EA03-005

## Kimberley Cliffe-Phillips

**From:** Jody Irish [Jody.Irish@paramountres.com]
**Sent:** Tuesday, February 03, 2004 8:30 AM
**To:** Kimberley Cliffe-Phillips
**Cc:** Shirley Maaskant
**Subject:** Final Participants for Hearing

Paula Bentham Resume.doc (82 K...

Good morning, Kimberley,

We have confirmed the hearing attendees. Please note the following clarifications:

Paramount Resources Representatives:

1) Ed Kustan (Environmental Consultant) WILL NOT participate
2) Nadine Berge (Associate, Gowlings) WILL participate
3) Alan Hollingworth, QC (Partner, Gowlings) WILL NOT participate

Expert Witnesses:

1) Martin Rawlings (Golder Associates) WILL participate
2) Pamela De Pauw (Golder Associates) WILL NOT participate
3) A new addition - Paula Bentham (Golder Associates) WILL participate. Resume attached.

Thank you,
Jody

# Paula R. Bentham

**Education**

M.Sc. Wildlife Ecology and Management, Department of Renewable Resources, University of Alberta, 2001.

B.Sc. Environmental and Conservation Sciences *with distinction*, Conservation Biology and Management, University of Alberta, 1997.

**Affiliations**

Alberta Society of Professional Biologists
Alberta Chapter of the Wildlife Society
Boreal Caribou Committee

**Experience**

2001-present **Golder Associates Ltd.** **Edmonton, Alberta**
*Wildlife Biologist.*
Preparation of wildlife baseline reports, project assessment and cumulative effects assessment as components of environmental impact assessments for oil and gas, mining and federal parks projects. Conduct wildlife inventories, ecological land classifications, statistical analyses of field data, permit applications and summary reports, prepare wildlife monitoring study designs, project feasibility studies, prepare caribou protection plans, conduct comprehensive literature reviews and develop mitigation and access management strategies. Currently serving as representative on the Boreal Caribou Committee. Conduct and report on Phase 1 Environmental Site Assessments and wellsite assessments.

2001 **Oberg Environmental Consulting Ltd.** **Edmonton, Alberta**
*Principal Owner / Wildlife Biologist*
Conducted wildlife inventories using ecological land classification, winter track count surveys, owl surveys, pellet surveys, and songbird surveys for Environmental Impact Assessment baseline reports. Prepared baseline reports and proposals for EIAs. Prepared caribou protection plans involving regulator and client consultation, access mitigation strategies, access management plans, and consulting on the current knowledge of pipeline and road development and access impacts on woodland caribou.

1998 – 2001 **University of Alberta.** **Edmonton, Alberta**
*M.Sc. Candidate, Department of Renewable Resources*
Master's research examined the response of threatened mountain caribou to linear developments, with an emphasis on industrial operating guidelines. Experience gained in GPS data collection, digitizing, creation and ground-truthing of linear feature (pipelines, seismic, roads) base layers using a GIS, cow/calf surveys, snow-tracking surveys, statistical analyses, and working with a multi-stakeholder group to achieve caribou conservation goals.

2000 - 2001 **Synergetiks 2000 Technologies Group Incorp.** **Crossfield, Alberta**
*Environmental Protection Team Leader*
Researched air emission credits, technologies for the treatment of hog manure, re-use of water supplies, and biogas utilization. Environmental leader on a start-up team preparing business plans, presentations, project proposals and environmental spokesperson.

1999 – 2000 **University of Alberta** **Edmonton, Alberta**
*Teaching Assistant, Wildlife Biodiversity and Ecology*
Laboratory teaching for undergraduate students in the areas of wildlife field identification, adaptive ecology, habitat relationships and current conservation issues.

# Paula R. Bentham

1997 - 1998 **Hycal Environmental Sciences Ltd. Calgary, Alberta**
*Environmental Regulatory Specialist*
Developed conclusive set of environmental operating guidelines for the petroleum industry covering Alberta, Saskatchewan, British Columbia and Federal environmental regulatory frameworks. Provided training for environmental compliance within the petroleum industry, performed external audits and developed internal auditing processes for environmental documentation control. Completed First Nation impact, riparian and aquatic ecological impact and socio-economic impact components of environmental impact assessment. Provided technical support for Phase I Environmental Site Assessments and on the collection of risk assessment data on Arctic wildlife receptors.

1996 **Imperial Oil Resources Ltd.** **Devon, Alberta**
*Environmental Assistant*
Coordinated reclamation projects, including long term planning of sites, and ensuring regulation standards achieved for wastewater, groundwater, and air quality monitoring.

1995 **Norcen Energy Resources Ltd.** **Buck Lake, Alberta**
*Environmental Summer Student*
Air monitoring, air violation reports, waste water sampling and biological treatment, groundwater monitoring, sour gas pipeline survey, relief Field Operator.

## Conference Presentations / Courses Instructed

- Woodland Caribou and Access Management: Putting the Environmental Impact Assessment Process into Practice for an At Risk Species,Western & Northern Affiliate of the International Association of Impact Assessment
- Caribou Response to Linear Developments in a West-Central Alberta Landscape, Mountain Caribou in 21st Century Ecosystems, Columbia Mountains Institute of Applied Ecology
- Responses of Mountain Caribou to Linear Features in a West-central Alberta Landscape, Seventh International Symposium on Environmental Concerns in Rights-of-Way Management
- Environmental Operating Guidelines for BC, Alberta and Saskatchewan, training course instructed for managers and field personnel of Symmetry Resources
- Wildlife Biodiversity and Ecology, teaching assistant, University of Alberta

## Courses / Training Attended

- Introduction to Geographical Information Systems (ArcView and Arc/Info)
- Biostatistical Analysis using SPSS
- Aboriginal Awareness Training, The Aboriginal Awareness Company
- ATV Rider Safety
- Bear Awareness
- Defensive Driving
- WHMIS, TDG
- Oil Spill Co-op Training
- Standard First Aid and CPR

## Paula R. Bentham

- Level 1 Wildlife Rehabilitation
- ISO 14000 Environmental Management Systems, University of Calgary
- Project Management, Golder Associates Ltd.
- Environmental Impact Assessment, University of Alberta
- James Halfpenny's Snow Tracking for Professionals

# Paula R. Bentham

## PROJECT RELATED EXPERIENCE – WILDLIFE ASSESSMENTS

**Imperial Oil Resources Ltd.** **Fort Simpson, NT**
Collected field data for the proposed Mackenzie Gas Pipeline Environmental Impact Assessment through winter track counts, aerial ungulate and ecological land classification surveys within the Deh Cho region.

**Alaska Gas Producers Pipeline Team** **NE British Columbia & NW Alberta**
Collected ecological land classification data in NE British Columbia and NW Alberta, and assisted in a summary report for wildlife data collected as part of a feasibility study for a proposed natural gas pipeline. Prepared permit applications and summary reports for wildlife studies, and completed comprehensive literature review on potential Valued Ecosystem Component (VEC) species occurring along the proposed pipeline route.

**Westcoast Energy Inc.** **NE British Columbia and NW Alberta**
Consulted on the threatened status of woodland caribou, access mitigation, and current knowledge of pipeline development and road/off-road access impacts on wildlife. Collected and analyzed songbird baseline data, and prepared technical report for Environmental Impact Assessment.

**Paramount Resources** **Cameron Hills, NT**
Responsible for responding to supplemental questions with respect to wildlife and woodland caribou cumulative environmental effects.

**Tempest Energy** **Hastings Lake, Alberta**
Conducted wildlife and siting assessment for two proposed wellsites and associated access.

**Opti-Nexen Inc** **Anzac, Alberta**
Responsible for writing a revision update of the wildlife component for the Environmental Impact Assessement for the Opti-Nexen Long Lake Project Application and responded to supplemental questions.

**Shell Canada Limited** **Fort McMurray, Alberta**
Wildlife component leader for Shell Jackpine – Phase 1 project. Prepared Application Case and Planned Development (CEA) Case for wildlife Environmental Impact Assessment component of a proposed oil sands open pit mine. Responded to supplemental questions from both government and stakeholder groups.

**Petro-Canada Resources Ltd.** **Anzac, Alberta**
As part of an annual caribou protection plan monitored the distribution, abundance, and habitat use of woodland caribou in relation to ongoing construction of a SAGD oilsands project. Responded to supplemental questions on a SAGD oilsands EIA from both government and stakeholder groups.

**Suncor Energy Inc.** **Fort McMurray, Alberta**
Wildlife component lead responsible for writing Application Case and Planned Development (CEA) Case for Environmental Impact Assessment of a proposed oil sands mine tailings pond. Collected baseline data on ungulate species presence, distribution, abundance, and productivity through aerial ungulate surveys. Established long-term monitoring plots and completed monitoring for amphibians.

# Paula R. Bentham

**Canadian Natural Resources Ltd.** **Fort McKay, Alberta**
Involved in the preparation of the the wildlife component of an Environmental Impact Assessment Application Case and Planned Development (CEA) Case which involved determining impacts to wildlife abundance, wildlife habitat and wildlife movement corridors from a proposed SAGD project.

**Minera Barrick Misquichilca S.A.** **Lima, Peru S.A.**
Provided technical review of wildlife baseline reports prepared for the Alto Chicama gold mine project. Assisted in the preparation of the EIA for wildlife, biodiversity and fish which included public consultation results, issue scoping and predicting project related effects on key wildlife species. The report also included a detailed mitigation and monitoring plan during operations and closure of the project.

**Japan Canada Oil Sands** **Fort McMurray, Alberta**
Collected baseline data for a proposed SAGD Environmental Impact Assessment through winter mammal track count survey, owl survey, ungulate pellet survey, and songbird survey. Prepared baseline reports on wildlife inventory analyses.

**Imperial Oil Resources Ltd.** **Cold Lake, Alberta**
Collected baseline data for Environmental Impact Assessment of a proposed SAGD project through winter mammal track count survey, owl survey, ungulate pellet survey, and songbird survey.

**Blackrock Energy** **Cold Lake, Alberta**
Collected baseline data for a proposed SAGD project Environmental Impact Assessment through winter mammal track count survey, owl survey, ungulate pellet survey, and songbird survey.

**TransCanada Pipelines** **Toronto and North Bay Regions, Ontario**
Compiled background site descriptions and determined exposure pathways and flora/fauna receptors for Enhanced Phase I Environmental Site Assessments along existing pipelines and facilities.

**Inuvialuit Regional Corporation** **Cape Parry, NWT**
Collected risk assessment data, based on U.S. EPA standards and literature review, to determine effects of North Warning System DEW Line sites on arctic wildlife receptors.

## PROJECT RELATED EXPERIENCE – WILDLIFE/FORESTRY

**Alberta Plywood Ltd.** **Slave Lake, Alberta**
Conducted a trial songbird long-term monitoring survey on the Slave Lake Pulp FMA. Revised study design for long-term wildlife monitoring based on corporate monitoring commitments.

## PROJECT RELATED EXPERIENCE – ASSESSMENTS AND AUDITS

**Northland Investments Ltd.** **Edmonton, Alberta**
Conducted and prepared Phase 1 Environmental Site Assessment.

# Paula R. Bentham

**GE Capital** **Edmonton, Alberta**
Conducted and prepared Phase 1 Environmental Site Assessment.

**Alberta Public Works and Supply** **Edmonton, Alberta**
Environmental Impact Assessment on the Old Man Dam following flood disaster with respect to First Nations, riparian and aquatic ecological impacts, and socioeconomic impacts.

**Debeer's Canada Inc.** **Yellowknife, NT**
Edited socio-economic component of the Environmental Impact Assessment for the Snap Lake Diamond Mine Project.

## PROJECT RELATED EXPERIENCE – OIL & GAS and INDUSTRIAL OPERATIONS

**Pursuit Resources Corp.** **Calgary, Alberta**
Developed conclusive set of environmental operating guidelines for a petroleum producer operating under Alberta, B.C., Saskatchewan, and federal regulatory frameworks. Consulted on environmental management system. Performed external audit on environmental documents to ensure regulatory compliance.

**Symmetry Resources Incorp.** **Calgary, Alberta**
Developed conclusive set of environmental operating guidelines for petroleum producers operating under Alberta, B.C., Saskatchewan, and federal regulatory frameworks. Consulted on environmental documentation, environmental management system and provided environmental operating guidelines training course.

**Cabre Explorations Ltd.** **Calgary, Alberta**
Developed conclusive set of environmental operating guidelines for petroleum producer operating under Alberta, British Columbia, and federal regulatory frameworks.

**Grad and Walker Energy Corporation** **Calgary, Alberta**
Developed conclusive set of environmental operating guidelines for petroleum producer operating under Alberta, British Columbia, and federal regulatory frameworks.

**Natural Resources Canada** **Battle River Lake, Alberta**
Monitored groundwater quality, performed piezometric analysis, surveyed site and system components and maintained an experimental bioremediation technology.

**Imperial Oil Resources Ltd.** **Battle River Area, Alberta**
Coordinated spill site reclamation projects: groundwater trench salt removal program, hydrocarbon contaminated land farming treatment, collected and interpreted data on soil and water quality, coordinated contractors, vegetation control, long term site planning, and landowner consultations. Ensured regulatory standards achieved for air, water, reclamation and spill clean up.

**Norcen Energy Resources Ltd.** **Buck Lake, Alberta**
Completed sour gas pipeline survey; monitoring for leaks, erosion, vegetation, and ensured regulatory requirements achieved. Relief field operator.

**Synergetik2000 Technologies Group Incorp.** **Crossfield, Alberta**
Researched air emission credit trading, technologies for the treatment of hog manure, re-use of water supplies, and biogas utilization. Consulted on start-up team preparing business plan, presentations, project proposals, and acted as environmental spokesperson during public and government meetings.

# Paula R. Bentham

## PUBLICATIONS AND REPORTS


Bentham, P.R. and C.J. De La Mare. 2003. Long-Term Songbird Monitoring Program: Trial Field Study 2003. Prepared for Alberta Plywood Ltd. by Golder Associates Ltd., Edmonton, AB.

Bentham, P.R. and C.J. De La Mare. 2003. Winter Aerial Caribou Survey for the Petro-Canada Meadow Creek Project. Prepared for: Petro-Canada, Calgary, Alberta by: Golder Associates Ltd., Calgary, Alberta. 30pp.

Golder Associates Ltd. 2002. Winter Aerial Ungulate Survey for the Petro-Canada Meadow Creek Project. Prepared for: Petro-Canada, Calgary, A lberta. Prepared by: Golder Associates Ltd., Calgary, Alberta. 21pp.

Golder (Golder Associates Ltd.). 2003. Suncor South Tailings Pond (STP) Project. Wildlife Baseline Report. Prepared for Suncor Energy Inc. December 2003. Calgary, AB.

*Jackpine Mine – Phase 1 Application, Environmental Impact Assessment.* Wildlife and Wildlife Habitat Assessment, Volume 4, Section 6. 2002. Prepared for: Shell Canada Ltd., Calgary, Alberta. Prepared by: Golder Associates Ltd., Calgary, Alberta.

Oberg, P. 2001. Responses of Mountain Caribou to Linear Features in a West-Central Alberta Landscape. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.

Oberg, P., C. Rohner, and F. Schmeigelow. 2000. Responses of Mountain Caribou to Linear Features in a West-central Alberta Landscape. In Proceedings from the *Seventh International Symposium on Environmental Concerns in Rights-of-Way Management*, Sept. 9-13, 2000, Calgary, AB.

*Phase I Environmental Impact Assessment of the Oldman River Valley Peigan Nation Reserve.* 1998. Prepared for: Public Works and Government Services Canada, Indian and Northern Affairs Canada, and the Peigan Nation, Edmonton, Alberta. Prepared by: Hycal Environmental Sciences Ltd., Calgary, Alberta.

## Kimberley Cliffe-Phillips

**From:** Jody Irish [Jody.Irish@paramountres.com]
**Sent:** Thursday, January 29, 2004 4:36 PM
**To:** Kimberley Cliffe-Phillips
**Subject:** Fwd: FW: Golder resumes




TCollard ume_Jan2004.pdf (
DJohannesen sume_Jan2004.pdf
MRawlings sume_Jan2004.pdf (
CDeLaMare sume_Jan2004.pdf (

Attached are the resumes for the first four expert witnesses. The last will be sent separately.

Thank you,
Jody

# Pamela DePauw B.Sc. (Eng.)

**EDUCATION**

Bachelor of Science, Environmental Engineering, University of Guelph, Guelph, Ontario, April 1999

Golder U – Golder 101, Calgary, AB (2000)

Golder U – Project Management, Calgary, AB (2001)

Golder U – Client Services and Business Development, Calgary, AB (2002)

Golder U – Communication and Interpersonal Skills, Calgary, AB (2002)

Golder U – Technical Writing, Calgary, AB (2002)

**AFFILIATION**

Member of the Air and Waste Management Association

**EXPERIENCE**

2000 to date — **Golder Associates Ltd.** — **Calgary, Alberta**

*Air Quality Scientist*

Mrs. DePauw is an air quality scientist at Golder working in the areas of atmospheric sciences; air dispersion modelling; air emission inventories; fugitive dust assessments; air quality and noise evaluations; and environmental impact assessments.

1999 — **Conor Pacific Environmental Technologies** — **Calgary, Alberta**

*Air Quality Scientist*

Performed hazard assessments on sweet and sour gas pipelines and wells, ammonia pipelines and $CO_2$ injection wells to establish Emergency Planning Zones (EPZs) and land use setbacks. Also, performed thermal hazard modelling to determine the EPZs for low $H_2S$ and sweet gas pipelines.

1998 — **Environment Canada, Pollution Data Branch** — **Hull, Quebec**

*Co-op Student*

Developed and updated methodologies to calculate greenhouse gas emissions from landfills, incineration, wastewater treatment, composting and HFC use.

# Pamela DePauw

## PROJECT EXPERIENCE

**Saskatchewan Highways and Transportation** **Southeastern, Saskatchewan**
**Highway No. 16 Twinning Project**

Golder was responsible for the completion of the Canadian Environmental Assessment Act Screening Report for the Highway No. 16 Twinning Project West of North Battleford to Maidstone. The air quality component of this project included a qualitative assessment of the current and future air emissions and noise from traffic and the air emissions and noise from the construction phase. Responsibilities included managing the air quality component and report writing.

**Saskatchewan Highways and Transportation** **Southeastern, Saskatchewan**
**Highway No. 1 Twinning Project**

Golder was responsible for the completion of the Canadian Environmental Assessment Act Screening Report for the Trans Canada East Twinning Project. The Trans Canada East Twinning Project included the twinning of the 132 km section of roadway between Wolsley and the Manitoba boarder. The air quality component of this project included a qualitative assessment of the current and future air emissions and noise from traffic and the air emissions and noise from the construction phase. Responsibilities included managing the air quality component and report writing.

**OPTI Canada Inc./Nexen Canada Ltd.** **Anzac, Alberta**
**Long Lake Project EIA Support**

Provided support to OPTI Canada Inc. and partner Nexen Canada Ltd. in their application to Alberta Environment and the Energy and Utilities Board to construct and operate the Long Lake commercial SAGD project. Work included re-assessment of facility emissions and an update to the EIA that was submitted in November 2000.

**CNRL** **Fort McMurray, Alberta**
**Horizon Project**

Golder Associates was responsible for the completion of the environmental impact assessment (EIA) for the Canadian Natural Resources Limited (CNRL) Horizon integrated oil sands mine and upgrading project. The air quality sections of the EIA evaluated cumulative air pollutant concentrations and acid deposition across the Oil Sands Region, using the CALPUFF dispersion model (3-D mode). The EIA made use of Golder's regional emissions database and 3-D meteorological data set, which covers the area from Fort Chipewyan in the north to the Cold Lake area in the south. Responsibilities included coordinating the emissions component of the project, client liaison and writing the emissions appendix for the EIA. The emissions component of the project included calculating the air emissions from the proposed project and updating and maintaining a regional emissions inventory of the other projects to be included in the dispersion modelling.

# Pamela DePauw

**Shell Canada Ltd.** **Fort McMurray, Alberta**

**Jackpine Mine-Phase 1 EIA**

Golder was responsible for the completion of the recent environmental impact assessment (EIA) of the Jackpine Mine – Phase 1 Oil Sands mine for Shell Canada Limited. As part of the EIA, Golder was responsible for the completion of the air quality components of the project, which included the use of the Golder's regional emissions database and 3-D meteorological data set. The air quality assessment evaluated air concentrations and acid deposition resulting from cumulative emissions sources across the Oil Sands Region, spanning from Fort Chipewyan in the north to the Cold Lake area in the south. Air quality predictions were made using the CALPUFF dispersion model, run in the 3-D mode. Responsibilities included coordinating the emissions component of the project, client liaison and writing the emissions appendix for the EIA. The emissions component of the project included calculating the air emissions from the proposed project and updating and maintaining a regional emissions inventory of the other projects to be included in the dispersion modelling.

