

Peter M. Chapman

- Education:** Ph.D., Benthic Ecology, University of Victoria, Victoria, BC, 1979
M.Sc., Biological Oceanography, 1976
B.Sc., Marine Biology, 1974
- Affiliations:** Member, American Water Works Association
Member, North American Benthological Society
Member, American Society for Testing and Materials
Charter Member, Estuarine Research Federation
Member, Society of Environmental Toxicology and Chemistry (SETAC)
Member, Water Environment Federation
- Awards:** USEPA Region 10 award - resolving environmental issues, 1996
Founders Award, Society of Environmental Toxicology and Chemistry, 2001
Environmental Toxicology and Chemistry – Exceptional Reviewer, 2013
- Languages:** English and Spanish fluent; Portuguese, Italian and German - reading ability
- Publications:** Over 220 journal articles and book chapters, 3 edited books
Over 400 technical reports; over 300 presentations at meetings
- Experience:**
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|----------------|--|----------------------------|
| 2004 – Present | Golder Associates Ltd.
<i>Senior Environmental Scientist, Principal</i>
Responsibilities include directing, designing, and managing environmental studies in Arctic, temperate, and tropical ecosystems. Primary areas of technical expertise are in monitoring, ecotoxicology, risk assessment, and aquatic ecology. Areas of specialisation include contaminated sediments, weight of evidence assessments, aquatic effects monitoring programs, oil and inorganics fate and effects, especially PAH and selenium. | Vancouver, BC |
| 1979 – 2004 | EVS Environmental Consultants
<i>Senior Environmental Scientist/Owner</i>
Responsibilities included directing, designing, and managing environmental studies in Arctic, temperate, and tropical ecosystems. Primary areas of expertise and responsibilities were monitoring, ecotoxicology, risk assessment, and aquatic ecology. | North Vancouver, BC |
| 1977 – 1979 | Environment Canada/Dept. Fisheries and Oceans Victoria,BC
<i>Independent Contractor</i>
Conducted independent research on aquatic oligochaete distributions in the Fraser River; assessed metal body burdens in aquatic benthos from various areas. Published several papers and one book chapter based on this work. | |
| 1976 – 1979 | University of Victoria
<i>Teaching and Research Assistant</i> | Victoria, BC |

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PROJECT RELATED EXPERIENCE – ECOTOXICOLOGY/TOXICITY TESTING

Ecotoxicology

North and South America, Europe, Australasia

- Directed development and source evaluation studies of chemical contaminants in water and sediment.
- Designed, directed and conducted studies involving sewage treatment plants, mining, manufacturing, pulp and paper, wood processing, hazardous waste disposal, landfill operations, oil and gas, smelting and food processing.
- Conducted pioneering toxicity studies in Arctic, temperate, and tropical ecosystems.

Toxicity Testing

North and South America, Europe, Australasia

- Nationally and internationally recognised expert in ecotoxicology.
- Developed and verified national and international bioassessment protocols for measuring/predicting toxicity and bioaccumulation.

Example Publications

International Peer-Reviewed Literature

Landrum, P.F., P.M. Chapman, J. Neff and D.S. Page. 2012. Evaluating the aquatic toxicity of complex organic chemical mixtures: Lessons learned from polycyclic aromatic hydrocarbon and petroleum hydrocarbon case studies. *Integr. Environ. Assess. Manage.* 8: 217-230.

Landis, W.G. and P.M. Chapman. 2011. Well past time to stop using NOEL/LOELs. *Integr. Environ. Assess. Manage.* 7(4): vi-viii.

Chapman, P.M., B.G. McDonald, H.M. Ohlendorf and R. Jones. 2009. A conceptual selenium-management model. *Integr. Environ. Assess. Manage.* 5: 461-469.

Chapman, P.M. and J. Anderson. 2005. A decision-making framework for sediment contamination. *Integr. Environ. Assess. Manage.* 1: 163-173.

Chapman, P.M. and M.J. Riddle. 2005. Toxic effects of contaminants in polar marine environments. *Environ. Sci. Technol.* 38: 200A-207A.

