

Jamie Van Gulck, Ph.D., P.Eng.

Principal

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EDUCATION

- J Ph.D., Geotechnical and Geoenvironmental Engineering, Department of Civil Engineering, Queen's University
- J B.E.Sc., Civil and Environmental Engineering University of Western Ontario

EMPLOYMENT HISTORY

- J ARKTIS Solutions Inc., Principal (08/2007 to present)
- J ARKTIS Piusitippaa Inc., Chief Technical Officer (04/2010 to present)
- J VGQ Consulting Inc., Director (04/2004 to present)
- J University of Manitoba, Department of Civil Engineering, Adjunct Professor (08/2007 to 08/2010)
- J University of Manitoba, Department of Civil Engineering, Assistant Professor (05/2003 to 08/2007)
- J Queen's University, Research Assistant (09/2000 to 04/2003)
- J Geotechnical Research Centre, University of Western Ontario, Research Contractor (04/1997 to 07/2000)

PROFESSIONAL SOCIETIES

- J Member, Association of Professional Engineers, Geologist & Geophysicists of NWT & Nunavut
- J Member, Professional Engineers Ontario

SUMMARY OF EXPERIENCE

Prior to being a co-founder for Arktis Solutions Inc., Jamie worked as an Assistant Professor in the Department of Civil Engineering at the University of Manitoba. Jamie left academia to become a private consultant to link business and research opportunity to the science and engineering sectors and resulted in the development of VGQ Consulting Inc.

Jamie is a Principal and founding partner with Arktis Solutions Inc. and lead engineer within the organization. Jamie's roles include contributing to the strategic, business and financial operations of the organizations, as well as, lead technical resource and project management.

Jamie has eighteen years of experience in the following areas: geotechnical and environmental engineering; mining; hydrogeology; northern infrastructure development; policy and regulatory review and development; land and environment management, and research and development. He has authored and co-authored numerous technical papers in various refereed journals and conferences. Additionally, he has contributed to the development of regulations and guidance documents for Government and Aboriginal organizations in the sectors of mining and municipal infrastructure.

Jamie specializes in cross-disciplinary design and analysis which has led to fluid collaborations with multi-disciplinary and multi-sector teams. He has acted as an expert technical reviewer of: northern mining and site remediation projects; contaminated site clean up projects; and municipal infrastructure design and construction projects. Additionally, Jamie has been: a lead designer and project manager for municipal infrastructure projects; and, instructor for drinking water treatment, waste water treatment and solid waste management courses for community operators.

PROJECTS BY SECTOR

MINING

-) **Aboriginal Affairs and Northern Development Canada (NT)** – Expert technical reviewer of the Tyhee Gold Project environmental impact assessment. Review focused on geotechnical and hydrogeological aspects of the project, as well as, water quality and quantity of surface water and groundwater from the mine site and tailings containment facility. Assisted in the development of information requests for submission to Mackenzie Valley Environmental Impact Review Board.
-) **Government of the Northwest Territories (NT)** – Expert technical reviewer of Dominion Diamond Corporation's Ekati Diamond Mine Jay-Pipe Environmental Assessment report and Water Licence application. Review focused on geotechnical design of the open pit and surrounding dykes and hydrogeology. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Environmental Impact Review Board (2015) and Mackenzie Valley Land and Water Board (2016/17). Expert witness at the public hearing.
-) **Government of the Northwest Territories (NT)** – Expert geotechnical technical reviewer of Dominion Diamond Corporation's Diavik Diamond Mine A-21 Pit Dyke engineering design and construction specifications (2015).
-) **Government of the Northwest Territories (NT)** – Expert technical reviewer of Avalon Rare Metals Inc.'s Nechalacho Rare Earth Metals Project Type A Water Licence application. Review focused on tailings management, tailings pond design, geochemistry, closure and reclamation and financial security. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Land and Water Board.
-) **Government of the Northwest Territories (NT)** – Expert technical reviewer of North American Tungsten Corporation's Cantung Mine Type A Water Licence amendment application. Review focused on tailings management, tailings pond design and geochemistry. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Land and Water Board. Expert witness at the public hearing.
-) **Qikiqtani Inuit Association (NU)** – Project lead in the development of the annual financial security assessment (2013 to 2017) for the Baffinland Iron Mines Corporation Mary River project on behalf of the land owner. Expert technical lead in regulatory and lease negotiations and workshops pertaining to financial security.
-) **Qikiqtani Inuit Association (NU)** – Technical resource and lead in the completion of an annual environmental inspection and audit (2009 to 2016) of the Baffinland Iron Mines Corporation Mary River project. Development of a site inspection protocol to evaluate site conditions in relation to environmental and lease requirements.
-) **Qikiqtani Inuit Association (NU)** – Environmental impact assessment and regulatory expert technical reviewer for the Baffinland Iron Mines Corporation proposed iron mine (2011 to 2013). Project manager of the Environmental Assessment team in the topics of socio-economics, terrestrial, marine, aquatic resources, engineering and regulatory. Assisted in the development of information requests and the intervention for submission to Nunavut Impact Review Board. Expert witness at the public hearing.
-) **Qikiqtani Inuit Association (NU)** – Expert technical reviewer of the abandonment and restoration plan and security estimate for Baffinland Iron Mines Corporation Mary River Bulk Sampling Program. Development of the 2010 financial security estimate for the landowner.
-) **Qikiqtani Inuit Association (NU)** – Expert technical and regulatory review of the Baffinland Iron Mines Corporation Type A and Type B water licence applications (2008 to 2015). Assisted in the development of information requests and the intervention for submission to Nunavut Water Board. Expert witness at the public hearing.
-) **Qikiqtani Inuit Association (NU)** – Expert technical and regulatory review of the Baffinland Iron Mines Corporation Aquatic Effects Monitoring Program, Interim Closure and Reclamation Plan, Annual Report, Annual Work Plan and Quarry/Borrow Management Plans. Reviews submitted to the Nunavut Water Board (2013 to 2016).