**Petro-Canada Oil and Gas** **Fort McMurray, Alberta**

**Meadow Creek Project EIA**

Golder was responsible for the completion of the environmental impact assessment (EIA) and application to develop a Steam-Assisted Gravity Drainage (SAGD) project in the Athabasca Oil Sands Region. The air quality component of the project evaluated acid deposition in the region as well as local and regional concentrations of sulphur dioxide, nitrogen dioxide, particulate matter, secondary particulates, carbon monoxide, reduced sulphurs, volatile organic compounds, trace metals and polycyclic aromatic hydrocarbons. The CALPUFF model (3-D mode) was used for this assessment. Responsibilities included estimating the emissions from the proposed project and updating and maintaining an emissions inventory of the other projects to be included in the dispersion modelling, as well as writing the emissions appendix for the EIA.

**Opti Canada Inc.** **Anzac, Alberta**

**Long Lake Project EIA and Project Update**

Golder was responsible for the preparation of the environmental impact assessment (EIA) and subsequent project update for the Long Lake Project, which includes an integrated steam assisted gravity drainage (SAGD) facility and upgrading complex. The air quality assessment included an evaluation of the cumulative air pollutant concentrations and acid deposition using the CALPUFF dispersion model (3-D mode). The project update made use of the Golder regional emissions and 3-D meteorological data sets, covering the area from Fort Chipewyan to south of the Cold Lake area. The use of these data sets made the update predictions consistent with the assessment approaches used on the majority of applications filed in the Oil Sands Region, as well as the work being conducted for the $NO_X$-SOX Management Working Group (NSMWG). In addition, the use of the large study area and greater number of sources were effective in addressing all of the concerns raised by Saskatchewan Environment. Responsibilities included coordinating the emissions component of the project, client liaison and writing the emissions appendix for the EIA. The emissions component of the project included calculating the air emissions from the proposed project and updating and maintaining a regional emissions inventory of the other projects to be included in the dispersion modelling.

# Pamela DePauw

**OPTI Canada Inc.** **Anzac, Alberta**

**Opti Long Lake Pilot Project**

Golder was responsible for the preparation of an air quality assessment for the Long Lake Pilot Project, which is a scaled down version of the Long Lake commercial Project. This project includes a small-scale integrated steam assisted gravity drainage (SAGD) facility and upgrading complex. The air quality assessment included an evaluation of the cumulative air concentrations and acid deposition using the CALPUFF dispersion model (3-D mode). The project made use of the Golder regional emissions and 3-D meteorological data sets, covering the area from Fort Chipewyan to south of the Cold Lake area.

**Paramount Resources Ltd.** **Cameron Hills, NWT**

**Cameron Hills Project**

The Cameron Hills project is a gas development that straddles the Alberta/NWT border. An air quality, noise and greenhouse gas assessment was submitted to the government of the NWT and the National Energy Board (NEB). This assessment was part of a comprehensive EIA completed for the application process. The assessment included the preparation of a facility emissions inventory, development of a meteorological data set, and the completion of refined dispersion modelling to determine regional and local air pollutant concentrations. Responsibilities included coordinating the air component of the EIA, estimating the emissions from the proposed project, client liaison and assisting in the preparation of the report.

**Canadian Natural Resources Limited (CNRL)** **Lac La Biche, Alberta**

**Kirby Project EIA**

Golder was responsible for the completion of the environmental impact assessment (EIA) and project application for the development of this Steam-Assisted Gravity Drainage (SAGD) project on the northern edge of the Cold Lake Air Weapons Range. The air quality assessment completed for the EIA evaluated local and regional concentrations of sulphur dioxide, nitrogen dioxide, particulate matter, secondary particulates, carbon monoxide, reduced sulphurs, volatile organic compounds, trace metals and polycyclic aromatic hydrocarbons using the 3-D CALPUFF model. The assessment also evaluated the cumulative acid deposition in the region and assessed possible impacts on the receiving environment. Responsibilities included estimating the emissions from the proposed project and updating and maintaining an emissions inventory of the other projects to be included in the dispersion modelling, as well as writing the emissions appendix for the EIA.

**Rio Alto Exploration Ltd.** **Kirby Lake Alberta**

**Kirby Thermal Pilot Project**

This project involved the preparation of the air quality sections for a thermal heavy oil pilot project in the Christina Lake region. An air quality assessment of the Rio Alto Kirby Thermal Pilot Project was completed as part of the application for the project. The assessment included evaluating the existing air quality and meteorological conditions, estimating the emissions from the project and dispersion modelling using the ISC3 model to determine ground level concentrations. Responsibilities included estimating the emissions from the proposed project and updating and maintaining an emissions inventory of the other projects to be included in the dispersion modelling.

# Pamela DePauw

**Rio Alto Exploration Ltd.** **Cold Lake, Alberta**

**Kirby Project Compliance Monitoring**

A review of compliance monitoring results was completed to assess whether steam generator emissions complied with approval emissions limits. Graphical comparisons of $NO_X$ emissions, power output and emission limits were provided.

**Paramount Resources Ltd.** **East Liard, NWT**

**Assessment of the East Liard Drilling Project**

Golder conducted an air quality dispersion modelling assessment of the Liard East drilling and well evaluation program. This assessment was part of a comprehensive evaluation of the potential vegetation, wildlife and socio-economic impacts of the program. The assessment included the evaluation of gas compositions and emissions from the proposed well tests, as well as development of a meteorological data set, and the completion of refined dispersion modelling using ISCST3 to determine regional and local air pollutant concentrations. Responsibilities included coordinating the air component of the EIA, estimating the emissions from the proposed project, client liaison and assisting in the preparation of the report.

**Post Energy Ltd.** **Kaybob, Alberta**

**Well Test Application**

A dispersion modelling assessment of $SO_2$ and $H_2S$ emissions was performed for a well test in Alberta. The study evaluated flare heights and the potential effect of ground-levelS $O_2$ concentrations on vegetation.

**Post Energy Ltd.** **Brazeau, Alberta**

**Well Test Application**

Conducted dispersion modelling for a well test in Alberta. The assessment considered ground-level $SO_2$ concentrations and presented maximums related to seasonal variability, atmospheric stability class, vegetation sensitivity and frequency of occurrence.

**Chevron/Upside Engineering** **Fort Liard, NWT**

**Chevron F25 Air Modelling**

Provided a dispersion modelling assessment of the F-25 well site and an associated gas dehydration facility and gas flare. The well and processing facility were situated in a region of steep terrain in the Franklin Mountains of the Liard Range. A variety of gas processing rates and facility locations were modelled to determine the optimal operating parameters that would maximize gas production while minimizing environmental impact. Responsibilities included numerous model runs using different facility throughput capacities and assisting with interpretation of the results and report preparation.

**Canadian Natural Resources Limited (CNRL)** **Bonnyville, Alberta**

**Primrose and Wolf Lake Expansion (PAW) Project**

An air quality assessment was completed to support the application for the expansion of the Primrose and Wolf Lake in-situ Oil Sands developments at the southern edge of the Cold Lake Air Weapons Range. The air quality assessment formed part of a comprehensive environmental impact assessment (EIA) for the

project. Project and cumulative regional emissions were calculated and modelled to determine ground-level pollutant concentrations and acid deposition. The dispersion modelling was performed using CALPUFF, run in 2-D mode. A noise assessment was also completed as part of the EIA, to evaluate the facility and traffic noise levels likely to result from varying stages of project development. Responsibilities included the quantification of facility and regional air emissions and assisting with dispersion modelling.

**Black Tusk Energy Inc.** **Pine Creek, Alberta**

**Pine Creek Well Test Application**

This project involved a dispersion modelling assessment of predicted $SO_2$ and $H_2S$ impacts associated with a proposed well test. Results were compared to vegetation thresholds and ambient air quality guidelines to quantify potential environmental effects.

**Paramount Resources Ltd.** **Northwestern, Alberta**

**Oil Well Battery Dispersion Modelling Assessment**

Paramount Resources Ltd. (Paramount) is proposing to install a single well oil battery at the Valhalla 4-20 site, in Northwestern Alberta. The combustion equipment to be installed at this site would consist of a flare and a Waukesha engine to run the pumpjack. For this site Golder calculated the overall site emissions for $SO_2$, $NO_X$, $CO_2$, and $ECO_2$, completed dispersion modelling for the $SO_2$ emissions and conducted a screening level dispersion modelling study to assess the ambient $H_2S$ concentrations for two venting scenarios at the proposed 4-20 Oil Well Battery.

**Suncor Energy Inc.** **Fort McMurray, Alberta**

**Firebag In-Situ Project**

Golder was responsible for the completion of the environmental impact assessment (EIA) and application to develop a Steam-Assisted Gravity Drainage (SAGD) project in the Athabasca Oil Sands Region. The project EIA included the evaluation of community and regional air pollutant concentrations and regional acid deposition from cumulative activities in the area. The Firebag Project EIA represented the first application to use the CALPUFF 3-D dispersion model for simulating concentrations and acid deposition patterns. Responsibilities included updating and maintaining the emission inventory and completing numerous modelling runs.

**CNRL** **Fort Liard, NWT**

**C-31 Air Quality Assessment**

Conducted an air quality and noise assessment to address potential impacts resulting from the construction and operation of a gas dehydration facility in the NWT. Ground-level concentrations were predicted for normal operations and emergency flaring events. In addition, noise levels resulting from the facility were assessed and compared with EUB sound level limits. Greenhouse gas emissions were estimated and compared to national and provincial emissions. Finally, an impact assessment was completed on the residential effects of the project and the overall significance of each impact was discussed. Responsibilities included quantifying the project emissions, completing the modelling runs and assisted in preparing the report for the client.

# Pamela DePauw

**Marathon Energy Limited** **Northeastern Alberta**
**Twining Battery and Liege Gas Plant**
Golder was retained to complete a dispersion modelling assessment of the $SO_2$ and $NO_X$ emissions from a pair of gas processing facilities in northeastern Alberta, as part of an application to amend the operating permits. The evaluations made use of the existing modelling analyses, and current regulatory guidance for such modelling, to determine the maximum ground-level concentrations adjacent to the sites. Responsibilities included quantifying the project emissions, completing the modelling runs and assisted in preparing the report for the client.

**Westcoast Energy Inc,** **Northern, BC**
**Review of Emergency Planning Zones (EPZs) for Sour Gas Gathering Pipelines**
Participated in creating a database for the data required to review the EPZs for sour gas pipelines such as the location and types of valves, direction of gas flow and gas composition etc. Performed a large portion of the toxic and thermal hazard modelling. Also participated in project management, client liaison and report preparation.

**PanCanadian,** **Southern, Saskatchewan**
**Hazard Modelling for a $CO_2$ Injection Well**
Assisted in conducting the hazard modelling for a $CO_2$ injection well and prepared the report for the client. Also participated in client liaison.

**Poco Petroleums Inc.** **Gregg Lake, Alberta**
**Hazard Modelling on Sour Gas Pipelines and Wells**
Participated in determining the emergency planning zones for several pipelines and wells in the Gregg Lake area. Responsible for completing the hazard modelling for one of the wells and assisted in the preparing the report.

**Centurion** **Joffre, Alberta**
**Ammonia Pipeline**
Completed the hazard modelling for additional release scenarios requested by the client after the initial report was completed and prepared an amendment for the initial report.

**Environment Canada, Pollution Data Branch** **Hull, Quebec**
**Green House Gas Division**
Assisted in the preparation of the document, Canada's Greenhouse Gas Inventory 1997 Emissions and Removals with Trends. Responsibilities included developing and updating methodologies to calculate greenhouse gas emissions from landfills, incineration, wastewater treatment, composting and HFC use.

# Tod Collard, B.Sc.

**EDUCATION** BSc, Ecology, University of Calgary, 1990

**AFFILIATION** Alberta Society of Professional Biologists
Member, Canadian Heavy Oil Association

## EMPLOYMENT SUMMARY

2002 to date, 1997 to 2000 — **Golder Associates Ltd.** — **Calgary, Alberta**

*Senior Project Manager/Director*

Responsible for project management and direction for a variety of environmental projects including oil sands and in-situ heavy oil developments, provincial and federal pipeline projects and oil and gas projects. Project work includes management of, and direction to, multi-disciplinary teams to identify and mitigate environmental effects arising from proposed developments. Provide liaison between clients, government agencies and consultants in terms of environmental impact assessments, cumulative effects assessments and application development.

2001 to 2002 — **Pine Creek Consulting Ltd.** — **Calgary, Alberta**

*Director*

Contracted to the Alaska Gas Producers Pipeline Team, ExxonMobil. The contract was to manage the environmental aspects of a feasibility study to transport gas from Prudhoe Bay, Alaska to Chicago, Illinois. Pine Creek Consulting Ltd. was responsible for the Mackenzie Valley and offshore portions of the feasibility study.

2000 to 2001 — **National Energy Board** — **Calgary, Alberta**

*Environmental Assessment Officer, Conservation Officer*

Responsible for CEAA screenings and preliminary screenings of oil and gas activities (drilling, offshore and onshore seismic projects, pipelines) in Frontier Areas under NEB jurisdiction. Presentations to various regulatory bodies and land use managers in the Inuvialuit Settlement Area regarding the role of the NEB in assessing oil and gas activity in the NWT. Conducted inspection of pipeline construction and seismic operations in the Inuvialuit Settlement Region and the Fort Liard area. Provide regulatory and environmental support to the Yukon Oil and Gas Branch.

1995 to 1997 — **Quadra Environmental Services Inc.** — **Calgary, Alberta**

*Project Manager, Environmental Planning*

Conducted environmental planning for pipelines and facilities, environmental monitoring for petroleum drilling and completions, as-built report writing, reclamation progress assessments, rare plant and wildlife studies, pre-construction site assessments, reclamation planning for a salt water spill.

1994 to 1995 — **Seacor Environmental Engineering Inc.** — **Calgary, Alberta**

*Project Manager, Environmental Planning*

Managed environmental planning projects for pipelines and facilities, environmental management systems, pre-construction site assessments, reclamation certificate applications, reclamation planning for a salt water spill, water well testing.

# Tod Collard

1991 to 1994 **Western Oilfield Environmental Services Inc** **Calgary, Alberta**

*Environmental Technician*

Completed environmental assessments for pipelines and facilities, reclamation studies, biophysical analysis of pipeline and wellsite facilities, rare plant and wildlife studies and manual development, environmental management systems, preconstruction site assessments, sulphur deposition studies, water well testing.

1990 **University of Calgary** **British Columbia and Zimbabwe Africa**

Habitat evaluation and population studies for several bat species in British Columbia and Africa, Committee on the Status of Endangered Wildlife in Canada report writing.

1987 to 1989 **Shell Canada** **Swan Hills Alberta**

Lease Operator in the House Mountain and Virginia Hills fields near Swan Hills, Alberta.

## Experience

Tod has a Bachelor of Science degree in Ecology from the University of Calgary. He has worked in both the environmental and petroleum industries since 1987. For the past 14 years, Tod has been employed as an environmental consultant and as a regulator for the National Energy Board, both specializing in environmental planning and impact assessments. He is currently a registered Professional Biologist in Alberta and a member of the Canadian Heavy Oil Association.

He has been involved in environmental studies in Canada in the Northwest Territories, British Columbia, the Prairie Provinces and the Maritimes (Nova Scotia and New Brunswick). Internationally, Tod has participated in environmental projects in the Philippines, Africa and South America.

Tod is currently an Environmental Assessment Project Manager/Director for both oil sands and conventional oil and gas development applications. He is an active member of the Senior EA Team, the Biophysical Team, the Core Energy Market Sector team and is the Oil and Gas Market Sector. Tod has contributed to the management of the Calgary office as the EA Division Manager and Terrestrial Sub-group Manager.

Tod's experience includes: environmental planning for several open pit and SAGD oil sands projects; upstream oil and gas projects including seismic, drilling, facility and pipelines assessments (international, federal and provincial); environmental monitoring; environmental auditing (transactional and operational); land reclamation for oil and produced water spills; reclamation certificate applications; sump testing and disposal; and Lease Operator for Shell Canada Resources.

Tod's experience in these roles and educational background provides him with a unique perspective regarding impact assessments and applications for conventional oil and gas and oil sands projects. Tod has focussed on providing practical solutions to environmental issues as they arise for heavy oil projects, pipelines, seismic projects, drilling programs and oil and gas facilities.

# Tod Collard

## PROJECT RELATED EXPERIENCE – NATIONAL ENERGY BOARD

### Wellsite Construction and Drilling — NWT

Federal environmental review and inspection of drilling projects conducted by Petro-Canada, Paramount Resources, Canadian Forest Oils and Chevron Canada Resources in the Fort Liard and Inuvialuit Settlement Area. Preliminary discussions with potential proponents regarding regulatory process for offshore drilling projects in the Beaufort Sea.

### Seismic Operations — NWT

Federal environmental review and inspection of onshore geophysical operations conducted by Anderson Exploration, AEC West, Burlington, Chevron, Shell Canada and Explor Data. CEAA environmental assessment of offshore seismic program conducted in the Davis Strait by Philips Petroleum. Preliminary discussions with potential proponents regarding regulatory process for offshore seismic projects in the Beaufort Sea.

### Pipeline — NWT

Federal environmental review and inspection of Chevron's M-25 pipeline construction project. Post-Construction assessment of Paramount's Shiha pipeline and F-36 facilities, Chevron K-29 pipeline and Ranger P-66 pipeline.

### Regulatory Contact/Coordination — NWT

Coordination of, and discussions with, federal and local regulatory bodies and land use managers in the NWT including Environment Canada, Department of Fisheries and Oceans, Indian and Northern Affairs Canada, NWT Water Board, Environmental Impact Screening Committee, Inuvialuit Land Administration, Gwich'in Land Use Planning Board, Sahtu Land and Water Board, Mackenzie Valley Land and Water Board, Fisheries Joint Management Committee, Hunters and Trappers Committees.

# Tod Collard

## PROJECT RELATED EXPERIENCE – ENVIRONMENTAL PLANNING

**NEB Application, Pipeline** — **Fort Liard, NWT and Fort Nelson, BC**

Project Manager for the Environmental Impact Assessment component of a Section 58 application to the National Energy Board for a 24 km pipeline and gathering system. Provide environmental and strategic advice for Information Requests from the NEB and public stakeholders. Project currently in progress. (Shiha Energy Transmission).

**Environmental Impact Assessment, Pipeline** — **Alberta, Saskatchewan**

Managed the terrestrial components for an EIA for construction of a proposed 1200 km natural gas pipeline project in Alberta and Saskatchewan. Participated in open houses, public consultation meetings and government regulatory meetings in Saskatchewan and Alberta (Alberta Pipeline Project).

**NEB Application, Pipeline** — **British Columbia, Alberta**

Project Manager for a NEB application for construction of a pipeline in northern British Columbia and Alberta (Canadian Hunter).

**Land Use Permit Application (Environmental Assessment)** — **Fort Liard, NWT**

Project Manager for an environmental assessment of a barge landing site, access road and wellsite drilling project near Fort Liard for a Land Use Permit Application. (Paramount Resources).

**Application to Construct and Operate, Heavy Oil Upgrader** — **Alberta**

Manage environmental components of applications to AEUB and AENV for a pilot project to upgrade bitumen recovered from an in-situ heavy oil development in the Cold Lake area.

**Environmental Impact Assessment, Heavy Oil** — **Alberta**

Managed the terrestrial, aquatic, air and socio-economic components of an Environmental Impact Assessment (EIA), EPEA application and EUB application for a SAGD heavy oil project in northeastern Alberta. Participated in open houses, public consultation meetings and government agency meetings (PanCanadian Resources).

**Environmental Impact Assessment, Heavy Oil** — **Alberta**

Managed all components of an EIA for a heavy oil project in Alberta and managed environmental components of a Life Cycle Value Assessment for several pipeline and road route options (confidential client).

**Environmental Impact Assessment, Oil Sands Mine** — **Alberta**

Managed the terrestrial components for an EIA and application to construct and operate an oil sands mine in northeastern Alberta (Suncor Energy Inc).

## PROJECT RELATED EXPERIENCE – ENVIRONMENTAL PLANNING (CONTINUED)

**Environmental Screening, Power line** — **Alberta**
Managed an Environmental Screening Report for a power line right-of-way through environmentally sensitive lands in an Indian Reserve (TransAlta Utilities).

**Environmental Assessments, Seismic Lines** — **Alberta**
Managed environmental assessments for approvals to complete seismic operations throughout Alberta (Norex, Mobil Oil, NRG).

**Environmental Assessments, Wellsites** — **United States**
Performed environmental assessments to describe potential environmental impacts and associated mitigation measures in support of an IOGC application in the Blood Indian Reserve (Mobil Oil).