McDonald, B.G. and P.M. Chapman. 2002. PAH phototoxicity – An ecologically irrelevant phenomenon? *Mar. Pollut. Bull.* 44: 1321-1326.

Chapman, P.M., H. Bailey, and E. Canaria. 2000. Toxicity of total dissolved solids (TDS) from two mine effluents to chironomid larvae and early life stages of rainbow trout. *Environ. Toxicol. Chem.* 19: 210-214.

Wang, F. and P.M. Chapman. 1999. The biological implications of sulfide in sediment - a review focusing on sediment toxicity. *Environ. Toxicol. Chem.* 18: 2526-2532.

Chapman, P.M. 1990. The Sediment Quality Triad approach to determining pollution-induced degradation. *Sci. Tot. Environ.* 97-8: 815-825.

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PROJECT RELATED EXPERIENCE – ENVIRONMENTAL RISK ASSESSMENT

Various Projects

North and South America, Europe, Australasia

- Involved in ecological risk assessment since this process was formalised in the 1980s.
- Served, at the request of the U.S. Environmental Protection Agency Risk Assessment Forum, as a peer reviewer for various Agency guidance documents.
- Published extensively on ecological risk assessment.

Global Experience

South America, Europe, Australasia

- Senior Editor of the international peer-reviewed journal, Human and Ecological Risk Assessment.
- Advisory and consulting services to the governments of Australia, Peru, Indonesia, Hong Kong, ASEAN (Association of South East Asian Nations).
- Helped set up the first Master's degree in Ecotoxicology in Portugal.
- Conducted pioneering toxicity testing studies in the Arctic, North Sea, and Venice lagoons.
- Lectured, taught, and worked extensively in Europe, South East Asia, Australia, and South America (fluent in Spanish).
- Independent, external examiner for Ph.D. dissertations in Spain, Finland, Canada, the U.S., Denmark, and Australia.

Large-Project Expertise

North and South America, Europe, Australasia

- Responsible for synthesis of all studies conducted through NSERC (Natural Sciences and Engineering Research Council) under the Metals in the Environment Research Network (MITE-RN; www.mite-rn.org). MITE-RN ran for 5 years and involved 7 major Canadian Universities, over 20 Principal Investigators from those Universities plus graduate students and other collaborators.
- Provided similar services to the successor of MITE-RN, the Metals in the Holistic Environment Strategic Network (MITHE-SN); www.mithe-sn.org.
- Directed regional-scale risk assessments in Alaska (Port Valdez), Papua New Guinea, Indonesia (Papua), Chile, and Peru.

Example Publications

International Peer-Reviewed Literature

Chapman PM. 2011. Guidance Document: Framework for Assessing and Managing Contaminated Aquatic Sites under the Federal Contaminated Sites Action Plan (FCSAP). Ottawa, ON, Canada.

Chapman PM. 2008. Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment (Environment Canada and Ontario Ministry of the Environment. 2008. Canada-Ontario decision-making framework for assessment of Great Lakes contaminated sediment. Ottawa, ON, Canada)

Campbell, P.G.C., P.M. Chapman, and B. Hale. 2006. Risk assessment of metals in the environment. pp 102-131, In: Hester, R. E. and R. M. Harrison (eds.), Chemicals in the Environment: Assessing and Managing Risk. Royal Society of Chemistry, Cambridge, UK.

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PROJECT RELATED EXPERIENCE – ENVIRONMENTAL QUALITY MANAGEMENT/AQUATIC POLLUTION ASSESSMENT

Environmental Quality North and South America, Europe, Australasia, Arctic

- Intimately involved in the process and methods for developing environmental quality guidelines, both nationally and internationally.
- Advisor to the federal governments of both the United States and Canada for environmental toxicology and biomonitoring assessment policy and protocols.
- Participated in and led aspects of international (South American, European, and Australasian) monitoring development projects.
- Published extensively on the subject of environmental quality guidelines.
- Member of the International Standards Organization, representing Canada.