-) **Qikiqtani Inuit Association (NU)** – Project manager and technical lead in the development of the annual Quarry Concession Report (2014 and 2016) that determines the royalty payments associated with borrow and quarry material used by Baffinland Iron Mines Corporation. Assessment of material usage and methodology for quantification on behalf of the land owner.
-) **Qikiqtani Inuit Association (NU)** – Project manager and technical lead in the development of an Operations Guide that is used by the Baffinland Iron Mines Corporation to ensure fulfillment of their obligations under the Commercial Production Lease with the Qikiqtani Inuit Association.
-) **Parks Canada Agency (NT)** – Expert technical reviewer of the Canadian Zinc Corporation, Prairie Creek environmental impact assessment. In 2011, the review focused on winter road construction and geotechnical stability, spill contingency and risk, geochemistry of tailings predictions, and mine water management and treatment. Assisted in the development of information requests on behalf of Parks Canada Agency for submission to Mackenzie Valley Environmental Impact Review Board.
-) **Parks Canada Agency (NT)** – Expert technical reviewer of the Canadian Zinc Corporation, Prairie Creek environmental impact assessment addendum. In 2015-2017, the review focused on the all-weather road construction and geotechnical stability, spill contingency and risk, and quarry/borrow source management. Assisted in the development of information requests on behalf of Parks Canada Agency for submission to Mackenzie Valley Environmental Impact Review Board.
-) **Parks Canada Agency (NT)** – Contracted to complete an expert technical reviewer of Selwyn Chihong's environmental impact assessment for the Howard's Pass Access Road Upgrade Project. The review is to focus on the all-weather road construction and geotechnical stability, spill contingency and risk, and quarry/borrow source management.
-) **DeBeers Canada (NT)** – Engineering lead in the development of a closure and reclamation plan (2011, 2013, and 2016/17) for the Snap Lake mine in Northwest Territories. Expert witness at the water licence public hearing. Organized and facilitated community engagement workshops regarding mine closure planning.
-) **DeBeers Canada (NT)** – Engineering lead in the development of mine closure financial liability estimate (2011, 2013, 2016/17) for the Snap Lake mine in the Northwest Territories. Expert witness at the water licence public hearing.
-) **DeBeers Canada (NT)** – Research and development engineering lead associated with closure and reclamation of the Snap Lake mine in Northwest Territories (2010 to 2017). Focus of research and development is associated with cover performance for the waste rock/tailings pile, progressive reclamation of impacted land, revegetation and contaminated site investigations and reclamation action plans.
-) **DeBeers Canada (NT)** – For the Snap Lake mine, project manager and technical resource in the completion of various environmental agreement and water licence annual reports, including: Annual Closure and Reclamation Plan Progress Report (2011 to 2016); Air Quality and Emissions Reporting (2016); Vegetation Monitoring (2016), Geotechnical Instrumentation Monitoring Data Report (2016); Seepage Survey Report (2016-2017); Acid Rock Drainage and Geochemical Characterization Report (2016-2017); Hydrology Report (2015-2016); Environmental Agreement Annual Report (2015-2016), Wildlife Effects Monitoring Plan (2016), Wildlife and Wildlife Habitat Protection Monitoring Plan (2016).
-) **DeBeers Canada (NT)** – Project manager for the 2013 implementation assessment of the four separate impact benefit agreements in place between De Beers and the local First Nations for the Snap Lake mine.
-) **DeBeers Canada (NT)** – Project manager and design engineer for the development of a new hazardous material containment facility and the expansion of an existing hazardous material containment facility at the Snap Lake mine.
-) **DeBeers Canada (NT)** – Project manager and technical resource to complete a dam feasibility study, and the engineering design and construction tender documents for two water retention dams at the Snap Lake mine.