**Environmental Assessments, Pipeline** — **Saskatchewan, Manitoba, Ontario**
Conducted Environmental Assessments for pipeline looping in Saskatchewan, Manitoba and Ontario (TransCanada PipeLines Ltd.).

**Conservation and Reclamation Applications, Pipelines** — **Alberta**
Managed various components of Conservation and Reclamation applications for submission to Alberta Environmental Protection for Class 1 pipelines in Alberta. (AEC, Petromet Resources, Amoco, Imperial Oil, Serenpet Inc., Canadian Hunter).

**Environmental Assessments and Licensing, Gas Field** — **Alberta**
Conducted environmental issues assessment and licensing requirements associated with gas field construction in central Alberta. (Petromet Resources).

**Biophysical Assessments, Oil and Gas Facilities** — **Argentina, Philippines**
Conducted field reconnaissance and/or biophysical analysis to develop environmental protection measures in Argentina and the Philippines.

**Pre-Construction Baseline Assessments, Wellsites** — **Alberta**
Conducted preconstruction baseline site assessment of wellsites in Alberta and Saskatchewan (Pajak, Petromet, Summit, Ocelot).

# Tod Collard

## PROJECT RELATED EXPERIENCE – ENVIRONMENTAL AUDITING

**Environmental/Construction Monitoring, Shallow gas** **Alberta, Saskatchewan**

Monitored drilling and completions activities for shallow gas in environmentally sensitive lands in Saskatchewan. Wrote "as-built" reports for oil and gas companies in Saskatchewan and Alberta. (Ocelot Energy, Snow Leopard Resources, Petro-Canada Resources).

**Environmental Audits, Wellsites and Facilities** **Alberta, British Columbia**

Performed phase 1 and 2 environmental audits in several areas of Alberta including Zama Lake, Whitecourt, Fox Creek, Twin Creeks and near Ft. St. John (Summit Resources, Pacific 66, CoEnerco).

**Environmental Audits, Drilling Rigs** **United States**

Performed environmental audits of drilling rigs in operation in Montana and North Dakota for Cardinal Drilling Company.

# Tod Collard

## RELATED EXPERIENCE – GROUP MANAGEMENT

### Environmental Assessment Group, Golder Associates — Alberta

Managed a group of 30+ people in the Environmental Assessment Group including Soils, Vegetation, Wildlife, Public Consultation, Socio-Economics and Archaeology personnel. Duties included fiscal management, time and resource allocation and participation in staffing requirement decisions. Prior to this, I was the Terrestrial Sub-Group leader responsible for time and workload allocation for a group of about 15 staff members. I am currently an active member of the senior EA Group team. This team is responsible for decisions regarding general direction and focus of the group.

### Planning Group, Quadra Environmental — Alberta

Developed a business plan and marketing plan for a small group of up to 5 people for a subsidiary company of Serval Group of Companies – Quadra Environmental Services.

# Daryl V. Johannesen, M.Sc., P.Biol.

**Education**

B.Sc., Biology, University of Saskatchewan, Saskatoon, 1980.
M.Sc., Biology, University of Saskatchewan, Saskatoon, 1985.
Habitat Evaluation Procedure Training, Regina, 1989
Hazardous Waste Operations and Emergency Response, Golder Training Institute, 1995.
The Canadian Red Cross Society Standard First Aid/CPR Course, 2001.

**Affiliations**

Member, The Wildlife Society.
Member, Alberta Society of Professional Biologists.

**Experience**

2000 - Present **Golder Associates Ltd.** **Calgary, Alberta**
*Manager, Oil & Gas Team, Associate.*
Responsible for direction and management of the oil and gas sector group of Golder Associates. This includes marketing and oil and gas sector strategy development to expand the market share and senior project direction. Also responsible for liaison with Alpine Environmental to ensure cohesive marketing, business planning and staff resource allocation.

1998 - 2000 **Golder Associates Ltd.** **Saskatoon, Saskatchewan**
*Senior Biologist/Bio-environmental Group Manager, Associate.*

1992 - 1998 **Golder Associates Ltd.** **Saskatoon, Saskatchewan**
*Senior Biologist/Bio-environmental Group Manager.*
With the merger of Golder Associates Ltd. and Environmental Management Associates in 1992, responsibilities and project work has continued to be primarily project management, environmental protection plans, project screening, impact assessments including wildlife and vegetation surveys, and environmental planning.

1987 - 1992 **Environmental Management Associates** **Regina, Saskatchewan**
*Senior Ecologist/Office Manager.*
Practical experience in the fields of environmental planning, resource management and protection, habitat evaluation, habitat enhancement, wildlife ecology, and fisheries biology. Formal training focused on biology, physiology and ecology. Involved in projects related to mitigating river impoundments, environmental assessment and protection for oil and gas production, and sport fisheries studies. Experience with Habitat Evaluation Procedures (HEP) involved developing models for wildlife species, as well as evaluating habitat for a variety of wildlife and fish species. Other experience includes literature review, mammal and bird population surveys, fish spawning studies and habitat assessments, and instream flow methodology (IFIM) field work. Provided project management, study design, data collection and analysis, computer modelling, expert testimony, and reporting expertise. Managed the bio environmental group in Saskatchewan.

1987 (summer) **Saskatchewan Parks, Recreation and Culture** **Regina, Saskatchewan**
*Biological Assistant.*
Responsible for data collection on sportfish populations and report writing.

# Daryl V. Johannesen

1981 - 1985 **University of Saskatchewan** **Saskatoon, Saskatchewan**

*Post-Graduate Studies.*

Examined the effects of winter on reproduction and physiology of white-tailed deer in Saskatchewan. This involved maintaining a captive herd as well as trapping, tagging, and collecting wild animals.

## PROJECT RELATED EXPERIENCE: ENVIRONMENTAL IMPACT ASSESSMENT AND REVIEW

**Developers Assessment Report** **Northwest Territories**

Directed the completion of the environmental cumulative effects assessment project that involved the construction and operations of reasonably foreseeable project components within the Cameron Hills. Involvement included project direction, client liaison, impact assessment and cumulative impact assessment.

**Liard East Gathering System** **Northwest Territories**

Directed the completion of the environmental impact assessment for this pipeline and road project that involved the construction of an all-weather road, gathering system and facilites in the Fort Liard Region. Involvement included project direction, client liaison, impact assessment and cumulative impact assessment.

**Mackenzie River 2D Seismic Program** **Northwest Territories**

Managed the completion of the environmental impact assessment for this marine 2D seismic project that involved airguns for data acquisition on the Mackenzie River from the Delta to Fort Simpson, then up the Liard River to the BC border. Involvement included project management, regulatory liaison, consultation, impact assessment writing and cumulative impact assessment.

**Cameron Hills TransBorder Pipeline Project** **Northwest Teritories**

Managed the completion of the environmental impact assessment for this project that involved the construction of a pipeline from the H-03 battery in the NT, into Alberta. Involvement included project management, routing, consultation, impact assessment writing and cumulative impact assessment.

**Ikhil Pipeline Project** **Northwest Territories**

Completed an environmental assessment of the pipeline route and subsequent re-routes for this natural gas pipeline in the NWT. Concerns were related to wildlife, fisheries, vegetation, land use, archaeology and reclamation.

**Seismic Exploration and Exploratory Drilling** **Northwest Territories**

Managed the completion of numerous environmental impact assessments for 2D and 3D seismic projects throughout the NWT. Typically, these projects were followed by exploratory wells. Involvement included project management, siting routing, consultation, impact assessment writing and cumulative impact assessment.

**Cameron Hills Gathering System and Facilities Project** **Northwest Territories**

Managed the completion of the environmental impact assessment for this project that involved the construction of a gathering system and facilites in the Paramount SDL. Involvement included project management, siting and routing, consultation, impact assessment writing and cumulative impact assessment.

## PROJECT RELATED EXPERIENCE: ENVIRONMENTAL IMPACT ASSESSMENT AND REVIEW (Continued)

**Cameron Hills Drilling and Evaluation Project** — **Northwest Territories**

Managed the completion of the environmental impact assessment for this project that involved the drilling and evaluation of nine new wells in the Paramount SDL. Involvement included project management, impact assessment, writing and cumulative impact assessment.

**Cameron Hills Drilling Project** — **Northwest Territories**

Managed the completion of the environmental screening report for this project that involved the drilling of nine new wells in the Paramount SDL. Involvement included project management, siting and access routing, consultation, impact assessment writing and cumulative impact assessment.

**Fort Liard Project LUP and WL Amendments** — **Northwest Territories**

Managed the completion of numerous land use permits and water licences for projects in the Paramount Fort Liard Project area. Involvement included project management, impact assessment writing and cumulative impact assessment.

**Cameron Hills and Fort Liard Wildlife Monitoring** — **Northwest Territories**

Designed and managed the completion of several monitoring projects in the Paramount Cameron Hills and Fort Liard regions, related to winter track counts. Involvement included project management, permit applications and report preparation.

**Alaska Producers Pipeline Group** — **Northwest Territories**

Provided senior advice related to project management, route selection, wildlife surveys, impact assessment for the Mackenzie Valley route for this project.

**Chevron M-25 Natural Gas Pipeline Project** — **Northwest Territories**

Directed the completion of the environmental impact assessment submitted to the National Energy Board for this project. Involvement included project direction, impact assessment writing and cumulative impact assessment.

**Chevron K-29 Natural Gas Pipeline Project** — **Northwest Territories**

Directed the completion of the environmental impact assessment submitted to the National Energy Board for this multi-phase project that included pipelines from the Canadian Forest Oil N-61 well, the Ranger P-66A wellsite and the Chevron K29 wellsite. Involvement included project direction, client liaison, impact assessment writing and cumulative impact assessment.

**Shiha Natural Gas Pipeline Project** — **Northwest Territories/British Columbia**

Involved in the completion of the environmental impact assessment submitted to the National Energy Board for this Paramount Resources project. Involvement included client liaison, impact assessment writing and cumulative impact assessment.

**Ranger Oil P66 Natural Gas Pipeline Project** — **Northwest Territories**

Managed the completion of the environmental impact assessment submitted to the National Energy Board for this project. Involvement included project management, wildlife surveys for Dall's sheep and raptors, First Nations consultation, impact assessment writing and cumulative impact assessment.

## PROJECT RELATED EXPERIENCE:
## ENVIRONMENTAL IMPACT ASSESSMENT AND REVIEW (Continued)

**PetroCanada Mackenzie Delta Exploration Project** **Northwest Territories**

Directed the completion of the environmental impact assessment submitted for this project. Involvement included project direction, client liaison, field assessment, impact assessment writing and cumulative impact assessment.

**Explor Data Mackenzie Delta Exploration Project** **Northwest Territories**

Directed the completion of the environmental impact assessment submitted for this project. Involvement included project direction, impact assessment writing and cumulative impact assessment.

**Weyerhaeuser 20-Year Forest Management Plan EIS** **Saskatchewan**

Directed wildlife and habitat assessment projects throughout the boreal forest in northern Saskatchewan. Projects include small mammal surveys, winter track counts, insect surveys, avian surveys, amphibian surveys, and aerial surveys for ungulates (moose, caribou, deer). Also responsible for impact assessment, project management and writing of portions of the document.

**Renaissance Energy West Webb Oil Development EPP** **Saskatchewan**

Directed the completion of a large scale EPP for an oil and gas development within the Webb Sand Hills in south-western Saskatchewan. This study included aerial surveys for ungulates and raptor nests, sharp-tailed grouse and breeding bird surveys, habitat mapping, and rare plant searches. Preparation of the document included impact assessments, mitigation plans, reclamation initiatives and monitoring strategies.

**Rosetown to Goodsoil Natural Gas Pipeline EIS** **Saskatchewan**

Completed various components required for the completion of an environmental impact statement for a 320 km long pipeline. Work included: wildlife surveys, vegetation mapping, rare plant surveys, stick nest surveys, as well as final formulation of the document. This included habitat evaluation, impact assessment, mitigation options, and reclamation strategies.

**Hatton Natural Gas Well Infill Project** **Saskatchewan**

Directed the completion of a large-scale (30+) well infill expansion project for Wascana in their Hatton field. The project included well siting, flowline routing, habitat assessment, rare and endangered species surveys, impact assessment, and reclamation planning.

**White-tailed Deer/Sharp-tailed Grouse Ecology Study** **Saskatchewan**

Completed a three year population and habitat evaluation project with white-tailed deer and sharp-tailed grouse for the Souris Basin Development Authority. The study involved systematic aerial and ground-based surveys, live capturing of animals, radio-telemetry, and habitat evaluation.

**Midwest Joint Venture Uranium Mine EIS** **Saskatchewan**

Project manager for the wildlife portion of the EIS which related to small mammal, amphibian, furbearer and ungulate (caribou, moose) populations in the north-central Saskatchewan. The project involved small mammal trapping, aerial surveys, habitat assessment, and winter track counts, as well as senior author to the document.

# Daryl V. Johannesen

## PROJECT RELATED EXPERIENCE:
## ENVIRONMENTAL IMPACT ASSESSMENT AND REVIEW (Continued)

**Musselwhite Gold Mine EIS** — **Ontario**

Project manager for the wildlife and habitat portion of the EIS which related to small mammal, amphibian, bird, furbearer, and ungulate populations in the north-western Ontario. The project involved small mammal trapping, aerial surveys (wolves, caribou and moose), habitat assessment, and winter track counts, as well as senior author to the document.

**Barren Ground Caribou Survey** — **Saskatchewan**

Completed aerial surveys and monitoring of caribou migration and their interaction with the SaskPower transmission line extending from Wollaston Lake to Uranium City.

**Eagle Point Uranium Mine Expansion EIS** — **Saskatchewan**

Project manager for several wildlife and habitat projects around Collins Bay on Wollaston Lake in northern Saskatchewan. Projects included small mammal surveys, avian surveys, raptor surveys, winter track counts, and ungulate (caribou and moose) aerial surveys.

**Decommissioning of Estevan Generating Station** — **Saskatchewan**

Involved in studies to determine the value of an oxbow of the Souris River to wildlife. Set gill nets to assess fish population, conducted winter track counts, tested dissolved oxygen levels, and conducted waterfowl breeding pair counts, bird surveys, and general wildlife counts.

**Churchill/Reindeer River Post-Project Environmental Impact Study** — **Saskatchewan**

Conducted aerial and ground surveys of the Churchill and Reindeer River systems upstream and downstream of the Island Falls and Whitesand Dam projects to assess the post-project impacts on wildlife and the subsequent changes for aboriginal peoples' lifestyles.

**Old Man on His Back Plateau Pipeline** — **Saskatchewan**

Completed fieldwork and Environmental Protection Plan writing for an 11 km long pipeline through native prairie lands in south-west Saskatchewan. The program involved rare and endangered species surveys, monitoring and reclamation.

**Merryflats Environmental Protection Plan** — **Saskatchewan**

Conducted reconnaissance wildlife, critical habitat, and sensitive terrain assessments for routing of a proposed SaskOil pipeline and several well sites in the Cypress Hills area.

**Bad Lake Flowline Protection Plan** — **Saskatchewan**

Evaluated the proposed well-sites and flowline route, determined acceptable alternate sites for wells proposed in sensitive areas, and formulated environmental protection plans for the project.

**Consumer's Co-operative Refineries Limited** — **Saskatchewan**

Collected ground-water and soil samples to be used as baseline data to be used for the development of a future management and remediation plan.

## PROJECT RELATED EXPERIENCE:
## ENVIRONMENTAL IMPACT ASSESSMENT AND REVIEW (Continued)

**R.M.s of King George and Lost River Wetland Assessment** — **Saskatchewan**

Conducted habitat and wetland field surveys for the Canadian Wildlife Service. Field data was used in Habitat Evaluation Procedure models to assess habitat for several species of waterfowl in the Rural Municipalities of King George and Lost River.

**Caroline Moose Habitat Study** — **Alberta**

Conducted moose surveys and habitat analysis for a Shell Canada project in the boreal forest region of Alberta.

**B.C. Gas Environmental Protection Plan** — **British Columbia**

Developed an EPP for a pipeline project in the vicinity of Kelowna, B.C. Involved field reconnaissance and mitigation recommendations.

**Brada to Lloydminster 230kv Transmission line Wildlife Survey** — **Saskatchewan**

Conducted aerial and ground wildlife surveys of the proposed routes for a SaskPower transmission line. Developed the Environmental Impact Statement and participated in the public open-house meetings and subsequent public hearing process as the environmental representative for SaskPower.

**Rosetown to Goodsoil EIS** — **Saskatchewan**

Prepared the Environmental Impact Statement which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route. Project included stream assessments, habitat mapping, rare plant survey and project routing option analysis.

**Cypress Hills Provincial Park EPP** — **Saskatchewan**

Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route that would service the Cypress Hills Park. Project included stream crossing assessments, habitat mapping and project routing option analysis.

**MIPL to Bi-Provincial Upgrader Natural Gas Pipeline EPP** — **Saskatchewan**

Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route, for submission to the NEB.

**Old Man on His Back Plateau Pipeline** — **Saskatchewan**

Completed fieldwork and Environmental Protection Plan writing for an 11 km long pipeline through native prairie lands in south-west Saskatchewan. The program involved rare and endangered species surveys, monitoring and reclamation.

**Webb Oil Sales Pipeline EPP** — **Saskatchewan**

Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the Renaissance oil battery sales line pipeline route.

## PROJECT RELATED EXPERIENCE: ENVIRONMENTAL IMPACT ASSESSMENT AND REVIEW (Continued)

**Coleville to Plover Lake Natural Gas Pipeline EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route.

**Natural Gas Pipeline NEB Environmental Review** **Saskatchewan**

**Beau/Winter Natural Gas Pipeline EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route located in the Manitou Sandhills in west central Saskatchewan.

**Prud'homme Natural Gas Storage Cavern Project Proposal** **Saskatchewan**
Developed an Environmental Protection Plan for the expansion of a natural gas storage facility in south-central Saskatchewan.

**Moosomin Natural Gas Storage Cavern EPP** **Saskatchewan**
Developed an Environmental Protection Plan for a natural gas storage facility in east-central Saskatchewan. Identified environmental concerns and sensitive areas for twelve existing pipelines for Many Islands Pipelines for compliance for NEB regulations.

**Husky-Marwayne Natural Gas Pipeline EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route, for submission to the NEB.

**Koch Exploration-Eyehill Tie-in Natural Gas Pipeline EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route, for submission to the NEB.

**Cyprus Area Natural Gas Pipeline Expansion EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route.

**Steelman to North Portal Natural Gas Pipeline EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route, for submission to the NEB.

**Northminster to Unity Natural Gas Pipeline EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route.

**Nekaneet Indian Reserve Natural Gas Supply Pipeline EPP** **Saskatchewan**
Prepared the Environmental Protection Plan which outlined the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route.

## PROJECT RELATED EXPERIENCE:
## ENVIRONMENTAL IMPACT ASSESSMENT AND REVIEW (Continued)

**TransCanada Pipelines Limited** **Saskatchewan**

Updated TransCanada Environmental Statements for several loops in Saskatchewan and Manitoba which outlined recent information with respect to the existing environment, potential impacts and mitigation/reclamation plans for the TransGas pipeline route.

**TransCanada Pipelines Limited** **Saskatchewan**

Completed an environmental assessment and report for a compressor site expansion. The project included wildlife and vegetation surveys, impact assessment and mitigation plans for the project area.

**TransCanada Pipelines Limited** **Saskatchewan**

Completed an environmental assessment and report, for submission to the NEB, for a power transmission line that would service a planned compressor site expansion. The project included wildlife and vegetation surveys, impact assessment and mitigation plans for the project area.

# Martin A. Rawlings, P.Eng.

**EDUCATION**

B.A.Sc. Civil Engineering, University of Toronto, 1985
Golder U Client Services, 2002
Golder U Communication & Interpersonal Skills, 2002
Allan Bonner Communications Training Course, 1998.
Air Quality Management Workshop, UBC Continuing Education, Kelowna, 1995.
Air Quality Management Course, UBC Continuing Education, Matsqui, 1994.
Performance Mastery Workshop, UBC Executive Programs, Vancouver, 1993.
Environmental Legislation and Compliance, University of Toronto Continuing Education, Toronto, 1991.
Fundamentals of Dispersion Modelling, Trinity Consultants, Toronto, 1989.
Certificate Environmental Noise Courses, Ontario Ministry of Environment, 1988.
Introductory Environmental Noise Courses, Ontario Ministry of Environment, 1988.

**AFFILIATION**

Association of Professional Engineers, Geologists and Geophysicists of Alberta

**EXPERIENCE**

1998 to date — **Golder Associates Ltd.** — **Calgary, Alberta**

*Senior Air Quality Engineer*

Responsible for the development, provision of air quality services to clients in Canada and internationally. Specialization in the areas of atmospheric sciences; air quality assessment, atmospheric dispersion modelling; environmental assessments; air emission inventories; transportation air quality impacts assessments; air quality and meteorological monitoring programs; the evaluation of air quality, noise, and odour impacts and expert testimony.