Pollution Assessment North and South America, Europe, Australasia, Arctic

- Developed the internationally recognised and accepted Sediment Quality Triad concept for determining pollution-induced degradation in aquatic habitats.
- Directed projects (for government and industry) for various studies involving: biological monitoring; assessment of contaminant levels (including Priority Pollutants) in tissues, sediments, and water; ecological surveys; literature reviews for ranking environmental contaminants; and bioassessment (e.g., toxicity testing).

Dredging/Sediment Projects USA, Canada, and elsewhere

- Peer reviewed the U.S. Environmental Protection Agency/Army Corps of Engineers [USEPA/USACE] “Green Book” on ocean disposal.
- Contracted author for the EPA/USACE Inland Testing Manual for Waters of the U.S.
- Designed and implemented monitoring and assessment projects for aquatic dredging in fresh, marine, and estuarine waters world-wide.

Example Publications International Peer-Reviewed Literature

Chapman, P.M., F. Wang and S.S. Caseiro. 2013. Assessing sediment contamination in transitional waters. *Environ. Intl.* 55: 71–91.

Chapman, P.M. and M. Smith. 2012. Assessing, managing and monitoring contaminated aquatic sediments. *Mar. Pollut. Bull.* 64: 2000-2004.

Chapman, P.M. 2012. Management of coastal lagoons under climate change. *Estuar. Coast Shelf Sci.* 110: 32-35.

Chapman, P.M., F. Wang, D.D. Germano, and G. Batley. 2002. Porewater testing and analysis: The good, the bad and the ugly. *Mar. Pollut. Bull.* 44: 359-366.

Chapman, P.M., F. Wang, W. Adams, and A. Green. 1999. Appropriate uses of sediment quality values for metals and metalloids. *Environ. Sci. Technol.* 33: 3937-3941.

Chapman, P.M., P.J. Allard, and G.A. Vigers. 1999. Development of sediment quality values for Hong Kong Special Administrative Region: a possible model. *Mar. Pollut. Bull.* 38: 161-169.

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PROJECT RELATED EXPERIENCE – EXPERT WITNESS AND PEER REVIEW

Expert Witness

USA and Canada

- Seven trials with testimony.
- Two trials with attendance but no testimony as cases settled.
- Two depositions (one videotaped).
- Appeared as an expert witness on 15 occasions before the Northwest Territories (Canada) Water Boards, on one occasion before the Nunavut (Canada) Water Board, on one occasion before the Joint Review Panel for the MacKenzie Gas Project, and on two occasions before the Joint Review Panels for oil sands developments.
- Provided expert advice, but not testimony, during five judicial or quasi-judicial Hearings in Canada.
- Clients include both government (e.g., U.S. Department of Justice) and industry.

Peer Reviewer/Editor

USA, Canada, Australasia, Europe

Currently:

- Peer reviewer for over 20 international scientific journals.
- Peer reviewer for American, Canadian, Australian, New Zealand, and European granting agencies.
- Senior Editor for Debates/Commentaries and Perspectives for the international, peer-reviewed journal, *Human and Ecological Risk Assessment*.
- Editor of the journal *Integrated Environmental Assessment and Management (IEAM)*
- Editor of the journal *Environmental Toxicology and Chemistry*
- Editorial Board of the international journal, *Marine Pollution Bulletin*.
- Member, U.S. Environmental Protection Agency (USEPA), Science Advisory Board (SAB) Scientific and Technological Achievement Awards Committee.
- Member, USEPA Chartered SAB

Previously:

- Member, USEPA SAB: Sediment Criteria Subcommittee; and, Environmental Processes and Effects Committee.
- Member, Washington State Biomonitoring Science Advisory Board (BSAB).
- Member, Canadian Environmental Advisory Council (advised four different Canadian Ministers of Environment).
- Member, NRC Committee on the Bioavailability of Metals in Sediments.
- Member, USEPA SAB, Global Climate Change Subcommittee.
- Editorial Board of the international journal, *Chemosphere*.
- Editorial Board of the international journal, *Ecotoxicology and Environmental Safety*.
- Member, Sewage Treatment Review Panel.
- Member, International Technical Advisory Panel on Ecotoxicity.
- Editorial Board of the international journal, *Environmental Toxicology and Chemistry*.
- Member, U.S. Environmental Protection Agency FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) Scientific Advisory Panel 2012.