- J **DeBeers Canada (NT)** – Project manager and technical lead for the preliminary design of a quarry and water retention sump, as well as, a water balance and chemical load balance model for the sump at the Snap Lake mine.
- J **DeBeers Canada (NT)** – Project manager for the development of emergency preparedness and emergency response plans for two dams at the Snap Lake mine.
- J **DeBeers Canada (NT)** – Project manager and technical resource for the development of the Gahcho Kue mine’s Interim Closure and Reclamation Plan, Reclamation Research Plan (2016) and Annual Closure and Reclamation Report (2015/2017) for submittal to the Mackenzie Valley Land and Water Board. Completed a community engagement workshop (2015) and regulator workshop (2016) regarding mine closure planning.
- J **DeBeers Canada (NT)** – Engineering lead in the development of mine closure financial liability estimate (2016) for the Gahcho Kue mine’s Land Use Permit amendment application.
- J **DeBeers Canada (NT)** – Engineering lead in the development of mine closure financial liability estimate (2017) for the Gahcho Kue mine in the Northwest Territories.
- J **DeBeers Canada (NT)** – For the Gahcho Kue mine, project manager and technical resource in the completion of Annual Closure and Reclamation Plan Progress Report (2016) to satisfy the mine’s water licence condition.
- J **Huckleberry Mines Ltd (BC)** – Project manager in the evaluation of mine water quality and sources of nutrients in mine water.
- J **Yellowknives Dene First Nation (NT)** – Expert technical reviewer in the evaluation of the Giant mine’s environmental impact assessment. Technical review focused on water quality, waste management, and site closure conditions. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Environmental Impact Review Board.
- J **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Bullmoose Area Mine Sites, NWT Remedial Action Plan.
- J **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Seven Mines Sites, NWT Remedial Action Plan.
- J **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Great Slave Lake Mines, NWT Remedial Action Plan. Participated in community engagement workshop regarding mine closure planning.
- J **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Tundra Mine, NWT Remedial Action Plan.
- J **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Hidden Lake Mine, NWT Remedial Action Plan.
- J **Tlicho Government (NT)** – Technical resource development consultant and contributed to the regulatory and technical review of Proponent information in their advancement towards entering into an environmental assessment.
- J **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer for the Phase II Remedial Action Plan for the Tundra Mine Site that included reclamation and closure of: tailing containment area for ARD/ML tailings and waste rock, site water management and treatment, petroleum hydrocarbon contaminated soil and rock. Lead engineer in technical/regulator meetings with proponent and participant in the public hearing. Assisted in the development of the water licence.
- J **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer for the Miramar Northern Mining Ltd. Con Mine closure plans for backfill and cover of the tailings containment ponds and hazardous waste areas.
- J **Mackenzie Valley Land and Water Board (NT)** – Project manager for a team of scientist and engineers in the water licence review of the North American Tungsten Corporation mine in the NWT. Technical lead in the review of surface infrastructure, hydrologic, hydrogeologic, geochemistry, abandonment and reclamation, and security components. Lead engineer in technical/regulator

meetings with proponent and participant in the public hearing. Assisted in the development of the water licence.

