



## EDUCATION

### 1990 Ph.D., Biology, Dalhousie University

Thesis: The response of invertebrates to the disturbance of a seagrass bed by simulated ice rafting.

### 1984 B.Sc. (First Class Honours), Ecology, University of Manitoba

## AREAS OF EXPERTISE

- Environmental Impact Assessment
- Water quality study design and monitoring
- Community consultation
- Aquatic ecology
- Interpretation of environmental legislation as it relates to the aquatic environment
- Aquatic monitoring
- Client liaison

## RESPONSIBILITIES (1992 - PRESENT)

- Project design and management
- Supervision and coordination of multidisciplinary professional personnel preparing environmental impact assessments
- Interaction with regulators, including preparation of applications for Authorizations under Canada's *Fisheries Act*
- Design of long term monitoring programs
- Research, data analysis, and report preparation, including environmental impact assessments
- Facilitate communication of technical results to non-technical audiences (First Nation, local stakeholders)
- Client liaison

## PROJECT EXPERIENCE

### ***Environmental Impact Assessment and Monitoring***

- Manitoba Hydro: Managing the conduct of aquatic, terrestrial and resource use monitoring during the construction phase of the Keeyask Generation Project, a 695 MW hydroelectric generating station being constructed in northern Manitoba. Responsibilities include preparation and review of



reports, overseeing the implementation of field programs, and provision of advice with respect to regulatory concerns.

- Ontario Power Generation: Managed the preparation of an environmental assessment for the North Channel Block Dam Improvement Project on the Winnipeg River at the Whitedog Falls Generating Station. Work involved managing aquatic, terrestrial and archaeological studies. A request for review under Section 35 of the *Fisheries Act* was also completed.
- Manitoba and Manitoba Hydro: Participated in the preparation of a regional cumulative effects assessment to address the effects of hydroelectric development to the aquatic environment over a fifty year period in northern Manitoba.
- Manitoba Hydro: Co-ordinated the preparation of an environmental impact assessment of the Keeyask hydroelectric generation station in northern Manitoba including identification of necessary mitigation measures for the aquatic environment, interaction with regulators to address specific concerns with respect to the aquatic environment, and liaison with members of First Nations communities. Work included provision of expert testimony at Manitoba Clean Environment Commission hearings.
- Manitoba Hydro: Assessed effects of operational changes as a result of re-running a hydroelectric station on aquatic biota, including fish.
- Manitoba Hydro: Design and implementation of a detailed aquatic effects monitoring program for the construction and operation phases of the Wuskwatim Generating Station, a hydroelectric generating station currently under construction in northern Manitoba. Work also included providing assistance in the preparation of requests for habitat authorizations from the Department of Fisheries and Oceans and the development of specific habitat compensation measures.
- Manitoba Hydro: Conducted the aquatic portion of an Environment Act Licence Review for the Brandon Generating Station. The major issue assessed was the effect of the discharge of effluent from an ash lagoon on water quality in the Assiniboine River.
- Manitoba Hydro: Conducted the aquatic portion of an Environment Act Licence Review for the Selkirk Generating Station. Issues assessed included effects related to the withdrawal of water from the Red River the discharge of thermal effluent to Cooks Creek, a tributary of the Red River, and inputs from station run-off and treated sewage effluent.
- DLS Engineering: Assisted in the preparation of an aquatic impact assessment for the proposed Rancher's Choice Meat Processing Facility near Dauphin, MB. Major issues assessed include the effects of nutrients, ammonia, nitrate/nitrite, biochemical oxygen demand/dissolved oxygen, suspended solids, coliform bacteria on water quality and effects to aquatic biota, including algae.
- Shell Canada Limited: Participated in the preparation of the aquatic environment portion of an Environmental Impact Assessment for the proposed expansion of the Scotford Upgrader with respect to effects of altered water quality on aquatic biota in the North Saskatchewan River. Major issues included effects of nutrient enrichment on the algal, benthic invertebrate and fish communities.
- Manitoba Hydro: Assisted in the co-ordination of studies required to complete an Environmental Impact Assessment for the Wuskwatim Generating Station. Duties included assisting in the design and implementation of aquatic studies, and co-ordination of other study components (e.g., wildlife and vegetation assessments, archeological studies). Work also included preparation of briefs to be



used for the Clean Environment Commission hearings and provision of technical information to individuals testifying at the hearings. Additional tasks included consultation with the Department of Fisheries and Oceans in the preparation of a No Net Loss plan and detailed aquatic monitoring plan. Other work included preparation of materials related to community communication (e.g., open house presentations and newsletter articles), and preparation and presentation at study implementation meetings.

- City of Brandon: Preparation of the aquatic component of an environmental impact assessment for the expansion of a wastewater treatment facility to accommodate an expansion of a hog processing facility. Work included assessment of the impacts of increased loading of nutrients to the Assiniboine River in conjunction with existing inputs. Testimony was provided at Clean Environment Commission hearings.
- Manitoba Hydro: Participated in preparation of the Environmental Impact Assessment for the Lower Churchill Water Level Enhancement Study. Duties included design of baseline studies for the collection of information pertaining to water chemistry, aquatic plants, aquatic invertebrates, and fish habitat; preparation of reports describing baseline conditions for water chemistry and lower trophic levels; and analysis of impacts of the proposed development on water chemistry and lower trophic levels, particularly with reference to how such changes may affect the fish population.
- Asessippi Ski Inc.: Participated in the aquatic component of the Environmental Impact Assessment for the Asessippi Ski Hill Development in western Manitoba. Responsibilities included conducting the field survey of the area, describing the existing environment, assessing potential impacts of the development, and providing testimony at public hearings.

## ***Water Quality Study Design and Monitoring***

- City of Brandon: Designed and implemented an ongoing multi-year study to determine the potential effect of effluent discharges from a wastewater treatment facility constructed to process waste from the Maple Leaf Meat Processing Plant on the water quality in the Assiniboine River between the cities of Brandon and Portage la Prairie. The assessment includes consideration of the cumulative effect of all effluents discharged at Brandon, and incorporated both a monitoring and modelling component.
- City of Portage la Prairie: Designed and implemented a multi-year study of the Assiniboine River related to the effects of effluent from the municipal treatment facility on water quality in the Assiniboine River.
- Manitoba Hydro: Provided water quality expertise with respect to a legal claim pertaining to potable water quality for five communities in northern Manitoba. Work included gathering and evaluating existing water quality information, and determining whether water quality had changed over time and, if so, describing the nature and possible causes of those changes.
- CanadianOxy Chemical Group: conducted a study to determine whether groundwater inflow from a sodium chlorate facility was affecting the aquatic biota of the Assiniboine River. Work included field collection of sediment samples, interpretation of results of chemical analyses and report preparation.



