVAC and 230 kVAC XLPE insulated underground cables.

- **Long Island Cable Replacement Project (2003-2007):** Assistance to Northeast Utilities with provisional design studies, preparation of Technical Specifications and review of the Tenders received by NUSCO/LIPA for the supply and installation of a double circuit 138 kV, 300 MVA 3-core XLPE submarine cable link between Connecticut and Long Island, USA. Work also included the witnessing of Factory Acceptance Tests in Nexans submarine cable plant in Norway.

- **Java-Sumatra Interconnection Project (2005-2006):** Dr. Lawson performed a pre-feasibility study at the request of Black & Veatch, which concerned the proposed 2,000 MW submarine-cable interconnection between Sumatra and Java. The interconnection will form part of an approximately 500 km long transmission line which will bring electrical power from a large scale thermal power plant to be constructed near to the Sumatran coal mine region to the 500 kVAC grid in Java. The pre-feasibility study involved the development of optimum HVdc submarine cable designs and the preparation of budgetary costs.

B: UNDERGROUND CABLE ACTIVITIES

- **500 kV 600 MW HVDC Land Cable Interconnection: (2003)** Dr. Lawson carried out a feasibility study for a 60 km long Interconnection between Switzerland and Italy making use of a disused oil pipeline and existing tunnels in the Alps as a way leave. The Interconnection was never implemented due to permitting difficulties.

- **The Auckland Blackout: (1998)** Dr. Lawson was one of the cable experts selected by Mercury Energy Ltd. (now Vector Ltd.) to carry out investigations into the multiple failures of their 110 kV underground cable feeders which led to the 3 week blackout of Auckland's Central Business District in March 1998. Dr. Lawson worked as Power Technologies Inc. Associate in collaboration with the local consulting firm Worley International Ltd. of Auckland.

- **230 kV 1200 MVA XLPE Cable Project in Bangkok, Thailand**: A feasibility study was carried out on behalf of the Metropolitan Electricity Authority of Bangkok, Thailand. The study concerned the technical feasibility as well as the costs involved and the timeframe for implementation of a 230 kV, 1200 MVA link between two substations. The preferred solution was a deep cable tunnel installation with forced air cooling. Cable ratings studies were performed and cooling air velocity and fan power requirements were determined.

- **Pacific Gas & Electric, San Francisco, CA. 115 kV, 30 MVA XLPE Cable (2000):** Harza Engineering Co. prepared a conceptual study for PG&E involving two 115 kV, 30 MVA XLPE underground cable circuits between the Flynn and Pier Substations in San Francisco. These two circuits were to run parallel to a 12 kV distribution cable 6 x 3 horizontal duct bank for a distance of approximately 8,000 feet along 3rd Street, San Francisco. Harza carried out the sub-station work and retained Dr. Lawson as their power transmission cable expert. The Project Workscope was as follows:

  - Ampacity evaluation for the 12 kV cable duct bank installation- 18, 3/c cables in a 6 x 3 horizontal duct bank.
  - Development of a suitable 115 kV XLPE cable design based on AEIC CS7 - 93 Specifications.
  - Recommendations concerning suitable pulling lengths and splicing manhole dimensions for a 2 x 3 vertical duct bank installation.
  - Development of budgetary price for the supply of 48,000 ft. of the selected 115 kV XLPE cable size together with the required numbers of pre-molded splices and outdoor terminations.

- **Ceylon Electricity Board, Colombo, Sri Lanka 132 kV, 250 MVA XLPE Cable (2001):** Fichtner Consultants International carried out a design study for the Greater Colombo Grid Substation Project. This Project involved the system design of 30 circuit km of 132 kV, 250 MVA XLPE underground cable to loop in three new 33kV / 132kV substations to the existing grid. This part of the study was subcontracted to Dr. Lawson. The work involved Route Selection, System Design, Steady State and Emergency Load Carrying Capability, Magnetic Field Calculations, Development of Budgetary Costs and Project Scheduling.

- **Northeast Utilities, Berlin, CT. Bethel-Norwalk and Middletown-Norwalk 345 kV Projects (2002, 2005-2006).** Dr. Lawson provided consulting services to Northeast Utilities during the planning stages of these two projects. Among the activities carried out are the following:
  - Advice on the underground cable alternative solutions for a 345 kV, 70 mile long transmission line. Prequalification of potential vendors. Development of a Qualification Test Specification. (2002).
  - Bethel-Norwalk Project. This 21 mile long 345 kV, 600 MW double-circuit transmission line included 9.7 miles of HPFF cable plus 2.1 miles of XLPE cable – the longest and first installation of 345 kV XLPE cable to be installed in the USA with splices. Dr. Lawson participated in the development of Technical Specifications for this Project and in the review of Bidders Proposals. He also wrote a Position Paper on the technology,

testing and world-wide service experience of XLPE cables at 345 kV and above. (2005). Project completed 2006.

- Middletown – Norwalk Project. This 69 mile long double circuit transmission line included 24 miles of 345 kV, 600 MW XLPE cables and required the construction of 116 cable vaults and the installation of 372 splices. Dr. Lawson wrote white papers on various technical issues including, thermo-mechanical effects, thermal transients during emergency operation, and a review of worldwide long-length underground cable projects. He also participated in vendor pre-qualification and in the evaluation of Bidders Technical Proposals. (2006). Project completed 2008.

- **Abu Dhabi 400 kV XLPE Underground Cable Projects (2008).** Dr. Lawson supported Lahmeyer International with the design of a new 400 kV double circuit installation in Abu Dhabi by providing current rating analyses for 400 kV, 2500 mm^2 XLPE underground cables installed in a variety of configurations including direct burial in concrete troughs and deep burial in ducts installed by horizontal directional drilling in both flat and close triangular formations.

- **Hudson Transmission Project 345 kV XLPE Underground Cable Sections (2011).** During October Dr. Lawson visited Prysmian's new vertical continuous vulcanization plant in Abbeville, SC on behalf of Hudson Transmission Partners / Powerbridge, LLC., the developers on this Project. During the visit Dr. Lawson inspected the new line, witnessing cable manufacture in progress and witnessed factor inspection testing of ~ 10,000 ft. of finished cable. Electrical Testing was carried out to IEC 62067 / ICEA S-108-720 and material testing to ICEA S-108-720. This is the first 345 kV XLPE cable to be manufactured in the USA.

LANGUAGES:

	Speaking	Reading	Writing
English	Native	Native	Native
Italian	Good	Excellent	Good
Portuguese	Good	Excellent	Good

REFERENCES

Dipl. Ernst W. Kleine
Dept. Head Power Transmission and Distribution
Lahmeyer International GmbH
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West Bay Submarine Cable Project (refer to CV)

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San Francisco Bay Submarine Cable Feasibility Study (refer to CV)
Long Island Cable Replacement Project (refer to CV)

Charles E. Wilson, P.E.
Principal
Energy Initiative Group
176 Worcester-Providence Turnpike – Suite 102
Sutton, MA 01590
Phone 508-865-8021
Email: chuckw@eig-llc.com
Neptune HVDC Submarine Cable Project (refer to CV)
British Columbia / California Renewable Power Transmission Study (refer to CV)

Marc Gaboury, M.Sc.

Senior Fisheries Biologist, LGL Limited

EDUCATION

M.Sc. University of Waterloo, Ontario, 1980
B.Sc. Zoology, Honours, University of Manitoba, 1975

MEMBERSHIP AND CERTIFICATION

- College of Applied Biology British Columbia, Registered Professional Biologist #1537, 2003
- American Fisheries Society, Certified Fisheries Scientist, 1996

PROFESSIONAL EXPERIENCE

Senior Fisheries Biologist, LGL Limited environmental research associates, Sidney, B.C.

1998-present Designing fish habitat restoration prescriptions, preparing strategic plans, assessment and evaluation procedures for restoration programs.

Conducting environmental impact assessments and fisheries research studies.

Developed and supervised the implementation of a comprehensive mitigation and monitoring plan to protect fish populations and their habitats during a large infrastructure construction project.

Prepared fish habitat rehabilitation prescriptions for numerous watersheds within B.C.

1998 June Joined LGL Limited as a Senior Fisheries Biologist with over 35 years of experience in fish habitat restoration and enhancement, environmental impact assessment and research.

Fisheries Specialist - Region 1 (Vancouver Island), Watershed Restoration Program (WRP), BC Environment, Nanaimo, B.C.

1996-1998 Developed a watershed restoration strategy and setting watershed restoration priorities for Region 1.

Developed fish population, habitat assessment and monitoring protocols

Developed standards for habitat restoration surveys and designs, providing a technical review of WRP assessment, restoration planning and monitoring reports.

Conducted site evaluations and design plan reviews of restoration prescription designs with project consultants.

Designed restoration works and oversaw construction on Ministry led projects.

Provided public information, training and mentoring for biologists, geomorphologists, engineers and public volunteers engaged in stream restoration in all regions of British Columbia under WRP and Urban Salmon Habitat Program.

Head, Fisheries Enhancement, Fish Habitat Management Section, Manitoba Natural Resources, Winnipeg, Man.

1984-1995 Coordinated and advised on fish habitat projects funded by Manitoba Habitat Heritage Corporation, Special Conservation Fund, and Manitoba Fisheries Enhancement Initiative.

Designed and maintained a pan-provincial computerized Fisheries Inventory and Habitat Classification System.

Developed criteria, guidelines, methodologies and manuals for conservation, restoration and development of fish habitat, based on a watershed framework.

Fisheries Research Specialist, Fisheries Research Section, Manitoba Natural Resources, Winnipeg, Man.

1976-1984 Planned, implemented and supervised the collection of information on specific fisheries resource and habitat problems.

Specific studies and published reports related to: a five year research study on the impact of hydroelectric development on the Nelson River area Brook Trout populations; a two year research study on the impact of water level drawdown on the fish populations in Cross Lake, downstream of an hydroelectric impoundment; a two year research study on the effects of land use activities on physical, chemical, hydrological and biological features of the Valley River, concentrating on modeling the relationship between Walleye spawning success and watershed hydrology using Physical Habitat Simulation (PHABSIM).

Fisheries Technician, Fisheries Programs Section, Manitoba Mines, Resources and Environmental, Management, Winnipeg, Man.

1975 Conducted a creel census of Gods Lake, conducted standard lake inventory surveys, prepared lake bathymetric maps, prepared technical reports on creel census surveys.

Fisheries Technician, University of Manitoba, Winnipeg, Man.

1974 Assisted Dr. R.A. Bodaly with a research study on Lake Whitefish speciation in Dezadeash Lake, Yukon.

PUBLICATIONS

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Gaboury, M. 2011. Evaluation of restoration works in the lower Nass Watershed, 2010. Prepared for Nisga'a Lisims Government, New Aiyansh, B.C.

Gaboury, M. 2011. Protection and restoration strategy and action plan for Thames and Nash creeks. Prepared for Trout Unlimited Canada, Nile Creek Enhancement Society and Vancouver Island University.

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Gaboury, M. 2010. Proposed habitat compensation works for Stanley Lake control structure project. Prepared for Village of Queen Charlotte, B.C.

Glasbergen, K. and M. Gaboury. 2010. Fish habitat characterization of the Little River Watershed, New Brunswick (Final Report). Prepared for Xstrata Zinc Canada.

LGL Limited. 2010. Environmental assessment of alternative water intake sites in Englishman River. Prepared for Associated Engineering, Burnaby, B.C.

LGL Limited and Pacheedaht First Nation. 2010. Effectiveness monitoring of the remediation project at the abandoned industrial site on the San Juan River. Prepared for SLR Consulting (Canada) Ltd.

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LGL Limited, Musqueam Indian Band, Mountain Station Consultants Inc., and Kerr Wood Leidal Associates, Ltd. 2009. Prioritization of and rehabilitation considerations for fish migration impediments in lower Fraser River. Prepared for Fraser Salmon and Watersheds Program, Vancouver, B.C.

Gaboury, M. 2008. Coldwater River habitat restoration 2007 as built report. Prepared for Nicola Tribal Association, Merritt, B.C.

Gaboury, M. 2008. Culvert assessment and fish passage designs in south Peace region. Prepared for Ministry of Environment, Fort St. John, B.C.

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Gaboury, M. 2008. Monitoring of habitat compensation works – Catstream detention pond project for 2007-2008. Prepared for City of Nanaimo, B.C.

Gaboury, M. 2008. Nicola River instream habitat rehabilitation 2008 as built report. Prepared for Nicola Tribal Association, Merritt, B.C.

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Gaboury, M. and K. Pellett. 2008. Identification of fish habitat restoration opportunities in the lower Ash River. Prepared for Hupacasath First Nation, Port Alberni, B.C.

Gaboury, M., S. Silvestri and J. O'Brien. 2008. Assessment and prioritization of sediment point sources along Cowichan River mainstem, with emphasis upstream of Skutz Falls. Prepared for Living Rivers – Georgia Basin/Vancouver Island.

Lanarc Consultants Ltd. and LGL Limited. 2008. Englishman River Regional Park, a conservation area along the river corridor, 2008-2012 management plan. Prepared for The Regional District of Nanaimo, Recreation and Parks Department and The Nature Trust of British Columbia.

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Senior Wildlife Ecologist, LGL Limited

EDUCATION

MSc Forestry-Wildlife Ecology and Management, University of British Columbia, 1992
BSc Marine Biology, University of Victoria, 1988

AFFILIATIONS

- British Columbia College of Applied Biology

PROFESSIONAL EXPERIENCE

2011	Providing technical assistance to the Gitga'at First Nation on Enbridge Pipeline Northern Gateway Project environmental assessment
2011	Working with the Department of National Defence to develop a Range and Training Area Management Program for CFB Esquimalt's naval operations
2011	Conducted a technical assessment of Mount Polley Mine's Proposed Discharge of Mine Effluent on behalf of the Mount Polley Mining Corporation, Soda Creek First Nation and Williams Lake First Nation
2011	Conducted a technical assessment of aspects of the Raven Underground Coal Project on behalf of the Maa-nulth First Nations.
2011	Conducted an aerial inventory of moose in westcentral, B.C. on behalf of the Nisga'a Lisims Government
2010	Analyzed dust (air quality) issues resulting from reservoir operational scenarios for BC Hydro.
2009-present	Assisting TI Corp within wildlife and habitat matters pertaining to the Wilson Farm property in Colony Farm Regional Park, Coquitlam, B.C.
2008-present	Providing the Nisga'a Lisims Government with technical advice pertaining to wildlife and habitat impacts of proposed development projects proceeding through formal EA processes (i.e., a transmission line; hydroelectric; open-pit mines) in and near the Nass River watershed.
2008-2009	Conducted inventories of feral rabbits on the University of Victoria campus.
2008-2009	Assisted the Tsawwassen First Nation with Treaty implementation.
2008	Conducted an environmental assessment of a revised, land-based BATHOLITHS seismic experiment in westcentral B.C.
2008	Reviewed a Strategic Land Use Plan and a number of other development proposals in the Nass River watershed on behalf of the Nisga'a Lisims Government.
2008	Conducted winter aerial and ground-based investigations of ungulate and carnivore habitat use in southeastern B.C. on behalf of Matrix Solutions Inc. and BP Canada.