1996 to 1998 — **SEACOR Environmental Eng. Inc.** — **Vancouver, BC**

*Senior Air Quality Engineer*

Responsible for the development, marketing and provision of corporate air services to clients across Canada. Specialized experience in: dispersion modelling; air impact evaluations in complex terrain; ambient air monitoring programs; air impact evaluations of waste management operations; and air permitting.

1991 to 1996 — **B.H. Levelton & Associates Ltd.** — **Vancouver, BC**

*Senior Air Quality Engineer*

Responsible for the development, marketing and provision of air modelling and assessment services to clients in British Columbia. Specialized experience in: dispersion modelling; environmental impact assessments; emission inventories; air evaluations associated with transportation issues and complex terrain; ambient air monitoring programs; and permitting.

1991 — **Acres International Ltd.** — **Niagara Falls, Ontario**

*Senior Air Quality Engineer*

Responsible for the development, marketing and provision of air quality services to support Acres worldwide clients. Additional responsibilities included development of corporate strategies for servicing U.S. clients.

# Martin A. Rawlings

1987 to 1991 **SENES Consultants Ltd.** **Richmond Hill, Ontario**

*Air Quality Engineer*

Responsible for the development and provision of air quality and noise services to support project work across North America. Specialized experience in: dispersion modelling; environmental impact assessments; and air impact evaluations of mining operations.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE — OVERVIEW

Over sixteen years in the environmental consulting industry with specialized experience in the areas of:

- air dispersion modelling;
- meteorological and ambient air quality monitoring programs;
- atmospheric sciences;
- air emission inventories;
- air pollution controls and mitigation;
- the assessment of air quality, noise and odours.
- assessment of transportation air quality impacts;
- environmental assessments;
- public consultation; and
- expert testimony.

This experience involves the provision of air quality solutions to clients in a range of industries, including:

**OIL SANDS**

- Canadian Natural Resources Limited (CNRL)
- Cumulative Environmental Management Association (CEMA)
- EnCana Energy
- Nexen Canada Ltd.
- $NO_X$-$SO_X$ Management Working Group (NSMWG)
- OPTI Canada Inc.
- PanCanadian Resources
- Petro-Canada Oil and Gas Limited
- Rio Alto Exploration Ltd.
- Shell Canada Limited
- Suncor Energy Inc.
- Syncrude Canada Ltd.

**OIL &GAS**

- Anadarko
- BC Star Partners Limited
- BP Resources
- Big Horn Energy
- Black Tusk Resources
- Canadian Natural Resources Limited (CNRL)
- Chevron Canada Limited
- Consumers Co-op Refineries Limited
- Devlin Energy
- Marathon Canada Limited
- Murphy Oil Company Ltd.
- Newport Petroleum Ltd.
- Nova Gas Clearinghouse Limited
- Paramount Resources Ltd.
- Ranger Oil Limited
- Rio Alto Exploration Ltd.
- Westcoast Energy Inc.
- Westcoast Gas Services Inc.

# Martin A. Rawlings

**PIPELINES**

- BC Star Partners Limited
- CEMIG
- Mackenzie Gas Pipeline
- Paramount Resources Ltd.
- TransGas Inc.
- Westcoast Energy Inc.
- Westcoast Transmission Limited

**MINING**

- Amok Resources Ltd.
- BC Ministry of Energy Mines & Petroleum Resources
- De Beers Mining Canada
- Diavik Diamond Mines
- K.J. Beamish Limited
- Mobil Mining & Minerals
- National Uranium Tailings Assessment Program
- Winspear Resources Limited

**POWER UTILITIES**

- Canadian Niagara Power Inc.
- EPCOR
- Manitoba Hydro
- SaskPower Limited
- TransAlta Utilities Limited

**FOREST PRODUCTS**

- CANPAR Industries
- Enderby Forest Products
- Harmac Pacific Limited
- Louisiana Pacific Canada Limited
- Weyerhaeuser Canada

**INDUSTRIES**

- Bethlehem Steel Corporation
- Bombardier
- Campion Marine
- Diapac Industries
- Ebco-Hamilton Partners
- Global Thermaelectric (GTE) Inc.
- GWIL Industries
- Hi Temp Products
- ITT Aimco Corporation
- Kelowna Industrial Plastics
- Lefarge Construction Materials
- Lehigh Inland Cement Limited
- Shield Source Incorporated
- Vancouver Port Corporation

**AGRICULTURE & FEED**

- Alberta Agriculture and Rural Development (AAFRD)
- Checkerboard Foods Limited
- MSA Terminals Limited
- Pacific Bio-Waste Recovery Society
- Ralston Purina Canada

## Martin A. Rawlings

**GOVERNMENT & INSTITUTIONAL**

- BC Ministry of Environment Lands & Parks
- BC Ministry of Transportation
- Cadomin Environmental Coalition
- Canadian Petroleum Producers Association
- Canadian Pulp & Paper Association
- City of Kelowna
- City of Nanaimo
- City of North York
- Cumulative Environmental Management Association (CEMA)
- Greater Vancouver Regional District
- National Emissions Inventory Task Group
- Plumbers Road Citizens

**LANDFILLS &WASTE MANAGEMENT**

- Alberta Environment
- Caribou Regional District
- Chevron Canada Limited
- City of Niagara Falls
- City of Welland
- Envirogreen Technologies Ltd.
- Greater Vancouver Regional District
- Municipality of Grimsby
- Municipality of Lincoln
- Municipality of Metropolitan Toronto
- Simcoe County
- Township of West Lincoln

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – OIL SANDS DEVELOPMENTS

**Shell Canada Limited** **Fort McMurray, Alberta**

**Jackpine Mine – Phase 1 EIA**

Responsible for the direction of the air quality components of the recent environmental impact assessment (EIA) of the Jackpine Mine – Phase 1 oils sands mine for Shell Canada Limited. As part of the EIA, Golder was responsible for the completion of the air quality components of the project, which included the use of the Golder's regional emissions database and 3-D meteorological data set. The air quality assessment evaluated air concentrations and acid deposition resulting from cumulative emissions sources across the Oil Sands Region, spanning from Fort Chipewyan in the north to the Cold Lake area in the south. Air quality predictions were made using the CALPUFF dispersion model, run in the 3-D mode. Specific roles on the project included: providing overall direction to the air quality components; liaison with clients, regulators and stakeholders; and participation in project workshops.

**Canadian Natural Resources Limited (CNRL)** **Fort McMurray, Alberta**

**Horizon Project EIA**

Golder Associates was responsible for the completion of the environmental impact assessment (EIA) for the Canadian Natural Resources Limited (CNRL) Horizon integrated oil sands mine and upgrading project. The air quality sections of the EIA evaluated cumulative air concentrations and acid deposition across the Oil Sands Region, using the CALPUFF dispersion model (3-D mode). The EIA made use of Golder's regional emissions database and 3-D meteorological data set, which covers the area from Fort Chipewyan in the north to the Cold Lake area in the south. Specific roles on the project included: providing overall direction to the air quality components; liaison with clients, regulators and stakeholders; participation in project workshops; and providing input to the project engineering team with respect to mitigation strategies.

**OPTI Canada Inc./Nexen Canada Ltd.** **Fort McMurray, Alberta**

**Long Lake Project EIA and Project Update**

Golder was responsible for the preparation of the environmental impact assessment (EIA) and subsequent project update for the Long Lake Project, which includes an integrated steam assisted gravity drainage (SAGD) facility and upgrading complex. The air quality assessment included an evaluation of the cumulative air concentrations and acid deposition using the CALPUFF dispersion model (3-D mode). The project update made use of the Golder regional emissions and 3-D meteorological data sets, covering the area from Fort Chipewyan to south of the Cold Lake area. The use of these data sets made the update predictions consistent with the assessment approaches used on the majority of applications filed in the Oil Sands Region, as well as the work being conducted for the $NO_X$-$SO_X$ Management Working Group (NSMWG). In addition, the use of the large study area and greater number of sources were effective in addressing all of the concerns raised by Saskatchewan Environment.

**Petro-Canada Oil and Gas** **Fort McMurray, Alberta**

**Meadow Creek Project EIA**

Golder was responsible for the completion of the environmental impact assessment (EIA) and application to develop a Steam-Assisted Gravity Drainage (SAGD) project in the Athabasca Oil Sands Region. The air quality component of the project evaluated acid deposition in the region as well as local and regional concentrations of sulphur dioxide, nitrogen dioxide, particulate matter, secondary particulates, carbon monoxide, reduced sulphurs, volatile organic compounds, trace metals and polycyclic aromatic hydrocarbons using the 3-D CALPUFF model.

PROJECT RELATED EXPERIENCE – OIL SANDS DEVELOPMENTS (CONTINUED)

**Canadian Natural Resources Limited (CNRL)** **Fort McMurray, Alberta**
**Kirby Project EIA**

Golder was responsible for the completion of the environmental impact assessment (EIA) and project application for the development of this Steam-Assisted Gravity Drainage (SAGD) project on the northern edge of the Cold Lake Air Weapons Range. The air quality assessment completed for the EIA evaluated local and regional concentrations of sulphur dioxide, nitrogen dioxide, particulate matter, secondary particulates, carbon monoxide, reduced sulphurs, volatile organic compounds, trace metals and polycyclic aromatic hydrocarbons using the 3-D CALPUFF model. The assessment also evaluated the cumulative acid deposition in the region and assessed possible impacts on the receiving environment.

**$NO_X$-$SO_X$ Management Working Group (NSMWG)** **Northeastern Alberta**
**Acid Deposition Management Options for the Oil Sands Region**

Golder have been retained to as part of an ongoing series of projects for the NSMWG committee reviewing possible air quality options for the Athabasca Oil Sands Region. The initial stage of the project conducted an regional analysis of possible soils impacts using exposure times of 30, 50 and 100 years. The results of the integrated air quality and GIS analysis produced estimates for the areas of soils at risk from acid-forming emissions for each township in the region. The second stage of the project took the analysis several steps further by evaluating the cumulative effects of historic acid deposition on regional soils over the last 32 years (1970 to 2002), as well as the expected deposition from planned and approved projects for the next 15 (2003 to 2017) and 30 (2018 to 2032) years. As part of this project is was necessary to develop an annual emissions profile for the region and predict acid deposition rates using the CALPUFF 3-D dispersion model.

**Canadian Natural Resources Limited (CNRL)** **Cold Lake, Alberta**
**Primrose and Wolf Lake Expansion (PAW) Project**

An air quality assessment was completed to support the application for the expansion of the Primrose and Wolf Lake in-situ oil sands developments at the southern edge of the Cold Lake Air Weapons Range. The air quality assessment formed part of a comprehensive environmental impact assessment (EIA) for the project, and evaluated ground-level concentrations and acid deposition of project and cumulative regional emissions using the CALPUFF 2-D dispersion model. A noise assessment was also completed as part of the EIA, evaluating the facility and traffic noise levels likely to result from varying stages of project development.

**Suncor Energy Inc.** **Fort McMurray, Alberta**
**Firebag In-Situ Oil Sands Project**

Golder was responsible for the completion of the environmental impact assessment (EIA) and application to develop a Steam-Assisted Gravity Drainage (SAGD) project in the Athabasca Oil Sands Region. The project EIA included the evaluation of community and regional concentrations and regional acid deposition from cumulative activities in the area. The Firebag Project EIA represented the first application to use the CALPUFF 3D dispersion model for simulating concentrations and acid deposition patterns. A key component of the project was addressing specific regulatory and stakeholder concerns early assessment process through consultation and project workshops.

PROJECT RELATED EXPERIENCE – OIL SANDS DEVELOPMENTS (CONTINUED)

**Suncor Energy Inc., Oil Sands** **Fort McMurray, Alberta**
**Project Millennium**

As part of the environmental impact assessment (EIA) and application for the Project Millennium expansion, Golder was responsible for the preparation of a comprehensive air quality assessment. The air assessment evaluated local and regional concentrations of selected compounds of concern, and evaluated acidic deposition impacts across the region. After the submission of the EIA, the bulk of the work involved the preparation of responses to supplemental requests from outside agencies. Interaction with local stakeholders and the communication of the assessment results was essential in the months prior to the hearings. Finally, the work required the participation in the project hearings as an expert witness on the environmental panel.

**PanCanadian Resources Inc.** **Conklin, Alberta**
**Christina Lake Thermal Project EIA and Hearing**

Golder was responsible for the preparation of the environmental impact assessment of the Christina Lake Thermal Project, which was the first commercial Steam-Assisted Gravity Drainage (SAGD) development to receive approval in Alberta. The work was completed for PanCanadian Resources Ltd., which have subsequently merged with Alberta Energy Corporation to form EnCana Energy. Specific project responsibilities included supporting the air quality and noise evaluations, co-ordination and preparation of responses to air quality and noise supplemental requests from outside agencies and non-government organizations and participation in the EUB hearings.

**EnCana Energy** **Fort McMurray, Alberta**
**Christina Lake Monitoring Program**

Golder was responsible for the development of an air quality monitoring program for the Christina Lake Thermal Project in the Athabasca Oils Sands Region of Alberta. The ambient monitoring consisted of four static exposure stations and one continuous station collecting. The program included options and recommendations for monitoring locations and equipment based on the requirements of the Alberta Monitoring Directive. Documentation was prepared to provide regulators with the information necessary to evaluate the suitability and effectiveness of the planned program.

**Suncor Energy Inc.** **Fort McMurray, AB**
**Firebag ETS Pilot Project**

Golder was responsible for the environmental and air quality evaluation of the Enhanced Thermal Solvent pilot project, which is located adjacent o the Firebag commercial SAGD development. In addition to providing environmental support, Golder participated in the preparation of the Environmental Protection and Enhancement Act (EPEA) application for the project.

**Syncrude Canada** **Fort McMurray, AB**
**Ongoing Work**

Golder has been providing air quality support to Syncrude on a series of evaluations for engineering components of the approved Mildred Lake Upgrader, located to the north of Fort McMurray. Interaction with the engineering design team has been an integral component of the work.

PROJECT RELATED EXPERIENCE – OIL SANDS DEVELOPMENTS (CONTINUED)

**Cumulative Environmental Management Association** **Northeastern Alberta**
**Sensitivity Mapping Project**

Golder was responsible for a detailed project to map receptor sensitivity to acid deposition in the Oil Sands Region for the Cumulative Environmental Management Association (CEMA). The project made use of acid deposition predictions made using the CALPUFF dispersion model (3-D mode) to update earlier studies highlighting soils and water bodies that might be affected by emissions from the existing and planned developments in the region. A significant component of the study involved the integration of air quality predictions and mapping of sensitive soils into a GIS model for the Oil Sands Region.

**EnCana Energy** **Fort McMurray, Alberta**
**Christina Lake Monitoring Program**

Golder was responsible for the development of an air quality monitoring program for the Christina Lake Thermal Project in the Athabasca Oils Sands Region of Alberta. The ambient monitoring consisted of four static exposure stations and one continuous station collecting. The program included options and recommendations for monitoring locations and equipment based on the requirements of the Alberta Monitoring Directive. Documentation was prepared to provide regulators with the information necessary to evaluate the suitability and effectiveness of the planned program.

**Suncor Energy Inc.** **Fort McMurray, Alberta**
**Firebag Monitoring Program**

Golder was responsible for preparing the air monitoring plan for the Firebag In-Situ Oil Sands Project. The ambient monitoring plan was prepared in accordance with the requirements of the Alberta Monitoring Directive, and identified monitoring locations and equipment necessary to meet the compliance requirements of the operating approval.

**OPTI Canada Inc.** **Burnt Lake, Alberta**
**Bitumen Upgrader**

Prepared an air quality report that was included as part of two applications to the Alberta Environmental Protection agency and the Energy and Utilities Board (EUB) to construct an upgrading facility adjacent to a thermal oil extraction project in the Burnt Lake region of Alberta. The work involved: determining the criteria pollutant emissions of $SO_2$ and $NO_X$ from the facility; conducting a dispersion modelling analysis of the emissions with consideration given to Baseline, Application and Cumulative Effects impacts. Modelling was performed using both the ISCST3 model and CALPUFF for short range and long range transport respectively. Additional responsibilities included considerable client liaison and co-ordination of the report preparation.

**OPTI Canada Inc.** **Anzac, Alberta**
**Ambient Monitoring Program**

Golder was responsible for commissioning an ambient air quality monitoring station near the community of Anzac as part of the baseline air studies for the Long Lake Project. The program, which operated for 12 months, included support and participation from several of the in situ oil sands developers with existing or planned projects located to the south of Fort McMurray.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – OIL &G AS DEVELOPMENTS

**Consumers' Co-operative Refineries Ltd.** **Regina, Saskatchewan**

**Regina Refinery Expansion Project**

Golder Associates is participating in this ongoing work looking at ways to extend the life of the Lake Wabamun Power Plant in central Alberta. The Wabamun facility is a mine-mouth coal fired generating station that started operations nearly 30 years ago. The study involved a comprehensive evaluation of air quality in the region, with a focus on identifying the key contributors to the local ground level concentrations of airborne particulate matter. A key source of emissions was the contribution from mobile sources. The project also involved participation with a multi-stakeholder group of concerned parties to address the possible concerns associated with the facility.

**Anadarko** **Fort Liard, NWT**

**Air Quality Evaluation of the P-16 Well**

Conducted a well-test flaring assessment of the P-16 well near Ft. Liard, NWT. The project involved the estimation of emissions from the well during the testing period and a dispersion modelling assessment to determine the resulting ground-level $SO_2$ concentrations. The well was located in complex terrain and the dispersion modelling was completed using the ISCST3 model. As a result of the dispersion modelling results, a management plan was developed to determine the optimal conditions and timeframe within which the well test could proceed with minimal environmental impacts.

**Chevron Canada Resources** **Fort Liard, NWT**

**Air Quality Evaluation of the K-29 Facility**

A well-test flaring assessment was completed for a proposed gas processing facility near Ft. Liard, NWT. The project involved the estimation of facility emissions and a dispersion modelling analysis of the $SO_2$ emissions from a flare. The site location was in very complex terrain and required the use of the CTSCREEN model to determine the necessary flare height that would result in no exceedances of the ambient $SO_2$ guidelines.

**Chevron Canada Limited** **Vancouver, BC**

**Dense Gas Dispersion Modelling**

Conducted a dispersion modelling analysis of the potential effects of heavier than air releases associated with operations at the Chevron Burnaby refinery and tank farm. The modelling made use of state-of-the-art modelling techniques that considered not only the effects of topography on the dispersion of the clouds, but also evaluated the likelihood of concern in the nearby residential areas.

**Paramount Resources Limited** **Fort Liard, NWT**

**Assessment of the East Liard Development**

Golder conducted an air quality dispersion modelling assessment of the Liard East drilling and well evaluation program. This assessment was part of a comprehensive evaluation of the potential vegetation, wildlife and socio-economic impacts of the program. The assessment included the evaluation of gas compositions and emissions from the proposed well tests, as well as development of a meteorological data set, and the completion of refined dispersion modelling using ISCST3 to determine regional and local air pollutant concentrations. The assessment also provided an evaluation of the preferred options for dealing with gasses released during these well tests.

PROJECT RELATED EXPERIENCE – OIL &G AS DEVELOPMENTS (CONTINUED)

**Paramount Resources Limited** **Fort Liard, NWT**

**Assessment of the Cameron Hills Development Facilities**

The Cameron Hills project is a gas development that straddles the Alberta/NWT border. An air quality, noise and greenhouse gas evaluation was submitted to the government of the NWT and the National Energy Board. (NEB) as part of a comprehensive EIA completed for the application process. The assessment included the preparation of a facility emissions inventory, development of a meteorological data set, and the completion of refined dispersion modelling to determine regional and local air pollutant concentrations.

**Ranger Oil Limited** **Liard, NWT**

**Environmental Assessment of the P-66A Well**

Golder was retained to evaluate the possible air quality and noise impacts associated with a gas dehydration facility located in the Liard river district of the NWT. The project presented unique challenges due to the complex terrain adjacent to the site. The results of the air modelling and emissions evaluation were incorporated into the facility designs to ensure that operations could proceed without adversely effecting the local air quality.

**Canadian Natural Resources Limited** **Cold Lake, Alberta**

**C-31 Battery**

Golder completed an air quality and noise assessment to address potential impacts resulting from the construction and operation of a gas dehydration facility in the NWT. Ground-level concentrations were predicted for normal operations, emergency flaring events and noise levels resulting from the facility were assessed and compared with EUB sound level limits. Greenhouse gas emissions were estimated and compared to national and provincial emissions. Finally, an impact assessment was completed on the residential effects of the project and the overall significance of each impact was discussed.