- Manitoba Hydro: Conducted a two-year study of a river in eastern Manitoba to determine causes (nutrient loading) and potential remedial action for blooms of nuisance algae. Responsibilities included design and implementation of field studies, data analysis and interpretation, and development of recommendations for possible remedial action.
- TransCanada Pipelines: Identified sources of water quality problems along the Whitemouth River and suggested remedial measures for specific sites. Responsible for the identification and description of problem sites (most of which were associated with agricultural land use), and presentation of results detailing the problems and potential solutions.

## ***Aquatic Environment***

- Ontario Power Generation: Managed the implementation of post-Project monitoring of the aquatic and terrestrial environments for the Lower Mattagami River Project. Aquatic studies included assessment of adult and juvenile Lake Sturgeon, Walleye, and benthic invertebrates upstream and downstream of the Project as well as within the headponds. Monitoring was also conducted to determine whether offsetting habitats were functioning as intended.
- Province of Manitoba and Manitoba Hydro: Participated in the planning and reporting for the benthic invertebrate component of Manitoba's Coordinated Aquatic Monitoring Program (CAMP).
- Yamana Gold: Designed and implemented an aquatic baseline data collection program at a potential mine site in northern Manitoba to provide necessary data to support an environmental impact assessment. Work included a multi-year fish movement study.
- New Britannia Mine: Designed and conducted the first year of a monitoring program to determine the potential effect of effluent from a tailings pond (New Britannia Mine, Snow Lake, Manitoba) on the aquatic environment in the receiving waterbody (Herblet Lake). The monitoring program included analysis of water chemistry, sediments, benthic invertebrates, and fish.
- INCO: Conducted an assessment of the potential effects of effluent from water treatment plant backwash and thermal discharge from a compressor cooling system on fish habitat in a small creek near Thompson, Manitoba.
- Manitoba Hydro: Provided an analysis to determine thermal requirements for fish in the Red River, based on temperature and fish distribution data obtained from field studies, in conjunction with published studies pertaining to thermal requirements. Thermal requirements were used to determine a suitable approach to regulating thermal discharges.
- Department of Fisheries and Oceans: Reviewed the Cheviot Mine Application with respect to issues pertaining to fish and fish habitat. Participated in preparation of the Department's submission to the Joint Panel of the Alberta Energy and Utilities Board and Canadian Environmental Assessment Agency and appeared as an expert witness before the panel.
- Manitoba Hydro: Prepared the aquatic component of an opinion concerning the environmental issues related to the life extension of two thermal generating stations in Manitoba. Work included the assessment of effects of water withdrawal, and release of thermal and chemical effluents (in particular heavy metal inputs from ash lagoon discharge and coal pile runoff).
- Manitoba Natural Resources: Conducted a survey of representative reaches in several streams in eastern Manitoba (Duck Mountains) as part of the Manitoba Fish Habitat Inventory. The project



included preparation of longitudinal and cross sectional profiles of the stream sections, estimation of hydrological characteristics, preparation of a scaled map of the study reach, and description of fish habitat and the fish community.

- Manitoba Model Forest: Designed and implemented a four year study measuring changes in the physical and biological characteristics of a small river/stream system occurring during and after logging.
- Manitoba Hydro: Aquatic ecologist for studies of stream habitat utilization by fish in creeks flowing into the lower Nelson River. Responsible for the analysis, interpretation, and presentation of data describing the distribution of fish among habitats and probable causes for observed distributions.

## **Marine Environment**

- Parks Canada: Prepared a report providing an overview of the marine ecosystems in the six national parks within the northern bioregion, including a description of the physical, chemical, and biological components and stressors; developed conceptual ecosystem models; and provided a potential approach to monitoring the marine components of these parks. Work included preparing and leading a workshop to discuss potential approaches to monitoring.
- Parks Canada: Conducted an inventory of marine monitoring activities in the coastal and nearshore environments of northern Canada and identified a protocol to implement a late winter marine monitoring program in Auyuittuq National Park.
- Department of Fisheries and Oceans: Participated in the update and expansion of an Ecosystem Overview Report for the Beaufort Sea Large Ocean Management Area.
- Manitoba Hydro: Prepared a report describing the physical and chemical oceanography of the Churchill River estuary and adjoining Hudson Bay.
- Manitoba Hydro: Reviewed estuarine environments within Hudson Bay, with emphasis on the relationship between physical and chemical characteristics of freshwater inflow and estuarine biota. The influence of hydroelectric development on river flow and water quality and the subsequent effect on estuarine biota also was assessed.

## **EMPLOYMENT HISTORY**

**1989 – 1990    Research Associate in Marine Ecology**  
**Department of Fisheries & Oceans, Bedford Institute of Oceanography,**  
**Halifax, NS**

- Prepared scientific manuscripts for publication. Planned future research directions and prepared research proposals for ecological investigations of coastal marine food webs.

**1985 – 1990    Doctoral Student, Department of Biology, Dalhousie University**  
**Department of Fisheries & Oceans, Bedford Institute of Oceanography,**  
**Halifax, NS**



- Assessed the impact of ice rafting of seagrass on the fauna of a coastal seagrass bed using correlational studies of natural populations and field and laboratory experiments.

**1986 – 1989 Teaching Assistant**

**Department of Biology, Dalhousie University, Halifax, NS**

- Prepared and presented lectures for Introductory Biology and Marine Ecology undergraduate courses.

**1981 – 1983 Technician, Student Researcher**

**University of Manitoba, Delta Marsh Field Station, MB**

- Monitored fish movements within a freshwater marsh. Studied algal colonization of natural and artificial substrata and studied the effects of herbicides on algal photosynthesis.