- J) **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer of the following De Beer’s Snap Lake mine engineering documents pertaining to the waste rock, ore storage and tailings management.
- J) **Lutsel K’e Dene First Nation (NT)** – Expert technical reviewer for following BHP Billiton Diamonds Inc. – EKATI diamond mine engineering documents pertaining to adaptive management, closure and reclamation, financial security, waste rock and tailings management.
- J) **Lutsel K’e Dene First Nation (NT)** – Expert technical reviewer for the following Diavik Diamond Mine Inc. – management documents pertaining to hazardous materials and spill contingency.
- J) **Lutsel K’e Dene First Nation (NT)** – Participated in Deze Energy Corporation Taltson Hydroelectric Expansion Project, Environmental Impact Assessment technical sessions organized by the Mackenzie Valley Environmental Impact Review Board.
- J) **Mackenzie Valley Environmental Impact Review Board (NT)** - Project manager for the socio-economic review of the proposed Gahcho Kué diamond mine in the NWT.
- J) **Saskatchewan Environment Resource Management (SK)** – Expert technical reviewer of groundwater and brine migration model predictions below the Cory, Mosaic, Mosaic K1, Mosaic K2, and Patience Lake, Saskatchewan potash mines during operation and post-closure.
- J) **Nunavut Water Board (NU)** – Expert technical reviewer and licence compliance assessor for the Miramar Hope Bay Limited Windy Lake and Boston Exploration Camps, specifically, the water monitoring program, QA/QC plan, annual reporting, and abandonment and restoration plan.
- J) **Nunavut Water Board (NU)** – Technical reviewer of the following Tahara Diamond Corporation- Jericho Diamond Mine application documents for water licence consideration.
- J) **Nunavut Water Board (NU)** - Technical reviewer of the following Miramar Hope Bay Limited- Doris North Gold Mine application documents for water licence consideration.
- J) **UMA Engineering Ltd. (MB)** - Chemical treatment of mine water effluent at the closed Fox Lake, Manitoba.
- J) **INCO LTD. (MB)** - Contributed to the characterization and trial revegetation of mine tailings at INCO Ltd., Thompson, Manitoba.
- J) **INCO LTD., Manitoba Sustainable Development Innovation Fund, and University of Manitoba (MB)** - Field and laboratory measurement of unconsolidated and cemented (hard-pan) tailings hydraulic properties and implications on metal leachate and acid mine drainage.
- J) **Manitoba Mines Branch, Manitoba Sustainable Development Innovation Fund, and University of Manitoba (MB)** - Assessment of attenuation and potential mobility of arsenic at the abandoned New Britannia Mine, Manitoba.
- J) **Federal University of Rio Grande do Sul, Brazil and University of Manitoba (MB and Brazil)** – Project manager and engineering advisor in the assessment of contaminant transport properties through compacted soil liners subjected to acid mine drainage percolation.
- J) **Federal University of Rio Grande do Sul, Brazil and University of Manitoba (MB and Brazil)** - Project manager and engineering advisor in the measurement of geotechnical strength characteristics of residual soils, with and without cement additives, subjected to acid mine drainage percolation.

OIL AND GAS

- J) **Government of the Northwest Territories (NT)** – Expert technical reviewer of Imperial Oil Limited’s Norman Wells Production Facility Interim Closure and Reclamation Plan.
- J) **Government of the Northwest Territories (NT)** – Expert technical reviewer of Imperial Oil Limited’s Norman Wells Production Facility security estimate. Expert advisor regarding financial security and closure and reclamation of the facility.
- J) **Government of the Northwest Territories (NT)** – Development of a RECLAIM Oil and Gas user manual to complete reclamation liability estimates.

-) **Aboriginal Affairs and Northern Development Canada (NT)** – Review and update of the existing RECLAIM model used in the NWT for estimating reclamation liabilities at oil & gas sites through to oil & gas production sites.
-) **Inuvialuit Water Board (NT)** – Expert technical and regulatory assessment of Imperial Oil Limited's Type B water licence application pertaining to the reclamation of Bar-C in the Inuvialuit Settlement Region.
-) **Inuvialuit Water Board (NT)** – Expert technical and regulatory assessment of Shell Canada's Closure and Reclamation Plan for the Camp Farewell site.
-) **Government of Northwest Territories – Environment and Natural Resources (NT)** – Expert technical reviewer of Oil & Gas Drilling Waste Disposal Practices for the Proposed Type A Water Licence in the Cameron Hills, NWT Region. Expert technical witness during the water licence public hearing.
-) **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer for Paramount Resources Ltd. water licence and land use permit application materials to support their Cameron Hills extension project.
-) **Department of Indian Affairs and Northern Development (NT)** – Technical and regulatory reviewer for the Paramount Resources Ltd. Cameron Hills Type 'B' Water Licence Application that included aspect to evaluate impacts on surface water quality and quantity.
-) **Northwest Territories Water Board (NT)** - Preliminary technical review of Shell Canada Ltd. Camp Farewell, NT Environmental Site Assessment.
-) **Northwest Territories Water Board (NT)** - Preliminary technical review of MGM Energy Corporation 2D, 3D, and seismic drilling operations and review of draft water licence conditions.