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PROJECT RELATED EXPERIENCE – METALS/OTHER INORGANICS

Metals, Metalloids, Non-Metals North/South America, Europe, Australasia, Arctic

- Chaired 2009 SETAC Pellston Workshop on Ecological Assessment of Selenium in the Aquatic Environment; senior editor of resulting book.
- Past member of the International Technical Advisory Panel on Ecotoxicology, for nonferrous metals.
- Participated in an OECD Expert Workshop on Toxicity Testing of Metals and Metalloids as Chair of an International Expert Group.
- Participated in a Canada/European Union Expert Workshop on Persistence and Bioaccumulation of Metals and Metalloids as a speaker and workshop rapporteur.
- Participated in a World Health Organization Expert Workshop on Global Criteria for Zinc.
- Extensive experience and expertise with metals from sources including mining, smelters, sewage, and landfills.
- Extensive publications regarding metals, metalloids and non-metals fate and effects in the environment.

Example Publications

International Peer-Reviewed Literature

Trenfield, M.A., P.M. Chapman and R.A. van Dam. In preparation. Appropriate water quality benchmarks for uranium. *Sci. Tot. Environ.*

Chapman, P.M. 2012. 'Heavy metal' – cacophony not symphony. *Integr. Environ. Assess. Manage.* 8: 216.

Chapman, P.M., W.J. Adams, M.L. Brooks, C.G. Delos, S.N. Luoma, W.A. Maher, H.M. Ohlendorf, T.S. Presser, D.P. Shaw (eds). 2010. *Ecological Assessment of Selenium in the Aquatic Environment*. SETAC Press, Pensacola, FL, USA.

Chapman, P.M. 2008. Environmental risks of inorganic metals and metalloids: a continuing, evolving scientific odyssey. *Human Ecol. Risk Assess.* 14: 5-40.

Chapman, P.M. and A.M.H. de Bruyn. 2007. A control-chart approach to monitoring and communicating trends in tissue selenium concentrations. *Environ. Toxicol. Chem.* 26: 2237-2240.

Adams, W. and P.M. Chapman (eds). 2006. *Assessing the Hazard of Metals and Inorganic Metal Substances in Aquatic and Terrestrial Systems*. SETAC Press, Pensacola, FL.

Chapman, P.M. and F. Wang. 2000. Issues in ecological risk assessment of inorganic metals and metalloids. *Human Ecol. Risk Assess.* 6: 965-988.

Chapman, P.M., F. Wang, C. Janssen, G. Persoone, and H. Allen. 1998. Ecotoxicology of metals in aquatic sediments: binding and release, bioavailability, hazard, risk and remediation. *Can. J. Fish. Aquat. Sci.* 55: 2221-2243.

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PROJECT RELATED EXPERIENCE – SEWAGE EFFLUENT AND TREATMENT

Sewage

North and South America, Europe, Australasia, Arctic

- Extensive project experience assessing fate and effects of sewage effluents.
- Evaluations for cities with populations over 1,000,000 and small local discharges.
- Expert advice regarding design and placement of sewage discharges to minimise environmental concerns.
- Expert advice regarding levels of sewage treatment required relative to the receiving environment.
- Interpretative advice and studies regarding environmental effects and regulatory requirements.
- Member, Sewage Treatment Review Panel (Greater Vancouver Regional District).