## LANGUAGES

English-fluent

## AWARDS AND DISTINCTIONS

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|-----------|--|
| 1987      | Predocctoral Killam Award  |
| 1985-1987 | Science and Engineering Scholarship from the Natural Sciences and Engineering Research Council of Canada |
| 1984      | University of Manitoba, Faculty of Science Gold Medal for highest standing in an undergraduate program   |
| 1983      | Undergraduate student research award, Natural Sciences and Engineering Research Council of Canada        |
| 1982      | Undergraduate student research award, Natural Sciences and Engineering Research Council of Canada        |



## EDUCATION

1998 M.Sc., Zoology, University of Manitoba

Thesis: The accumulation, distribution, and adverse effects of dietary uranium in Lake Whitefish (*Coregonus clupeaformis*)

1993 B.Sc. (First Class Honours), Zoology, University of Manitoba

## MEMBERSHIPS AND AFFILIATIONS

- Registered Professional Biologist, Alberta Society of Professional Biologists

## AREAS OF EXPERTISE

- Aquatic impact assessment
- Water quality assessment and modelling
- Limnology and water and sediment chemistry
- Aquatic toxicology
- Design and interpretation of aquatic monitoring programs

## RESPONSIBILITIES (1999 – PRESENT)

- Project management and client liaison
- Environmental impact assessment
- Design and supervision of aquatic studies, monitoring programs, and environmental assessments
- Data analysis, interpretation, research, assessment, literature review, and report preparation

## PROJECT EXPERIENCE

### *Environmental Impact Assessment*

- **Baffinland Iron Mines Corporation and Knight Piésold Ltd.:** Managed multi-year freshwater aquatic baseline studies conducted by NSC and preparation of freshwater biota and habitat components of the EIS (Draft, Final, and Addendum to the Final EIS) for the approved Mary River iron ore mine on Baffin Island, Nunavut. Currently managing the freshwater biota and habitat assessment component for the Phase 2 Proposal EIS and baseline field programs.
- **Manitoba Hydro:** Prepared the water and sediment quality components of the EIS for the Keeyask Hydroelectric Generating Station (GS) in northern MB and attended the Clean Environment Commission (CEC) Hearings.
- **Manitoba Hydro:** Designed and oversaw water quality baseline studies and prepared the water and sediment quality components of an EIS for relicensing of the Pointe du Bois GS, MB.



- **Manitoba Hydro:** Prepared the water quality component of an EIS for the Wuskwatim GS in northern Manitoba and attended the CEC Hearings.
- **Manitoba Hydro:** Prepared the water quality component of a submission to the CEC for relicensing of the Lake Winnipeg Regulation Project and attended the CEC Hearings.
- **SaskPower:** Assisted with the design of baseline water and sediment quality field programs for the Tazi Twé Hydroelectric Project in northern Saskatchewan.
- **Manitoba Hydro:** Lead for the preparation of the water quality component of a Regional Cumulative Effects Assessment for Manitoba Hydro including the upper and lower Nelson River, the Rat/Burntwood River, and the upper and lower Churchill River systems.
- **Jacques Whitford/AXYS Environmental Ltd.:** Assisted with preparation of the aquatic component of two EISs for Shell Canada's Scotford Upgrader Complex, AB.
- **City of Brandon, Maple Leaf Canada:** Assisted in the preparation of the aquatic component of an EIS for a proposed production expansion at the Maple Leaf Hog Processing Plant near the City of Brandon and attended the CEC Hearings.
- **Athabasca Chipewyan First Nation (sub-consultant to DS Environmental):** Provided technical review of water and sediment chemistry sections of several EISs for oil sands developments in Alberta (Shell Canada Jackpine – Phase I, CNRL Horizon, and Husky Energy Sunrise SAGD Project).
- **Government of Nunavut (sub-consultant to Kavik-Axys Inc.):** Provided technical review of water and sediment chemistry and toxicology components of the Draft Environmental Impact Statement for a proposed gold mine (Doris North) for the Government of Nunavut.
- **Jacques Whitford/AXYS Environmental Ltd.:** Assisted with preparation of the aquatic component of two EISs for Shell Canada's Scotford Upgrader Complex, AB.

### **Monitoring Programs**

- **Diavik Diamond Mines Environmental Monitoring Advisory Board (EMAB):** Ongoing provision of technical review services and technical advisement in relation to the Diavik Diamond Mines Inc. Project in the Northwest Territories. Technical services have included reviews of monitoring reports, monitoring program design documents, and materials in relation to licencing.
- **Manitoba/Manitoba Hydro's Coordinated Aquatic Monitoring Program (CAMP):** Managing implementation of a long-term joint Manitoba/Manitoba Hydro CAMP. The program covers 41 waterbodies on and off the Manitoba Hydro hydraulic operating system and extends from south-central to northern areas of Manitoba and includes aquatic habitat, water quality, sediment quality, phytoplankton, benthic macroinvertebrates, fish, and fish mercury.
- **Baffinland Iron Mines Corporation:** Assisted with the development of an aquatic effects monitoring plan (AEMP) for the freshwater environment for the Mary River iron ore mine on Baffin Island, Nunavut, including conduct of a detailed review of aquatic baseline data to determine the level of effort (i.e., power), metrics, and benchmarks.
- **Havilah Mining Canada Ltd.:** Managing preparation of annual aquatic monitoring reports submitted as part of provincial and federal regulatory requirements and an Environmental Effects Monitoring (EEM) program for the Klondex True North Gold Mine near Bissett, MB.



- **Manitoba Hydro (sub-consultant to KGS Group):** Managing implementation of, and reporting on, portions of the Long Term Remedial Monitoring Program at a site historically contaminated with coal tar.
- **Manitoba Hydro:** Designed and developed the water quality component of the AEMP for the Keeyask Hydroelectric GS in northern MB, including review of baseline data to assist with determining study design, sites, level of effort (i.e., power), and development of benchmarks.
- **Manitoba Hydro:** Technical lead for the implementation and reporting on the water quality component of the AEMP for the Keeyask Generation Project in northern Manitoba.
- **Manitoba Hydro:** Designed the water quality component of the AEMP for the Pointe du Bois GS Spillway Replacement Project, MB. Providing on-going technical expertise for implementation and reporting on the water quality component of the AEMP.
- **Manitoba Hydro:** Designed the water quality component of the AEMP for the approved Wuskwatim Generation Project, near Thompson, MB. Providing on-going technical expertise for implementation and reporting on the water quality component of the AEMP.
- **Baffinland Iron Mines Corporation:** Managed aquatic habitat and fish passage monitoring programs conducted along the 100-km Milne Inlet Tote Road on northern Baffin Island, since 2009.
- **SaskPower:** Assisted with the development of an aquatic effects monitoring plan for the Tazi Twé Hydroelectric Project in northern Saskatchewan.