**Plummers Road Residents' Group** **Southern Alberta**

**Sour Gas Well — Intervenor Review**

Golder was retained to provide an independent review of a sour gas well planned for a rural community near Millarville, Alberta. The project focussed on reviewing the proponent reports and meeting with the local residents to explain the findings in clear concise language. The main purpose was to help the local residents understand the air quality implications of the planned well.

**Marathon Energy Limited** **Slave Lake, Alberta**

**Slave Lake Development**

Performed an air quality impact assessment to evaluate the maximum ground level concentrations resulting from the expansion of the existing Slave Lake gas gathering system. Additionally, calculation of facility emissions and refined dispersion modelling for the proposed construction of a compressor station and processing facility were conducted.

PROJECT RELATED EXPERIENCE – OIL &G AS DEVELOPMENTS (CONTINUED)

**Marathon Energy Limited** **Northeastern Alberta**

**Twining Battery and Liege Gas Plant**

Golder was retained to complete a dispersion modelling assessment of the $SO_2$ and $NO_X$ emissions from a pair of gas processing facilities in northeastern Alberta, as part of an application to amend the operating permits. The evaluations made use of the existing modelling analyses, and current regulatory guidance for such modelling, to determine the maximum ground-level concentrations adjacent to the sites.

**Westcoast Energy Inc.** **Chetwynd, BC**

**Pine River Gas Plant – Phase I Expansion EIA**

This assessment covered the impacts on air quality, water quality, waste disposal, vegetation, and wildlife of the plant expansion. Report was successfully submitted to the National Energy Board for approval.

**Westcoast Energy Inc.** **Chetwynd, BC**

**Pine River Gas Plant – Modelling and Assessment of $SO_2$**

Served as Project Manager and Principal Investigator for an advanced air quality assessment of the $SO_2$ emissions from the proposed plant expansion. Study made use of site-specific meteorological data and the CTDMPLUS dispersion model to provide a refined assessment of the air quality impacts likely on terrain above the stack elevation. Study results were utilized to support the permit application for the plant.

**Westcoast Energy Inc.** **Chetwynd, BC**

**Pine River Gas Plant – Phase II Expansion**

Completed an extensive assessment of the continuous and flaring emissions from the proposed plant expansion. Study made use of site-specific meteorological data and the CTDMPLUS dispersion model to provide a refined assessment of the air quality impacts likely on terrain above the stack elevation. This U.S. EPA model has advantages over the typical models applied as it accounts more accurately for the manner in which pollutants interact with hills. An assessment of flaring emissions made use of a sophisticated statistical approach to ascertain the likelihood that high ground-level concentrations would occur. Study results were utilized to refine the proposed plant design in order to minimize the potential air quality impacts.

**Westcoast Energy Inc.** **Chetwynd, BC**

**Pine River Gas Plant – $SO_2$ Monitoring Framework**

Study established a monitoring framework to evaluate the potential vegetation impacts resulting from continuous stack and intermittent flaring emissions of $SO_2$ from the proposed expansion to the Pine River Gas Plant. Study made extensive use of site-specific meteorological data and refined dispersion modelling techniques to identify those areas most likely to be at risk from plant emissions.

**Westcoast Energy Inc.** **Tumbler Ridge, BC**

**Proposed Tumbler Ridge Gas Plant – EIA**

A detailed assessment covered the impacts on air quality, water quality, waste disposal, vegetation, and wildlife of the planned construction and operation of a new gas plant near Tumbler Ridge, British Columbia.

PROJECT RELATED EXPERIENCE – OIL &G AS DEVELOPMENTS (CONTINUED)

**Westcoast Energy Inc.** **Northeastern BC**

**Grizzly Valley Expansion – EIA**

A detailed assessment covered the impacts on air quality, water quality, waste disposal, vegetation, and wildlife of the planned expansion of a sour gas processing capabilities for the Grizzly Valley gas catchment. Study's key element was the evaluation of a proposed expansion to the Pine River gas plant near Chetwynd, British Columbia. Included the use of state-of-the-art atmospheric dispersion models and site-specific meteorology to evaluate the potential for impacts from the plant emissions on the surrounding terrain. An application for the project was submitted to the National Energy Board for consideration.

**Westcoast Energy Inc.** **Taylor, BC**

**McMahon Gas Plant Dispersion Modelling**

A detailed evaluation of the $SO_2$ impacts on the complex terrain surrounding the sour gas processing facility in Taylor, BC. Had overall responsibility for the provision of the air quality modelling services, including the reporting and liaison with regulators. The study was notable in its successful use of sophisticated meteorological data gathered in the community as inputs to the CTDMPLUS dispersion model.

**Westcoast Energy Inc.** **Taylor, BC**

**Community of Taylor – Cumulative $NO_x$ Modelling**

This cumulative evaluation of the $NO_X$ emissions in the community of Taylor considered combined impacts of the industrial, residential and motor vehicle emissions on the air quality in the community. Dispersion modelling was done using a combination of the CTDMPLUS and ISC3 dispersion models. Chemical transformations of the emitted pollutants were done using both deterministic and probabilistic methods. The modelling results were then compared to local observed concentrations to confirm consistency and applicability of the methods used.

**Westcoast Energy Inc.** **Northeastern BC**

**Proposed Jedney Gas Plant**

This assessment covered all aspects of the environmental assessment process including public consultation, socio-economic impacts, air quality, water quality, waste disposal, vegetation, and wildlife of the proposed gas plant. Proposed facility was designed to make use of an acid gas re-injection technique to limit sulphur emissions to the atmosphere. Key technical input was provided to evaluate the likely air quality impacts from the continuous $SO_2$ and $NO_X$ emission sources as well as $SO_2$ from the intermittent flare stacks. Environmental assessment of the facility was prepared for submission to the BC Environmental Assessment Review Office.

**Westcoast Energy Inc.** **Northeastern BC**

**New Aitken Creek Gas Plant – EIA**

This assessment covered the impacts on air quality, water quality, waste disposal, vegetation, and wildlife of the proposed gas plant. Report was submitted to the National Energy Board for approval; however, the final decision on the project is pending a jurisdictional decision from the Supreme Court of Canada.

PROJECT RELATED EXPERIENCE – OIL &G AS DEVELOPMENTS (CONTINUED)

**Westcoast Gas Service Inc.** **Northeastern BC**

**Bulrush Gas Processing Facility**

Served as Principal Investigator for the assessment of the potential air quality impacts associated with proposed sour gas processing facility designed to utilize an acid gas re-injection technique to limit sulphur emissions to the atmosphere. Screening dispersion modelling of the continuous $NO_X$ emission sources, as well as $SO_2$ from the intermittent flare stacks, was performed. Study results were incorporated into an environmental assessment of the facility, prepared for submission to the BC Environmental Assessment Review Office.

**Westcoast Energy Inc.** **Chetwynd, BC**

**Pine River Gas Plant – Meteorological Monitoring**

An advanced meteorological monitoring station was installed and operated at the Pine River gas plant, near Chetwynd, BC. The project necessitated the development of system specifications for a meteorological monitoring station capable of collecting on-site readings needed to run the CTDMPLUS dispersion model. Harsh climatic conditions and remote location of the site presented unique problems, previously not encountered in projects of this type. An exceptionally high data capture rate was achieved by developing rigorous protocols for remote site interrogation and on-site inspection.

**Westcoast Energy Inc.** **Taylor, BC**

**McMahon Gas Plant – Meteorological Monitoring**

An advanced meteorological monitoring station was installed in the vicinity of the McMahon gas processing facility in Taylor, British Columbia, based on the unprecedented success of the meteorological monitoring programs at the Pine River gas plant near Tumbler Ridge. Detailed site specifications and operation protocols were prepared to ensure that the quantity and quality of data from the station was comparable with the other site operated for Westcoast Energy.

**Westcoast Energy Inc.** **Tumbler Ridge, BC**

**Tumbler Ridge Gas Plant – Meteorological Monitoring**

An advanced meteorological monitoring station was installed and operated in the vicinity of a proposed sour gas processing facility south of Tumbler Ridge, British Columbia. Detailed site specifications and operation protocols were prepared to ensure that the maximum quantity of high quality data from the station was captured. On-site meteorology formed an essential part of the Environmental Assessment of the proposed gas plant. A high data capture rate was maintained during the life of the project.

**Newport Petroleum Ltd.** **Hoosier, Saskatchewan**

**Ambient Air Quality Monitoring**

Compiled the ambient monitoring information collected in the vicinity of a small sour gas processing facility. The results of the monitoring program indicated that the operation of the facility had not measurably effected the air quality in the vicinity of the plant. As a result, permission was obtained from Saskatchewan Energy and Mines for the de-commissioning of the continuous monitoring trailers.

PROJECT RELATED EXPERIENCE – OIL &G AS DEVELOPMENTS (CONTINUED)

**BC Star Partners Limited** **Chetwynd, BC**

**Stone Creek Gas Processing Facility**

Served as Project Manager and Principal Investigator for an air assessment of the $SO_2$ emissions from a continuous flare stack at the proposed facility near Chetwynd, British Columbia. Study was commissioned to re-model the facility emissions using the CTDMPLUS dispersion model so as to more accurately assess the potential ground-level $SO_2$ concentrations. Modelling results showed that the concentrations predicted using CTDMPLUS were significantly lower than those estimated using simplified models.

**Nova Gas Clearinghouse Limited** **Southern Alberta**

**Compliance Review of Gas Processing Facilities**

A review of the level of compliance at two gas processing facilities was completed as part of a planned purchase of the operations. The assessment considered the current and planned regulatory criteria that the industry would face over the next few years.

**Amber Energy Limited** **Alberta**

**Evaluation of a Sour Gas Well**

Conducted dispersion modelling of the $H_2S$ emissions from a sour gas well in Alberta. The study was completed as a compliment to the consequence modelling completed on the same facility, and was designed to determine the likelihood of odours effecting the surrounding area.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – PIPELINES

**Paramount Resources** **Fort Liard, NWT**

**Sheha Pipeline**

Golder was responsible for completing the environmental assessment of the Sheha production field and associated pipeline infrastructure for Paramount Resources. Due to the location of the project, the development required approval from the federal, territorial and British Columbia regulators.

**TransGas Inc.** **Saskatoon, Saskatchewan**

**Pipeline Consequence Analysis**

Analysis to determine the extent of flammable clouds and heat risks resulting from a pipeline failure was conducted in a mixed rural- residential area of Saskatoon. The study combined the results of consequence models with local meteorological conditions to determine the likelihood of risk to people living in the area.

**BC Star Partners Limited** **Northeastern BC**

**Rigel Booster Station – Air Modelling**

An air quality modelling evaluation of the combined emissions from two natural gas booster stations located in northeastern British Columbia. Maximum ground-level concentrations in the vicinity of the facility were determined using screening modelling techniques. Study results were used in support of air quality permits for the site.

**CEMIG** **Brazil**

**Pipeline Consequence Analysis**

Participated in the analysis of possible pipeline failures in residential areas of Brazil using a combination of consequence models with local meteorological conditions to determine the likelihood of risk to people living in the area.

**Westcoast Transmission Inc.** **Northeastern BC.**

**Mainline Compressor Emission Modelling**

Conducted an evaluation of the potential air quality impacts due to continuous $NO_X$ emissions from a series of five main-line natural gas compressor stations located in the Pine and Fraser river valleys in northern British Columbia. Consideration was given to both the simple and complex terrain modelling at each facility, depending on the local topography.

**Westcoast Energy Inc.** **Taylor, BC**

**CS-1 Compressor Station $NO_X$ Modelling**

Served as Project Manager and Principal Investigator for an air quality evaluation of expected continuous $NO_X$ emissions from the main-line natural gas compressor station in Taylor, BC. Study was commissioned to respond to information requested from the National Energy Board and made use of statistical modelling techniques to determine those areas most likely to experience elevated $NO_X$ and $NO_2$ concentrations.

**PROJECT RELATED EXPERIENCE – PIPELINES (CONTINUED)**

**Westcoast Energy Inc.** **Merritt, BC**

**Australian and Bubbles Compressor Stations**

Served as Project Manager and Principal Investigator for an air quality evaluation of $NO_X$ emissions from the main-line compressor stations in the vicinity of Merritt, British Columbia. The study made use of statistical modelling techniques to determine those areas most likely to experience elevated $NO_X$ and $NO_2$ concentrations in the complex terrain around the stations.

**Westcoast Energy Inc.** **Northeastern BC**

**Nig, Beg and Jedney Booster Stations**

An air quality modelling evaluation of the emissions from three natural gas booster stations located in northeastern British Columbia. Maximum ground-level concentrations in the vicinity of the facility were determined using screening modelling techniques. Study results were used in support of air quality permits for the site.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – MINING

**De Beers Canada Mining Limited** — **Northwest Territories**

**Assessment of the Snap Lake Diamond Mine**

Golder Associates Ltd. was responsible for the preparation of an integrated environmental impact assessment (EIA) for the Snap Lake Diamond Mine Project. The work entailed extensive environmental monitoring to establish the naturally occurring levels of metals in the vegetation, soils and precipitation in the region, as well as the enhanced levels resulting from the preliminary exploration work. The EIA work included an evaluation of the concentrations and deposition rates of metals and other airborne contaminants on vegetation, soils and water bodies in the region. These were then used to establish the changes within the ecosystem likely to result from the project development and the ultimate risk to various components of the ecosystem.

**K.J. Beamish Limited** — **Cardin, Ontario**

**Air Quality Assessment – Campbell Quarry**

A dust impact assessment of a proposed limestone quarry. The assessment, used successfully in an Ontario Municipal Board hearing, required the application of state-of-the-art techniques to predict and describe particulate dispersion in the atmosphere.

**Mobil Mining and Minerals** — **Houston, Texas**

**Health Risk Evaluation of the Use of Phosphogypsum**

A study to determine possible health risks from the use of phosphogypsum as a construction aggregate material in the Houston, Texas area of the United States. Project used extensive atmospheric modelling to assess both on-site and off-site exposure pathways.

**BC Ministry of Energy Mines and Petroleum Resources** — **British Columbia**

**Gravel Pit Reclamation Manual**

Prepared the sections of the BC Gravel Pit Reclamation Manual dealing with the mitigation and control of air quality impacts; specifically, fugitive dust releases. Manual included a series of practical solutions that can be used by gravel pit operators to minimize the environmental impacts from the operation and reclamation of gravel pits in British Columbia.

**Diavik Diamond Mine** — **Northwest Territories**

**Air Quality and Dust EMS Components**

Prepared the air quality and dust sections of the facility EMS for a diamond mine in the North West Territories. The manual will become part of the day-to-day operations at the mine to ensure than the air quality resulting from the operations remains at acceptable levels.

**Confidential Client** — **Baker Lake, NWT**

**Baker Lake Uranium Mine Project**

An environmental assessment of a proposed uranium mine in the North West Territories. Technical input and review was provided for the air quality and noise impact components, with specific emphasis on the dispersion of pollutants under the extreme climatic conditions.

PROJECT RELATED EXPERIENCE – MINING (CONTINUED)

**Cadomin Environmental Coalition** — **Cadomin, Alberta**

**Review of Air & Noise –Cardinal River Coal**

Provided an independent evaluation of the air quality assessment prepared in support of a proposed expansion to the Cardinal River Coal facility near Cadomin, Alberta. Work involved a review of the air quality components of the permit application documents and the recommendation of additional mitigation measures that could be adopted by Cardinal River Coals to minimize potential air quality impacts.

**Amok Resource Ltd.** — **Northwestern Saskatchewan**

**Cluff Lake Mine Ventilation Study**

Participated in the analysis and calibration of a mine ventilation model designed to provide estimates of Radon and Radon-Daughter concentrations within an active uranium mine. In addition to the model evaluation, extensive measurements were taken within the mine to confirm the accuracy of the predictions.

**DeBeers Canada** — **Northwest Territories**

**Snap Lake Diamond Mine Monitoring Program**

Provided ongoing support to DeBeers Canada for applications to the Government of the Northwest Territories to construct and operate an underground diamond mine in the vicinity of Snap Lake, NT. Support activities included assistance with response to regulator, information requests and liaison with stakeholders. Work was conducted as part of ongoing support to DeBeers Canada Inc. for applications to the regulating authority to construct and operate an underground diamond mine in the vicinity of Snap Lake, NT. The monitoring programs included siting, installing, maintaining and calibrating the equipment, as well as developing standard operating procedures for the collection of samples, and completing monitoring reports.

**Various Clients** — **Northern Saskatchewan**

**EIA for a Series of Proposed Uranium Mines**

Provided technical input and review of the air quality components of a series of environmental assessments for proposed uranium mining projects in Northern Saskatchewan. Studies involved extensive use of sophisticated models to predict the dispersion and deposition of particulates from mining activities.

**National Uranium Tailings Assessment Program** — **Canada**

**Reactive Acid Tailings Assessment Program (RATAP)**

Involved in the refinement of the RATAP algorithms to reflect improved understanding of the behaviour of pyritic tailings.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – POWER UTILITIES

**TransAlta Utilities Limited** **Wabamun, Alberta**

**Wabamun Thermal Station – Life Extension**

Golder Associates is participating in this ongoing work looking at ways to extend the life of the Lake Wabamun Power Plant in central Alberta. The Wabamun facility is a mine-mouth coal fired generating station that started operations nearly 30 years ago. The study involved a comprehensive evaluation of air quality in the region, with a focus on identifying the key contributors to the local ground level concentrations of airborne particulate matter. A key source of emissions was the contribution from mobile sources. The project also involved participation with a multi-stakeholder group of concerned parties to address the possible concerns associated with the facility.

**EPCOR** **Wabamun, Alberta**

**Genessee Expansion Project**

Golder Associates were retained by EPCOR to assist them in the planning and development of the proposed expansion to the Genessee coal fired power plant to the west of Edmonton. Project responsibilities included the preparation of briefing and position papers on potential environmental issues and participation in strategic planning sessions with the project and engineering teams.

**Manitoba Hydro** **Manitoba**

**Selkirk and Brandon Generating Stations – Life Extension**

This study focused on evaluating the environmental impacts associated with extending the operating life of two thermal generating stations. Specialized technical input was provided for the evaluation of impacts from the emissions of standard air pollutants, as well as the evaluation of air quality and visibility impacts from cooling towers.

**Canadian Niagara Power Inc.** **Niagara Falls, Ontario**

**Table Rock Hydro Plant – Compliance Review**

Reviewed of the compliance with environmental regulations at the Canadian Niagara facilities in Niagara Falls. The bulk of the operations in Niagara Falls were built in the early part of the century and required the preparation of detailed compliance plans to assist the company in priorizing the remedial measures that were required at the facility.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – FOREST PRODUCTS INDUSTRIES

**Louisiana Pacific Canada Limited** **Swan Valley, Manitoba**

**Ambient Air Monitoring**

This ambient monitoring program was part of the permitting requirements for an OSB facility in west central Manitoba. The project included the operation and maintenance of air quality and meteorological measurements gathered at two stations. Responsibilities included the distillation of the data and preparation of extensive monitoring reports which were submitted to the local regulators. The project also required participation in air quality guideline workshops with regulatory agencies trying to establish air guidelines for formaldehyde.

**Norske Skog Inc.** **Vancouver Island, BC**

**Crofton Landfill**

Implemented a dust-fall and meteorological monitoring program at a water reservoir adjacent to the Norske Skog Inc. landfill in Crofton B.C. The objective of the program was to assess the impact of dust emissions from the landfill on the water reservoir. The monitoring program consisted of two dust-fall canisters monthly samples that were analysed for dust-fall amounts and trace metal concentrations.

**Canadian Pulp & Paper Association** **Canada**

**Dispersion Modelling of $PM_{10}$ and $PM_{2.5}$**

Conducted a series of dispersion modelling analyses on the $PM_{10}$ and $PM_{2.5}$ emissions from two Kraft pulp mills in western Canada as part of an evaluation of the implications of the proposed Canada-Wide standards for fine particulate matter. At the conclusion of the analysis, a brief presentation was made to the members of the CPPA sub-committee dealing with the implications of the regulations on the Canadian pulp and paper industry.

**CANPAR Industries** **Grand Forks, BC**

**Dispersion Modelling**

An air quality modelling evaluation of the formaldehyde emissions from a forest products facility in Grand Forks, British Columbia. Screening dispersion modelling of the facility emissions was performed to determine the maximum ground-level concentrations in both simple and complex terrain. Modelling results were utilized to support a provision air permit application for the facility.

**Confidential Client** **Nanaimo, BC**

**Compliance Evaluation of the Harmac Pacific Pulp Mill**

Completed an air quality compliance review of the operations at the Harmac Pacific Pulp Mill in Nanaimo, as part of a planned property transfer of the facility.