2007-present	Assessing approaches to mitigating impacts of military training exercises on pinnipeds at Race Rocks, B.C. on behalf of the DND.
2007-2011	Conducted an environmental assessment and environmental indicator appraisal, together with a natural resources inventory on military training ranges administered by Area Support Unit Chilliwack (Department of National Defence).
2007-2009	Conducted an environmental assessment and provided expert advice to NaiKun Wind Energy Group Inc. regarding migratory birds and marine mammals in relation to an offshore windfarm development in coastal B.C. waters.
2007-2008	Designed and installed mitigation measures to solve a flooding problem created by beavers at the site of some of BC Hydro's power-generating infrastructure.
2007	Provided advice to the Tsilhqot'in National Government regarding environmental effects of the proposed Prosperity Mine.
2007	Designed a marine mammal and marine bird monitoring program in the Nass River estuary and nearby marine environment.
2007	Conducted an aerial survey of moose in westcentral B.C.
2006-2007	Reviewed and assessed impacts of seismic survey operations on marine birds throughout the world on behalf of Lamont-Doherty Earth Observatory and National Science Foundation.
2005-2010	Managed a study of the potential human-health hazards posed by particulate matter originating from the exposed draw-down zone of the Williston Reservoir.
2005-2006	Conducted an assessment of mountain goat winter habitat in the Nass Timber Supply Area in westcentral B.C. on behalf of the BC Ministry of Environment
2005	Prepared a review of information pertaining marine birds in the Gulf of California in conjunction with a proposed natural gas plant development.
2005	Conducted an audit of 140 km of wildlife exclusion fencing along the Coquihalla Highway in southwestern B.C. on behalf of the BC Ministry of Transportation.
2004-2007	Conducted marine and terrestrial environmental assessments of a proposed seismic exploration survey off the coast of B.C. on behalf of Lamont-Doherty Earth Observatory.
2004-2006	Conducted an environmental assessment of a proposed geothermal power plant development in southwestern B.C. on behalf of the Meager Creek Development Corporation.
2004	Assisted with the design, implementation, analyses and reporting for an intensive Beluga Whale monitoring project in Cook Inlet, Alaska on behalf of the Knik Arm Bridge and Toll Authority (KABATA).
2004	Prepared a review and update of information on transient and continuous sounds in the marine environment and their effects on marine mammals on behalf of ExxonMobil Upstream Research Company.
2004	Conducted a review of regulatory practices governing the limits of sound energy produced by explosive sources used during seismic operations on behalf of the Canadian Government.

2004	Prepared Best Management Practices guidelines for raptors in urban and rural areas of British Columbia on behalf of the BC Ministry of Water, Land and Air Protection.
2003-2006	Served as an expert witness providing an affidavit on wildlife ecology (focus on mountain goats) and conservation in the context of forest ecology and industrial forestry developments; also provided critical reviews of other witnesses' reports, prepared GIS mapping of mountain pine beetle infestations.
2003	Conducted an assessment and nest relocation using an artificial structure for ospreys on southern Vancouver Island on behalf of the Department of National Defence (DND).
2002-2009	Worked with the Tsay Keh Dene First Nation on several initiatives involving BC Hydro, including the Peace Water Use Plan.
2002-2007	Investigated the effects of different forest harvesting practices on birds in riparian areas of the Pacific Northwest on behalf of the Washington State Department of Natural Resources.
2002-2004	Assessed effects of disturbance on marine birds and pinnipeds at Race Rocks, B.C. on behalf of the DND.
2002-2003	Conducted a land needs analysis for the Tsay Keh Dene First Nation.
2002	Reviewed and updated the Sea Island Conservation Area Management Plan on behalf of the Canadian Wildlife Service.
2001-2010	Conducted a 10-year monitoring program to document the effects of a road development on Grizzly Bears in the Nass Valley, B.C. on behalf of the BC Ministry of Water Land and Air Protection.
2001-2002	Deployed remote video stations to enumerate salmon escapement in key streams in the lower Nass Area on behalf of the Nisga'a Lisims Government.
2001-2002	Investigated the effects of Caspian Tern and gull predation on salmonid smolts in the Columbia River, Wash. on behalf of the Grant County Public Utility District.
2001	Conducted a critical review of an aerial moose survey in the East Kootenay, B.C.
2001	Analyzed caribou survey data from the North Slope of Alaska.
2001	Prepared a problem analysis of Grizzly Bears, salmon, and forestry near Rivers Inlet, B.C.
2001	Assisted provincial biologists with an aerial moose survey in the Nass Valley, B.C.
2000-2003	Conducted an environmental assessment of a BC Hydro/Williams Pipeline natural gas pipeline development on southern Vancouver Island, B.C.
2000-2001	Assessed environmental impacts of a DND jetty reconstruction project in Esquimalt Harbour, B.C.
2000	Assessed impacts of BC Ferries' ferry-terminal upgrading on great blue herons
2000	Assessed impacts of a DND refuelling facility upgrading on great blue herons
2000	Designed and conducted an aerial survey of moose in northcentral B.C.
1999	Assisted the Te'mexw Treaty Association with wildlife-related land-claim issues.

1998-2010	Assisted the Tsay Keh Dene with wildlife- and natural resource-related issues in their traditional territory.
1998-2002	Conducted an assessment of the impacts of the proposed Rapid Transit expansion on wildlife in Greater Vancouver, B.C.
1998	Conducted an assessment of the impacts of excluding snow geese from the foreshore of Sea Island (Vancouver International Airport) as required to mitigate air-safety concerns stemming from hazards this species presents to aircraft.
1998	Conducted an overview assessment of bird hazards and land-use zoning near CFB Comox, B.C. on behalf of DND.
1997-2000	Conducted a multi-year study of radio-collared and uncollared Grizzly Bears in the Nisga'a Traditional Territory in westcentral B.C. for the Nisga'a Lisims Government.
1997-2000	Conducted a moose inventory and multi-year study of habitat-use by radio-collared moose in the Nisga'a Traditional Territory in westcentral B.C. for the Nisga'a Lisims Government.
1997-1998	Conducted an investigation of the impacts of demolition (explosives training) activities, on behalf of, and as carried out by the DND, on selected marine life of southern Vancouver Island, B.C.
1996-1999	Conducted a wildlife and habitat impact assessment for the proposed highway development between Greenville and Kincolith in the Nass Valley for the BC Ministry of Transportation and Highways.
1996-1998	Conducted a multi-year mountain goat inventory and habitat-use study in the Nisga'a Wildlife Management in westcentral B.C. for the Nisga'a Lisims Government.
1996-1997	Monitored the effectiveness of earthworm control on the airfield of the Vancouver International Airport for the Vancouver International Airport Authority.
1996-1997	Conducted a study of the impact of the proposed Trans Canada Highway upgrade on wildlife distributions and movement patterns in the Kicking Horse Valley for the BC Ministry of Transportation and Highways.
1996	Developed a wildlife hazard control program at the Vancouver International Airport for the Vancouver International Airport Authority.
1995	Conducted a route assessment for the BC Ministry of Transportation and Highways for the proposed Greenville to Kincolith access development.
1995	Conducted a study of marine bird and mammal distributions along the west coast of Vancouver Island for the BC Land Use Coordination Office.
1995	Conducted an assessment of airport guidelines on Bald Eagle nesting in the vicinity of the Nanaimo Airport.
1994-1999	Conducted a study to assess bird hazards to aircraft for the Parallel Runway at Vancouver International Airport. The distribution, abundance movements, behaviour and habitat use was monitored throughout the year through a variety of aerial, ground and radio-telemetry surveys. Emphasis of the study was on raptors, waterfowl and great blue herons.

1994	Contract with BC Ministry of Environment, Lands and Parks (MELP) as a habitat protection biologist. Duties included: developing biodiversity management guidelines for woodlots and Christmas tree permits, analysis of TRP's, PHSP's and other forestry referrals from a wildlife habitat perspective.
1994	Contract with MELP to develop maps and metes and bounds for the Galton Range Access Management Plan.
1993-1994	Contract with MELP to develop a 10-year Bighorn Sheep population and habitat enhancement plan for the Kootenay Region.
1993	Lab instructor for a first-year university transfer biology course (BIOL 101) at EKCC. Duties included: lecturing, lab preparation, and assignment grading.
1993	Contract with MELP implementing Project Wild in communities within the Mica Compensation area. Duties included: coordinating teacher training sessions, and student activity facilitation.
1993	Assisted MELP personnel with capture, tagging and transplanting of Rocky Mountain Bighorn Sheep.
1992	Contract with Parks Canada. Using Ministry of Forests databases, forest stand attributes for regions adjacent to Glacier and Mt. Revelstoke National Parks were analyzed.
1992	Sessional lecturer at UBC. Course lectured: Forestry 395 - Forest Wildlife Ecology and Management (FRST 395).
1991	Contract work with provincial government to monitor vegetation plots at sites enhanced by thinning and burning.
1991	Lab instructor for BIOL 101 at EKCC (see above).
1990-1991	Teaching assistant for FRST 395 (see above). Duties included: lecturing, lab preparation, and assignment grading.
1990	Collected data for my M.Sc. thesis. Field activities included the monitoring of radio-collared moose, erection and maintenance of a computerized weather station, and sampling forest stands on the southern Thompson Plateau.
1990	Assisted MELP personnel with the capture and radio-collaring of Roosevelt elk on northern Vancouver Island.
1989	Contract with the Ministry of Transportation and Highways. Field work consisted of monitoring radio-collared moose for the purpose of identifying daily habitat-use patterns. During that same period, assisted members of Keystone Bioresearch in the field, collecting habitat-use information on mule deer and moose on the Thompson Plateau.

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Demarchi, M.W. and G. Schultze. 2011. A stratified random block survey of moose in the Nass River Watershed: February 2011. LGL Report EA3270. Prepared for the Nisga'a Lisims Government.

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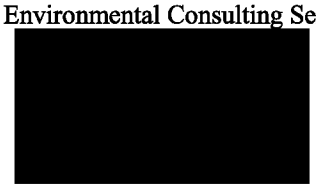

EDUCATION

Simon Fraser University
Master of Natural Resources Management, 1993

University of Guelph
Bachelor of Landscape Architecture, 1984
Bachelor of Arts, 1984

University of Victoria
Unclassified, Environmental Studies, 1981/1982

ACADEMIC ACHIEVEMENTS

Deans Honour List, University of Guelph, 1983
Canada Mortgage and Housing Scholarship, 1987, 1988
Simon Fraser University Special Fellowship, 1987

PROFESSIONAL AFFILIATIONS

Environmental Professional (EP) certification with Eco Canada; in good standing with proven competencies as Environmental Manager and in Natural Resources Management and Policy and Legislation.

AREA OF EXPERTISE

Isobel has over 21 years experience in the areas of environmental management and impact assessment, with specific expertise in environmental review processes. Her career in the private sector began in 1990 when she and her partner established the firm Par Terre Environmental Consulting Services Ltd. As principal of the firm, her area of expertise includes:

- Project Management and Coordination of Environmental Services;
- Environmental Impact Assessment;
- Cumulative Effects Assessment;
- Preparation of Applications pursuant to the *BC Environmental Assessment Act;*
- Preparation of Screening Reports and Comprehensive Studies pursuant to the *Canadian Environmental Assessment Act;*
- Environmental Permit and Approval Processes;
- Regulatory Agency Liaison
- Environmental Management Plans and Procedures, Guidance Manuals and Best Practices Documents;
- Natural Ecosystem Restoration and Stormwater System Design for Water Quality Improvement;
- Quality Control of Documents and Services; and
- Quality Assurance to the Client

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PROFESSIONAL EXPERIENCE

Project Director, Hemmera Envirochem Inc, July 2011 to current: Isobel is currently providing senior review and advisory services on the CEAA screening process and report for Port Metro Vancouver's Deltaport Terminal, Road and Rail Improvement Project.

Environmental Manager, Sea-to-Sky Highway Improvement Project, Ministry of Transportation and Highways, 2002 – 2010: Isobel served as environmental manager on this 100km long improvement project. She assembled and managed a team of nine environmental subconsultant firms who provided multi-disciplinary environmental services. Her initial responsibilities included management of environmental impact assessment work, input into preliminary alignment level highway design, preparation of the Project Application to the BC Environmental Assessment Office and shepherding the project through the joint BCEAA/CEAA review process. The project obtained approval in 2004 and Isobel prepared the environmental component of the DBFO RFP and participated in the DBFO proposal evaluation. During Project construction she represented the Province as environmental manager. She managed the environmental quality audit program and coordinated the services of environmental specialists to ensure that the project achieved its environmental objectives and met the standards specified by law, regulation, contractual agreement and the commitments attached to the EA certificate. The Transportation Association of Canada awarded the Project the 2008 Environmental Achievement Award.

Preparation of web-based site: Environmental Regulatory Compliance for British Columbia Highway Development and Operation, Ministry of Transportation and Infrastructure, 2008 – 2009: On behalf of the Environmental Management Section, Isobel has developed an interactive, web-based site that explains the Federal and provincial environmental permitting and approval requirements that might be encountered during highway development and operation. The site provides links to the majority of related process descriptions, application forms and information. The site is now operational.

Environmental Coordinator, Cache Creek to the Rockies Program, Ministry of Transportation and Highways, 1998 – 2002: During this period Isobel coordinated the functional design level environmental assessment work for Highway 1 between Salmon Arm and Revelstoke. Work included compilation of existing information, identification of environmental issues, coordination of environmental workplans and studies, liaison with environmental agencies and input into the highway design.

Environmental Coordinator, Greenville to Kincolith Project, Ministry of Transportation and Highways, 1996 – 2000: The Greenville to Kincolith project was the construction of a new 2-lane gravel road between Greenville and Mill Bay at the mouth of the Nass River north of Terrace, BC. Isobel's responsibilities included management of the environmental impact assessment work, input into the highway design, preparation of the Project Application to the BC Environmental Assessment Office, preparation of the Comprehensive Study Report pursuant to CEAA and taking the project through the joint BCEAA/CEAA review process. The project was certified October 20, 1999 and Isobel prepared the draft environmental action plans to ensure that the project achieved its environmental objectives during construction.