### ***Water and Sediment Quality Studies and Assessments***

- **Manitoba Hydro (sub-consultant to UMA Engineering Ltd):** participated in a study conducted as a component of an ecological risk assessment for a site historically contaminated with coal-tar of in a portion of the Red River in the City of Winnipeg.
- **Manitoba Water Stewardship:** Managed a project to develop site-specific water quality objectives for nutrients in 16 tributaries to Lake Winnipeg. The study included trend analysis, examination of seasonality of data, and relationships between nutrients and benthic macroinvertebrate community indicators in the streams using change point analysis.
- **Lacombe and Red Deer Counties, Town of Sylvan Lake, Summer Villages of Birchcliff, Half Moon Bay, Jarvis Bay, Norglenwold, and Sunbreaker Cove:** In association with AXYS Environmental, conducted the surface water component of a cumulative effects study of Sylvan Lake. Evaluated the current and historical nutrient status of the lake, constructed water and nutrient balances, evaluated capacity for future development, and generated recommendations for future management and monitoring.
- **Manitoba Water Stewardship:** Co-authored a literature review for Manitoba Water Stewardship related to setting nutrient objectives for Lake Winnipeg, which included consideration of nutrient management and mitigation options and factors affecting eutrophication and response of aquatic ecosystems to nutrients.
- **Ontario Ministry of the Environment:** Managed and participated in a study to better define concentrations and the spatial extent of mercury and organic fiber/pulp in sediments in Thunder Bay North Harbour (a Great Lakes Area of Concern).



North/South  
Consultants Inc.

**Megan Cooley, M.Sc., P.Biol.**  
Senior Aquatic Biologist / Toxicologist / Principal

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- **Alberta Environment (AENV):** Participated in a synthesis of surface water and sediment quality information as part of an initial assessment of the status and health of aquatic ecosystems in Alberta (component of the Alberta “Water For Life: Alberta’s Strategy for Sustainability” program).

# RANDALL A. KNAPP

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## EDUCATION

B.A.Sc., Chemical Engineering, 1973, University of Waterloo

## PROFESSIONAL AFFILIATIONS

Professional Engineers of Ontario

## Experience

**Randy Knapp, P. Eng.** is a chemical engineer with more than 40 years' experience in environmental projects related to the mining industry. Mr. Knapp is recognized within the industry for his leadership in assessment challenging environmental issues and the development of cost effective and practical technical and solutions. Mr. Knapp specializes in projects involving mine decommissioning and closure, acid generation modelling, geochemistry, liability assessment, tailings management, site selection, development of monitoring and response plans, risk assessment and effluent treatment. He has participated in environmental due diligence evaluations for properties on five continents.

Mr. Knapp has extensive experience in the mining sector, including compliance and due diligence audits, tailings basin assessments, design and assessment of effluent treatment plants, acidic rock drainage/acidic mine drainage assessment and management, assessments and siting of tailings management facilities and development of closure plans. Representative clients in the mining sector include: Barrick Gold Corporation, INCO Limited, Falconbridge Limited, Placer Dome, Cambior Inc., WMC International, Homestake, Rio Algom, Agnico-Eagle Mines and Teck Corporation.

Mr. Knapp has an international reputation, which has led to contract work throughout North America, as well as in Europe, Russia, Kazakhstan, Africa, South America and Australia. His work in the area of acid mine drainage (AMD) has included: experimental design of techniques to assess AMD; modelling and evaluation of AMD control technologies; design of treatment systems to manage acid releases; and evaluation of remedial measures to mitigate AMD production. He is quite knowledgeable of environmental regulations in many jurisdictions from his participation on compliance audits and from his extensive work in environmental assessments, development of site closure plans, and reviews of

effluent treatment systems. He has presented environmental auditing courses to industrial clients as well as general environmental audit courses. He has authored over 50 technical papers relating to mining environmental practices and has been a presenter at a number of seminars and short courses.

## KEY INFORMATION ON R. A. KNAPP

The following is an expansion of selected key information on Mr. Knapp including:

- Expert Panels and Review Boards
- Selected list of publications
- Key government reports
- Seminars/workshops/courses
- Recent participation in environmental hearings
- Key industrial clients - strategic planning and mine waste management
- Key projects for Financial Institutions

### EXPERT PANELS AND REVIEW BOARDS

MR. Knapp has participated in numerous review boards for both Industry and Industrial clients.

Recent Panels and Boards have included:

- Red Dog Mine Engineering Review Panel
- Teck Resources -Independent Tailings Review Board for Legacy Mines (4 mine sites)
- Independent Review Board for the Faro Mine Closure, Giant Mine Closure and other Northern mines for Indian and Northern Affairs Canada
- Independent Review Board for the Voisey's Bay Metallurgical Plant.
- Independent Technical Reviewer-Geochemical programs for Antamina Mine, Peru.

### SELECTED LIST OF PUBLICATIONS

Mr Knapp has more than 50 publications with a selected papers listed below:

Knapp R. A., Scharer J. M., Arthurs P. A. and Halbert B. E., Fate of Cyanide and Ammonia in Gold Tailings, Mining and the Environment II, Sudbury, Ont., 1999.

Knapp R. A., Aiken S. R., Pettit C. M., and Halbert B. E., Whistle Mine Closure- Modelling Studies and Water Treatment Considerations, Mining and the Environment II, Sudbury, Ont., 1999.

Knapp R. A., Kam S. N., Balins J. K. and Payne R. A., Interim Assessment of Flooded Tailings Performance: Quirke Mine Waste Management Area, Fourth Conference on Acid Rock, Drainage, Vancouver, B. C.,

1997.

Knapp R. A., Kam S. N., Morrell R. and Ludgate I. R., Decommissioning of the Denison Tailings Area, Fourth Conference on Acid Rock, Drainage, Vancouver, B. C., 1997.

Knapp R. A., Aubertain M., Ricard J. F., McMullen J. and Julien M., Design and Construction of a Dry Cover Made of Tailings for the Closure of Les Terrains Auriferes Site, Malartic, Quebec, Fourth Conference on Acid Rock, Drainage, Vancouver, B. C., 1997.