Example Publications

International Peer-Reviewed Literature

- Chapman, P.M., J. Cullen, C. Garrett, J. Littlepage, T. Pedersen, D. Varela, R.W. Macdonald, R. Thomson, T. Parsons. 2008. Sewage treatment wasted – The Victoria (BC, Canada) example. *Mar. Pollut. Bull.* 56: 815-816.
- Chapman, P.M. 2007. Determining when contamination is pollution – weight of evidence determinations for sediments and effluents. *Environ. Intern.* 33: 492-501.
- McPherson, C.A., A.R. Tang, P.M. Chapman, L.A. Taylor and S. J. Gormican. 2002. Toxicity of 1,4-dichlorobenzene in sediments to juvenile polychaete worms. *Mar. Pollut. Bull.* 44: 1405-1414.
- Chapman, P.M. 2000. Whole Effluent Toxicity (WET) Testing - usefulness, level of protection, and risk assessment. *Environ. Toxicol. Chem.* 19: 3-13.
- Taylor, L.A., P.M. Chapman, R.A. Miller, and R.V. Pym. 1998. The effects of untreated municipal sewage discharge to the marine environment off Victoria, British Columbia, Canada. *Water Sci. Technol.* 38: 285-292.
- McGroddy, S. and P.M. Chapman. 1997. Is mercury from dental amalgam an environmental problem? *Environ. Toxicol. Chem.* 16: 2213-2214.
- Chapman, P.M., J. Downie, A. Maynard, and L. Taylor. 1996. Deodorizer residue and coal in marine sediments contaminants or pollutants? *Environ. Toxicol. Chem.* 15: 638-642.
- Chapman, P.M., M.D. Paine, A.D. Arthur, and L.A. Taylor. 1996. A triad study of sediment quality associated with a major, relatively untreated marine sewage discharge. *Mar. Pollut. Bull.* 32: 47-64.
- Chapman, P.M. 1996. A test of sediment effects concentrations: DDT and PCB in the Southern California Bight. *Environ. Toxicol. Chem.* 15: 1197-1198.
- Chapman, P.M., A.D. Arthur, M.D. Paine, and L.A. Taylor. 1994. Sediment studies provide key information on the need to treat sewage discharged to sea by a major Canadian city. *Water Sci. Technol.* 28: 255-261.

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JOURNAL PUBLICATIONS

[* = Editorials or Letters to the Editor]

- Fitzsimons, J., D. Coulton, K. Hille and P. M. Chapman. In preparation. The use of Bayesian mixing models to evaluate the food web and dietary niche of lake trout in a sub-arctic lake. *N Am J Fish Manage*
- Trenfield, M.A., P.M. Chapman and R.A. van Dam. In preparation. Appropriate water quality benchmarks for uranium. *Sci. Tot. Environ.*
- Wernick, B. G., A. M. H. de Bruyn, B. D. McDonald, C. Stefura, L. Patterson and P. M. Chapman. In preparation. Assessing effects of a freshwater oil spill on *in situ* development of northern pike embryos. *Can. J. Fish. Aquat. Sci.*
- Chapman, P. M. and C. A. McPherson. In preparation. Development of a total dissolved solids (TDS) site-specific water quality objective for a Canadian diamond mine. *Integr. Environ. Assess. Manage.*
- Chapman, P. M. and J. R. Elphick. In preparation. Predicted no effect concentrations (PNECs) should not be based on a single toxicity test. *Environ. Toxicol. Chem.*
- Stevenson, R. and P. M. Chapman. In preparation. Weight of evidence assessment of mine-related chemical toxicity and nutrient enhancement. *Integr. Environ. Assess. Manage.*
- Baker, J. A., J. R. Elphick, C. A. McPherson, and P. M. Chapman. In preparation. Effect of total dissolved solids (TDS) on fertilization and development of two salmonids. *Arch. Environ. Contam. Toxicol.*
- Barrett, T., K. Hille, K. Harris, R. Sharpe, H. Machtans, S. Usyatsov, and P. M. Chapman. In preparation. Quantifying natural variability as a method to detect environmental change: definitions of the normal range for a single observation and the mean of *m* observations. *Environ. Toxicol. Chem.*
- McPherson, C., D. H. Y. Lee, and P. M. Chapman. In review. Development of a fluoride chronic effects benchmark for aquatic life in freshwater. *Environ. Toxicol. Chem.*
- McPherson, C., G. Lawrence, J. Elphick, and P. M. Chapman. In review. Development of a strontium chronic effects benchmark for aquatic life in freshwater. *Environ. Toxicol. Chem.*
- *Chapman, P.M. and W. A. Maher. 2014. The need for truly integrated environmental assessments. *Integr. Environ. Assess. Manage.* 10: 151.
- Greenberg, M., P. M. Chapman, I. Allen, K. Anderson, S. Apitz, C. Beegan, T. Bridges, S. Brown, J. Cargill, M. McCulloch, C. Menzie, J. Shine, Parkerton TF. 2014. Passive sampling for assessment of contaminated sediments: Risk management. *Integr. Environ. Assess. Manage.* 10: 224-236.
- *Chapman, P. M. 2013. Treatment by any other name would be more environmentally friendly. *Mar. Pollut. Bull.* 77: 1-2.
- *Page, D.S., P.M. Chapman, P.F. Landrum, J. Neff and R. Eston. It's the dose, not the hypothesis: Reply to Heintz et al. In press. *Human Ecol. Risk Assess.*
- *Chapman, P. M. 2013. Fluoride does not biomagnify – comment on Del Piero et al. (2012). *Environ. Toxicol. Chem.* 32: 1215.