REGULATORY

-) **Government of the Northwest Territories (NT)** – Completed a state of knowledge report for groundwater resources within the transboundary reaches of the NWT to support the bi-lateral water agreements with the Yukon, British Columbia, Alberta, and Saskatchewan.
-) **Government of the Northwest Territories (NT)** – Expert technical reviewer of the draft solid waste facility design and operation guidelines developed by the Mackenzie Valley Land and Water Board.
-) **DeBeers Canada (NT)** – For the Gahcho Kue mine, provided expert technical reviewer of the draft guidelines for closure and reclamation cost estimates for mines developed by the Mackenzie Valley Land and Water Board.
-) **Northwest Territories Water Board (NT)** – Expert technical reviewer for the Inuvik to Tuktoyuktuk all-weather highway project. Acted as regulatory officer throughout the licensing process, and prime expert witness during the water licence public hearing (2013). Post hearing activities involved review of the Type A water licence submittals (as needed, 2013 to 2016).
-) **Wek'eezhii Land and Water Board (NT)** – Project manager in the jurisdictional review of land and water use permits in Saskatchewan, Yukon, Alberta, Alaska, British Columbia, and Ontario. Focus of review was focused on the following resource sector activities: waste disposal sumps, diamond drilling on land and ice, camp waste management, on-land seismic activities, and winter road activities on land and ice.
-) **Qikiqtani Inuit Association (NU)** – Contributed to the development of a lands resource security policy in conjunction with this landowner.
-) **Plan Review Process & Guideline Working Group – Mackenzie Valley Land and Water Boards (NT)** – Lead engineer and technical resource consultant in the completion of a guideline for waste management practices that proponents seeking a water licence can use to ensure that their plans and designs capture elements necessary to understand waste management and the expectations that the Water Boards within the Mackenzie Valley. The guideline is applicable to the mining, oil and gas, exploration, industrial, and municipal sectors, and includes all sources of waste ranging from tailings, construction & demolition waste, hazardous waste, contaminated soil, and municipal refuse.

- J **Environment Canada (YK, NT, NU)** – Project manager and lead engineer to evaluate the legal obligations (e.g., permitting, compliance promotion, and enforcement) and authorities of governments and Boards within the Canadian North responsible for environmental legislation and protection. Also, evaluated the potential implementation issues for the new CEPA Storage Tank regulation in the North and the proposed federal Clean Air Regulatory Agenda for the Northern Oil and Gas Sector.
- J **South Australia Environmental Protection Authority (Australia)** - Contributed to the development of the landfill standards, specifically, barrier system design and contaminant transport, test methods for organic matter and calcium content for leachate collection drainage materials, leachate collection system design and service life predictions, and expert review of draft standards.
- J **Nunavut Water Board (NU)** – Lead engineer responsible for the development of draft guidance document for northern waste and water containment facilities, specifically, landfills, landfarms, lagoons, and water retention structures. Document provides proponents involved in these facilities of the hydrology, hydrogeologic, geotechnical, design, operation, monitoring, and maintenance issues that may be considered and detailed in an application for the purposes of obtaining a water licence.
- J **Nunavut Water Board (NU)** - Contributed to the development of application guidelines for Miramar Hope Bay Ltd.- Doris North Gold Mine and Cumberland Resources Ltd.- Meadowbank Gold Mine.
- J **Nunavut Water Board (NU)** - Technical review and licence compliance assessment for monitoring program, QA/QC plan, annual reporting, and abandonment and restoration plan for the following Distant Early Warning (DEW) line sites: DYE-M- Cape Dyer; CAM-2- Gladman Point; FOX-2- Longstaff Bluff; FOX-5- Qikiqtarjuaq; BAF-5- Resolution Island; and, CAM-1- Jenny Lind Island.
- J **Ontario Ministry of Environment (ON)** - Contributed to the review of state-of-the-art of landfill design, specifically pertaining to leachate characteristics for municipal solid waste landfills, leachate collection system design, and geosynthetics use in leachate collection system and cover applications.

MUNICIPAL INFRASTRUCTURE

- J **City of Iqaluit (NU)** – Project manager and technical lead in the contract administration support for various water, wastewater, and solid waste infrastructure projects, including: solid waste facility fence design (2016 to 2017), water and sewer inventory update and model development (2017), supplementary water supply pipeline (2017), construction contractor support package (2017). As needed (2016 to 2017).
- J **City of Iqaluit (NU)** – Project manager for the construction administration of the city’s solid waste and wastewater treatment facility (2016).
- J **City of Iqaluit (NU)** – Project manager for the structural and electrical evaluation of the City of Iqaluit’s Fire Station back-up generator (2016).
- J **Inuvialuit Water Board (NT)** – Expert technical review of the Hamlet of Aklavik’s water licence application materials (2016).
- J **Environment Canada (YK, NT, NU)** – Expert technical reviewer of draft guidance document “Solid Waste Facilities in Northern Climate”.
- J **Environment Canada (YK, NT, NU)** – Expert technical support for the development of the document “Modern Municipal Solid Waste Facilities in Northern Climate”. Performed consultation activities between Environment Canada and various Territorial Government departments.
- J **Environment Canada (YK, NT, NU)** – Project lead in the development of a foundation report for a technical document on municipal solid waste landfills in northern conditions: engineering design, costing, construction, and operation.
- J **Environment Canada (YK, NT, NU)** – Project lead in the review of the state of waste management practices for community solid waste within the three territories. The focus of the study was on regulatory requirements, territory wide solid waste profiles and challenges, as well as, community scale operations and challenges.
- J **Government of Nunavut (NU)** – Project manager and technical lead in the completion of best management practices for landfills in Nunavut. Analysis includes strategic planning, options analysis, and cost-benefit analysis.