Knapp R. A., Puro M. J., Kipkie W. B., McDonald T. J. and Stuparyk R. R., INCO's Copper Cliff Tailings Area, Sudbury '95- Mining and the Environment, Sudbury, Ont., 1995.

Knapp, R. A., Martin J. C. and Pettit C. M., Waste Rock Sampling Techniques for Acid Rock Drainage (ARD) Assessment, Sudbury '95- Mining and the Environment, Sudbury, Ont., 1995.

Knapp R. A., Balins J. K. and Welch D. E., Decommissioning of the Quirke Uranium Tailings Basin to Eliminate Acid Production, Second International Conference on the Abatement of Acidic Drainage, Montreal, Que., 1991.

Knapp R. A., Halbert B. E., Maltby, J. W. and Vivyurka A. J., Application of the Reactive Tailings Assessment Program to Pyritic Mine Tailings, International Symposium on Tailings and Effluent Management, Halifax, NS, 1989.

Knapp R. A., The Biogeochemistry of Acid generation in Tailings and Waste Rock, Acid Mine Drainage Seminar/Workshop, Halifax, NS, 1987.

Knapp R. A., Halbert B. E., Gorber D. M. and Scharer J. M., Determination of Acid Generation Rates in Pyritic Tailings, 56<sup>th</sup> Conference on Water Pollution Control, Atlanta, Ga, 1983.

### **KEY GOVERNMENT REPORTS**

Mr. Knapp was the project director and a primary author on the following reports/publications for government bodies.

Environmental Standards And Guidelines For Environmental Impact Assessment In Mining Report To The Environmental Protection Agency, Guyana, South America, 1999.

Technologies Applicable to the Management of

Canadian Mining Effluents, Report to Environment Canada, 1999.

Environmental Pollution Management For Mines And Industries in Uzbekistan, Report to the Uzbekistan Environmental Protection Agency and the Asian Development Bank, 1998.

Review of Use of an Elevated Water Table as a Method to Control and Reduce Acidic Drainage from Tailings, the MEND program, Energy Mines and Resources Canada, 1996.

Review of In-pit Disposal practices for the Prevention of Acid Drainage, the MEND program, Energy Mines and Resources Canada, 1995.

Evaluation of Alternative Dry Covers for the Abatement of Acid Mine Drainage, the MEND program, Energy Mines and Resources Canada, 1994.

Handbook for Waste Rock Sampling Techniques, the MEND program, Energy Mines and Resources Canada, 1994.

Acid Mine Drainage- Status of Chemical Treatment and Sludge Management Practices, the MEND program, Energy Mines and Resources Canada, 1994.

### **SEMINARS/WORKSHOPS/COURSES**

Mr. Knapp has participated in more than 20 seminars, workshops and courses. Key programs are presented below:

Numerous Mine Closure workshops.

Course on Technologies for Acid Mine Drainage Control, 1995. Presented on 3 occasions to government, research and development groups and industry personnel in Brazil (Rio, Belo Horizonte and Florianopolis).

Course on Environmental Auditing. Presented on numerous occasions.

Chemical Treatment of Mine Effluents. Numerous courses, seminars and workshops presented across Canada.

Course on Gold Mining and the Environment. A five-day course presented to approximately 30 regulatory and industry personnel in Guyana, 1996.

Workshop on Risk Assessment. Mr. Knapp has participated in 2 workshops on risk assessment in

Mining.

**RECENT PARTICIPATION IN ENVIRONMENTAL HEARINGS**

Technical review and advice on numerous Territorial Water Board licence applications and renewals.

Federal Environmental Assessment of the Voisey's Bay Mine proposal. Mr. Knapp was responsible for preparation and presentation of information on waste water treatment and water quality predictions for the operating and closed-out tailings ponds. The project was approved as presented.

Federal Environmental Assessment of the Closure of the Quirke, Panel, Denison and Stanrock Uranium Mines. Mr. Knapp was primary author of the EIS, attended all sessions on behalf of the proponents and presented evidence before the EA panel 1995/96. The project was approved as proposed.

Miscellaneous. - Mr. Knapp has presented information at several other hearings into the opening and expansion of mines in Canada.

**KEY INDUSTRIAL CLIENTS - STRATEGIC PLANNING AND MINE WASTE MANAGEMENT**

Rio Algom Limited-A continuous and ongoing involvement on environmental aspects and hearings associated with the expansion of the Elliot Lake mines in 1976 through to the successful hearings and closure of the mines in the 1990's.

Denison Mines Limited-A continuous and ongoing involvement on environmental aspects and hearings associated with the expansion of the Elliot Lake mines in 1976 through to the successful hearings and closure of the mines in the 1990's.

INCO Limited. Involved in strategic planning for the ongoing management and closure of all INCO Central division operations. This includes the development of long term management strategies for the 800 million ton Central tailings area.

Teck Corporation. Involved in EIS documents, peer review, audits and ARD studies.

Barrick Gold Corporation, Involved in numerous projects involving audits, strategic planning, site decommissioning and remediation, ARD, and effluent treatment.

Iron Ore Company of Canada, Participant on the Technical Review team on the development of a new tailings management plan for an 800 million ton containment facility.

**KEY PROJECTS FOR INTERNATIONAL FINANCIAL INSTITUTIONS**

Environmental Standards and Guidelines for Environmental Impact Assessment in Mining Report to the Environmental Protection Agency, Guyana, South America and the IADB (1999).

Environmental review of a cyanide spill in the former Soviet Union for the IFC (1999).

Environmental Pollution Management for Mines and Industries in Uzbekistan, Report to the Uzbekistan Environmental Protection Agency and the Asian Development Bank (1998).

Environmental audit of 2 mining properties in the Lake Baykal region of Russia for the EBRD (1995).

Environmental Due Diligence-Esperanza Mine in Chile for the ING bank (2009-2014)

*Resume*

**Bill Slater**

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Whitehorse, Yukon

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bslater@bslater.ca

**EDUCATION**

**Honours Bachelor of Science**

**Engineering**

Agricultural Engineering

University of Guelph

1988

Association of Professional Engineers - Gold Medal, 1988

For Highest Academic Standing in Engineering at U of G.