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Environmental Consultant and Coordinator, Vancouver Island Highway Project, Ministry of Transportation and Highways, 1993 – 2002: Under contracts with UMA and the Ministry of Transportation, Isobel provided environmental services throughout the design and construction phases of the various VIHP sections. Services included the preparation of a functional design level scoping report, screening reports in accordance with the *Canadian Environmental Assessment Act (CEAA)*, and the environmental Project Implementation Plan. Volume 3D - Environmental Management of the Vancouver Island Highway Project Implementation Plan describes the administration of the Vancouver Island Highway Project environmental assessment program and the functional responsibilities of staff and consultants in delivering environmental services during all phases of highway design and construction. Services included the management of both the Agricultural Land Reserve approval process and the Water Quality Treatment System Program, whereby construction sediment ponds were converted into permanent engineered wetlands, wet ponds or infiltration basins designed to filter out sediments and capture the contaminants that are typically associated with highway runoff during the operating life of the highway.

PARTIAL LIST OF PUBLICATION AND REPORTS

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5 Mile Bridge Environmental Screening Report, Pursuant to the Canadian Environmental Assessment Act, 1992 c.37. Prepared for the Ministry of Transportation for submission to Transport Canada to enable partial funding of the project under the Strategic Highway Improvement Program. March 2002.

Moyie Bluffs Environmental Screening Report, Pursuant to the Canadian Environmental Assessment Act, 1992 c.3. 2002 (draft*)*. Prepared for the Ministry of Transportation for submission to Transport Canada to enable partial funding of the project under the Strategic Highway Improvement Program. March 2002.

Victoria Road Environmental Screening Report, Pursuant to the Canadian Environmental Assessment Act, 1992 c.3. 2002 (draft*)*. Prepared for the Ministry of Transportation for submission to Transport Canada to enable partial funding of the project under the Strategic Highway Improvement Program. March 2002.

*Strategic Environmental Assessment of the 2010 Olympic Bid Venues (*preliminary draft). Prepared by Acres International Ltd. in Association with Par Terre Environmental Consulting Services Ltd. for submission to the 2010 Bid Development Team. March 2002.

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Greenville to Kincolith Road Project Report; Submission to the British Columbia Environmental Assessment Office. Ministry of Transportation and Highways. April 1999.

Maintenance Guide for Water Quality Treatment Systems, Vancouver Island Highway Project, 1998.

Environmental Assessment Report, Highway Upgrading Project Trans Canada Highway No. 1, Jones Road to North Boundary Indian Reserve 12. Submission to the Department of Indian Affairs and

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Northern Development for Screening under the Canadian Environmental Assessment Process. Vancouver Island Highway Project. 1998.

A Guide to Applying the Highway Environmental Assessment Process. Ministry of Transportation and Highways. 1997

Environmental Management; Vancouver Island Highway Project Implementation Plan, Vancouver Island Highway Project, 1997.

Greenville to Kincolith Project, Application to the British Columbia Environmental Assessment Office. Ministry of Transportation and Highways. 1996.

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Integrated Environmental and Engineering Status Report. Prepared for the Vancouver Island Highway Project.1995.

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Environmental Report and Submission to Inuit and Indian Affairs Program. Jones Road to North Boundary Indian Reserve No. 12. Vancouver Island Highway Project. 1994.

Environmental Report and Submission to Department of National Defence for EARP Screening, Nanaimo Parkway, Harewood Mines Road to East Wellington Road. Vancouver Island Highway Project. 1993.

Environmental Coordination and Report Submissions to Transport Canada, Strategic Highway Improvement Program (SHIP*).* Ministry of Transportation and Highways. 1993 & 1994.

Environmental and Social Review of Christmas Hill Rezoning Application, Visual and Aesthetic Resource Component. Corporation of the District of Saanich. 1993.

Stormwater Quality Management, Intersection of Highway 97 & 3, Osoyoos. Ministry of Transportation and Highways. 1993.

Environmental Report and Submission to Department of National Defence for EARP Screening. Nanaimo Parkway, Harewood Mines Road to East Wellington Road. Vancouver Island Highway Project. 1993.

Initial Environmental Screening Report and Submission to Indian and Inuit Affairs Program, Alert Bay Indian Reserve No.2, Nimpkish Band. Ministry of Transportation and Highways. 1993.

Scott Road Extension, Wildlife Habitat Mitigation Plans. Ministry of Transportation and Highways. 1993.

Quadra to Martindale, Highway 17. Vancouver Island Highway; Heritage Tree and Visual Resource Impact Assessment. Vancouver Island Highway Project. 1992.

Island View, Highway 17, Vancouver Island Highway; Heritage Tree and Visual Resource Impact Assessment. Vancouver Island Highway Project. 1992.

Winfield to Oyama, Highway 97; Recreation, Visual Impact Assessment and Mitigation Design. Ministry of Transportation and Highways. 1991.

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ARCHAEOLOGICAL AND HERITAGE CONSULTING

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President – Millennia Research Limited

SUMMARY

Morley has conducted archaeological research in Western Canada and abroad since 1969. He received his BA at the University of British Columbia, and his MA at the University of Victoria. He subsequently pioneered research associated with archaeological site modelling, culturally modified tree (CMT) and wet site recording and reporting, and resource management procedures. He was the President of the BC Association of Professional Archaeologists (BCAPA) in 2000-2001. He has served as Expert Witness in several legal actions including BC Supreme Court. He was a member of two BC Science Council multidisciplinary review committees responsible for making recommendations for millions of dollars of research money. Morley strives for a high professional standard of work, providing guidance and direction to Millennia Research's project directors. He takes time from administrative duties to participate in fieldwork several times a year, recognizing that this keeps him in touch with basic archaeological issues and skills. Morley's particular interests are in GIS site potential modelling and wet lands archaeology, particularly preserved organic artifacts such as basketry.

EXPERIENCE *Selected Projects of Interest*

- BC Hydro Site C Potential Modeling 2010
- Proposed Tsussie IR sewerline upgrade 2009-2010
- BC Hydro Williston Lake Dust Abatement Archaeology Program, 2008-2010
- Fort Nelson Forest District, Archaeological Potential modeling using LiDAR, 2008-2010
- Williston Lake-Peace River Erosion of Archaeological Sites study, BC Hydro, 2009
- Naikun Wind Development Terrestrial and Underwater Archaeology, Hecate Strait, 2007-2009
- Williston Lake Dust Mitigation Archaeological Impact Assessment, BC Hydro, 2008-2009
- Peace Forest District AOA Archaeological Potential TRIM and LiDAR-based modeling, 2007-2009 (with AMEC/ARCAS)
- Various projects for Encana Corporation, archaeological potential modeling using LiDAR in the Peace and Fort Nelson regions
- Capital Regional District Archaeological Potential Modeling, 2008
- City of Langford Archaeological Potential Modeling, 2008
- Archaeological Impact Assessment of Phase I and II Quamichan Village Sewer Line for UMA AECOM.
- Prince Rupert Harbour Port Authority, Fairview Container Terminal Archaeological Impact Assessment, 2006-2008
- Fairview Container Terminal expansion archaeological studies, Prince Rupert Harbour Authority, 2006-2008
- Southern Vancouver Island and Gulf Islands, Hulquminum Treaty Group modeling using digital sources including LiDAR 2006-2007
- *Queen of the North* diesel spill assessment, for Coastal and Ocean Resources, 2006
- Nanaimo Foundry AIAs and Mitigative Studies, 2006
- LiDAR modeling various areas NE BC for EnCana, 2004-2006
- Haida Gwaii, various forestry and highways developments, 2002-2006
- North East BC Overview, 2000-2004
- Ft St James Overview (modelling section) 2003
- Ditidaht Overview, 2001

- Lakes Forest District Archaeological Overview, 2000
- Lillooet Forest District Archaeological Overview, 1998
- Kispiox Forest District Overview, 1998
- Cassiar Forest District Overview, 1998
- Williams Lake Forest District Overview, 1997/1998
- Vancouver Island Highway Project - Victoria Approaches mitigative excavations, 1995 - 1997
- Vancouver Island cultural resource inventory, ethnogeography and GIS (Heritage Conservation Branch), 1993

ARCHAEOLOGICAL TRAINING, WORKSHOPS & SEMINARS *Partial List*

- Archaeological Field Assistant Training Course, Tsay Keh First Nation, 2009
- Professional Development CMT Workshop Leader, BCAPCA 2002
- North Coast RIC Archaeological Training Course, 2001
- CMT Identification Workshop, North Coast Forest District, 2001
- Co-author of RISC and RIC training course curriculum for archaeological research assistants
- Port Alberni CMT Workshop, 2001
- Mid Coast Forest District Dendroanalysis Workshop, 2000
- Ditidaht/Hupacasath RIC Archaeological Training Course, 2000
- Heiltsuk CMT Training Course, 1998
- RIC Archaeology Training Course Pilot, Stave Lake 1999

EDUCATION

1982 Masters of Arts (Anthropology) University of Victoria
1976 Bachelor of Arts (Anthropology) University of British Columbia

PUBLICATIONS

Eldridge, M. and M. Steffen
2008 Serrated projectile points from inland raised elevation sites in the Greater Victoria area. In *Projectile Point Sequences in Northwestern North America*, edited by R. L. Carlson and M. P. R. Magne, pp. 87-104. Archaeology Press, SFU, Burnaby, BC.

Eldridge, M.
2008 A remarkable glimpse into life on a Victoria beach 3,000 years ago. In *Victoria Underfoot*, edited by B. Clarke and N. Kilburn. Harbour Publishing, Victoria.
1981 The Hope highway archaeological salvage project. In: *Annual Research Report I. Activities of the Heritage Conservation Branch for the Year 1978*, Heritage Conservation Branch, Victoria, pp.53-110.
1974 Recent archaeological investigations near Chase, BC *Cariboo College Papers in Archaeology* 2.

Eldridge, Morley and Steven Acheson
1992 The antiquity of fish weirs on the southern coast: a response to Moss, Erlandson, and Stuckenrath. *Canadian Journal of Archaeology* 16:112-116.

Stafford, James and Morley Eldridge
1995 The bear facts in the Ursus Valley: Deadfall traps. *The Midden* Vol. 27, No. 4: 7-9.

Styrd, Arnoud and Morley Eldridge
1993 CMT archaeology in British Columbia: the Meares Island studies. *BC Studies* No.99:184-234

Mobley, Charles M. and Morley Eldridge
1992 Culturally Modified Trees in the Pacific Northwest. *Arctic Anthropology.* Vol. 29, No. 2: 91-110.

Mobley, Charles M., James C. Haggarty, Charles J. Utermohle**,** Morley Eldridge, Richard E. Reanier, Aron Crowell, Bruce A. Ream, David R. Yesner, Jon M. Erlandson, and Paul E. Buck
1990 *The 1989 Exxon Valdez Cultural Resources Program*. Exxon Company U.S.A., Anchorage.

Hayden, Brian, Morley Eldridge, Anne Eldridge, and Aubrey Cannon
1985 "Complex hunter-gatherers in Interior British Columbia." In *Prehistoric Hunter-Gatherers*, ed. B. Price and H. Brown. Academic Press.

Cybulski, Jerome S., Donald E. Howes, James C. Haggarty, and Morley Eldridge
1981 An early human skeleton from south-central British Columbia: dating and bioarchaeological inference.

PROFESSIONAL REPORTS *Selected Recent and Regional*

Eldridge, Morley, Jo Brunsden, Alyssa Parker, and Roger Eldridge
2009 Permit 2008-0179 BC Hydro 2008 Williston Dust Abatement Project Archaeological Impact Assessment Final Report: Millennia Research Limited.

Eldridge, M., M. Fisher, V. Thiesson and A. Parker
2009 Archaeological Impact Assessment for the Naikun Wind Development Inc. Technical Report Volume 10 of the NaiKun Wind Development Environmental Assessment.

Eldridge, M. and A. Anaya
2005 *Archaeological Overview of Northeastern British Columbia: Year Four and Five Report and Project Summary*. Prepared for the Steering Committee: Vera Brandzin (Chair) Tom Ouellette (Oil and Gas Commission), Mary Viszlai-Beale (Ministry of Forests) Jim Pike (Archaeology and Registry Services Branch), Quentin Mackie (University of Victoria), Bob Powell (Ministry of Energy and Mines). Submitted to the following First Nations: The Fort Nelson First Nation, the Halfway River First Nations, the Dene Tha', the Blueberry River First Nation, the West Moberly First Nations, the Doig River First Nation, the Prophet River First Nation, the Acho Dene Koe, the Saulteau First Nation, and the Treaty Eight Tribal Association. Archaeology Branch permit 2001-270.

PROFESSIONAL MEMBERSHIPS

Registered Professional Archaeologist, BC
Association of Professional Archaeologists (BCAPA)
Wetland Archaeological Research Project (International)
Society of American Archaeology (International)
Canadian Archaeological Association

REFERENCES

Lorne Keller, Vice President, Marketing and Business Development,
Prince Rupert Port Authority
lkeller@rupertport.com (250) 627-2503

Dean Daly
Williston Dust Mitigation Project Manager,
BC Hydro
dean.daly@bchydro.com (604) 992-2578

Ali Moshref

Profession:	Over 30 years of experience in power system planning, system operation, asset management, alternate energy resources for power generation, and software development for the analysis of power system.
Nationality:	Canadian Citizen
Years of Experience:	32 years
Education:	Ph.D., Electrical Engineering, McGill University (1983) M.S., Electrical Engineering, The George Washington University (1979) B.S., Electrical Engineering, Iran University of Science and Technology(1977)
Position:	Senior Director, Transmission West Region, Quanta Technology

Summary:

With over 30 years of power system experience in the energy industry covering power system planning, system operation, asset management, alternate energy resources for power generation, and software development for the analysis of power system. A Senior member of IEEE with areas of expertise including:

- Development of Planning and Operational Policies
- Power System Stability and Control,
- WECC/NERC synchronous generator testing and model validation, PSS/AVR tuning
- Design of Under Frequency and Under Voltage Load Shedding (UFLS and UVLS) Schemes
- Power Quality and Harmonics
- Design of System Protection Schemes (SPS/RAS)
- Electromagnetic Transients
- Transmission Line Modeling, electric and magnetic fields, and grounding
- Software Development for Power System Analysis – Designed/developed CYMHARMO program at CYME International and IREQ
- Power System Training – designed/delivered courses in Power

System Analysis to a number of utilities in North America, Middle east and Asia

Experience:

Jan 2012 – Now	Quanta Technology, Raleigh, NC Senior Director, Transmission West Region
Nov 95 – Oct 2011	Powertech Labs Inc., Surrey, BC, Canada, Manager, Power System Studies reporting to the director Smart Utility Business unit, contributed to the development of the five-year strategy for Powertech, improved reliability and maximized grid utilization by managing analysis/studies and developing planning and power system operation strategies and policies for utilities and industrial organizations
Jan 86 – Dec 1995	CYME International Inc., Montreal, Quebec, Canada, Cofounder and Director, System Engineering, reporting to the president and CEO, responsible for product and business development, designed/developed more than 12 computer programs for power system analysis. Within three years of startup, the company revenue increased to $5M with clients in over 70 countries

Professional Affiliations: Senior Member, Institute of Electrical and Electronics Engineers (IEEE)

Publications: Over 40 published articles in industry magazines and conference proceedings and other publications.