- J **Government of Nunavut, Hamlet of Sanikiluaq (NU)** – Technical resource in the design, construction, and costing of the community’s wastewater lagoon expansion cell. Evaluation of the existing lagoon and wetland treatment capabilities and design of modifications to the current system to achieved effluent water quality criteria.
- J **Government of Nunavut, Hamlet of Igloodik (NU)** – Project manager and technical resource in the design and construction of a new drinking water containment structure and associated infrastructure / piping for water treatment/delivery.
- J **Government of Nunavut, Hamlet of Resolute Bay (NU)** – Project lead and engineer in the development of a new solid waste facility and decommission of the existing solid waste site (municipal landfill, recycling area, and bulky metals site) in Resolute Bay, Nunavut. Core activities included: siting and design of a new solid waste disposal facility; waste audit and development of waste management plan for the new disposal facility; construction costing; closure and reclamation plan; and, provision of tendering services upon acceptance of design including tender documents, construction specifications and QA/QC plan, drawings, and contract administration during construction.
- J **Government of Nunavut, Hamlet of Grise Fiord (NU)** – Technical resource in the development of a new solid waste facility and decommission of the existing solid waste site (municipal landfill, recycling area, and bulky metals site) in Grise Fiord, Nunavut. Core activities included: siting and design of a new solid waste disposal facility; construction costing; closure and reclamation plan; and, provision of tendering services upon acceptance of design including tender documents, construction specifications and QA/QC plan, drawings, and contract administration during construction.
- J **Government of Nunavut, Hamlet of Pangnirtung (NU)** – Project manager and lead environmental and geotechnical designer and engineer in the optimization of the hamlet’s water supply facility and completion of a Comprehensive Performance Evaluation report. Activities include: assessment and repair of water retention structure and associated infrastructure; geotechnical and geothermal modelling of the water reservoir slopes; and, design of an improved water supply facility to meet current and future community needs.
- J **Government of Nunavut, Hamlet of Arviat (NU)** – Lead geotechnical designer in the geothermal modelling of the water retention structure slopes and foundation.
- J **Mackenzie Valley Land and Water Board (NT)** – Project manager for a technical team to technically review the City of Yellowknife’s water licence application and supporting documents. Topics covered included review of the proponent’s landfilling and wastewater treatment practices and future expansion plans. Participant in technical /regulatory meetings with the proponent. Assisted in the development of the water licence.
- J **Mackenzie Valley Land and Water Board (NT)** – Technical reviewer of the Town of Hay River’s water licence application and supporting documents. Topics covered included review of the proponent’s landfilling and wastewater treatment practices and future expansion plans. Participant in technical /regulatory meetings with the proponent. Assisted in the development of the water licence.
- J **Department of Indian Affairs and Northern Development (NT)** – Lead geotechnical engineer in the completion of a desktop study for a leased land in Ft. Simpson, NT that is proposed for two storage facilities.
- J **Department of Indian Affairs and Northern Development (NT)** – Project manager and geotechnical engineer in the completion of a geotechnical field investigation for a leased land in Ft. Simpson, NT that is proposed for two storage facilities.
- J **Wekweeti Community Government – Tlicho (NT)** – Project manager for a community energy audit.
- J **Gameti Community Government – Tlicho (NT)** – Project manager for a community energy audit.
- J **Infrastructure Canada- Knowledge-building, Outreach, and Awareness Program (Canada)** - Assessment of national incidence of water well infrastructure deterioration in Canada, life-cycle cost analysis of groundwater extraction wells with consideration given to operations and maintenance, and characterization of water quality, hydrogeology, and well design and operation impacts on water well deterioration.