**SELECTED WORK EXPERIENCE**

**Environmental Consultant** *November 2003 to Present*

Slater Environmental Consulting

Whitehorse, Yukon

- Owner and principle consultant of a Whitehorse based independent environmental consulting company.
- Consulting expertise and experience includes:
  - Mine closure and remediation
  - Environmental effects assessment and analysis
  - Environmental and socio-economic assessment processes and requirements
  - Permitting and regulatory processes and requirements
  - Community engagement and capacity development, especially in First Nation communities
  - Monitoring program development, analysis and interpretation
  - Environmental policy/regulation
  - Water resource management, water quality
- Consulting experience is described in the attached Company Profile and Project List for Slater Environmental Consulting.

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**Senior Program Scientist** *Part-time, December 2003 to March 2004*

Environmental Protection Services,

Environment Canada

Whitehorse, Yukon

- Responsible for advising on closure planning for the Brewery Creek Mine.

**Manager, Environmental Assessment and Planning** *April 2003 to October 2003*

Water Resources Branch

Department of Environment, Government of Yukon

Whitehorse, Yukon

- Managed the environmental assessment programs and projects for the Water Resources Branch. See responsibilities below for Head, Environmental Assessment and Planning, DIAND.

**Head, Environmental Assessment and Planning** *August 1996 to March 2003*

Water Resources Division *March 1996 to May 1996*

Indian and Northern Affairs Canada

Whitehorse, Yukon

- Managed the environmental assessment programs and projects for the Water Resources Division.
- Evaluated and made recommendations on designs, best management practices and mitigation measures for mining, mine decommissioning and closure, hydroelectric, infrastructure, municipal, and other projects.
- Conducted and coordinated environmental assessments for development proposals, under the *Canadian Environmental Assessment Act*.
- Advised the Department on meeting its obligations under environmental assessment and water management legislation and land claims agreements.

**Environmental Advisor** *Half-time Secondment, February 2001 to July 2001*

**Environmental Consultant** *April/May 2002*

Council of Yukon First Nations

Whitehorse, Yukon

- Provided technical and policy advice on the development of the development of the *Yukon Environmental and Socio-Economic Assessment Act* and Regulations.
- Provided information and completed research to support decision making by the First Nations caucus.

Resume – Bill Slater October 2014

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**Land Claims Implementation Advisor** *May 1996 to August 1996*

Indian and Northern Affairs Canada

Whitehorse, Yukon

- Advised the department on implementation of land claims legislation, land claims/self government agreements and land claims/self government implementation plans. Encouraged departmental staff to effectively implement land claims/self government agreements.

**Water Resources Planner** *June 1993 to March 1996*

Water Resources Division

Indian and Northern Affairs Canada

Whitehorse, Yukon

- Advised on policy and programs related to water management and application of environmental assessment and water management legislation.
- Promoted the importance of effective planning in conserving water resources and aquatic ecosystems.

**Soils and Materials Testing Technician** *May 1993 to June 1993*  
J.R. Paine and Associates Ltd., Consulting and Testing Engineers  
Whitehorse, Yukon

- Quality control technician for highway construction project.

**Research Technician** *January 1991 to May 1991*  
University of Guelph, School of Engineering, Guelph, Ontario

- Designed and carried out laboratory investigations to evaluate methods and materials for minimizing soil erosion on road construction projects and highway right-of-ways.

Slater Environmental Consulting Project List

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**Company Profile and Project List**  
**Bill Slater Environmental Consulting**  
**February 2015**

Slater Environmental Consulting has operated in Whitehorse since 2003. The company provides

technical, regulatory and policy consulting services in environmental management, environmental impact assessment, water management, mining, mine closure and infrastructure

development. The company's client base is broad and includes Yukon Government, First Nation

governments, federal government, independent resource management agencies, nongovernment

organizations and private companies.

Prior to starting his consulting business, Bill Slater had over ten years of experience working in

Yukon for the federal and territorial governments in the fields of environmental assessment,

water management and First Nation land claims implementation. Bill graduated with distinction

from the University of Guelph in 1988, receiving an honours degree in Agricultural Engineering

and the "Association of Professional Engineers Gold Medal" for highest academic standing.

Slater Environmental Consulting provides a unique combination of technical, process and policy

expertise that supports wellreasoned and integrated decisionmaking

by clients. This same

combination of expertise has led to recognition of Slater Environmental Consulting as an

authority on environmental assessment requirements and processes in Yukon.

Slater Environmental Consulting works extensively with First Nation governments and organizations, providing technical expertise related to mining and infrastructure development

projects and also helping to articulate the views and interests of First Nations in various government and regulatory processes.

In addition to the demand for technical, process and policy expertise, Slater Environmental Consulting also fills a niche in the area of community relations, community engagement and facilitation. The company's services are in demand for helping to bridge the gap between technical information, government processes and community understanding. Because Slater Environmental Consulting's work in community engagement is combined with technical services for a broad range of clients, the company's technical work is highly regarded at a grassroots community level in Whitehorse and Yukon. Slater Environmental Consulting works mostly in Yukon, but has completed projects in other jurisdictions. Because the company is small, our team often works collaboratively with other consultants to address client needs. Slater Environmental Consulting often works on projects with strict deadlines (i.e., YESAA process or Yukon Water Board deadlines) and is known for completing these projects on time and within budget.

The following is a list of projects undertaken by Slater Environmental Consulting:

- Regulatory Technical Manager for Project Design Team for the Faro Mine Remediation Project, in association with CH2M Hill Ltd. 2011 to present.
  - Technical Manager for regulatory component of multidisciplinary team preparing closure plan and YESAA project proposal for Faro Mine Remediation Project.
  - Leading development of Approval Process Strategy (including regulatory risk assessment), assessment methodology, assessment scoping.
- Slater Environmental Consulting Project List  
February 2015 Page 2 of 7
  - Guiding and coordinating multidisciplinary team for gap analysis, and development and implementation of baseline investigations programs.
  - Preparing gap analysis report.
  - Developing project schedules and budgets, and tracking progress.
  - Author and technical content lead for Interim Works Project Proposal – a YESAA application for ten years of activities at the Faro Mine
  - Ongoing communication with client and regulators.
- Technical Advisor, Faro Mine Closure Project – April 2005 to February 2011.