Selected publications:

"Network Security Assessments for Integrating Large-Scale Tidal Current and Ocean Wave Resources into Future Electrical Grids", Proceedings of the IEEE, 2011

"A Scenario Analysis of Northwest Electrical System toward Determining the Level of Wave Power that Can be Integrated By 2019 in Oregon", www.oregonwave.org, 2010.

"Key Features and Identification of Needed Improvements to Existing Interconnection Guidelines for Facilitating Integration of Ocean Energy Pilot Projects", a report prepared by Powertech Labs for the IEA-OES Annex III, [Online], www.iea-oceans.org, 2009

"Systematic Approach for Identification of Voltage Collapse Areas and the Reactive Power Reserve Requirements in Large Interconnected Transmission Grids" CIGRE, Paris, France, 2008.

"Annex III: Integration of Ocean Energy Plants into Distribution and Transmission Electrical Grids", IEA-OES, Annual report 2007, pp 22-28.

"An Assessment of Variable Characteristics of the Pacific Northwest

Regions Wave and Tidal Current Power Resources, and their Interaction with Electricity Demand & Implications for Large Scale Development Scenarios for the Region: Phase-1 Report", Report No: 17485-21-00(REP#3); Powertech Labs Inc., Dec 2007.

"A PI Control of DFIG-Based Wind Farm for Voltage Regulation at Remote Location", Approved for publication in the IEEE Transactions on Power Delivery, November 2006.

"Oscillatory Stability Limit Prediction Using Stochastic Subspace Identification", approved for publication in the IEEE Transactions on Power Delivery, August 2005.

"Assessing and Limiting Impact of Transformer Inrush Current on Power Quality", approved for publication in the IEEE Transactions on Power Delivery, June 2005.

"Design of a Special Protection System to Maintain System Security at High Import", Presented to IEEE-PES conference, July 2003

"An Intelligent System for Advanced Dynamic Security Assessment" IEEE-PES/CSEE INTERNATIONAL CONFERENCE ON POWER SYSTEM TECHNOLOGY, October 13-17, 2002 Kunming, China

"Simulation of Start-Up of a Hydro Power Plant for the emergency Power Supply of a Nuclear Power Station", IEEE Transactions on Power System, Vol. 16, No. 1, 2001, pp.163-169

"Experience with Testing and Modeling of Gas Turbines", IEEE winter meeting at Columbus Ohio, USA, Jan. 2001

"A Framework for Power System Restoration", proceedings of the CCECE '00, May 2000, Halifax, Canada.

"Measures To Improve Power System Security In The New Competitive Market Environment", SEPOPE, Brazil, 2000

"Analysis and Control of Harmonic Overvoltages during Power System Restoration", International Conference on Power System Transients - IPST '99, June 20-24, 1999, Budapest, Hungary.

Selected Experience:

Project Leader for "Development of the North American Reliability Council (NERC) Dynamic Simulation Cases and Dynamic Database". Technical leader for ERAG/NERC dynamic database and case development. Designed and developed synchronous generator testing and model validation procedures in compliance with WECC and NERC standards.

Project Leader for "POSSIT - POwer System Security Using Intelligent Technologies", Precarn Incorporated, Intelligent Systems. Developed

and implemented data mining in conjunction with modal analysis for predicting power system security.

Project Leader for "Special Protection System" Saudi Electric Company Designed and analyzed a system protection scheme to defer capital investment. SPS is successfully in operation for the past several years.

Project Leader for UFLS program assessment for SERC, SPP, TNB, SEC.

Project Leader for "Capacitor Application" PowerGrid Singapore. Determined optimum location and size for the implementation in the Power Grid of Singapore, the first of such installation in PG power system.

Project Leader for "Generator Testing and Model Validation" for BC Hydro in compliance with WECC

Project Leader for "Review of Steady-State Operating Guidelines and Procedures", SEC, Saudi Arabia.

Project Leader for "Design of Automatic Load Shedding Schemes", American Electric Power (AEP). Designed scheme for the load shedding in the AEP to defer millions of dollars of capital investment for a 765 kV transmission line.

Co-supervised M.Sc. and Ph.D. students at UBC and Concordia University

Developed a Harmonic Analysis Program (CYMHARMO) the first of its kind in North America. Conducted Harmonic Study for HVDC filter design of NTPC India.

KOJIMA, Takashi, P. Eng.
Transmission Cable Specialist

More than 40 years of combined experience in both manufacturing and utility industries on design, feasibility studies, trouble shooting of the underground and submarine cable systems and their components ranging from 69 kV through 525 kV voltage level. In addition to work on the ac and dc transmission cable systems of BC Hydro, the work covered projects in Singapore, Egypt and Jordan. Mr. Kojima also has an extensive experience in evaluation of mechanical performance of transmission cables including seismic performance of cables in ducts, buried and tunnel as well as submarine cables installed in slope with potential for slide. Mr. Kojima has been with BC Hydro since 1990 as a senior, specialist and principal engineer. He was previously with Canada Wire and Cable Ltd of Toronto, Ontario, one of the leading cable manufacturers in the world where he was responsible for design of transmission cables, accessories and distribution cables ranging from 5 kV through 345 kV level as well as transmission cable systems design. Mr. Kojima participated in preparation of IEEE1425 standard. Mr. Kojima acted as an advisor to EPRI on several research projects involving XLPE transmission cables.

EDUCATION

1969 Bachelor of Engineering, Mechanical Engineering
Musashi Institute of Technology, Tokyo, Japan

Certificate, Electrical Engineering Technology
Ryerson Polytechnical Institute, Toronto, Canada,

PROFESSIONAL ASSOCIATIONS

Member, Association of Professional Engineers and Geoscientists of British Columbia
Senior member, Institute of Electrical and Electronics Engineers, Power Engineering Societies

PROFESSIONAL EXPERIENCE

1990 to date BC Hydro, Vancouver, Canada

Title: Principal engineer/Specialist Engineer / Sr. Engineer

As a leader or part of an engineering project team, designed and provided engineering inputs for many land and submarine cable systems ranging in voltage level from 69 kV to 525 kV for both BC Hydro and international applications. Activities included technical studies, trouble shooting, cost estimating, land as well as underwater surveys and reviews, route

selection, specification and drawing preparations, accessory designs, bid evaluation, contract negotiations, contractors' design approvals, factory test, site test and report reviews, construction inspection and commissioning test acceptance. Performed studies and investigations to determine optimum cable types and systems; prepared technical specifications, evaluated tenders, and acted as BC Hydro technical representative for a supply and installation contract for 242 kV transmission cable circuits.
Designed/modified straight through and oil stop joints for SCFF cables rated up to 242 kV to suite available cables for speedy restoration of failed cable circuits. Studied and investigated ratings of transmission cable circuits crossing steam pipes, and designed methods of mitigation; reviewed fluid reservoir capacities of various fluid filled cable circuits and upgraded the systems as necessary.
Lead refurbishment project of 525 kV Submarine cable contaminated with moist air due to termination failure using a novel method not experienced previously in the world.

Through BC Hydro International Ltd, performed studies and investigations to determine optimum cable type and system for 400/ 500 kV underground transmission cable circuits for Singapore PUB and prepared technical specifications for a 400 kV cable circuit. . As the owner’s representative, witnessed 400 kV submarine cable laying operation across Gulf of Aqaba between Egypt and Jordan with 850m depth

Planed, coordinated and administered a series of tests to determine mechanical properties required for analyses of thermal-mechanical and seismic performances of various types of transmission cables supplied by different cable manufacturers and recommended allowable limits of deformations for use by BC Hydro.
Conducted seismic performance evaluation of various underground and submarine transmission cables and associated equipment rated up to 525 kV and coordinated seismic upgrade design and site work.
Chaired a meeting attended by geotechnical/geological experts from University of Alberta, University of BC, University of Victoria, Pacific and Atlantic Geo-Science Centres, consulting firms as well as BC Hydro to assess seismic stability of BC Hydro submarine cable corridors.
Coordinated and administered geotechnical studies and field drilling program to determine slope stability of new 242 kV submarine cable corridors as well as to assess performance of submarine cable under expected slope failure.
Coauthored a report on condition assessment of 300 kV DC submarine cables, reviewed various technical reports including vortex shading vibration and lead sheath fatigue of submarine cables submitted by contractors; participated in preparation of IEEE1425 standard and drafted two sections on selection and aging of metal sheaths on SCLF cables.

Represented BCTC and BC Hydro at EPRI Underground Transmission Task Force, and acted as an advisor on several research projects involving XLPE transmission cables.

1985-1990 Canada Wire and Cable Ltd., Toronto, Canada

Title: HV Cable Design Engineer and Supervisor of Drafting Section

Responsible for optimization of the mechanical and electrical design of underground high voltage power transmission cable systems; cables, terminations, joints, oil feeding systems, cross bonding equipment and other related accessories. Responsibilities included development of flexible submarine cable joints, process improvement and trouble shooting related to cable production and installation. Prepared system, cable and associated equipment designs including hydraulic, mechanical and electrical calculations required for various contracts and tenders for domestic and international clients.

Developed a number of computer programs required for cable design, cable accessory design, supporting system, oil feed system designs, oil demand, and cable installation. Carried out analytical studies on behavior of high pressure oil filled pipe type cables installed in slopes.

1975-1985 Canada Wire and Cable Ltd.

Title: Mechanical Engineer, High Voltage Systems

Responsible for the coordination of mechanical design and supply of equipment required for high voltage underground transmission cable systems. Designed accessories including joint, termination and spreader head for 3/C 138 kV high pressure gas filled composite submarine power/communication cable.

Coordinated design and supply of 220 kV high pressure pipe type cable accessories, and handled liaison with three SF6 switchgear suppliers from three different countries for a contract in Cairo, Egypt.

Carried out various analytical and experimental studies on mechanical properties of cables and their components including strain induced along corrugated aluminum sheaths, fatigues and creep properties of aluminum for sheath, and compressive, tensile and bending rigidities of cable cores.

Designed 230 kV self-contained oil filled cable installed in a 600 m deep shaft, accessories, cable support systems and support structures for cable terminations and auxiliary equipment. Prepared a number of technical study reports for approval by customers.

1971-1975 Canada Wire and Cable Ltd.

Title: Senior Draftsman, High Voltage Systems

Responsible for preparation of designs and drawings for cable accessories, pressure vessels and test set-ups.

1969-1971 Aero Auto Engineering, Toronto, Canada

Draftsman, High Voltage Systems (Canada Wire and Cable Ltd

Dispatched to Canada Wire and Cable. Responsible for preparation of designs and drawings for cable accessories for low voltage and high .

TECHNICAL PAPERS - Examples

"A Novel Method of Restoring BCTC 525 kV Submarine Cable Following a Catastrophic Breakage of a Termination at a Cable Landing Site" 2010 CIGRE Summer Meeting, Paris, France (co-authored)

"Dynamic Response of Underground Transmission Cables to Seismic Waive", 1997 IEE of Japan, National Convention, Kyoto, Japan (co-authored)

"Response of Underground Cable Duct System to Travelling Seismic Waves" 2000 Lifeline Conference, Vancouver Canada (co-authored)

"Emergency Operating Temperature for XLPE Cables" 2002 EPRI Underground Transmission Task Force Meeting

"Generic Cable Study and Specific Underground Cable Review" BC Hydro internal report (co-authored)

"500 kV & DC Submarine Cable Terminal Sites – Seismic Evaluation of Non-Early Attention Items" BC Hydro internal report.

"Cable Deformation vs. Electrical Failure" BC Hydro internal report

"60L51/52/53 Hotspot Mitigation & Cable Evaluation" BC Hydro internal report

LANGUAGES

Fluent in English and Japanese

G.C. (GERRY) GERMAIN

CAREER SUMMARY

Extensive and broad range of experience in construction and corporate management. Held senior management positions during the implementation of numerous construction projects in the heavy civil, hydroelectric, offshore oil & gas, marine, mining, and building disciplines in Eastern Canada, and on international locations.

AREAS OF STRENGTH

Highly motivated manager with excellent leadership and team building skills. Outstanding track record in contract administration, project controls, and quality systems.

WORK HISTORY

GENERGY INC. – 1991 to date

Genergy is a wholly owned St. John's based company that provides my services to client companies; assignments have included the following:

- Since 1991, completed pre-feasibility studies and provided project management services to developers of proposed hydroelectric power stations in Newfoundland and Labrador.
- February 2009 to October 2010, Project Manager during the design, construction and commissioning of a marine services facility for Rolls-Royce Canada at Mount Pearl, NL.
- May 2003 to August 2006, senior executive with Rutter Inc. (see below).
- December 2000 to November 2001, Project Manager with SNC-Lavalin during a concentrator upgrade project for the Iron Ore Company of Canada at Labrador City, NL.
- During 1995 and 1996, local representative to Bouygues Offshore (now Saipem) during the preparation of proposals for the development of Petro Canada's Terra Nova project.
- During 1992, volunteer Project Manager during the design and construction of the St. John's SPCA shelter.

RUTTER ENGINEERING & AUTOMATION (REA) – 2003 to 2006

- **President & CEO – May 2005 to August 2006**

  Responsible for the operations of St. John's based REA, a Rutter Inc. subsidiary, with engineering, automation and project management expertise in the oil & gas, commercial and heavy industrial sectors, and which employed more than 250 engineers and technicians in Canada, the US and Brazil.