**Enderby Forest Products** **Enderby, BC**

**Emissions Monitoring and Evaluation**

Involved in the design and implementation of a testing program to determine the atmospheric emissions that would result from the addition of waste paint into a wood waste gasifier at a sawmill in central British Columbia. The results of the emission tests were incorporated into dispersion models to establish the possible exposures to residents that live near the facility.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – INDUSTRIAL CLIENTS

**Lehigh Inland Cement Limited** **Edmonton, Alberta**

**Substitution Fuel Project, Appeal Board Hearings**

Golder was retained by the proponent to provide expert witness testimony in the Environmental Appeals Board hearing of the Lehigh Inland Cement substitution fuel project approval. The work included the completion of supplementary responses and hearing preparation for the air quality component of the hearing. Specific responsibilities included the preparation of affidavits, review of appellant affidavits, hearing preparation and participation as a panel member during the hearing.

**Lafarge Construction Materials Limited** **Calgary, Alberta**

**Ambient Air Quality Monitoring**

Provided consulting services to Lafarge regarding a proposed gravel pit east of Calgary, Alberta. Work included preparation of a monitoring plan and guidance to Lafarge on placement options for a particulate and meteorological monitoring system in the vicinity of the proposed operation.

**Lehigh Inland Cement Limited** **Edmonton, Alberta**

**Substitution Fuel Project**

Golder Associates were retained to prepare the Environmental Protection and Enhancement Act (EPEA) application for the proposed conversion of the Lehigh Inland Cement facility in Edmonton to allow the use of coal as a primary fuel. The project involved a detailed review of the facility emissions and resulting off-site concentrations, and evaluation of current operations, recommendations for future mitigation. Liaison with regulators during the application process formed an integral part of the air quality assessment.

**Bethlehem Steel Corporation** **Lackawana, New York**

**Emissions Testing of Coke Ovens**

An extensive emissions sampling program to determine particulate and PAH emissions from a series of coke ovens on the shore of Lake Erie, Lackawana, N.Y. Study made use of innovative isokinetic sampling techniques developed specifically for this project.

**Domtar Canada Ltd.** **Calgary, Alberta**

**Particulate Monitoring**

Conducted short-term particulate monitoring services to Domtar using hi-volume sampling devices. The objective of the work was to obtain estimates of airborne total suspended particulate (TSP) levels in the vicinity of an excavation site.

**Campion Marine** **Kelowna, BC**

**Dispersion Modelling of Industrial Odours**

Screening dispersion modelling was performed to determine the potential ground-level concentrations of styrene resulting from the venting emissions from a fibreglass boat manufacturer in Kelowna, British Columbia. Study made use of screening dispersion modelling techniques to determine the maximum and peak ground-level concentrations of styrene in the surrounding areas.

PROJECT RELATED EXPERIENCE – INDUSTRIAL CLIENTS (CONTINUED)

**ITT Aimco Corporation** — **St. Catharine's, Ontario**

**Fugitive Dust Assessment**

Project evaluated the fugitive dust emissions from a ferrous metal foundry in St. Catharine's, Ontario. Study involved a series of air monitoring stations and the development of a phased mitigation program to minimize off-site impact. Public and regulatory liaison was integral components of the study.

**Diapac Industries** — **Squamish, BC**

**Dispersion Modelling and Permitting**

An air quality modelling assessment of industrial emissions from a plastics manufacturer in Squamish, British Columbia. Study utilized screening dispersion modelling techniques to determine the maximum off-site concentrations in support of an air permit applications. Consideration was given to the simple and complex terrain in the vicinity of the plant.

**Vancouver Port Corporation** — **Vancouver, BC**

**Vanterm Computainer Facility –Initial Air Quality Evaluation**

An evaluation of the likely air quality impacts due to the increased truck traffic and decreased on-site activity resulting from the proposed computainer facility at Vanterm site at the foot of Clark Street. Study incorporated an evaluation of changes in vehicle emissions using the most up to date techniques.

**Ebco-Hamilton Partners** — **Burnaby, BC**

**Dispersion Modelling**

Conducted a screening dispersion modelling analysis of the air quality concerns associated with the operation of an AirCare testing facility in a mixed residential/institutional area of Burnaby. The AirCare vehicle-monitoring program requires annual exhaust testing for all light duty vehicles operating in the Lower Fraser Valley. The possible air quality impacts of the vehicles queuing up at the testing facilities were assessed using screening dispersion modelling techniques to determine the maximum off-site concentrations.

**GWIL Industries** — **Winfield, BC**

**Dispersion Modelling**

An air quality modelling assessment of styrene emissions from an industrial incinerator located in Winfield, British Columbia. Study utilized screening dispersion modelling techniques to determine the maximum off-site concentrations in the simple and complex terrain located in the vicinity of the plant. The modelling results were used to support the provincial air permit application for the plant.

**Kelowna Industrial Plastics** — **Kelowna, BC**

**Dispersion Modelling and Odour Evaluation**

Screening dispersion modelling was performed to determine the potential ground-level concentrations of styrene resulting from the venting emissions from a fibreglass reinforced plastics fabrication facility in Kelowna, British Columbia. Study made use of screening dispersion modelling techniques to determine the maximum and peak ground-level concentrations of styrene in the surrounding areas.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – AGRICULTURE & FEED INDUSTRIES

### Alberta Agriculture, Food and Rural Development (AAFRD) — Alberta
**Environmental Assessment of Intensive Agriculture**

Participated in the assessment of potential environmental effects of increasing the levels of intensive agricultural activity in the province of Alberta. Particular responsibilities included the development of simplified evaluation methods to determine the relative impacts on air quality from several provincial growth scenarios.

### MSA Terminals Limited — Abbotsford, BC
**Dust and Odour Evaluation of a Feedmill**

The MSA terminals facility is located in the heat of Abbotsford in close proximity to residential homes. Despite efforts from the facility operators to address the air quality concerns, a confrontational situation had developed with several neighbours. Responsibilities on the project included: visiting the most concerned residents in their homes; identifying the key concerns of the residents; explaining and communicating the actions taken by the operator; developing an engineering report; and recommending a mitigation plan. The planned mitigation would have involved input from residents, government and the operator.

### Ralston Purina Canada — Woodstock, Ontario
**Noise Assessment of the Woodstock and Addison Feed Mills**

Conducted noise assessments of two feed mills located in the heart of Woodstock and Addison, Ontario. A program was developed to ameliorate the off-site noise impacts through a series of site visits and on-site noise measurements. Noise reduction program was developed in co-operation with the facility personnel, government regulators, and nearby residents.

### Checkerboard Foods Limited — Newmarket, Ontario
**Noise Assessment and Odour Assessment of a Processing Facility**

A noise and odour assessment was conducted on an operating processing facility in a residential area of Newmarket Ontario. Originally located in an industrial area, residential expansion has resulted in homes being located adjacent to the facility. In response to numerous complaints from the residents, the client commissioned the assessment aimed at identifying remedial measures that would allow for continued operations and minimal impacts on nearby residents.

### Pacific Bio-Waste Recovery Society — Campbell River, BC
**Odour Evaluation of a Fish Composting Facility**

Conducted an odour evaluation of a fish composting facility to be operated in Campbell River, BC. Responsibilities included the determination of the likely odour emissions, off-site odour impacts and optimal mitigation techniques.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – GOVERNMENT AND INSTITUTIONAL CLIENTS

**Alberta Environment** — **Alberta**

**Provincial Waste Incinerator Inventory Project**

A survey of existing waste incinerators across the province of Alberta was conducted. The project was used to characterise the number and operating parameters of existing incinerators and involved the development, distribution and analysis of results of a survey for multiple targeted sectors.

**National Emission Inventory Task Group** — **Vancouver, BC**

**Road Dust Assessment**

Participated, as part of the National Pollutant Release Inventory (NPRI) program, in a study of dust emissions from urban roadways. Responsibilities including the scheduling and planning of the sampling program, collecting samples, analyzing the results and developing suitable emission factors to be used in national emissions inventories.

**BC Ministry of Transportation** — **Vancouver, BC**

**Current & Future Air Quality in the West End**

A study built on the findings of earlier projects and made use of refined transportation estimates for the current and future vehicle behavior in the West End of Vancouver. Predictive dispersion modelling was performed using the latest models and most up to date emission estimates. Study findings were to be used in developing a short list of proposed options for the upgrade of the First Narrows Crossing.

**BC Ministry of Transportation** — **Vancouver, BC**

**Air Quality Assessment – West End of Vancouver**

This study made use of innovative field monitoring techniques and state-of-the-art models to evaluate the current status of the air quality in the West End of Vancouver. Unlike most ambient air quality monitoring programs, the measurements of the carbon monoxide levels along the roadways in the study area were made on a continuous basis in the areas where pedestrians would be exposed. Comparisons of the monitored results and the dispersion modelling estimates showed a generally good agreement; however, differences were noted in areas where high emitting vehicles were monitored. Study results were used in the public consultation process.

**City of Kelowna** — **Kelowna, BC**

**City of Kelowna Transportation Study**

An evaluation of the current and future air emissions from motor vehicle in the City of Kelowna planning area. Study made use of available emission models, and results of the transportation forecasting models to determine if the air quality in Kelowna is expected to improve or degrade as a result of increased vehicle activity and more stringent vehicle emission standards in the future.

**Canadian Petroleum Producers Institute** — **Canada**

**Comparison of Urban Ambient Air Quality**

An evaluation of the ambient air quality in a selected number of urban centres in Canada and the United States was performed on behalf of the Canadian Petroleum Produces Institute. The evaluation included a comparison of the monitored air quality against both Canadian and U.S. standards.

PROJECT RELATED EXPERIENCE – GOVERNMENT AND INSTITUTIONAL (CONTINUED)

**Greater Vancouver Regional District** **Vancouver, BC**

**Backcast and Forecast of the 1990 LFV Emission Inventory**

Motor vehicle emissions in the 1990 Lower Fraser Valley Emissions Inventory were used to estimate the emission levels in 1985, 1995, 2000, and 2005 using the most current emissions modelling and forecasting methodologies available.

**Greater Vancouver Regional District** **Vancouver, BC**

**Air Quality Management Plan/Stage 2**

Responsibilities included the review of current and proposed motor vehicle emission regulations in North America, as well as forecasting the likely emissions from mobile sources using the latest emissions modelling and forecasting methodologies.

**Greater Vancouver Regional District** **Vancouver, BC**

**Mobile Source Emissions Inventory – Lower Fraser Valley**

Development of a detailed mobile source air emissions inventory for the Lower Fraser Valley. Specific inventory techniques were developed during the project to ensure the greatest accuracy possible, as well as conformity with other transportation planning initiatives in the area.

**BC Ministry of Environment Lands and Parks** **British Columbia**

**Mobile Source Emissions Inventory – Province of British Columbia**

Development of a mobile air emissions inventory for the province of British Columbia. As part of the project, it was necessary to develop up to date inventory techniques which coordinated the approaches used by the Federal and regional governments.

**BC Ministry of Transportation** **Vancouver, BC**

**First Narrows Crossing Air Quality Assessment Study**

Study used state-of-the-art models to estimate the likely emissions and air quality impacts associated with the existing traffic conditions, as well as a comparative evaluation of the proposed solutions.

**City of Nanaimo** **Nanaimo, BC**

**Sheton Truck Access – Air Assessment**

An evaluation of the likely air quality impacts due to the re-routing of truck traffic adjacent to residential dwellings in Nanaimo. Study incorporated an evaluation of changes in vehicle emissions as well as using dispersion modelling to determine likely impacts at the homes along the planned route.

**City of North York** **North York, Ontario**

**Air Quality Evaluation of the City Centre Ring Road**

Study assessed the air quality impacts from a proposed traffic by-pass on nearby residential areas and made extensive use of state-of-the-art dispersion and emission models to account for the behaviour of reactive vehicle exhausts adjacent to the roadway.

# Martin A. Rawlings

## PROJECT RELATED EXPERIENCE – LANDFILLS & WASTE MANAGEMENT

**Greater Vancouver Regional District** **Ashcroft Ranch, BC**
**Ashcroft Ranch Landfill**

An air quality modelling and monitoring project is being prepared for the Greater Vancouver Regional District to support the development of the proposed Ashcroft Ranch Landfill site. The project will include a climate and meteorological summary, a review of dust-fall impacts, potential odour impacts and a review of potential noise levels off-site. It will also include a dispersion modelling component and a baseline particulate monitoring program to support the submission of an environmental impact assessment.

**Municipality of Metropolitan Toronto** **Vaughan, Ontario**
**Air Quality & Dust Assessment – Avondale North Clay Borrow**

An air quality and dust assessment of a large clay borrow operation associated with the Keele Valley Landfill. Assessment involved a baseline air quality monitoring program, the development of site-specific emission data, public and regulatory liaison, interaction with legal council in preparation for the hearings, assessment of potential health impacts, and review of existing and proposed regulations in North America.

**Envirogreen Technologies Limited** **Princeton, BC**
**Waste Destruction Facility**

Participated in an ongoing evaluation and approval process for a waste destruction facility in Princeton, BC. The facility used an innovative approach for the treatment of contaminated soils that utilized the energy bound within the soils as a fuel in the thermal treatment process. Specific responsibilities included: the evaluation of regulatory requirements; recommendations for monitoring; interaction with operations personnel to optimize the efficiency; and regulatory liaison. The ongoing dialogue with the regulatory agencies was essential in achieving timely issuance of permits and approvals for the facility.

**Municipality of Metropolitan Toronto** **Vaughan, Ontario**
**Real-Time Monitoring/Prediction System**

Project involved the development of a real-time pollution prediction and control system for a large clay extraction operation associated with the Keele Valley Landfill, Ontario. The computer control system which utilized real-time (on-site) meteorological data, predictive modelling results, computer graphics and expert system technology, advised in which areas of the pit operations could proceed without exceeding the air quality standards off site.

**Municipality of Metropolitan Toronto** **Pickering, Ontario**
**Pickering Landfill Odour Evaluation**

An in-depth study to determine odour release rates and potential off-site odour impacts from a large municipal landfill site in Pickering, Ontario. Study made use of novel emission sampling techniques and a novel statistical approach for evaluating community odour complaints. Also made extensive use of computer dispersion modelling techniques to predict and correlate the off-site odour levels with the existing and projected odour release levels.

PROJECT RELATED EXPERIENCE – LANDFILLS & WASTE MANAGEMENT (CONTINUED)

**Caribou Regional District** **Kimberly , BC**
**Kimberly Landfill**
Conducted an evaluation of the waste management practices at the Kimberly Landfill to identify the possible sources of odours effecting the nearby residential homes. As part of the evaluation, a series of mitigation measures were proposed to mitigate the odours off-site.

**Township of West Lincoln** **South central Ontario**
**Ontario Waste Management Corporation**
Participated in an air quality evaluation of the proposed OWMC special waste handling facility in West Lincoln Ontario. The facility was the focus of extensive hearings and public meetings where the concerns of the local residents were highlighted.

**Simcoe County** **Innisfil, Ontario**
**Innisfil Landfill Life Extension Project**
Completed an air quality and dust assessment of a proposed expansion to a landfill north of Toronto. Work was prepared for presentation to a hearing board and involved the application of state-of-the-art techniques to predict and describe particulate behaviour, public liaison, and the interaction with legal council in preparation for the hearings.

**Municipality of Metropolitan Toronto** **Toronto, Ontario**
**Commissioner Street Incinerator**
A comprehensive modelling assessment and risk assessment was completed on the possible atmospheric releases that would result from the renewed use of the Commissioner Street Incinerator in Toronto. The study was completed as part of an evaluation of the overall waste management planning study to evaluate the possible options for addressing municipal waste in the Greater Toronto area.

**Chevron Canada Limited** **Oliver, BC**
**Air Assessment of a Soil Remediation System**
Completed a dispersion modelling evaluation of the emissions from a soil remediation system in the heart of Oliver, BC. The study quantified the emissions from an extensive soil stripping system to establish the likelihood that odours would be detected in the homes within the community. As part of the study, an evaluation of the possible options for mitigating the air emissions was evaluated.

**City of Niagara Falls** **Niagara Falls, Ontario**
**Noise and Odour Assessment – Mountain Road Landfill**
Completed a noise and odour assessment of an expansion to a landfill in Niagara Falls, Ontario. Work involved environmental approvals, public liaison, predictive modelling, and impact assessment.

PROJECT RELATED EXPERIENCE – LANDFILLS & WASTE MANAGEMENT (CONTINUED)

**City of Welland** — **Welland, Ontario**

**Demonstration Canal Dredging Project**

Completed an evaluation of the potential air quality impacts associated with a demonstration-dredging project on stretches of the Welland River. The overall project was focussed on remediating the river sediments by selective dredging in the most effected areas..

**Municipalities of Lincoln, Grimsby and West Lincoln** — **Southern Ontario**

**Noise and Odour Assessment – Niagara Road 12 Landfill**

Completed a noise and odour assessment of a proposed expansion to the Niagara Road 12 landfill. The site was located in south Central Ontario. The bulk of the project work involved environmental approvals, public liaison, predictive modelling, and impact assessment.

**Municipality of Metropolitan Toronto** — **Toronto, Ontario**

**Commissioner Street Commingled Facility**

Completed a comprehensive evaluation of the potential noise from the commingled waste sorting facility on the grounds of the old Commissioner Street Incinerator. An integral component of the study was the recommendation of suitable mitigation measures to ensure that nearby residents would not be adversely effected.

**Biowaste Management Limited** — **Langley, BC**

**Odour Evaluation of a Waste Composting Facility**

Completed a evaluation of the potential odours from a domestic waste composting facility located in the community of Langley, BC. An integral component of the study was the recommendation of suitable mitigation measures to ensure that nearby residents would not be adversely effected.

**Kamloops Airport** — **Kamloops, BC**

**Air Assessment of a Soil Remediation System**

Completed a dispersion modelling evaluation of the emissions from a soil stripping system was designed to remove ethylene glycol in the soil at the Kamloops Airport. The study focused on determining the exposures of local residents to elevated concentrations of the compound. Kamloops Airport is located in very complex terrain that effected the predicted concentrations in the vicinity of the site.

**Canadian Turbo Limited** — **Nanaimo, BC**

**Air Assessment of a Soil Remediation System**

Completed an air quality and noise evaluation of a small incinerator designed to treat emissions from a soil stripping system in Nanaimo, BC. The study quantified the noise and air emissions from the incinerator and evaluated the effects at the nearby homes.

# Martin A. Rawlings

## PUBLICATIONS & PRESENTATIONS

Chambers, D.B., M.A. Rawlings et al, 1991. *Standard Development: Can We Learn from the Nuclear Industry*, Air & Waste Management Association, Ontario Section, Spring Conference, Hamilton, Ontario, April.

Chambers, D.B., J.D. Phyper, M..A. Rawlings et al, 1988. *The Development of the Assessment of Incinerator Risk (A.I.R.) Model* Society for Risk Analysis, Annual Conference, Washington.

Edwards, W.C., M.A. Rawlings, J.G. Wilkin and R. Dunlop and M. Virani, 1993. *Development and Use of the 1990 Emissions Inventory for the Lower Fraser Valley Region in British Columbia*, AWMA, the Emission Inventory - Perception and Reality, Pasadena, October

Lauzon, L., M.A. Rawlings and J. Petersen, 1995. *Meteorological Observations in Complex Terrain.* The Canadian Meteorological and Oceanographic Society (CMOS) Annual Congress, Kelowna, May.

Rawlings, M.A., G.D. Unrau and W.E. Speller, 2002. *Air Quality Assessments in the Athabasca Oil Sands Region: An Airshed Approach.* The Resources 2 Reserves 2 Results Conference, Calgary, AB, November.

Rawlings, M.A., S.A. Scott-Longley and G. Unrau, 1998. *Evaluation of Particulate Concentration in Hinton and Skookumchuck.* The Canadian Pulp and Paper Association, Air Quality Sub-Committee Meeting, Toronto, ON, November.

Rawlings, M.A. and K.L. Currie, 1997. *Overview of Canadian Environmental Business – A Consultants Perspective*. Presented to the UBC Chapter of the Canadian Society of Chemical Engineers.

Rawlings, M.A., 1995. *Estimates of the Current and Future Air Quality in Kelowna Due to Motor Vehicle Emissions*, Air Quality Management Workshop, Kelowna, BC, March.

Rawlings, M.A. and K.L. Currie, 1993. *A Comparison of Ambient Air Quality in Major Urban Areas in Canada and the United States*, CPPI Report No. 93-1, ISBN 1-1895582-97-0.

Rawlings, M.A. and K.L. Currie, 1992. *Overview of Canadian Air Quality C A Comparison of Ambient Air Quality in Major Urban Areas in Canada and the United States*, C ANMET, R eformulated Gasolines: Issues and Options for Canada, Aylmer, P.Q. October.