Member of

the senior Technical Advisor Team for the Faro Mine Closure Project

- Providing overall technical guidance for all aspects of closure planning
- Senior reviewer for closure plan research, studies, investigations and design

- Advisor and participant re: risk assessment, evaluation and selection of closure options
- Monitoring program analysis, development and interpretation
- Coordination and management of research, investigation, design, monitoring and effects assessment projects and programs
- Community engagement and discussion
- Advising on care and maintenance and early remediation activities
- Coauthor of mine closure options report and YESAA project proposal
- Independent technical advisor to the Giant Mine Project Working Group – a Working Group that provides a forum for engagement of interested parties in the planning and implementation of the Giant Mine Remediation Project. 2014 to present.
  - Advisor on all aspects of remediation project implementation, development of mitigation measures, and ongoing site operations
- Technical Consultant to Yukon Water Board for development of guidance documents for water licence applications, including guidance on Reclamation and Closure Planning, Heap Leaching, Tailings Management and Waste Rock Management. 2012 to 2014.
- Technical Consultant to Yukon Government as part of a working group tasked with the “development of design standards for mine workings related to the use and deposit of waste to water.” 2014 to present.
- Senior Consultant to Council of Yukon First Nations (CYFN) on the five year review of the Yukon Environmental and SocioEconomic Assessment (YESAA) Process and on proposed amendments of YESAA. 2007 to present.
  - Project management and guidance for CYFN's participation in the YESAA review
  - Policy advice for CYFN and Yukon First Nations for participation in the review
  - Facilitation of First Nation discussions and submissions with respect to the review
  - Coordination of issues discussion and analysis re: First Nation concerns about YESAA
  - Preparation of review submissions describing First Nations' issues and concerns
  - Coauthor of final review report
  - Coordination and support for Yukon First Nation leadership for lobbying trip with federal government politicians, including participation as a technical advisor in meetings with politicians and senior officials.
- Technical Consultant to First Nation of Nacho Nyak Dun (FNNND) on a proposed

project to reestablish

Chinook salmon in the Upper Mayo River. 2013 to present.

- Lead advisor on YESAA and regulatory requirements
- Preparation of YESAA project proposal and coordination of YESAA assessment needs for supporting field trial and investigation, and for overall project

Slater Environmental Consulting Project List

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- Participation in community and stakeholder engagement activities
- Development of mitigation to address issues and concerns
- Technical Consultant to FNNND on closure planning and care and maintenance

for the

Keno Hill properties. 2007 to present.

- Providing overall technical guidance for the FNNND on all aspects of closure planning and care and maintenance
- Reviewing and advising on research, monitoring, investigations, design, risk assessment and implementation for closure planning and care and maintenance activities
- Developing and guiding processes for ensuring adequate participation of FNNND
- Community engagement and discussion
- Development of work plans and budgets for FNNND Keno Hill closure planning office
- Advising on negotiation of agreements related to Keno Hill closure planning
- Advising on the development and implementation of training and capacity building plans and programs

- Technical Consultant to FNNND on advanced exploration and development of mines at

Keno Hill. 2007 to present.

- Providing overall technical guidance for the FNNND on planning, permitting and development of mines at Keno Hill
- Preparing technical review reports and assessment/regulatory submissions to support FNNND participation in permitting processes
- Advising on closure costs, liability and security bonding
- Advisor and participant in negotiation of participation agreements re: exploration and development
- Representing FNNND in discussions with proponent, regulators, assessment agencies, etc.
- Community engagement and discussion

- Technical Consultant to FNNND on development of the Mayo B hydro enhancement project. 2008 to present.

- Providing overall technical guidance for the FNNND on planning, permitting and development of the Mayo B project
- Preparing technical review reports and assessment/regulatory submissions to support FNNND participation in permitting processes

- Coordinating input from the FNNND government team and other technical advisors
- Advisor on negotiation of participation, consultation and ownership agreements re: Mayo B project
- Representing FNNND in discussions with proponent, regulators, assessment agencies, etc.
- Representing FNNND at regulatory hearings (e.g. water board)
- Community engagement and discussion
- Technical consultant to FNNND on the Eagle Gold heap leach mine. 2011 to present.
- Similar role as for other projects for FNNND, including review and participation in YESAA and water licensing processes.
- Technical Consultant to Little Salmon Carmacks First Nation (LSCFN) on closure planning for the Mt. Nansen mine. 2007 to present.
- Providing overall technical guidance for the LSCFN on all aspects of closure planning and careandmaintenance
- Slater Environmental Consulting Project List  
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- Reviewing and advising on research, monitoring, investigations, design and implementation for closure planning and careandmaintenance activities
- Developing and guiding processes for ensuring adequate participation of LSCFN
- Developing and advising on processes for community and technical evaluation and risk assessment of mine closure options
- Community engagement and discussion
- Development of work plans and budgets for LSCFN Mt. Nansen Mine closure planning office.
- Technical Consultant to LSCFN on the proposed development of the Carmacks Copper project. 2005 to present.
- Providing technical advice related to project planning, environmental assessment, socioeconomic assessment and regulatory processes.
- Preparing technical review reports and assessment/regulatory submissions to support LSCFN participation in permitting processes
- Participating as part of LSCFN's overall technical team for the Carmacks Copper project.
- Advising on risk assessment, closure costs, liability and security bonding
- Advising on negotiation of participation and intergovernmental agreements re:  
Carmacks Copper project
- Representing LSCFN in discussions with proponent, regulators, assessment agencies, etc.
- Representing LSCFN as a technical witness at water board hearing

- Technical Advisor to Selkirk First Nation (SFN) on the Minto Mine project: providing technical advice and review on closure plans, changes to mining plans and site water management. 2006 to present.
  - Providing overall technical guidance for the SFN on all technical aspects of development, operation and closure for the Minto Mine
  - Participation on technical working groups related to mine permitting and site water management
  - Preparing technical review reports and assessment/regulatory submissions to support SFN participation in permitting processes
  - Coordinating input from the SFN government team and other technical advisors
  - Advising on closure costs, liability and security bonding
  - Representing SFN in discussions with proponent, regulators, assessment agencies, etc.
  - Advising SFN and Minto on the development of water management plan for the Minto Mine
  - Representing SFN as an expert witness at water board hearing
- Technical Consultant to the Teslin Tlingit Council on the Ketzka River Mine project: providing technical advice and review related to water quality conditions, status of mine facilities, assessment and regulatory requirements, and potential site risks. 2014 to present.
- Technical Consultant to Council of Yukon First Nations on mining land use activities: providing technical advice and review related to regulation of mining land use activities. Work often included representing First Nations at intergovernmental meetings and forums. 2006 to 2012.
- Technical Consultant to Liard First Nation on the Selwyn mine project: providing technical advice and review on exploration and mine development proposals.
  - Providing overall technical guidance for the LFN on all technical aspects of exploration and development for the proposed Selwyn Mine
  - Preparing technical review reports and assessment/regulatory submissions to support LFN participation in permitting processes
  - Representing LFN in discussions with regulators and assessment agencies.
- Technical Consultant to Kwanlin Dun First Nation (KDFN) on assessment and permitting for the Kwanlin Dun Cultural Centre. May to September 2009.
  - Completed environmental effects assessment and prepared all documentation to support YESAA process and permitting for Kwanlin Dun Cultural Centre (riverfront development in downtown Whitehorse)
  - Advised on assessment and regulatory processes and requirements
  - Advised on contaminated site concerns and issues