-) **Grundfos Management A/S (Denmark)** – Grundfos is the world leader in the manufacturing of pumps. Acted as an expert participant in a workshop in Denmark to review mechanisms and process leading to biological, chemical, and physical clogging mechanisms and process for groundwater wells and pumps.
-) **Agriculture and Agri-Foods Canada Water Supply and Expansion Program and City of North Battleford (SK)** – Project lead and engineer to complete a groundwater capture zone study. The capture zone objectives were to: establish the causes of well and water quality deterioration and formulate methods of predicting long term well performance and service life.
-) **Nunavut Water Board (NU)** – Expert technical reviewer of the geotechnical, construction specifications, containment function, and water quality impact, for the following:
 - o Hamlet of Qikiqtarjuaq- lagoon, landfill, landfarm hazardous waste storage area, and water reservoir
 - o Hamlet of Kugluktuk- lagoon, landfill, and landfarm
 - o Hamlet of Kugaaruk- lagoon
 - o Hamlet of Taloyoak- landfarm
-) **Deline Land Corporation (NT)** - Lead geotechnical engineer in the investigation of the Grey Goose Lodge foundation evaluation and repair.
-) **UMA Engineering Ltd. (MB)** – Field engineer to completed aquifer pump tests at Keewatin and PTH 59 North locations.
-) **City of Winnipeg, Manitoba Waste Reduction and Pollution Prevention (MB)** – Project manager and engineering advisor for the field measurement of refuse hydraulic properties and efficiency of leachate extraction wells to reduce leachate levels in municipal solid waste landfills.
-) **City of Winnipeg, Manitoba Waste Reduction and Pollution Prevention (MB)** – Engineering advisor for the bench top assessment of submerged membrane bioreactor to aerobically treat landfill leachate.

ENVIRONMENTAL ASSESSMENTS AND SITE REMEDIATION

-) **Public Works and Government Services Canada (NU)** – Project manager and construction contract administrator for the demolition and reclamation of a building in Baker Lake, NU. Environmental engineer responsible for soil and water reclamation requirements.
-) **Inuvialuit Water Board (NT)** – Expert opinion on water licence sampling and reporting with regards to the Prince Patrick Island reclamation project.
-) **Wekweeti Community Government – Tlichio (NT)** – Environmental engineer responsible to complete a fuel spill investigation that occurred adjacent to a community building in Wekweeti, NT. In addition to an assessment of the physical site characteristics, soil samples were collected and analyzed for total petroleum hydrocarbon levels. General recommendations for site restoration were provided.
-) **Smiths Landing First Nation (AB)** – Lead engineer to compete a Phase 1 Environmental Site Assessment of a transfer land from the Crown to the Band through the provisions set in the Treaty Lands Entitlement framework.
-) **Smith Landing First Nation (AB)** – Expert review the findings of Hay Camp, Wood Buffalo Park Phase 1, 2, and 3 Environmental Site Assessment, and remediation action plan, to understand environmental and human health risk for the First Nation. Participant in technical meetings with consultant and government organizations regarding clean up strategies and proposed remedial action.
-) **Smith Landing First Nation (AB)** – Expert technical and regulatory support pertaining to risk management and remedial actions associated with uranium and radiation contamination on Reserve lands. Participant in technical discussions on behalf of First Nation with various government organizations with regards action plans.
-) **Government of Northwest Territories – Transportation: Policy, Planning, and Environment (NT)** – Phase 1 Environmental Site Assessment of leased land within the First Simpson, NT airport.

AGRICULTURAL

-) **Prairie Farm Rehabilitation Association- Agriculture and Agri-Foods Canada (Canada)** - Clogging of agricultural tile drains, impacts on performance, and field crop revenue loss.
-) **Prairie Farm Rehabilitation Association- Agriculture and Agri-Foods Canada (Canada)** - Review of impressed current systems to mitigate biofouling clogging effects in groundwater extraction wells.
-) **Manitoba Conservation and University of Manitoba (MB)** - Measurement of contaminant and nutrient migration below earthen manure storage lagoons in southern Manitoba. Evaluation of contaminant transport parameters for inorganic and nutrient constituents in various aquitards below manure lagoons.