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- Meador JP, Warne St JM, Chapman PM, Chan KM, Yu S, Leung KMY. 2013. Tissue-based environmental quality standards. *Environ. Sci. Pollut. Res.* DOI 10.1007/s11356-013-1714-x
- *Chapman, P. M. 2013. Polluting to pollute or “polluting” to protect? *Mar. Pollut. Bull.* 70:1-2
- Chapman, P.M., F. Wang and S.S. Caseiro. 2013. Assessing sediment contamination in transitional waters. *Environ. Intern.* 55: 71–91.
- Neff J., D. S. Page, P.F. Landrum and P.M. Chapman. 2013. The importance of both potency and mechanism in dose-response analysis: An example from exposure of Pacific herring (*Clupea pallasii*) embryos to low concentrations of weathered crude oil. *Mar. Pollut. Bull.* 67: 7-15.
- Landrum, P.F., P.M. Chapman, D.S. Page and J. Neff. 2013. Influence of exposure and toxicokinetics on measures of aquatic toxicity for organic contaminants: a case study review. *Integr. Environ. Assess. Manage.* 9: 196-210.
- Wepener, V. and P.M. Chapman. 2012. South African ecotoxicology — present status and future prognosis. *African J. Aquat. Sci.* 37: 229-234.
- Landis, W.G., J.L. Durda, M.L. Brooks, P.M. Chapman, C. Menzie, R.G. Stahl Jr. and J.L. Stauber. 2012. Ecological risk assessment in the context of global climate change. *Environ. Toxicol. Chem.* 32: 1–14.
- Chapman, P.M. and M. Smith. 2012. Assessing, managing and monitoring contaminated aquatic sediments. *Mar. Pollut. Bull.* 64: 2000-2004.
- *Chapman, P.M. 2012. Adaptation to global climate change – A bandage as the guillotine descends. *Integr. Environ. Assess. Manage.* 8: 577.
- *Chapman, P.M. 2012. 'Heavy metal' – cacophony not symphony. *Integr. Environ. Assess. Manage.* 8: 216.
- Chapman, P.M. 2012. Management of coastal lagoons under climate change. *Estuar. Coast Shelf Sci.* 110: 32-35.
- *Chapman, P.M. 2012. Crossing the line: Sins of omission and commission. *Mar. Pollut. Bull.* 64: 457-458.
- Caseiro, S. S., T. A. DelValls and P.M. Chapman. 2012. Considerations for integrative environmental assessments of contaminated estuarine sediments. *Man. Environ. Qual.* 23 (4): 400 – 413.
- Page, D.S., P.M. Chapman, P.F. Landrum, J. Neff and R. Eston. 2012. A perspective on the toxicity to low levels of petroleum-derived PAH to early life stages of herring and salmon. *Human Ecol. Risk Assess.* 18: 229-260.
- *Landis, W.G. and P.M. Chapman. 2012. Response to Fox: Education alone will not stop incorrect scientific practices. *Integr. Environ. Assess. Manage.* 8:5.
- Landrum, P.F., P.M. Chapman, J. Neff and D.S. Page. 2012. Evaluating the aquatic toxicity of complex organic chemical mixtures: Lessons learned from polycyclic aromatic hydrocarbon and petroleum hydrocarbon case studies. *Integr. Environ. Assess. Manage.* 8: 217-230.
- *Page, D.S., P.F. Landrum, J. Neff and P.M. Chapman. 2012. Author's reply to Heintz et al. [1]. *Environ. Toxicol. Chem.* 31: 473-475.