- **President – May 2003 to May 2005**

  President of Unicontrol International Ltda., REA's São Paulo based Brazilian subsidiary, with offices in Rio do Janeiro, Macaé, and Victoria. Unicontrol is an engineering company specializing in instrumentation, controls and systems integration, as well as field installation and maintenance services for the oil & gas and industrial sectors, and which employed more than 150 engineers and technicians.

BOUYGUES OFFSHORE (now Saipem) – 1985 to 1990

- **President (1988 to 1990)**

  Managed the Halifax based Canadian subsidiary (Bouygues Offshore Canada), which was involved in the development and marketing of three (3) concrete production structures for the Canadian offshore. As a member of the Hibernia Builders Joint Venture (Kiewit/Bouygues/ Pennecon), the company was a proponent for the design, construction and installation of Mobil's Hibernia gravity base structure (GBS). The company also submitted a proposal for the marine works for the Confederation Bridge between New Brunswick and Prince Edward Island.

- **Director – Marketing and Business Development (1985 to 1988)**

  Managed the London based marketing and business development operations of a UK subsidiary (UIE Scotland), which owned and operated a significant fabrication yard located at Clydebank, Scotland. Participated in the yard's transition from 'shipyard' (John Brown & Company) to a premier fabricator of offshore oil & gas production modules, and produced the corporate Quality System Manual.

  During this period, served as a Director and Deputy Chairman of the UK Module Constructors' Association (MCA) and was Chairman of the MCA's Standard Conditions of Contract and Annual Function Committees.

BECHTEL INC. – 1977 to 1984

- **Site Manager (1982 to 1984)**

  Managed site teams responsible for the fabrication supervision and quality management of several North Sea oil & gas modules. These included production modules for Mobil's Beryl B oil & gas platform, which were fabricated at Cherbourg, France; and the 4,800-ton central processing platform and jackets for Hamilton Brother's Esmond gas development, which were fabricated at Ardersier, Scotland.

  Between 1977 and 1982, I was seconded to the Société d'énergie de la Baie James' (SEBJ - a Hydro Quebec subsidiary) project management team and held the following positions:

- **Manager – Contract Administration (1979 to 1982)**

  Managed SEBJ's contract administration department during the construction and commissioning phases of the 2,304 MW LG 3 hydroelectric power station in northern Québec. The department was responsible for the administration of about 45 contracts ranging in value of between $10 and $450 million, and for budget and cost control, estimating, scheduling, management systems and project documentation.

  As deputy Site Manager, responsibilities included a wide range of administrative functions related to the operation of the camps and village housing the 5,000 workers and 300 families at the remote LG 3 site. Also, was Chairman of the LG 3 Emergency Measures Committee.

- **Manager – Project Controls (1977 to 1979)**

  Managed SEBJ's project controls department in Montréal during the engineering and procurement phases of the LG 3 project. The department was responsible for establishing the project schedule and budget, analysis of design alternatives, definition of work packages, tender documentation, and coordination between the engineering, procurement and construction departments.

TOWNEND AND GODFREY BROTHERS LTD. – 1971 to 1977

- **General Manager**

  Managed the company's construction operations. The Mandeville based company was a general contractor and producer of concrete and concrete products; one of the oldest and largest in Jamaica. During my term with Townend & Godfrey, some 40 projects were completed across the Island in the mining, civil and building disciplines. Mining projects included new construction and expansion programmes in the bauxite, alumina, and cement industries. Civil and building projects included bridges, resort hotels, commercial centres, housing estates, and secondary schools.

  In late 1974, was special consultant to the Overseas Private Investment Corporation (OPIC), a US State Department agency, during the settlement of an expropriation dispute between the Government of Guyana and Reynolds (Guyana) Mines Ltd.

WALSH CONSTRUCTION COMPANY – 1968 to 1971

- **Assistant Project Manager**

  Managed the procurement, contract administration, and project controls departments during the turnkey construction of the Revere alumina plant at Maggotty, Jamaica, WI. Responsibilities also included administrative functions with respect to labour and government relations.

OTHER EMPLOYMENT

During 1967, was Director of the Expo '67 theme pavilion 'Man and the Oceans' and in collaboration with Commandant Jacques-Yves Cousteau's team, co-produced and directed the live underwater exhibit that depicted man's conquest of the undersea.

Prior to 1967, worked on several heavy civil and mining projects. These included hydroelectric, highway, tunnel, and bridge construction in Québec and in South Vietnam; the dredging of the St. Lawrence Seaway; and the turnkey construction of an iron ore concentrator at Wabush Lake, Labrador. Held positions in contract administration, project controls, construction supervision, inspection and surveying.

ASSOCIATIONS & COMMUNITY ACTIVITIES

Past-Chair of the Board of Directors of the Newfoundland Symphony Orchestra. Served as a Director of the Newfoundland and Labrador Oil & Gas Industries Association (NOIA), President of the Newfoundland and Labrador Waterpower Association; and volunteered with other community and business associations. Member of the Royal Newfoundland Yacht Club and the Crow's Nest Officers Club.

EDUCATION

Sir George William University, Faculty of Science, Montréal, QC; Collège Saint-Laurent (secondary), Saint-Laurent, QC; and Ecole St. Antonin (primary), Montréal, QC. Completed numerous continuing education courses/seminars in project management, contract administration, cost engineering, computer application, and emergency measures. Fluent in both French and English.

SECTION

4

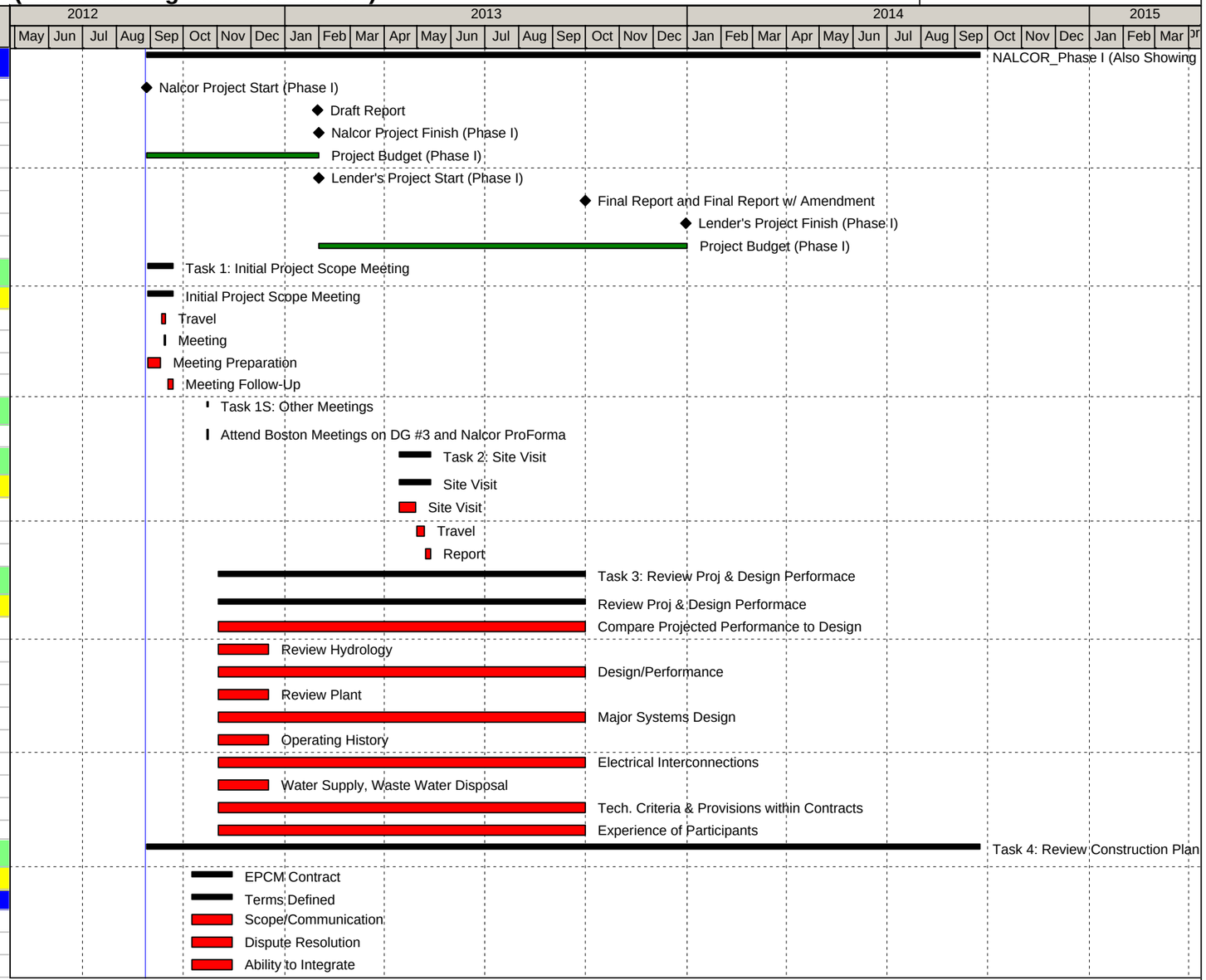
Work Schedule of Independent Engineer
Phase 1 and Phase 2
Lower Churchill Project
LC-PM-0832
NALCOR ENERGY

IE EXECUTION PLAN WORK SCHEDULE

WORK SCHEDULE PHASE 1

NALCOR_Phase I (Also Showing Lenders Phase I)

Activity ID	Activity Name	Rem Duration	Start	Finish
NALCOR_Phase I (Also Showing Lenders P...		524.00d	28-Aug-12	23-Sep-14
A2340	Nalcor Project Start (Phase I)	0.00d	28-Aug-12*	
A2341	Draft Report	0.00d		31-Jan-13*
A2342	Nalcor Project Finish (Phase I)	0.00d		31-Jan-13*
A2343	Project Budget (Phase I)	107.50d	28-Aug-12	31-Jan-13
A2350	Lender's Project Start (Phase I)	0.00d	01-Feb-13*	
A2351	Final Report and Final Report w/ Amendment	0.00d		30-Sep-13*
A2352	Lender's Project Finish (Phase I)	0.00d		31-Dec-13*
A2353	Project Budget (Phase I)	232.50d	01-Feb-13	31-Dec-13
Task 1: Initial Project Scope Meeting		16.00d	30-Aug-12	21-Sep-12
Initial Project Scope Meeting		16.00d	30-Aug-12	21-Sep-12
A1090	Travel	4.00d	11-Sep-12*	14-Sep-12
A1100	Meeting	2.00d	13-Sep-12*	14-Sep-12
A1110	Meeting Preparation	7.00d	30-Aug-12*	10-Sep-12
A1120	Meeting Follow-Up	5.00d	17-Sep-12*	21-Sep-12
Task 1S: Other Meetings		2.00d	22-Oct-12	23-Oct-12
A3230	Attend Boston Meetings on DG #3 and Nalcor ProFo...	2.00d	22-Oct-12*	23-Oct-12
Task 2: Site Visit		21.00d	15-Apr-13	13-May-13
Site Visit		21.00d	15-Apr-13	13-May-13
A1130	Site Visit	11.00d	15-Apr-13*	29-Apr-13
A1140	Travel	6.00d	30-Apr-13*	07-May-13
A1150	Report	4.00d	08-May-13*	13-May-13
Task 3: Review Proj & Design Performace		230.00d	01-Nov-12	30-Sep-13
Review Proj & Design Performace		230.00d	01-Nov-12	30-Sep-13
A1160	Compare Projected Performance to Design	230.00d	01-Nov-12*	30-Sep-13
A1170	Review Hydrology	32.00d	01-Nov-12*	17-Dec-12
A1180	Design/Performance	230.00d	01-Nov-12*	30-Sep-13
A1190	Review Plant	32.00d	01-Nov-12*	17-Dec-12
A1200	Major Systems Design	230.00d	01-Nov-12*	30-Sep-13
A1210	Operating History	32.00d	01-Nov-12*	17-Dec-12
A1220	Electrical Interconnections	230.00d	01-Nov-12*	30-Sep-13
A1230	Water Supply, Waste Water Disposal	32.00d	01-Nov-12*	17-Dec-12
A1240	Tech. Criteria & Provisions within Contracts	230.00d	01-Nov-12*	30-Sep-13
A1250	Experience of Participants	230.00d	01-Nov-12*	30-Sep-13
Task 4: Review Construction Plan & Schedule		524.00d	28-Aug-12	23-Sep-14
EPCM Contract		28.00d	08-Oct-12	14-Nov-12
Terms Defined		28.00d	08-Oct-12	14-Nov-12
A1260	Scope/Communication	28.00d	08-Oct-12*	14-Nov-12
A1270	Dispute Resolution	28.00d	08-Oct-12*	14-Nov-12
A1280	Ability to Integrate	28.00d	08-Oct-12*	14-Nov-12