Rawlings, M.A., 1992. *The Fugitive Dust Model (FDM): Its Use and Application in Canada*, Canadian Institute for Research i n Atmospheric Chemistry/Air & Waste Management A ssociation Joint International Conference on Atmospheric Chemistry, Toronto, Ontario, January.

Rawlings, M.A., 1991. *Ethics, the Environment and Engineers: What is an Engineer's Ethical Responsibility for the Environment*, Presented at a Student Professional Awareness Conference, McMaster University, Hamilton, Ontario, February.

# Corey J. De La Mare, B.Sc.

**Education** B.Sc., (Zoology) University of Alberta, 1995

**Affiliations**
Alberta Society of Professional Biologists
Alberta Chapter of the Wildlife Society
Federation of Alberta Naturalists
Alberta Native Plant Council

## Experience

2001-present **Golder Associates Ltd.** **Calgary/Edmonton, Alberta**

*Terrestrial Ecologist/Wildlife Biologist*

Preparing baseline reports, impact assessments and cumulative effects assessment as components of large multi-disciplined environmental impact assessments for industry in western and northern Canada and South America. Conducting wildlife inventories, survey designs and developing mitigative strategies for oil and gas developments and oil sands work. Wildlife habitat and population modelling using a variety of statistical and modelling packages including Habitat Suitability Index (HSI) models, Resource Selection Functions (RSF). Population Viability Analysis (PVA) and multi-variate modelling techniques. Developing field protocols for wildlife and biophysical inventories. Involved in business development, interviewing staff, managing the wildlife group across three Alberta offices and coordinating group initiatives.

1995-2001 **Geographic Dynamics Corp. (GDC)** **Edmonton, Alberta**

*Wildlife Ecologist*

Involved in proposal writing, data collection, data analysis, report writing and review for forest ecology studies and surveys. Writing ecological components of Detailed Forest Management Plans and Sustainable Forest Management Plans. Fieldwork involved vegetation inventory, soils inventory, and wildlife habitat inventory. Developed landscape level habitat evaluation models for wildlife guilds. Conducted GIS modelling for terrestrial ecosystem modelling and wildlife habitat modelling. Interviewed and hired new seasonal and permanent staff.

## Courses/Presentation Presented

- Species at Risk Act in Alberta: Implications; Western Canadian Auditing Roundtable
- Species At Risk Act in Alberta: Implications; Consulting Engineers of Alberta
- Resource Selection Functions for Canadian Toads in Northeastern Alberta: Natural Habitat vs. Reclaimed Habitat, Alberta Chapter of the Wildlife Society
- Bird Paradigms and the Need for Local Data: A Case Study from Northeastern Alberta, Alberta Chapter of the Wildlife Society
- Ecological Site Classification and Applications for the Forest Industry, Weldwood, Weyerhaeuser, Millar Western Forest Products Ltd, Alberta Newsprint Company and Blue Ridge Lumber
- Wildlife Habitat Evaluation for CANFOR, Grande Prairie
- Wildlife sighting/sign/browse identification and habitat preferences
- Feasibility of a biomass – fired power plant in the White Zone of Alberta

### Courses/Training Attended

- Migratory Birds Workshop, Canadian Energy Pipeline Association and Canadian Wildlife Service
- Canadian Environmental Assessment Act Training, Environment Canada
- Species at Risk Information Session, Environment Canada
- ALCES Users Workshop, ForemTech Consulting
- Non-Invasive DNA Hair Sampling Techniques, Columbia Mountain Institute
- Project Management, Golder Associates Ltd.
- Introduction to Environmental Impact Assessment (Provincial and Federal)
- Cumulative Effects Impacts (Alberta Society of Professional Biologists Workshop)
- Introduction to Traditional Ecological Knowledge (TEK)
- Introduction to SAS and Advanced Statistics Using SAS
- Firearms Safety and Firearms Acquisition Certificate (FAC)
- Standard First Aid and CPR
- Advanced Open Water SCUBA Diver (PADI)

## RELEVANT PROJECT EXPERIENCE – MINING AND OIL SANDS

*Environmental Impact Assessment*

**Suncor Energy Inc.** **Fort McMurray, Alberta**

As part of the South Tailings Pond Project, conducted resource selection analysis for determining wildlife species habitat preferences and assessing potential impacts from a proposed tailings pond development. Also conducted Population Viability Analysis (PVA) to determine habitat changes from the project and from cumulative effects on moose and black bear populations.

**DeBeers** **Snap Lake, Northwest Territories**

Responsible for developing a vegetation and reclamation monitoring program that was adaptive in nature and coordinated with other monitoring programs such as the wildlife monitoring program. The vegetation monitoring program was designed to be implemented should anticipated effects from the mine be triggered. Vegetation parameters such as community encroachment (both natural and anthropogenic), species richness, diversity, plant vigour and cover would be monitored. The reclamation monitoring program was designed as an adaptive experiment to explore different reclamation techniques and seed mixes as reclamation in the arctic tundra is still in its infancy stage.

**Minera Barrick Misquichilca** **Peru**

Responsible for writing the wildlife and biodiversity Environmental Impact Assessment reports for the proposed Alto Chicama gold mine project in the Andes of Peru. This report included public consultation results, issue scoping and predicting project related effects on key wildlife species. The report also included a detailed mitigation and monitoring plan during operations and closure of the project.

**Canadian Natural Resources Ltd.** **Fort McKay, Alberta**

Wildlife component leader for the Horizon Oil Sands Project. Responsible for component budget, liaison for first nations and local trappers, coordinating field program, conducting fieldwork and primary author of the wildlife baseline and wildlife impact assessment reports. Wrote the wildlife components for the effects of air emissions on ecological receptors chapter and the closure and reclamation plan. Involved in consultation with regulators, First Nations groups and local stakeholders. Involved in preparation of materials for joint Federal-Provincial Panel Hearing and providing expert testimony.

# Corey J. De La Mare

**Fording Coal** — **Brooks, Alberta**

Conducted issue scoping exercise and authored the wildlife impact assessment report for the Brooks Power Project, a coal-fired power plant. This report included, a literature search, selection of Valued Ecosystem Components (VECs), description of potential impacts to federal and provincially-listed species, and Wildlife Habitat Suitability Index (HSI) modelling. Developed mitigation, reclamation and re-introduction strategies.

**Rio Alto Exploration Ltd.** — **Conklin, Alberta**

Wildlife component leader for the Kirby Oil Sands Project. Responsible for component budget, coordinating field program, conducting fieldwork and primary author of the wildlife baseline and wildlife impact assessment reports. Wrote the wildlife components for the effects of air emissions on ecological receptors chapter and the closure and reclamation plan.

**Petro-Canada** — **Anzac, Alberta**

Wildlife component leader for the Meadow Creek Oil Sands Project. Responsible for component budget, liaison for first nations and local trappers, coordinating field program, conducting fieldwork. Primary author of the wildlife baseline and wildlife impact assessment reports. Wrote the wildlife components for the effects of air emissions on ecological receptors chapter, closure and reclamation plan. Developed supplemental question responses for Alberta Environment, Alberta Energy and Utilities Board, First Nations Groups and Non-government organizations. Presented terrestrial issues to Fort McMurray First Nations in Anzac and Dene-Chippewan Prairie First Nations in Janvier. Prepared for potential Provincial Environmental Hearing and was trained to provide expert testimony.

**Shell Canada Ltd.** — **Fort McMurray, Alberta**

As part of the Jackpine Mine-Phase 1 Project, responsible for analysing field data including browse-pellet data and breeding bird data. Authored sections of the impact assessment including effects of air emissions on ecological receptors and the wildlife component of the conservation and reclamation plan. Developed supplemental question responses for Alberta Environment, Alberta Energy and Utilities Board, First Nations Groups and Non-government organizations. Presented on wildlife issues and concerns at public consultation workshops held for First Nations. Prepared materials for joint federal-provincial panel environmental hearing and was prepared for expert testimony.

**Suncor Inc.** — **Fort McMurray, Alberta**

As part of the Voyageur Project, responsible for scoping issues for developing wildlife in Local and Regional Study Areas. Conducted fieldwork and aerial surveys for bats, northern flying squirrels, beaver, muskrat and owls. Developed and re-examined several HSI models to refine and calibrate them based on local field data for use in northeastern Alberta.

**Suncor Inc.** — **Fort McMurray, Alberta**

As part of the approval conditions for the Firebag In-Situ Project, assisted in developing a 10-year plan for wildlife monitoring on the Firebag Local Study Area. The plan focussed on monitoring listed species in Alberta and included a variety of different survey techniques for different taxonomic groups.

**Opti-Nexen Inc** — **Anzac, Alberta**

Wildlife component leader for the Long Lake SAGD Project. Responsible for component budget, writing and coordination a revision update for the Environmental Impact Assessment (EIA) using Habitat Suitability Index (HSI) models (HSI) and responded to supplemental questions from Alberta Environment, Alberta Energy and Utilities Board, First Nations and Non-Government Organizations

# Corey J. De La Mare

**Smoky River Coal Ltd.** **Grande Cache, Alberta**

Developed caribou winter and summer range maps for public consultation and presentation purposes using several years of field observations. Also proposed likely travel/migration routes between ranges.

***Wildlife Corridor Monitoring***

**Canadian Natural** **Fort McKay, Alberta**

As the principal investigator, designed a wildlife corridor study (in 2003/2004) to determine if areas adjacent to the Athabasca River are used more frequently than areas further away from the river for a variety of terrestrial wildlife species over all seasons of the year. The study employs winter track surveys, aerial surveys, and remote cameras to capture data across all seasons. This project is unique in that it has also incorporated input from provincial and federal governments, academia, other industrial players and local communities. The objective is to determine if the Athabasca River corridor area provides important habitat for certain species during certain times of the year. This information will be used to further enhance mitigation strategies in the Oil Sands Region.

**Suncor Energy Inc.** **Fort McMurray, Alberta**

As part of a summary report for five years of wildlife monitoring (i.e., 2003), compiled all known winter track data collected within Suncor's Lease boundaries. The data was then analyzed according to habitat type, distance from the development, distance from river valleys and width of vegetation buffers to determine use of river valley areas and effects of oil sands mining operations on wildlife species. Recommendations were provided for future growth plans, enhancement of existing mitigation plans and further monitoring.

**Suncor Energy Inc.** **Fort McMurray, Alberta**

As part of the approval conditions for the Suncor Steepbank and Millennium Mines, wildlife corridor monitoring was conducted during 1999, 2000 and 2001 employing winter track surveys. Summarized results from year three (2001) and compared them to previous years results to develop recommendations for future monitoring.

**Shell Canada Ltd.** **Fort McMurray, Alberta**

As part of the approval conditions for Muskeg River Mine, wildlife corridor monitoring was conducted for three river valleys within their oil sands lease. Analyzed and summarized data from three winter track sessions (2000 and 2001) to determine the presence of potential movement corridors and to provide recommendations for future monitoring.

**Canadian Natural Resources Ltd.** **Cold Lake, Alberta**

As part of baseline survey work for CNRL's proposed expansion of the Primrose and Wolf Lake SAGD expansion project I designed a winter track survey to examine relative wildlife abundance and assess for the existence of wildlife corridors.

# Corey J. De La Mare

## PROJECT RELATED EXPERIENCE – OIL/GAS AND POWER

**Anadarko** **Ft. Liard, Northwest Territories**

Responsible for conducting the Cumulative Effects Assessment (CEA) for a proposed pipeline and gathering system near Fort Liard. This assessment included scoping suitable modelling techniques and software, acquiring spatial disturbance data and assessing reasonably foreseeable developments. The CEA was conducted for effects on soils, vegetation, wildlife, fisheries, water quality, surface hydrology and traditional land use.

**Paramount Resources Ltd.** **Cameron Hills, Northwest Territories**

Responsible for conducting the Cumulative Effects Assessment (CEA) and wildlife habitat modelling for a proposed oil and gas development in the Cameron Hills. This included the use of habitat suitability index modelling to assess project-related and cumulative effects on wildlife. In addition, cumulative effects were conducted for soils, vegetation, wildlife, fisheries, water quality, surface hydrology and traditional land use.

**Sunbridge Energy Inc.** **Gull Lake, Saskatchewan**

Analyzed breeding bird data and used statistical procedures such as Analysis of Covariance (ANCOVA) and regression analyses to determine the effects of wind-power turbines on breeding bird abundance and community structure. Developed mitigation techniques and recommendations with regards to placement of wind turbines.

**TransCanada Pipelines** **Grande Prairie, Alberta**

Collected wildlife, vegetation and soils data for Cutbank Extension Project in west-central Alberta. Developed ecological land classification for pipeline route and conducted risk assessment for each unique vegetation type. Developed mitigation and reclamation strategies.

**BonaVista Exploration Ltd.** **Lethbridge, Alberta**

Wildlife pre-site assessment for several wellpads and pipelines on the Blood Indian Reserve near Lethbridge, Alberta. The area provides habitat for several federally-listed species including long-billed curlew, Sprague's pipit, loggerhead shrike and ferruginous hawks. Identified observations and/or signs of the presence of these species within setback distances from the proposed development areas. Timing restrictions and mitigation measures were developed for each proposed development location or access route that was near listed species.

**TransAlta Utilities** **Lake Wabamun, Alberta**

Conducted electro-fishing surveys as part of a salvage program within the outlet canal for the Wabamun power plant.

## PROJECT RELATED EXPERIENCE – FORESTRY

**Alberta Plywood Ltd.** **Slave Lake, Alberta**

Project manager for an on-going wildlife monitoring program as part of the operational natural disturbance model. The monitoring program entails breeding bird surveys, winter track surveys and winter bird (resident) surveys. Responsibilities included client liaison, development of an experimental design, conducting field work, statistical analysis and report writing.

**Alberta Newsprint Company (ANC) Ltd.** **Whitecourt, Alberta**

Developed wildlife management plan as part of the 10-year Detailed Forest Management Plan. Assessed potential wildlife resources on the ANC Forest Management Agreement area and potential impacts to

wildlife from forest harvesting and silvicultural practices. Developed caribou protection plan as part of the detailed forest management plan.

**Sunpine Forest Products Ltd.** **Sundre, Alberta**
Collected field data, conducted data analysis and assisted in report writing for refining the Subalpine Natural Subregion boundary within the Sunpine Forest Management Agreement (FMA) area. Assisted in developing applications for new subregion boundary refinement.

**Canadian Forest Products (CANFOR) Ltd.** **Grande Prairie, Alberta**
Developed sustainable strategies related to wildlife and wildlife habitat, wood residue and slash, and ecological yield curves as part of the CANFOR Sustainable Forest Management Plan submission to the Canadian Standards Association (CSA).

**Canadian Forest Service (CFS)** **Edmonton, Alberta**
Project manager for ecological classification of managed stands involving the Canadian Forest Service as the lead proponent and several forestry companies including Weldwood of Canada Ltd., Sunpine Forest Products Ltd., Weyerhaeuser Canada Ltd., Blue Ridge Lumber Ltd., Millar Western Forest Products Ltd. and Alberta Newsprint Company. The project involved field data collection from several FMAs in Alberta over three years. The data culminated in a final classification field guide for silvicultural applications on managed (second-growth) stands (in progress).

**Millar Western Forest Products Ltd.** **Whitecourt, Alberta**
As part of the detailed forest management plan, responsible for bio-climate analysis and surface modelling, assessment of wildlife species of concern in the FMA and establishing timing and mitigation measures, and developing monitoring strategies for biophysical resources within the FMA area.

**Weldwood of Canada Ltd.** **Hinton, Alberta**
Analysed site index data and co-authored a report entitled An Ecological Approach to Estimating Site Quality, Treatment Response and Site Productivity. The document is used as an internal strategy for silvicultural treatments using ecological site classification.

**Canadian Forest Products Ltd.** **Hines Creek, Alberta**
Conducted fieldwork for ecological classification modelling on the Hines Creek FMA area. Field plots included collecting site, soils, vegetation and site index data.

**Canadian Forest Products Ltd.** **Hines Creek, Alberta**
Conducted fieldwork for ecological classification modelling on the Millar Western Forest Products Ltd. FMA area. Field plots included collecting site, soils and vegetation data.

**Alberta Newsprint Company (ANC) Ltd.** **Whitecourt, Alberta**
Conducted fieldwork for ecological classification modelling on ANC FMA area. Field plots included collecting site, soils and vegetation data.

**Weyerhaeuser Canada Ltd.** **Drayton Valley, Alberta**
Conducted fieldwork for ecological classification modelling on the Weyerhaeuser, Drayton Valley FMA area. Field plots included collecting site, soils and vegetation data.

**Canadian Forest Products Ltd.** **Grande Prairie, Alberta**
Conducted fieldwork for ecological classification modelling on the CANFOR, Grande Prairie FMA area. Field plots included collecting site, soils and vegetation data.

# Corey J. De La Mare

**Resource Data Division, Alberta Environment** **Edmonton, Alberta**

Conducted a literature review and authored a report describing the six natural regions and two natural subregions of Alberta. Analysed provincial climate data to develop climate summaries and climate diagrams for each natural subregion. Developed wildlife and vegetation lists based on species ranges for each natural subregion.

**Weyerhaeuser Canada** **Prince Albert, Saskatchewan**

Conducted a statistical analysis to develop two-, three- and four-variable multiple regression models for determining site quality based on site index values for seven tree species and ecological variables collected in the field. The data set consisted of over 300 plots and approximately 200 stand-level variables.

**Canadian Forest Service (CFS) and Prairie Farm Rehabilitation Administration (PFRA)** **Edmonton, Alberta**

Using private woodlot data collected in the White Zone of Alberta, developed a model that would utilize GIS to optimize the location of a biomass-fired power plant within the white zone. The model considered capital costs, wood volume, transportation distance, proximity to the power grid, current electricity costs, and environmental/sustainability fees, among others.

**Saskfor MacMillan Ltd. Partnership** **Hudson Bay, Saskatchewan**

Developed a rare plant species management program as part of Saskfor MacMillan's environmental impact statement. The plan included rare plant habitat potential, known rare plant locations, guidelines for rare plant surveys and, mitigation and timing restrictions.

**Sunpine Forest Products Ltd.** **Sundre, Alberta**

Developed the text for a self-guided tour along the forestry trunk road within Sunpine's FMA area. The tour explained different aspects of forest ecology including natural disturbance regime, commercial tree species, differences in stand ecology, wildlife habitat, and importance of wetland habitat, among others.

**Sunpine Forest Products Ltd.** **Sundre, Alberta**

Conducted pre-harvest site assessments (PHAs) for Sunpine's Swan Lake, Cripple Creek and Pinto operating compartments within their FMA area. Developed a pre-harvest site assessment manual for Sunpine staff and contractors to use in the field. PHA work consisted of collecting site, soils and vegetation data and mapping the compartment into ecological units.

**Weyerhaeuser Canada Ltd.** **Prince Albert, Saskatchewan**

Conducted ecological field data collection on the Canadian Shield in Saskatchewan for Weyerhaeuser's Reserve Areas. Conducted data analysis and report writing for the Reserve Areas Site Classification.

**Farm Woodlot Association of Saskatchewan** **Meadow Lake, Saskatchewan**

Collected ungulate and livestock habitat use data within the Whitehood Forest in western Saskatchewan. Conducted statistical analysis, modelled important wildlife cover habitat, important wildlife forage habitat and livestock grazing habitat. Authored the wildlife components of the report.

**Canada-Alberta Partnership Agreement in Forestry** **Edmonton, Alberta**

Involved with field checking of preliminary ecosite classification for the Field Guide to Ecosites of West-Central Alberta, Field Guide to Ecosites of Northern Alberta and Field Guide to Ecosites of Southwestern Alberta. Involved in final editing and writing of field guides for publication.

**Canada-Saskcatchewan Partnership Agreement in Forestry** **Edmonton, Alberta**
Involved with field data collection and checking of preliminary ecosite classification for the Field Guide to Ecosites of the Mid-Boreal Ecoregions of Saskatchewan. Involved in final editing and writing for publication.

## PROJECT RELATED EXPERIENCE - WILDLIFE MODELLING

**Golder Associates Ltd.** **Edmonton, Alberta**
Developed a new habitat model for Canadian toads using empirical data and GIS techniques to assess resource selection of Canadian toads. This model was validated using field results and found that 90% of known toad observations occurred in suitable habitat, with a significant preference for high and moderate habitats. This model was developed internally for future use within the oil sands region.

**Paramount Resources Ltd.** **Cameron Hills, Northwest Territories**
Modelled woodland caribou, moose, marten and forest songbirds to assess direct habitat loss due to site clearing and indirect habitat loss due to sensory disturbance for proposed oil and gas development within the Cameron Hills.