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- *Page, D.S., P.F. Landrum, J. Neff and P.M. Chapman. 2012. Sensitivity of pink salmon (*Oncorhynchus gorbuscha*) embryos to weathered crude oil. *Environ. Toxicol. Chem.* 31: 469-471.
- *Chapman, P.M. 2012. Global climate change and risk assessment: invasive species. *Integr. Environ. Assess. Manage.* 8: 199-200.
- Chapman, P.M. 2012. Adaptive monitoring based on ecosystem services. *Sci. Tot. Environ.* 415: 55-60.
- *Chapman, P.M. 2011. Global climate change means never going home again. *Mar. Pollut. Bull.* 62: 2269-2270.
- *Landis, W.G. and P.M. Chapman. 2011. Well past time to stop using NOEL/LOELs. *Integr. Environ. Assess. Manage.* 7(4): vi-viii.
- *Wenning R.J., S, E. Apitz, T. Backhaus, L. Barnhouse, G. Batley, B. Brooks, P.M. Chapman, M. Griffin, L. Kapustka, W. Landis, K. Leung, I. Linkov, T. Seager, G. Suter, L. Tannenbaum. 2011. Introduction to invited commentaries – challenges posed by radiation and radionuclide releases to the environment. *Integr. Environ. Assess. Manage.* 7(3).
- *Chapman, P.M. 2011. Indices – attractive delusions. *Integr. Environ. Assess. Manage.* 7: 313.
- *Green, R. and P.M. Chapman. 2011. The problem with indices. *Mar. Pollut. Bull.* 62: 1377-1380.
- McDonald, B.G., A.M.H. deBruyn, J. Elphick, M. Davies, D. Bustard and P.M. Chapman. 2010. Development of a selenium tissue toxicity threshold for Dolly Varden char (*Salvelinus malma*). *Environ. Toxicol. Chem.* 29: 2800-2805.
- Wernick, B.G., A.M.H. deBruyn, L. Patterson and P.M. Chapman. 2009. Effects of an oil spill on the regrowth of emergent vegetation in a northern Alberta lake. *Arch. Environ. Contam. Toxicol.* 57: 697-706.
- *Chapman, P.M. 2009. Selenium: when a good nutrient goes bad. *Integr. Environ. Assess. Manage.* 5:363.
- McDonald, B. G. and P.M. Chapman. 2009. The need for adequate QA/QC measures for Se larval deformity assessments: Implications for tissue residue guidelines. *Integr. Environ. Assess. Manage.* 5: 470-475.
- Chapman, P.M, B.G. McDonald, H.M. Ohlendorf and R. Jones. 2009. A conceptual selenium-management model. *Integr. Environ. Assess. Manage.* 5: 461-469.
- *Chapman, P.M. 2009. Borja et al.'s (2008) "Overview of integrative tools and methods...worldwide" omits key elements. *Mar. Pollut. Bull.* 58: 456.
- *Chapman, P.M, J. Cullen, C. Garrett, J. Littlepage, T. Pedersen, D. Varela, R.W. Macdonald, R. Thomson, T. Parsons. 2008. Sewage treatment wasted – The Victoria (BC, Canada) example. *Mar. Pollut. Bull.* 56: 815-816.
- *Chapman, P.M. 2008. Ecosystem services – assessment endpoints for scientific investigations. *Mar. Pollut. Bull.* 56: 1237-1238.
- McPherson, C., P.M. Chapman, A. de Bruyn and L. Cooper. 2008. The importance of benthos in weight of evidence (WOE) sediment assessments – a case study. *Sci. Total Environ.* 394: 252-264.