MWH

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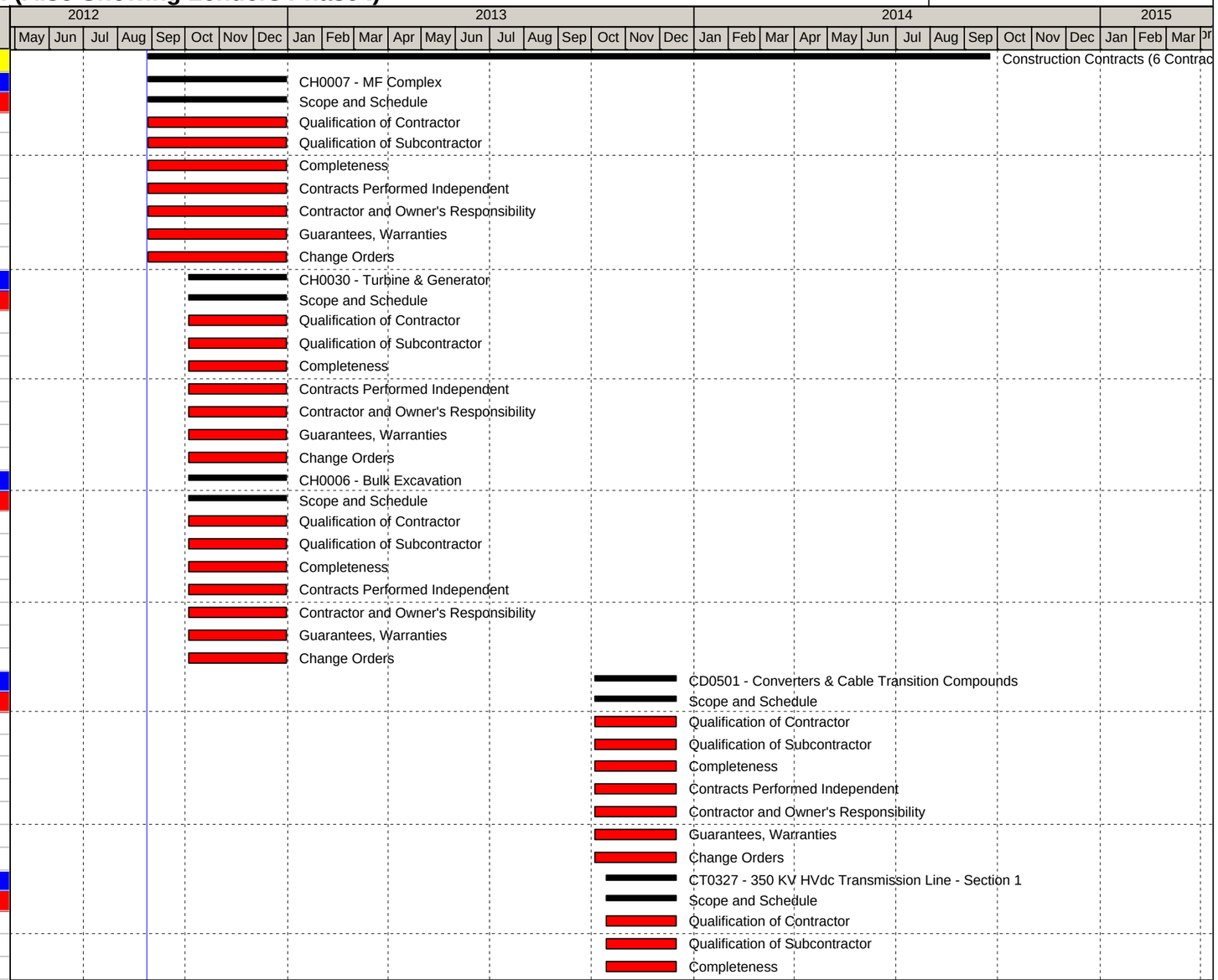
NALCOR_Phase I (Also Showing Lenders Phase I)

Activity ID	Activity Name	Rem Duration	Start	Finish
Construction Contracts (6 Contracts)		524.00d	28-Aug-12	23-Sep-14
CH0007 - MF Complex		86.00d	28-Aug-12	31-Dec-12
Scope and Schedule		86.00d	28-Aug-12	31-Dec-12
A1290	Qualification of Contractor	86.00d	28-Aug-12*	31-Dec-12
A1300	Qualification of Subcontractor	86.00d	28-Aug-12*	31-Dec-12
A1310	Completeness	86.00d	28-Aug-12*	31-Dec-12
A1320	Contracts Performed Independent	86.00d	28-Aug-12*	31-Dec-12
A1330	Contractor and Owner's Responsibility	86.00d	28-Aug-12*	31-Dec-12
A1340	Guarantees, Warranties	86.00d	28-Aug-12*	31-Dec-12
A1350	Change Orders	86.00d	28-Aug-12*	31-Dec-12
CH0030 - Turbine & Generator		60.00d	04-Oct-12	31-Dec-12
Scope and Schedule		60.00d	04-Oct-12	31-Dec-12
A2410	Qualification of Contractor	60.00d	04-Oct-12*	31-Dec-12
A2420	Qualification of Subcontractor	60.00d	04-Oct-12*	31-Dec-12
A2430	Completeness	60.00d	04-Oct-12*	31-Dec-12
A2440	Contracts Performed Independent	60.00d	04-Oct-12*	31-Dec-12
A2450	Contractor and Owner's Responsibility	60.00d	04-Oct-12*	31-Dec-12
A2460	Guarantees, Warranties	60.00d	04-Oct-12*	31-Dec-12
A2470	Change Orders	60.00d	04-Oct-12*	31-Dec-12
CH0006 - Bulk Excavation		60.00d	04-Oct-12	31-Dec-12
Scope and Schedule		60.00d	04-Oct-12	31-Dec-12
A2530	Qualification of Contractor	60.00d	04-Oct-12*	31-Dec-12
A2540	Qualification of Subcontractor	60.00d	04-Oct-12*	31-Dec-12
A2550	Completeness	60.00d	04-Oct-12*	31-Dec-12
A2560	Contracts Performed Independent	60.00d	04-Oct-12*	31-Dec-12
A2570	Contractor and Owner's Responsibility	60.00d	04-Oct-12*	31-Dec-12
A2580	Guarantees, Warranties	60.00d	04-Oct-12*	31-Dec-12
A2590	Change Orders	60.00d	04-Oct-12*	31-Dec-12
CD0501 - Converters & Cable Transition Compounds		51.00d	04-Oct-13	16-Dec-13
Scope and Schedule		51.00d	04-Oct-13	16-Dec-13
A2650	Qualification of Contractor	51.00d	04-Oct-13*	16-Dec-13
A2660	Qualification of Subcontractor	51.00d	04-Oct-13*	16-Dec-13
A2670	Completeness	51.00d	04-Oct-13*	16-Dec-13
A2680	Contracts Performed Independent	51.00d	04-Oct-13*	16-Dec-13
A2690	Contractor and Owner's Responsibility	51.00d	04-Oct-13*	16-Dec-13
A2700	Guarantees, Warranties	51.00d	04-Oct-13*	16-Dec-13
A2710	Change Orders	51.00d	04-Oct-13*	16-Dec-13
CT0327 - 350 KV HVdc Transmission Line - Section 1		45.00d	14-Oct-13	16-Dec-13
Scope and Schedule		45.00d	14-Oct-13	16-Dec-13
A2770	Qualification of Contractor	45.00d	14-Oct-13*	16-Dec-13
A2780	Qualification of Subcontractor	45.00d	14-Oct-13*	16-Dec-13
A2790	Completeness	45.00d	14-Oct-13*	16-Dec-13



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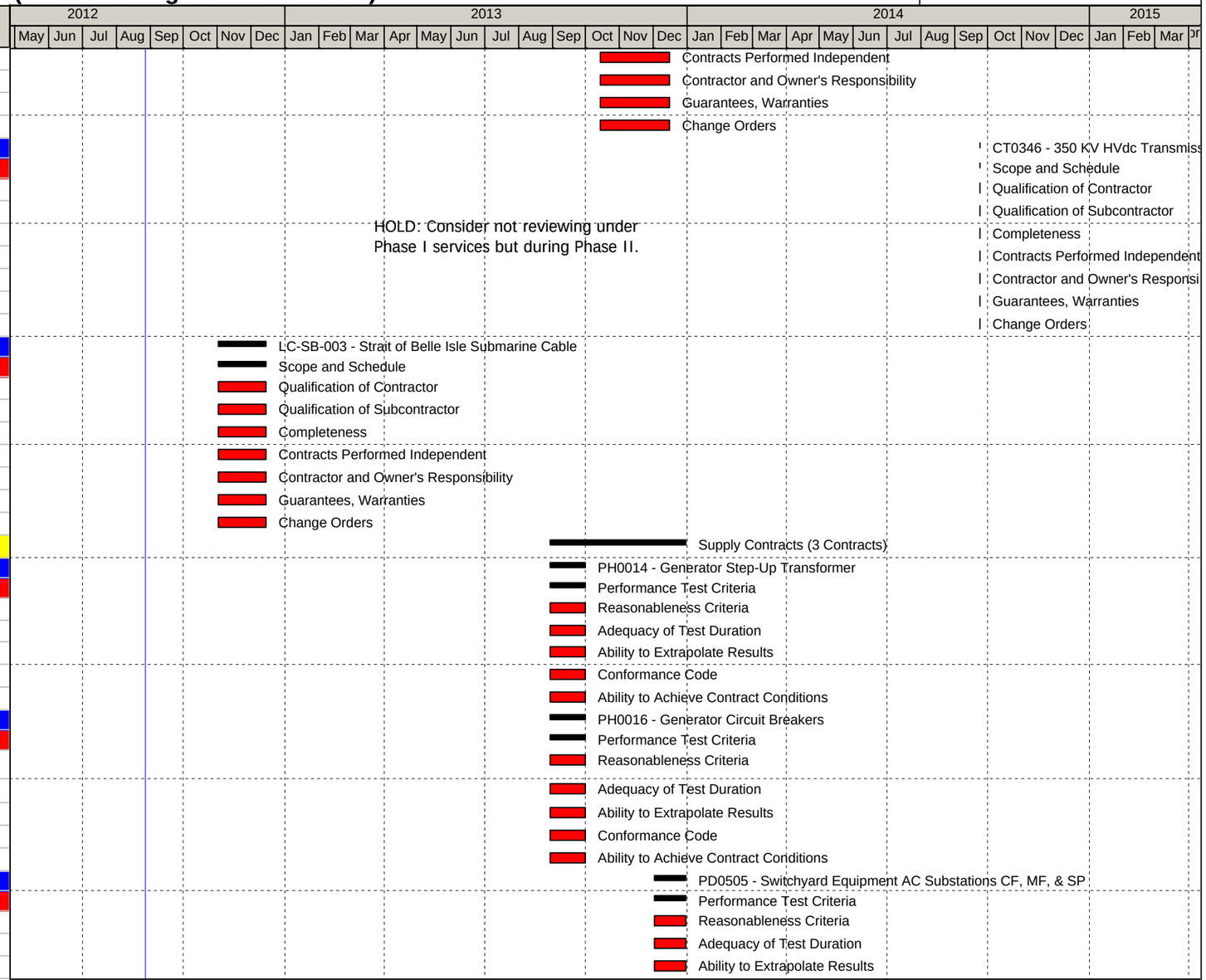
NALCOR_Phase I (Also Showing Lenders Phase I)

Activity ID	Activity Name	Rem Duration	Start	Finish
A2800	Contracts Performed Independent	45.00d	14-Oct-13*	16-Dec-13
A2810	Contractor and Owner's Responsibility	45.00d	14-Oct-13*	16-Dec-13
A2820	Guarantees, Warranties	45.00d	14-Oct-13*	16-Dec-13
A2830	Change Orders	45.00d	14-Oct-13*	16-Dec-13
CT0346 - 350 KV HVdc Transmission Line - Section 2		0.00d	23-Sep-14	23-Sep-14
Scope and Schedule		0.00d	23-Sep-14	23-Sep-14
A2890	Qualification of Contractor	0.00d	23-Sep-14*	23-Sep-14
A2900	Qualification of Subcontractor	0.00d	23-Sep-14*	23-Sep-14
A2910	Completeness	0.00d	23-Sep-14*	23-Sep-14
A2920	Contracts Performed Independent	0.00d	23-Sep-14*	23-Sep-14
A2930	Contractor and Owner's Responsibility	0.00d	23-Sep-14*	23-Sep-14
A2940	Guarantees, Warranties	0.00d	23-Sep-14*	23-Sep-14
A2950	Change Orders	0.00d	23-Sep-14*	23-Sep-14
LC-SB-003 - Strait of Belle Isle Submarine Cable		31.00d	01-Nov-12	14-Dec-12
Scope and Schedule		31.00d	01-Nov-12	14-Dec-12
A3010	Qualification of Contractor	31.00d	01-Nov-12*	14-Dec-12
A3020	Qualification of Subcontractor	31.00d	01-Nov-12*	14-Dec-12
A3030	Completeness	31.00d	01-Nov-12*	14-Dec-12
A3040	Contracts Performed Independent	31.00d	01-Nov-12*	14-Dec-12
A3050	Contractor and Owner's Responsibility	31.00d	01-Nov-12*	14-Dec-12
A3060	Guarantees, Warranties	31.00d	01-Nov-12*	14-Dec-12
A3070	Change Orders	31.00d	01-Nov-12*	14-Dec-12
Supply Contracts (3 Contracts)		84.00d	30-Aug-13	31-Dec-13
PH0014 - Generator Step-Up Transformer		21.00d	30-Aug-13	30-Sep-13
Performance Test Criteria		21.00d	30-Aug-13	30-Sep-13
A3080	Reasonableness Criteria	21.00d	30-Aug-13*	30-Sep-13
A3090	Adequacy of Test Duration	21.00d	30-Aug-13*	30-Sep-13
A3100	Ability to Extrapolate Results	21.00d	30-Aug-13*	30-Sep-13
A3110	Conformance Code	21.00d	30-Aug-13*	30-Sep-13
A3120	Ability to Achieve Contract Conditions	21.00d	30-Aug-13*	30-Sep-13
PH0016 - Generator Circuit Breakers		21.00d	30-Aug-13	30-Sep-13
Performance Test Criteria		21.00d	30-Aug-13	30-Sep-13
A3130	Reasonableness Criteria	21.00d	30-Aug-13*	30-Sep-13
A3140	Adequacy of Test Duration	21.00d	30-Aug-13*	30-Sep-13
A3150	Ability to Extrapolate Results	21.00d	30-Aug-13*	30-Sep-13
A3160	Conformance Code	21.00d	30-Aug-13*	30-Sep-13
A3170	Ability to Achieve Contract Conditions	21.00d	30-Aug-13*	30-Sep-13
PD0505 - Switchyard Equipment AC Substations CF, MF, & SP		20.00d	02-Dec-13	31-Dec-13
Performance Test Criteria		20.00d	02-Dec-13	31-Dec-13
A3180	Reasonableness Criteria	20.00d	02-Dec-13*	31-Dec-13
A3190	Adequacy of Test Duration	20.00d	02-Dec-13*	31-Dec-13
A3200	Ability to Extrapolate Results	20.00d	02-Dec-13*	31-Dec-13