**Suncor Energy Inc.** **Fort McMurray, Alberta**
Conducted Population Viability Analysis for moose and black bears using RAMAS GIS. This analysis included an assessment of the effects to moose and bear populations from a tailings pond and from regional cumulative effects.

**Minera Barrick Misquichilca** **Peru**
Developed and ran Habitat Suitability Index (HSI) models for three mammal species, four bird species and two herpetiles. Used HSI results to predict project-related impacts at baseline, during operations and at closure after reclamation. Developed a Biodiversity Index model to assess project related effects on terrestrial and aquatic flora and fauna.

**OPTI-Nexen** **Anzac, Alberta**
As part of the Long Lake SAGD Project and update to the Environmental Impact Assessment, Habitat Suitability Index models were used to assess the impacts of the project on wildlife habitat. Coordinated and wrote the results of the modelling analysis into an updated assessment report.

**Canadian Natural Resources Ltd.** **Fort McKay, Alberta**
Developed Habitat Suitability Index (HSI) models for 14 wildlife species for the Horizon Project application. Results of these models were used to predict the effects of the project on each wildlife species. Assisted in developing Population Viability Analysis (PVA) for moose, woodland caribou and black bears in northeastern Alberta. Helped interpret RAMAS GIS results for assessing p otential p roject i mpacts o n wildlife habitat and populations.

**Fording Coal** **Brooks, Alberta**
As part of the Brooks Power Project, helped assess and refine what Habitat Suitability Index (HSI) models to use and apply on prairie ecosystems. Helped GIS with modelling procedures and interpreted results incorporated into the environmental impact assessment report.

# Corey J. De La Mare

**PetroCanada Inc.** **Calgary, Alberta**

Assisted in developing Population Viability Analysis (PVA) for moose, woodland caribou and black bears in northeastern Alberta. Helped interpret RAMAS GIS results for assessing potential project impacts on wildlife habitat and populations.

**Canadian Forest Products (CANFOR) Ltd.** **Grande Prairie, Alberta**

Developed landscape-level wildlife habitat model for six wildlife guilds. Habitat information was collected from a detailed ecological inventory program and plot variables were analysed for assessing stand-level habitat attributes which were summarized at the landscape scale (i.e., ecosetions) for modelling.

**Canadian Forest Products (CANFOR) Ltd.** **Grande Prairie, Alberta**

Developed Habitat Suitability Index (HSI) Models for moose, marten and the pileated woodpecker. Also developed cursory-level models for woodland caribou and bull trout. Models were used as constraints for timber supply analysis.

## FIELD RELATED EXPERIENCE

### Vegetation

- conducted several vegetation surveys in foothills, subalpine, boreal forest and Canadian shield ecosystems in western Canada;
- conducted reconnaissance and detailed surveys;
- conducted rare plant surveys; and
- instructed courses on identifying indicator plant species.

### Soils

- conducted soil reconnaissance and detailed soil surveys in west-central Alberta and on the Canadian Shield in Saskatchewan;
- classified soils according to the Canadian System of Soil Classification; and
- instructed courses on identifying indicator soil characteristics.

# Corey J. De La Mare

## Wildlife

- designed wildlife corridor study in conjunction with industry, government and academia;
- use of remote cameras, non-invasive DNA techniques and GPS Collars for monitoring studies;
- developed survey methodologies;
- conducted aerial ungulate, winter track surveys, owl surveys, browse-pellet surveys, amphibian surveys, breeding bird surveys, bat surveys, small mammal surveys, flying squirrel surveys, beaver/muskrat surveys and waterfowl surveys;
- conducted wildlife surveys in the foothills of Alberta, boreal forest of Alberta and Saskatchewan and in the prairies of southern Alberta; and
- conducted surveys along road/pipeline right-of-ways for species of concern and important wildlife habitat.

## Fisheries

- conducted electro-fishing surveys as part of a salvage program;
- conducted seine-netting, fish necropsies and parasite/disease assessment; and
- sampled temperate reef fish communities in BC and freshwater lake and river systems in Alberta.

## Relevant Publications, Technical Reports and Presentations


Golder Associates Ltd. 2003. Environmental Sensitivities Assessment for Strategic Municipal Development Plan of the Coalbranch Area within the Yellowhead Count. Prepared for Urban Systems Ltd., Edmonton, AB. Prepared by Golder Associates Ltd., Edmonton, AB.

De La Mare, C.J. and N. McDonald. 2003. Suncor Energy Wildlife Monitoring Program: 5-Year Summary Report and Re-Analysis. Prepared for Suncor Energy Inc. by Golder Associates Ltd., Calgary, AB.

McDonald, N. and C.J. De La Mare. 2003. Suncor Energy Wildlife Monitoring Program and Wildlife Assessment Update: Year 5 (2003). Prepared for Suncor Energy Inc. by Golder Associates Ltd., Calgary, AB.

De La Mare, C.J. and N. McDonald. 2003. Habitat Suitability Index Model: Canadian toads in northerastern Alberta. Prepared by Golder Associates Ltd., Edmonton, AB.

Golder Associates Ltd. 2003. Environmental Assessment for Proposed Improvements to Highway 53 through Ponoka. Prepared for Infrastructure Systems Ltd., Edmonton, AB. Prepared by Golder Associates Ltd., Edmonton, AB.

Golder Associates Ltd. 2003. Developers Assessment Report for the Cameron Hills Extension Program. Prepared for Paramount Resources Ltd., Calgary, AB.

Bentham, P.R. and C.J. De La Mare. 2003. Long-Term Songbird Monitoring Program: Trial Field Study 2003. Prepared for Alberta Plywood Ltd. by Golder Associates Ltd., Edmonton, AB.

Glendinning, S. and C.J. De La Mare. 2003. Breeding Bird Survey 2002: Sunbridge Wind Power Generation Project. Prepared for Sunbridge Energy Inc., Canadian Wildlife Service, and Saskatchewan Environment and Resource Management by Golder Associates Ltd., Calgary, AB.

McDonald, N. and C.J. De La Mare. 2003. Suncor Energy Wildlife Monitoring Program and Wildlife Assessment Update: Year 4 (2002). Prepared for Suncor Energy Inc. by Golder Associates Ltd., Calgary, AB.

# Corey J. De La Mare


Bentham, P.R. and C.J. De La Mare. 2003. Winter Aerial Caribou Survey for the Petro-Canada Meadow Creek Project. Prepared for: Petro-Canada, Calgary, Alberta by: Golder Associates Ltd., Calgary, Alberta. 30pp.

McDonald, N., C.J. De La Mare and L. Paquin. 2003. Resource Selection Functions for Canadian Toads in Northeastern Alberta: Natural vs. Reclaimed Habitat. Presented at the 2003 Alberta Chapter of the Wildlife Society Annual General Meeting and Conference.

Hindmarch, T.D. and C.J. De La Mare. 2003. Firebag SAGD Project 2002 Amphibian Surveys. Prepared for Suncor Energy Inc., by Golder Associates Ltd.

Gurski, K. and C.J. De La Mare. 2002. Winter Track Count Survey for the Primrose and Wolf Lake (PAW) Expansion Project. Prepared for Canadian Natural Resources Ltd. by Golder Associates Ltd., Calgary, AB.

Fieldhouse, N., C. Stefan and C.J. De La Mare. 2002. Suncor Firebag SAGD Wildlife Monitoring Program. Prepared for Suncor Energy Inc. by Golder Associates Ltd., Calgary, AB.

Golder Associates Ltd. 2002. Fording Coal Ltd., Brooks Power Project Wildlife Assessment. Part 3. Prepared for Fording Coal Ltd., by Golder Associates Ltd., Calgary, AB.

Golder Associates Ltd. 2002. Wildlife Habitat Modelling for the Horizon Oil Sands Project Application. Volume 6, Appendix E. Prepared for Canadian Natural Resources Ltd. by Golder Associates Ltd, Calgary, AB.

Golder Associates Ltd. 2002. Wildlife Assessment for the Horizon Oil Sands Project Application. Volume 6, Section 5. Prepared for Canadian Natural Resources Ltd. by Golder Associates Ltd, Calgary, AB.

Golder Associates Ltd. 2002. Wildlife Baseline Report for the Horizon Oil Sands Project Application. Volume 6, Appendix C. Prepared for Canadian Natural Resources Ltd. by Golder Associates Ltd, Calgary, AB.

De La Mare, C.J. 2002. Bird Paradigms and the Need for Local Data: A Case Study from Northeastern Alberta. Presented at the 2002 Alberta Chapter of the Wildlife Society Annual General Meeting and Conference.

Golder Associates Ltd. 2001. Wildlife Environmental Assessment for the Kirby Lake SAGD Application. Volume 3, Section D4. Prepared for Rio Alto Exploration Ltd. by Golder Associates Ltd, Calgary, AB.

Golder Associates Ltd. 2001. Wildlife Baseline Report for the Kirby Lake SAGD Application. Volume 6, Appendix XIII. Prepared for Rio Alto Exploration Ltd. by Golder Associates Ltd, Calgary, AB.

Golder Associates Ltd. 2001. Wildlife Environmental Assessment for the Meadow Creek SAGD Application. Volume 3, Section D4. Prepared for Petro-Canada by Golder Associates Ltd, Calgary, AB.

Golder Associates Ltd. 2001. Wildlife Baseline Report for the Meadow Creek SAGD Application. Volume 6, Appendix XV. Prepared for Petro-Canada by Golder Associates Ltd, Calgary, AB.

Virgl, J. and C.J. De La Mare. 2001. Population Viability Analysis for Woodland Caribou, Moose and Black Bears. Prepared for Petro-Canada by Golder Associates Ltd., Calgary, AB.

De La Mare, C.J., and Stefan. C. 2001. Lease 13 West Albian Sands Winter Track Count Surveys to Investigate Potential Wildlife Movement Corridors. Prepared for Albian Sands Ltd. by Golder Associates Ltd., Calgary, AB.

De La Mare, C.J. and Stefan, C. 2001. Suncor Millennium and Steepbank Mine Projects Winter Wildlife Track Count Surveys 2001: Year Three. Prepared for Suncor Energy Inc. by Golder Associates Ltd., Calgary, AB.

## Corey J. De La Mare


De La Mare, C.J. 2001. Wildlife Habitat Evaluation: A Landscape and GIS Approach. Prepared for Canadian Forest Products Ltd. Grande Prairie, AB.

De La Mare, C.J. 2000. Preliminary Wildlife Guild Development and Wildlife Habitat Evaluation. Workshop prepared for Canadian Forest Products Ltd., Grande Praire, AB.

De La Mare, C.J. 1999. Bioclimate Analysis of the Millar Western Forest Products Ltd. FMA. Prepared for Millar Western Forest Products Ltd. Detailed Forest Management Plan, Whitecourt, AB.

Pawlina, I., L. Versteeg and C. De La Mare. 1999. Wildlife Species of Concern in the Millar Western Forest Products Ltd. FMA. Prepared for Millar Western Forest Products Ltd. Detailed Forest Management Plan, Whitecourt, AB.

De La Mare, C.J. 1998. Habitat Suitability Index Models for Moose, Marten and the Pileated Woodpecker and Cursory models for Woodland Caribou and Bull Trout. Prepared for Canadian Forest Products Ltd. (CANFOR), Grande Prairie, Alberta.

Beckingham, J., C. De La Mare, L. Versteeg, and V. Osachoff. 1998. Natural Regions and Subregions of Alberta. Prepared for Resource Data Division, Alberta Environmental Protection by Geographic Dynamics Corp.

Beckingham, J.D., C.J. De La Mare and M. Desilets. 1997. Soil, Landscape and Site Index Relationships in the Mid-Boreal Upland Ecoregion of Saskatchewan. Prepared for Weyerhaeuser Canada Ltd. by Geographic Dynamics Corp.

Nielsen, D., C. Manderson and C. De La Mare. 1997 Data Evaluation and Analyses for the Milk River Natural Area and Kennedy Coulee Ecological Reserve Monitoring Program. Prepared for the Resource Data Division, Alberta Environmental Protection by Geographic Dynamics Corp.

02/10/04


# Deborah Johnson

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## Professional Profile

A biologist that is primarily working with boreal and barren ground caribou in the north. Boreal caribou projects involve monitoring population trends, identifying annual home ranges and high quality habitats, and examining lichen regrowth rates following fires in black spruce peatlands in the south-central NWT. Other projects include analysis of genetic relatedness of boreal caribou populations in the NWT, as well as baseline monitoring of disease and parasites.

## EDUCATION:

1998-2002. Distant Education, University of British Columbia, Faculty of Forestry

M. Sc. Faculty of Forestry, University of British Columbia, April 1995

B. Sc. Biology, Simon Fraser University, April 1991

## Professional Experience:

**Regional Biologist**, Government of the Northwest Territories – Department of Resources Wildlife and Economic Development. October 2001 – present.

- Develop and implement wildlife research projects.
- Provide ecological advice to other government agencies and boards, communities and industry on conservation, environmental impact and management concerns.

**Pre-Tenure Biologist**, BC Ministry of Sustainable Resource. June 2000 – October 2001.

- Develop and implement wildlife, fisheries and habitat projects to contribute to pre-tenure planning of oil and gas activity in special management areas.
- Participate in pre-tenure planning by providing leadership and guidance on technical and written information related to wildlife and wilderness values, in consultation with technical and public planning teams and other resource specialists.
- Develop results-based management guidelines for pre-tenure planning to minimise impacts related to oil and gas development.

**Planning Assistant**, BC Parks Peace Liard District. October 1999 - June 2000.

- Assist the District Planner in all aspects of park management planning.

**District Extension Officer**, BC Parks Peace Liard District. September 1999 – May 2000 and April 1998 – January 1999.

- Develop and implement communication interpretive plans for the district.
- Supervise staff delivery of BC Parks' interpretive and school education programs.

**A/District Resource Officer**, BC Parks Peace Liard District. February 1999 – August 1999.

- Develop and implement projects related to wildlife and ecological management.
- Lead the district impact assessment program and conduct impact assessments for reviewable park projects.
- Provide technical advice to staff on a wide range of environmental issues.

**Environmental Consultant**, July 1995 – 2001.

- Winter wildlife tracking, radio-telemetry work and small mammal trapping.
- Vegetation inventories and timber cruising.

## PUBLICATIONS:

Johnson D. Draft. Status of Boreal Caribou in the NWT. Department of Resources, Wildlife and Economic Development – Government of the Northwest Territories

Johnson, D. and R. Mulders. Draft. Reconnaissance survey of the Beverly barren ground caribou calving ground – June 2002. Department of Resources, Wildlife and Economic Development – Government of the Northwest Territories

Larter, N. and D. Johnson. Draft. Aerial wildlife survey of the Edehzhie protected area and vicinity – February 2003. Department of Resources, Wildlife and Economic Development – Government of the Northwest Territories

Larter, N., J. Nishi, T. Ellsworth, D. Johnson, G. Moore and D. Allaire. 2003. Observations of wood bison swimming across the Liard River, Northwest Territories, Canada. Arctic:56(4)

Johnson, D. 1995. Defining wilderness quality in the Height-of-the-Rockies Wilderness Area, M.Sc. thesis, University of British Columbia

# CURRICULUM VITAE


## J. Graham Veale

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## EDUCATION

**Bachelor of Environmental Studies,** Applied Physical Geography, Honours 4 Year Program, Univ. of Waterloo, Ont., May 1986

- Courses emphasised applied physical sciences including meteorology, climatology, geomorphology, ecology, biology, geology and hydrology.

Post grad. course in Environmental Toxicology, Simon Fraser University, 1991

## EMPLOYMENT HISTORY

**May-August 1986 & 1987** — **Research Officer**
Canada-Pakistan Snow & Ice Hydrology Project, Wilfred Laurier Univ., Ontario

- Snow sampling, meteorological monitoring and instrument set up, operation and servicing in Pakistani Himalayas

**November 1989 to July 1991** — **Air Monitoring Technician**
BC Ministry of Environment
Waste Management Branch

- Air quality monitoring and meteorological instrumentation set up, operation and maintenance

**July 1991 to November 1999** — **Air Resources Officer**
BC Ministry of Environment, Lands & Parks
Environmental Protection/Pollution Prevention

- Review and evaluate existing and proposed emission sources for compliance with Ministry air quality objectives and impacts on receiving environment
- Design and conduct environmental impact studies to assess impacts to atmospheric and terrestrial receiving environments, including reviews of scientific literature and writing technical reports

**November 1999 to April 2000**

**Acting Regional Air Quality Specialist**
BC Ministry of Environment, Lands & Parks
Pollution Prevention

- Design data acquisition programs; provide interpretation and assessment of emissions and meteorology on air quality for purposes of environmental planning, impact assessment and air quality management
- Provide direction and guidance for air management staff and provide regional input into policy and technical matters related to administration of the Air Management Program

**April 2000 to April 2002**

**Regional Air Quality Specialist**
BC Ministry of Water, Land & Air Protection (formerly BC Ministry of Environment, Lands & Parks)
Pollution Prevention

- As above

**April 2002 to date**

**Air Quality Programs Coordinator**
GNWT Department of Resources, Wildlife & Economic Development
Environmental Protection Service

- Recommend, plan, design, coordinate, implement and evaluate air quality management strategies and programs to achieve Departments air quality management objectives and protection of air quality in the NWT.
- Recommend, design, manage and coordinate programs to monitor ambient air quality and point-source air pollution problems in the Northwest Territories to provide information for assessment and reporting.
- Review and analyse environmental assessments, plans, proposals and studies submitted by proponents and consultants regarding construction and operation of facilities which emit air pollutants and make recommendations to ensure compliance with territorial air quality objectives and applicable air quality standards.

**EXPERIENCE**

- 17 years experience in the field of environmental monitoring and assessment, focussing on air quality issues
- Designed, implemented and reported on atmospheric and terrestrial environmental monitoring programs for both long term trend monitoring and shorter term impact assessment of various air pollution sources e.g.

  Metalex Receiving Environment Survey, 1991 - report assessing metals levels in air/soil/vegetation due to emissions from battery recycling operation.

Resort Municipality of Whistler Inhalable Particulate ($PM_{10}$) Study, 1994/95 - report reviewing results of $PM_{10}$ monitoring and recommendations for future monitoring programme

Boston Bar Inhalable Particulate ($PM_{10}$) Study, 1997-2002 - report reviewing results of $PM_{10}$ and meteorological monitoring to assess impact from sawmill burner

2000/2001 & 2001/2002 Northwest Territories Air Quality Reports – annual reports summarising and assessing results of territorial ambient air quality monitoring program

- Reviewed and commented on regulatory (permit, license, approval, etc) applications for the discharge of air contaminants under the BC *Waste Management Act* and *Mackenzie Valley Resource Management Act* including review and assessment of consultant reports and emissions testing reports submitted in support of applications.
- Provided advice and recommendations to various NWT Boards (e.g. Mackenzie Valley Environmental Impact Review Board, Mackenzie Valley Land and Water Board) and Agencies (e.g. Independent Environmental Monitoring Agency – BHP Billiton Ekati diamond mine) on air quality issues
- Represented GNWT at public hearings to present air quality concerns (e.g. DeBeers Snap Lake Diamond Project – 2002/3)
- Conducted environmental impact assessments related to established and proposed industrial facilities e.g.

  Powell River Metals Processing Inc. (1998) – secondary aluminium smelter; emissions of fine particulate, metals and PAH's

  Premdor (1999) – door and window manufacturing plant; emissions of paint fumes (toluene and methylethylketone)

  SNC Lavalin (2001) – wood residue incinerator; emissions of fine particulate
- Recommended emission limits and/or ambient monitoring programs for inclusion in regulatory instruments (permits, license, approvals, etc) issued under the BC *Waste Management Act* and *Mackenzie Valley Resource Management Act*
- Provided expert witness testimony on behalf of BC provincial government in legal proceedings:

  Environmental Appeal Board, *Waste Management Act* Appeal – Terry Jacks v. November 23, 1999 Amendments to Waste Permit PA-3095 issued to Howe Sound Pulp & Paper Ltd. By the Deputy Director of Waste Management (2000) - air quality and environmental impacts of increase in mills Permit limits for NOx and SOx
- Active member of several intergovernmental committees focussing on air quality issues, including:

  Canadian Council for Ministers of the Environment (CCME) National Air Issues Coordinating Committee

  CCME Canada-wide Standards for Particulate Matter & Ozone: Joint Action & Implementation Coordinating Committee

  CCME Canada-wide Standards for Dioxins & Furans Development Committee

  CCME Hazardous Air Pollutants Working Group

- Current projects include expansion of NWT air quality monitoring network; participating in development of Air Quality Code of Practice for the Upstream Oil and Gas Industry; preparation of NWT Canada-wide Standard implementation plans for ozone, fine particulate and dioxin/furan emissions; updating of NWT guidelines e.g. Guideline for Ozone Depleting Substances and Halocarbon Alternatives