- Technical Consultant to Kwanlin Dun First Nation (KDFN) on renewal of water licences for the Fish Lake Hydro Project, Whitehorse. 2007 – 2013.
  - Advising on environmental assessment and water licensing processes
  - Review of applications and preparation of technical reports and regulatory/assessment submissions to support KDFN participation
  - Representing KDFN on technical working groups and at water board hearing
- Technical consultant to Rivers Without Borders on Hoverbarge Transportation Proposal for Tulsequah Chief Mine. 2007.
  - As part of the Mining Environmental Neutral Drainage (MEND) program, and in collaboration with CCSG Associates, completion of a research project comparing acid rock drainage predictions at the Vangorda/Grum Mine with actual water quality outcomes. 2007/2008.
- Technical consultant to the Tr'ondek Hwech'in on the proposed Yukon River Bridge at Dawson City. 2005/2006.
  - Providing technical evaluation, advice and recommendations and preparing technical reports and regulatory submissions to support TH participation in water licensing processes.
  - Sought support from additional technical advisors and coordinated input from the technical team.
  - Represented TH in discussions/meetings with proponent and regulators, and at water board hearing
- Technical consultant to Environment Canada on the closure planning for the Brewery Creek Mine – May to August 2004: work included the review and evaluation of closure plans/designs; identification of outstanding issues; proposals for mitigation; development of Environment Canada recommendations for water licensing; collection and analysis of water quality data; representing Environment Canada at multiagency meetings; and, participation as a technical expert during water licensing processes including Yukon Water Board hearings.
- Technical consultant to Government of Yukon's Abandoned Mines Office – April 2004 to November 2006: work included review and evaluation of technical/research/design reports for the Faro Mine closure planning (up to February 2005); options paper for regulatory authorization of interim care and maintenance activities; preparation of environmental assessment screening report for Government of Yukon's activities at United Keno Hill Mine; participation at technical meetings/workshops; review and advice on closure planning studies for the Mt. Nansen Mine; and, advice on development of mine closure objectives.

- Technical consultant to Teslin Tlingit Council on a variety of projects proposed in their traditional territory.
- Technical consultant to Council of Yukon First Nations (CYFN) on the development and implementation of the Yukon Environmental and Socioeconomic Assessment Act (YESAA) – November 2003 to present: work includes review of proposals for regulations; representing CYFN on multiagency working group; developing proposals for regulations; advising and consulting with First Nation caucuses; and, advising CYFN staff and leadership. Work on various other projects continues on an “asrequired” basis in addition to the specific work described above related to the YESAA fiveyear review.
- Consultant to Nancy Morgan and Associates – Developed template assessment documents for First Nations decision making legislation for environmental and socioeconomic assessments in Yukon.
- Consultant to Indian and Northern Affairs Canada – Preparation and facilitation of two 2day workshops (January 2005 and October 2005 – 70 and 130 participants respectively) on coordination of assessment and decision making processes under YESAA. Assisted by JC Environmental (Jillian Chown) and R White Consulting.
- Consultant to Indian and Northern Affairs Canada – In cooperation with Brodie Consulting and Steve Wilbur Consulting, researching the participation of First Nations in closure planning for mines across northern Canada (Yukon, NWT and Nunavut), as part of a report prepared for DIAND – January to April 2004. Bill Slater was responsible for research related to the Giant and Colomac Mines.
- Consultant to Indian and Northern Affairs Canada – In cooperation with R. White Consulting, development and delivery of training courses on YESAA for First Nations and government agencies – February 2004 to December 2006.
- 2004 to 2007 development and delivery of YESAA training programs for various clients (all levels of government, NGOs).
- Consultant to Yukon Environmental and Socioeconomic Assessment Board – In

cooperation with R. White Consulting, development and delivery of training courses on YESAA, environmental assessment methodology and socioeconomic assessment

methodology for the YESA Board – July 2004 to December 2004.

- Consultant to Materials Efficiency Research Group – Technical review and evaluation of proposal for large nickel mining project: as a subcontractor to Materials Efficiency Research Group, on behalf of Noranda/Falconbridge, completed the technical aspects of a third party review of the company's Koniambo Project Proposal (a nickel mine proposal in New Caledonia) – February 2004.
  - Consultant to Yukon Conservation Society – Review and analysis of proposed regulatory and environmental assessment changes for placer mining projects: reports prepared for Yukon Conservation Society – November 2003, October 2004, and August 2005.
  - Consultant to Touch the North – Preparation of environmental assessment report for Kwanlin Dun Cultural Centre – September to November 2004: worked with Touch the North (a Whitehorse based project management company) as part of a team developing an application for federal funding for development of a cultural centre on the Whitehorse waterfront. Project proponent is Kwanlin Dun First Nation.
  - Consultant to Yukon Government, Community Services – In cooperation with Laberge Environmental Services, preparation of environmental assessment report for the Hamilton Boulevard Extension, Whitehorse – 2005/2007: working as part of a larger project team providing design and environmental assessment services to the Government of Yukon. Primary author and coordinator for YESAA project proposal.
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- Peer reviewer for research papers prepared as part of the Mine Environmental Neutral Drainage (MEND) program administered by Natural Resources Canada – work completed on behalf of Mining Watch Canada, September 2004.
  - Consultant to Yukon Environmental and Socioeconomic Assessment Board – Specialist advisor for YESA Board on some specific aspects related to rule development for the YESAA assessment process – September/October 2004.