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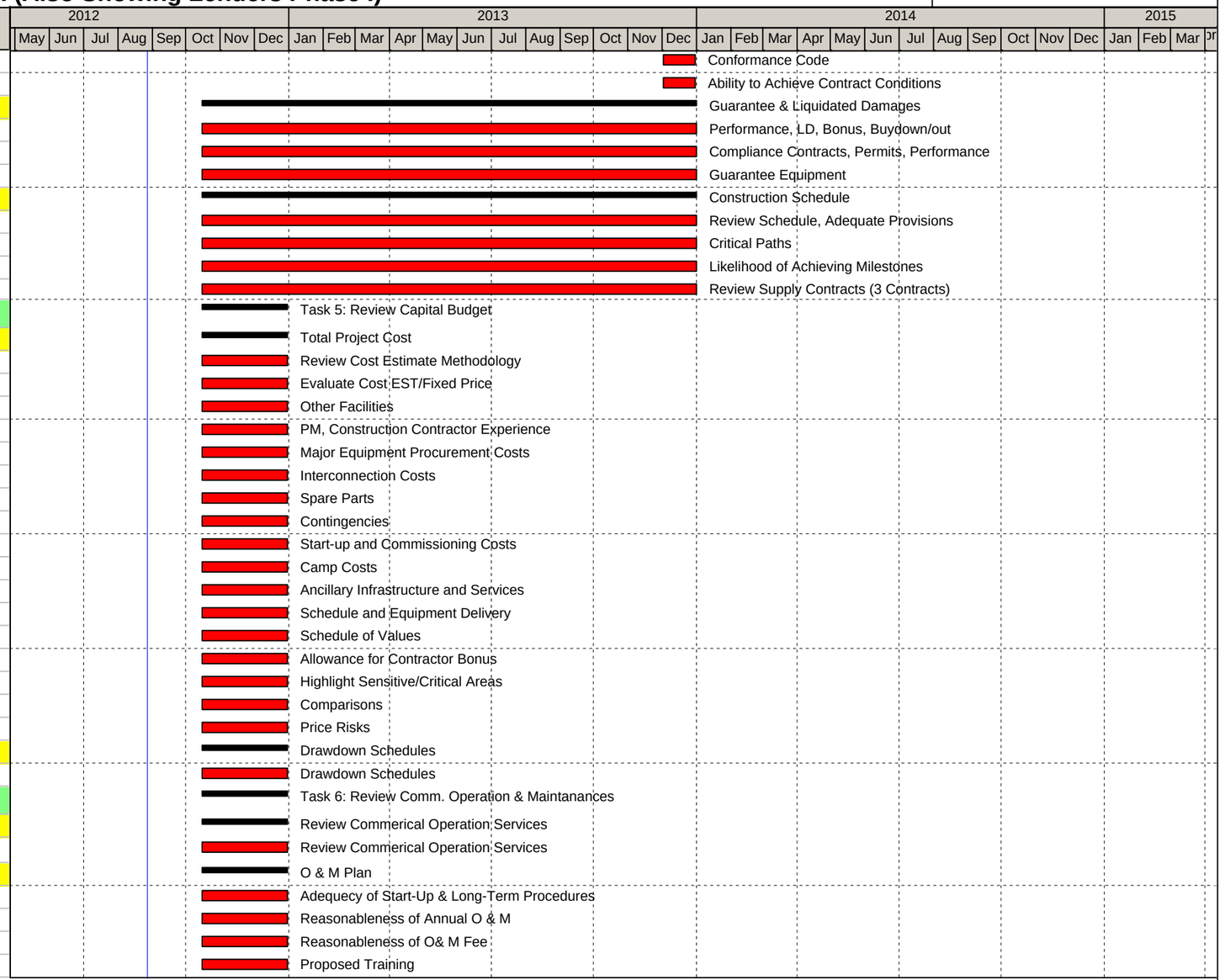
Activity ID	Activity Name	Rem Duration	Start	Finish
A3210	Conformance Code	20.00d	02-Dec-13*	31-Dec-13
A3220	Ability to Achieve Contract Conditions	20.00d	02-Dec-13*	31-Dec-13
Guarantee & Liquidated Damages		307.00d	15-Oct-12	31-Dec-13
A1360	Performance, LD, Bonus, Buydown/out	307.00d	15-Oct-12*	31-Dec-13
A1370	Compliance Contracts, Permits, Performance	307.00d	15-Oct-12*	31-Dec-13
A1380	Guarantee Equipment	307.00d	15-Oct-12*	31-Dec-13
Construction Schedule		307.00d	15-Oct-12	31-Dec-13
A1390	Review Schedule, Adequate Provisions	307.00d	15-Oct-12*	31-Dec-13
A1400	Critical Paths	307.00d	15-Oct-12*	31-Dec-13
A1410	Likelihood of Achieving Milestones	307.00d	15-Oct-12*	31-Dec-13
A1420	Review Supply Contracts (3 Contracts)	307.00d	15-Oct-12*	31-Dec-13
Task 5: Review Capital Budget		53.00d	15-Oct-12	31-Dec-12
Total Project Cost		53.00d	15-Oct-12	31-Dec-12
A1480	Review Cost Estimate Methodology	53.00d	15-Oct-12*	31-Dec-12
A1490	Evaluate Cost EST/Fixed Price	53.00d	15-Oct-12*	31-Dec-12
A1500	Other Facilities	53.00d	15-Oct-12*	31-Dec-12
A1510	PM, Construction Contractor Experience	53.00d	15-Oct-12*	31-Dec-12
A1520	Major Equipment Procurement Costs	53.00d	15-Oct-12*	31-Dec-12
A1530	Interconnection Costs	53.00d	15-Oct-12*	31-Dec-12
A1540	Spare Parts	53.00d	15-Oct-12*	31-Dec-12
A1550	Contingencies	53.00d	15-Oct-12*	31-Dec-12
A1560	Start-up and Commissioning Costs	53.00d	15-Oct-12*	31-Dec-12
A1570	Camp Costs	53.00d	15-Oct-12*	31-Dec-12
A1580	Ancillary Infrastructure and Services	53.00d	15-Oct-12*	31-Dec-12
A1590	Schedule and Equipment Delivery	53.00d	15-Oct-12*	31-Dec-12
A1600	Schedule of Values	53.00d	15-Oct-12*	31-Dec-12
A1610	Allowance for Contractor Bonus	53.00d	15-Oct-12*	31-Dec-12
A1620	Highlight Sensitive/Critical Areas	53.00d	15-Oct-12*	31-Dec-12
A1630	Comparisons	53.00d	15-Oct-12*	31-Dec-12
A1640	Price Risks	53.00d	15-Oct-12*	31-Dec-12
Drawdown Schedules		53.00d	15-Oct-12	31-Dec-12
A1650	Drawdown Schedules	53.00d	15-Oct-12*	31-Dec-12
Task 6: Review Comm. Operation & Maintanan...		53.00d	15-Oct-12	31-Dec-12
Review Commerical Operation Services		53.00d	15-Oct-12	31-Dec-12
A1660	Review Commerical Operation Services	53.00d	15-Oct-12*	31-Dec-12
O & M Plan		53.00d	15-Oct-12	31-Dec-12
A1670	Adequecy of Start-Up & Long-Term Procedures	53.00d	15-Oct-12*	31-Dec-12
A1680	Reasonableness of Annual O & M	53.00d	15-Oct-12*	31-Dec-12
A1690	Reasonableness of O& M Fee	53.00d	15-Oct-12*	31-Dec-12
A1700	Proposed Training	53.00d	15-Oct-12*	31-Dec-12



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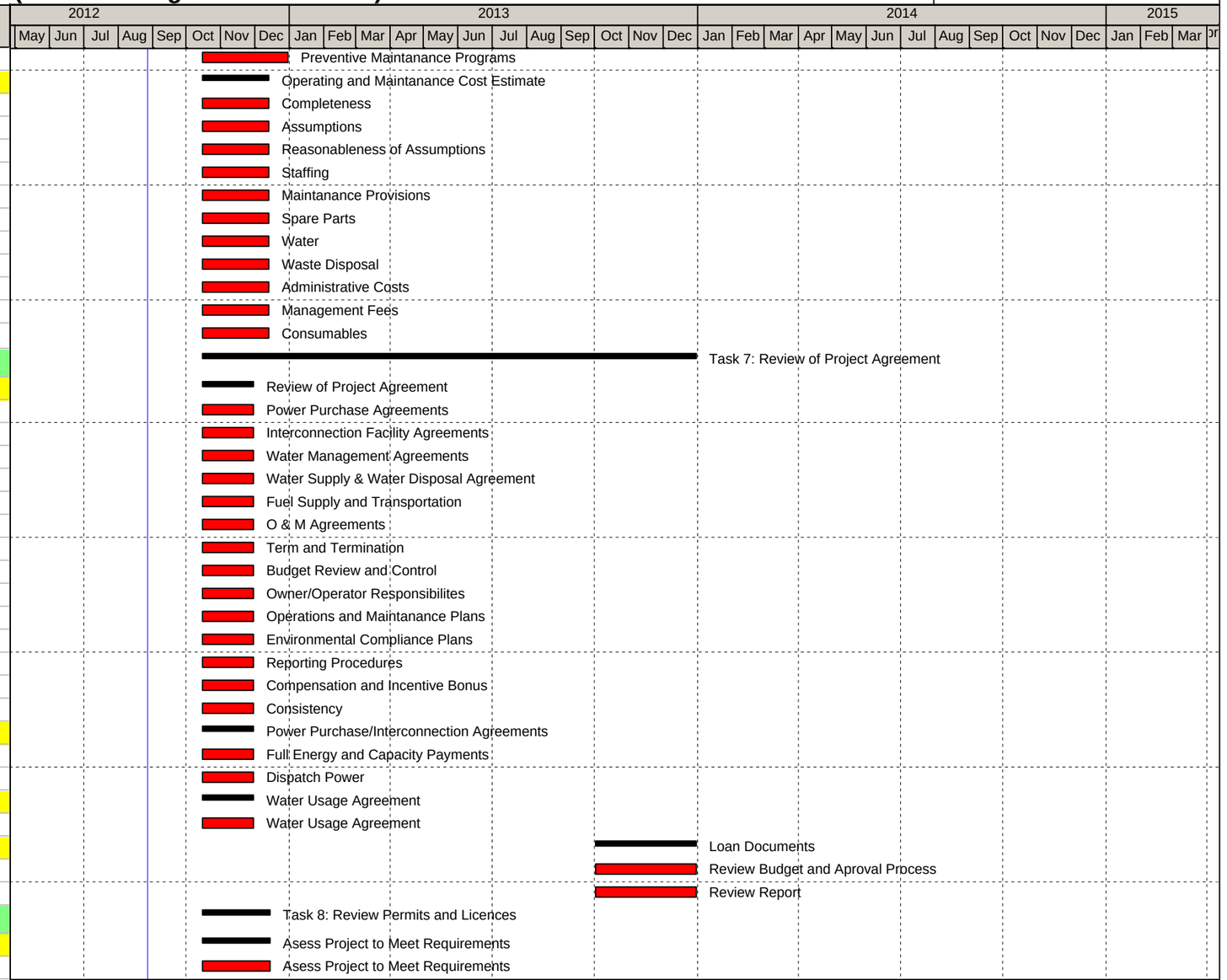
Activity ID	Activity Name	Rem Duration	Start	Finish
A1710	Preventive Maintanance Programs	53.00d	15-Oct-12*	31-Dec-12
Operating and Maintanance Cost Estimate		43.00d	15-Oct-12	13-Dec-12
A1720	Completeness	43.00d	15-Oct-12*	13-Dec-12
A1730	Assumptions	43.00d	15-Oct-12*	13-Dec-12
A1740	Reasonableness of Assumptions	43.00d	15-Oct-12*	13-Dec-12
A1750	Staffing	43.00d	15-Oct-12*	13-Dec-12
A1760	Maintanance Provisions	43.00d	15-Oct-12*	13-Dec-12
A1770	Spare Parts	43.00d	15-Oct-12*	13-Dec-12
A1780	Water	43.00d	15-Oct-12*	13-Dec-12
A1790	Waste Disposal	43.00d	15-Oct-12*	13-Dec-12
A1800	Administrative Costs	43.00d	15-Oct-12*	13-Dec-12
A1810	Management Fees	43.00d	15-Oct-12*	13-Dec-12
A1820	Consumables	43.00d	15-Oct-12*	13-Dec-12
Task 7: Review of Project Agreement		306.50d	15-Oct-12	31-Dec-13
Review of Project Agreement		34.00d	15-Oct-12	30-Nov-12
A1920	Power Purchase Agreements	34.00d	15-Oct-12*	30-Nov-12
A1930	Interconnection Facility Agreements	34.00d	15-Oct-12*	30-Nov-12
A1950	Water Management Agreements	34.00d	15-Oct-12*	30-Nov-12
A1960	Water Supply & Water Disposal Agreement	34.00d	15-Oct-12*	30-Nov-12
A1970	Fuel Supply and Transportation	34.00d	15-Oct-12*	30-Nov-12
A1980	O & M Agreements	34.00d	15-Oct-12*	30-Nov-12
A1990	Term and Termination	34.00d	15-Oct-12*	30-Nov-12
A2000	Budget Review and Control	34.00d	15-Oct-12*	30-Nov-12
A2010	Owner/Operator Responsibilites	34.00d	15-Oct-12*	30-Nov-12
A2020	Operations and Maintanance Plans	34.00d	15-Oct-12*	30-Nov-12
A2030	Environmental Compliance Plans	34.00d	15-Oct-12*	30-Nov-12
A2040	Reporting Procedures	34.00d	15-Oct-12*	30-Nov-12
A2050	Compensation and Incentive Bonus	34.00d	15-Oct-12*	30-Nov-12
A2060	Consistency	34.00d	15-Oct-12*	30-Nov-12
Power Purchase/Interconnection Agreements		34.00d	15-Oct-12	30-Nov-12
A2070	Full Energy and Capacity Payments	34.00d	15-Oct-12*	30-Nov-12
A2110	Dispatch Power	34.00d	15-Oct-12*	30-Nov-12
Water Usage Agreement		34.00d	15-Oct-12	30-Nov-12
A2080	Water Usage Agreement	34.00d	15-Oct-12*	30-Nov-12
Loan Documents		63.00d	01-Oct-13	31-Dec-13
A2090	Review Budget and Aproval Process	63.00d	01-Oct-13*	31-Dec-13
A2100	Review Report	63.00d	01-Oct-13*	31-Dec-13
Task 8: Review Permits and Licences		44.00d	15-Oct-12	14-Dec-12
Asess Project to Meet Requirements		44.00d	15-Oct-12	14-Dec-12
A1910	Asess Project to Meet Requirements	44.00d	15-Oct-12*	14-Dec-12