EDUCATION AND TRAINING

-) **Saskatchewan Ministry of Environment (SK)** – Developed and delivered a workshop to the Ministry of Environment on the topics of: groundwater flow and contaminant transport, site remediation, and porous media flow and transport modelling.
-) **Tlicho Government (NT)** – Developed and delivered a workshop to the Tlicho Assembly on the proposed NICO mine development.
-) **Nunavut Arctic College (NU)** - Developed and instructed a five day course for municipal operators and foremen in the areas of drinking water treatment, wastewater treatment, and solid waste management. The course was held in Rankin Inlet, NU in January, 2014.
-) **Nunavut Municipal Training Organization (NU)** – Developed and instructed a translation workshop to assist translators in communicating scientific and construction terms, common in municipal infrastructure activities, from English to Inuktitut.
-) **Nunavut Municipal Training Organization (NU)** – Developed and instructed a five day course for municipal operators and foremen in the areas of drinking water treatment, wastewater treatment, and solid waste management. The course was held in Iqaluit, NU and Rankin Inlet, NU in May, 2009, and in Iqaluit, NU in October, 2009.
-) **Building Environmental Aboriginal Human Resources –BEAHR (Canada)** – Developed student manual, instructor manual, and instructor presentation materials for a solid waste coordinator course. Curriculum materials are to be licenced by BEAHR to instructors to train Aboriginals in topics relevant to operate and manage a solid waste facility.
-) **Environmental Monitoring Advisory Board – EMAB (NT)** – Developed and facilitated a mining closure and reclamation workshop in Yellowknife, NT. EMAB is a consensus board of ensuring the protection of Lac De Gras environment where the Diavik Diamond Mines is located. Workshop participants included members of Aboriginal communities and regulators who ensure compliance with licences and leases, and Diavik personnel.
-) **Government of Northwest Territories – Municipal and Community Affairs** – Managed, developed, and instructed an eight day Introduction to Environmental Management course in Inuvik, NT in 2008 and 2011. Course topics included: general environmental awareness; roles and responsibilities of regulators and legislation that helps protect the environment; Mackenzie Valley Resource Management Act and associated Boards; Inuvialuit Land Administration; challenges of waste disposal and community infrastructure such as sanitary landfills and wastewater lagoons; contaminants in the North and their effects; site inspection; remediation technologies; and understanding of Government of Northwest Territories and Indian and Northern Affairs Canada programs.
-) **Government of Northwest Territories – Municipal and Community Affairs (NT)** – Managed, developed, and instructed a five day Class 1 Drinking Water Treatment Plant Operator course in Inuvik, NT in 2008. Hay River, NT in 2010, and Inuvik, NT in 2011.
-) **Government of Northwest Territories – Municipal and Community Affairs (NT)** – Managed, developed, and instructed a five day Class 2 Drinking Water Treatment Plant Operator course in Norman Wells, NT in 2010 and Fort Smith, NT in 2010.

-) **University of Manitoba – Department of Civil Engineering (MB)** – Managed, trained, and operated an independently funded research program to support the completion of 2 Ph.D, 6 M.Sc., and 2 B.Sc. student theses.
-) **University of Manitoba – Department of Civil Engineering (MB)** – Developed curriculum and instructed the following undergraduate and graduate student courses:
 - o Groundwater hydrology
 - o Hazardous waste management
 - o Fluid mechanics
 - o Groundwater contamination
 - o Solid waste engineering
 - o Physical and chemical hydrogeology
 - o Geoenvironmental engineering

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2. Clark, R., Koda, E., Lipinski, M., Wolski, W., Rowe, R.K., and VanGulck, J. 2005. Environmental Geotechnics- Chapter 1: Design Basics and Performance Criteria. Report for International Technical Committee No. 5 (ITC5) on Environmental Geotechnics of the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE).

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4. Lozecznik, S., Sparling, R., Clark, S.P., VanGulck, J.F., and Oleszkiewicz, J.A. 2012. Acetate and propionate impact on the methanogenesis of landfill leachate and the reduction of clogging components. *Bioresource Technology*, **104**: 37-43.
5. Sherriff, B.L., Etcheverry, D.J., Sidenko, N.V., and VanGulck, J. 2011. Spatial and temporal evolution of Cu-Zn tailings during dewatering. *Applied Geochemistry*, **26**(11): 1832-1842.
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9. VanGulck, J., Lozecznik, S., and Murdock, J. 2009. Hydraulic design tables for horizontal liquid injection systems in bioreactor landfills. *ASCE Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management (special edition)*, **13**(3): 147-155.
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12. VanGulck, J.F. and Rowe, R.K. 2008. Parameter estimation for modeling clogging of granular medium permeated with leachate. *Canadian Geotechnical Journal*, **45**(6): 812-823.

13. Sadri, S., Cicek, N., and VanGulck, J. 2008. Aerobic treatment of landfill leachate using a submerged membrane bioreactor – prospects for on-site use. *Environmental Technology*, **29**: 889-907.
14. Sherriff, B., Salzsauler, K.A., Simpson, S., Sidenko, N.V., and VanGulck, J. 2008. Arsenic mobility from arsenopyrite-rich gold mine waste in Snow Lake, Manitoba, Canada. *Chinese Journal of Geochemistry*, **25**(1): 29-30.
15. Cooke, A.J., Rowe, R.K., VanGulck, J.F. and Rittmann, B.E. 2005. Application of the BioClog model for landfill leachate clogging of gravel-packed columns, *Canadian Geotechnical Journal*, **42**: 1600-1614.
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CONTRIBUTIONS TO INDUSTRIAL RESEARCH AND DEVELOPMENT

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