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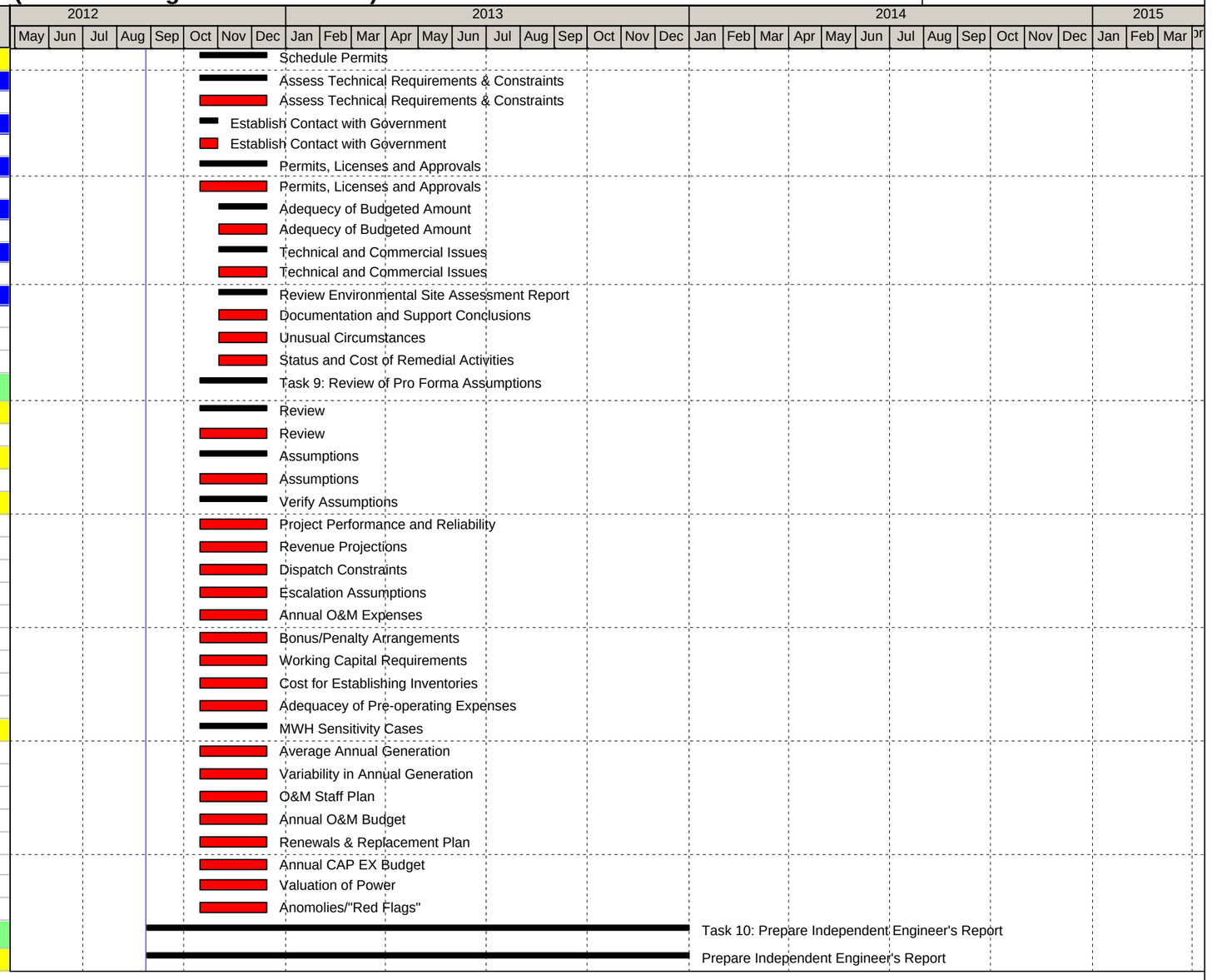
Schedule Permits		44.00d	15-Oct-12	14-Dec-12
Assess Technical Requirements & Constraints		44.00d	15-Oct-12	14-Dec-12
A1830	Assess Technical Requirements & Constraints	44.00d	15-Oct-12*	14-Dec-12
Establish Contact with Government		13.00d	15-Oct-12	31-Oct-12
A1840	Establish Contact with Government	13.00d	15-Oct-12*	31-Oct-12
Permits, Licenses and Approvals		44.00d	15-Oct-12	14-Dec-12
A1850	Permits, Licenses and Approvals	44.00d	15-Oct-12*	14-Dec-12
Adequecy of Budgeted Amount		31.00d	01-Nov-12	14-Dec-12
A1860	Adequecy of Budgeted Amount	31.00d	01-Nov-12*	14-Dec-12
Technical and Commercial Issues		31.00d	01-Nov-12	14-Dec-12
A1870	Technical and Commercial Issues	31.00d	01-Nov-12*	14-Dec-12
Review Environmental Site Assessment Report		31.00d	01-Nov-12	14-Dec-12
A1880	Documentation and Support Conclusions	31.00d	01-Nov-12*	14-Dec-12
A1890	Unusual Circumstances	31.00d	01-Nov-12*	14-Dec-12
A1900	Status and Cost of Remedial Activities	31.00d	01-Nov-12*	14-Dec-12
Task 9: Review of Pro Forma Assumptions		44.00d	15-Oct-12	14-Dec-12
Review		44.00d	15-Oct-12	14-Dec-12
A2120	Review	44.00d	15-Oct-12*	14-Dec-12
Assumptions		44.00d	15-Oct-12	14-Dec-12
A2130	Assumptions	44.00d	15-Oct-12*	14-Dec-12
Verify Assumptions		44.00d	15-Oct-12	14-Dec-12
A2140	Project Performance and Reliability	44.00d	15-Oct-12*	14-Dec-12
A2150	Revenue Projections	44.00d	15-Oct-12*	14-Dec-12
A2160	Dispatch Constraints	44.00d	15-Oct-12*	14-Dec-12
A2170	Escalation Assumptions	44.00d	15-Oct-12*	14-Dec-12
A2180	Annual O&M Expenses	44.00d	15-Oct-12*	14-Dec-12
A2190	Bonus/Penalty Arrangements	44.00d	15-Oct-12*	14-Dec-12
A2200	Working Capital Requirements	44.00d	15-Oct-12*	14-Dec-12
A2210	Cost for Establishing Inventories	44.00d	15-Oct-12*	14-Dec-12
A2220	Adequacy of Pre-operating Expenses	44.00d	15-Oct-12*	14-Dec-12
MWH Sensitivity Cases		44.00d	15-Oct-12	14-Dec-12
A2230	Average Annual Generation	44.00d	15-Oct-12*	14-Dec-12
A2240	Variability in Annual Generation	44.00d	15-Oct-12*	14-Dec-12
A2250	O&M Staff Plan	44.00d	15-Oct-12*	14-Dec-12
A2260	Annual O&M Budget	44.00d	15-Oct-12*	14-Dec-12
A2270	Renewals & Replacement Plan	44.00d	15-Oct-12*	14-Dec-12
A2280	Annual CAP EX Budget	44.00d	15-Oct-12*	14-Dec-12
A2290	Valuation of Power	44.00d	15-Oct-12*	14-Dec-12
A2300	Anomolies/"Red Flags"	44.00d	15-Oct-12*	14-Dec-12
Task 10: Prepare Independent Engineer's Report		340.00d	28-Aug-12	31-Dec-13
Prepare Independent Engineer's Report		340.00d	28-Aug-12	31-Dec-13



MWH

BUILDING A BETTER WORLD

NOTES:

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2 - 100% data assumed available at Start of Week 11 (Nov 4, 2012)
3 - Client Calls on Thursday
4 - End of 4th "Week" invoices
5 - QA/QC Review during Week 19 (REV Week 23)
6 - Client review of Draft EI Report: Week 21 & 22 (REV Week 24 NALCOR review)
7 - Final Report Submitted Week 24 (REV Jan 2014 to Lenders)
8 - Financial closing support services - Week 25 assumed (REV Oct 2013 - Dec 2013: No date yet selected.

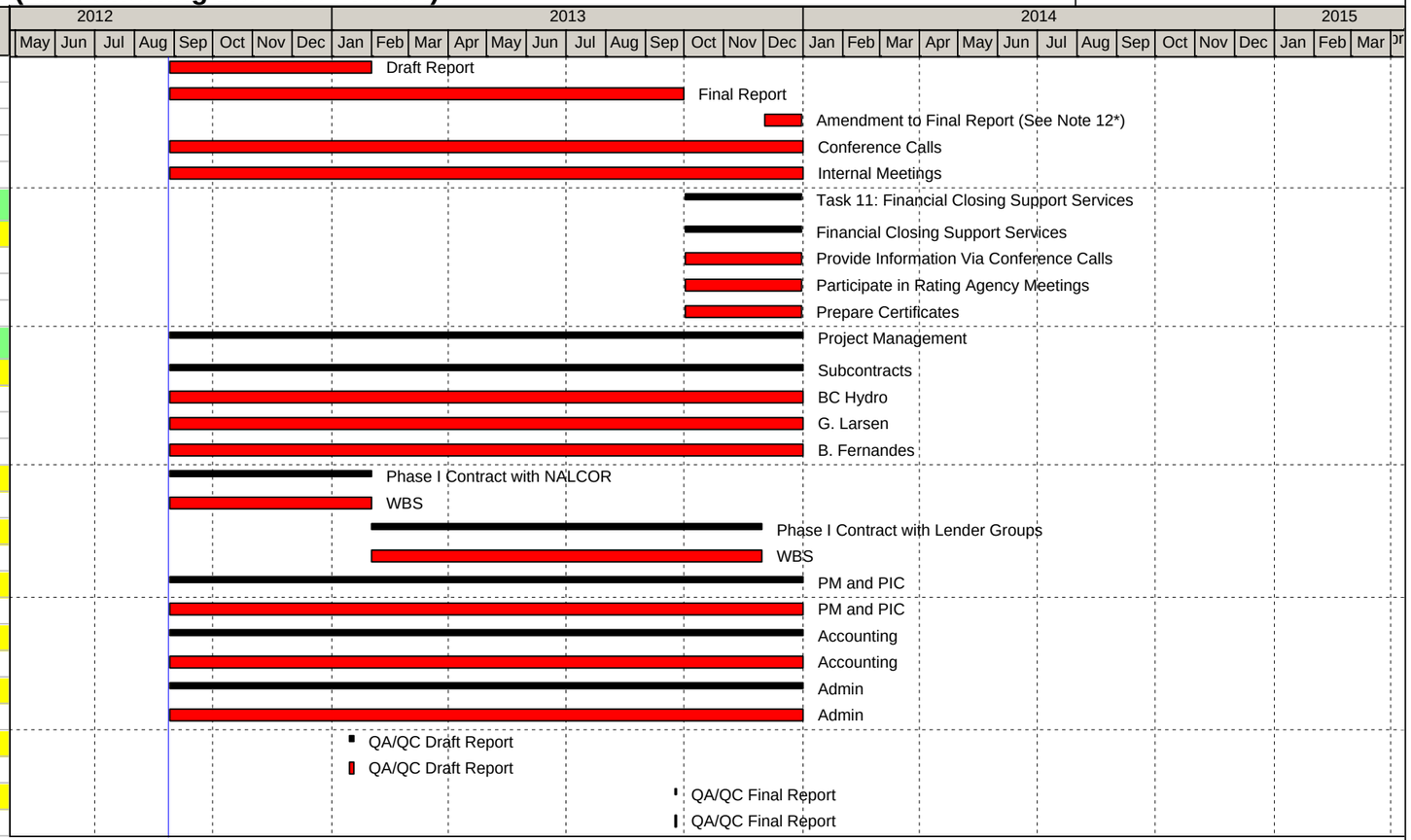
9 - This Schedule is developed based on several assumptions.

10 - Construction contracts to be reviewed are: CH0007 - Intake, Powerhouse, Spillway & Transition Dams; CH0030 - Supply & Install Turbines & Generators; CH0006 - Construction of Bulk Excavation Works & Associated Works; CD0501 - Supply & Install Converters & Cable Transition Compounds; CT0327 - Construction of 350KV HVdc Transmission Line - Section 1; CT0346 - Construction of 350KV HVdc Transmission Line - Section 2 (HOLD); LC-SB-003 - Strait of Belle Isle Submarine Cable Design, Supply and Install
11 - Supply Contracts: PH0014 - Supply of Generator Step-Up Transformer; PH0016 - Supply of Generator Circuit Breakers; PD0505 - Supply of Switchyard Equipment AC Substations at CF, MF, and SP
12 - Review of Contracts after Sept. 31, 2013 will be conducted and included in an amendment to IE Final Report assumed to be delivered Dec 31, 2013.

- Remaining Level of Effort
- Actual Level of Effort
- Remaining Work
- Actual Work
- Critical Remaining Work
- Milestone
- Summary

NALCOR_Phase I (Also Showing Lenders Phase I)

Activity ID	Activity Name	Rem Duration	Start	Finish
A2360	Draft Report	107.00d	28-Aug-12*	31-Jan-13
A2370	Final Report	276.00d	28-Aug-12*	30-Sep-13
A2375	Amendment to Final Report (See Note 12*)	20.00d	02-Dec-13*	31-Dec-13
A2380	Conference Calls	340.00d	28-Aug-12*	31-Dec-13
A2390	Internal Meetings	340.00d	28-Aug-12*	31-Dec-13
Task 11: Financial Closing Support Services		63.00d	01-Oct-13	31-Dec-13
Financial Closing Support Services		63.00d	01-Oct-13	31-Dec-13
A2310	Provide Information Via Conference Calls	63.00d	01-Oct-13*	31-Dec-13
A2320	Participate in Rating Agency Meetings	63.00d	01-Oct-13*	31-Dec-13
A2330	Prepare Certificates	63.00d	01-Oct-13*	31-Dec-13
Project Management		340.00d	28-Aug-12	31-Dec-13
Subcontracts		340.00d	28-Aug-12	31-Dec-13
A1000	BC Hydro	340.00d	28-Aug-12*	31-Dec-13
A1010	G. Larsen	340.00d	28-Aug-12*	31-Dec-13
A1020	B. Fernandes	340.00d	28-Aug-12*	31-Dec-13
Phase I Contract with NALCOR		107.00d	28-Aug-12	31-Jan-13
A1030	WBS	107.00d	28-Aug-12*	31-Jan-13
Phase I Contract with Lender Groups		212.00d	01-Feb-13	29-Nov-13
A1035	WBS	212.00d	01-Feb-13*	29-Nov-13
PM and PIC		340.00d	28-Aug-12	31-Dec-13
A1040	PM and PIC	340.00d	28-Aug-12*	31-Dec-13
Accounting		340.00d	28-Aug-12	31-Dec-13
A1050	Accounting	340.00d	28-Aug-12*	31-Dec-13
Admin		340.00d	28-Aug-12	31-Dec-13
A1060	Admin	340.00d	28-Aug-12*	31-Dec-13
QA/QC Draft Report		4.00d	15-Jan-13	18-Jan-13
A1070	QA/QC Draft Report	4.00d	15-Jan-13*	18-Jan-13
QA/QC Final Report		2.00d	23-Sep-13	24-Sep-13
A1080	QA/QC Final Report	2.00d	23-Sep-13*	24-Sep-13



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