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- Dale, V.H., G.R. Biddinger, M.C. Newman, J.T. Oris, G.W. Suter II, T. Thompson, T.M. Armitage, J.L. Meyer, R. M. Allen-King, E.F. Benfield, G.A. Burton, P.M. Chapman, L.L. Conquest, I.J. Fernandez, W.G. Landis, L.L. Master, W.J. Mitsch, T.C. Mueller, C.F. Rabeni, A.D. Rodewald, J.G. Sanders, and I.L. van Heerden. 2008. Enhancing the ecological risk assessment process. *Integr. Environ. Assess. Man.* 4: 306-313.
- Chapman, P.M. 2008. Environmental risks of inorganic metals and metalloids: a continuing, evolving scientific odyssey. *Human Ecol. Risk Assess.* 14: 5-40.
- *Chapman, P.M. 2007. Traditional ecological knowledge (TEK) and scientific weight of evidence determinations. *Mar. Pollut. Bull.* 54: 1839-1840.
- McDonald, B.G., A.M.H. de Bruyn, B.G. Wernick, L. Patterson, N. Pellerin and P.M. Chapman. 2007. Design and application of a transparent and scalable weight-of-evidence framework: An example from Wabamun Lake, Alberta, Canada. *Integr. Environ. Assess. Manage.* 3: 476-483.
- DeBruyn, A.M.H., B.G. Wernick, C. Stefura, B.B. McDonald, B.L. Rudolph, L. Patterson and P.M. Chapman. 2007. In situ experimental assessment of Lake whitefish development following a freshwater oil spill. *Environ. Sci. Technol.* 41: 6983-6989.
- Bay, S., W. Berry, P.M. Chapman, R. Fairey, T. Gries, E. Long, D. MacDonald and S.B. Weisberg. 2007. Evaluating consistency of best professional judgment in the application of a multiple lines of evidence Sediment Quality Triad. *Integr. Environ. Assess. Manage.* 3: 491-497.
- Lawrence, G.C. and P.M. Chapman. 2007. Human health risks of selenium-contaminated fish: a case study for risk assessment of essential elements. *Human Ecol. Risk Assess.* 13: 1192-1213.
- Chapman, P.M. and A.M.H. de Bruyn. 2007. A control-chart approach to monitoring and communicating trends in tissue selenium concentrations. *Environ. Toxicol. Chem.* 26: 2237-2240.
- *Chapman, P.M. 2007. Don't disregard the benthos in sediment quality assessments! *Mar. Pollut. Bull.* 54: 633-635.
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- Chapman, P.M., M.A. Farrell, and G.A. Vigers. 1981. Relative tolerances of selected aquatic oligochaetes to combinations of pollutants and environmental factors. Report prepared for Department of Fisheries and Oceans.
- Reid, B.J., R.W. Deverall, P.M. Chapman, and A.W. Maynard. 1981. Experimental investigation into the accumulation of cadmium by the polychaete worm *Capitella capitata* and the bivalve *Macoma balthica*. Report prepared for Department of Fisheries and Oceans.
- Chapman, P.M. 1980. Identification and analysis of oligochaete samples collected from the lower Fraser River, February - August 1977. Prepared for the Habitat Protection Section, Department of Fisheries and Oceans.
- Chapman, P.M., D. Munday, and G.A. Vigers. 1980. Determination of contaminant levels in fish species from the Fraser River. Prepared for the Habitat Protection Section, Department of Fisheries and Oceans.
- Chapman, P.M., D. Munday, and G.A. Vigers. 1980. Monitoring of polychlorinated biphenyls in the lower Fraser River - a data report. Prepared for the Environmental Protection Service.
- Chapman, P.M., W.R. Olmsted, and D. Storr. 1980. Stage One environmental impact assessment of a proposed Vancouver Island Gas Pipeline - Williams Lake to Comox and Squamish Lateral: climatology, marine and freshwater aquatic systems. Report prepared for Westcoast Transmission Company Ltd.
- Thompson, K.A., A. Cribb, D. Brown, and P.M. Chapman. 1980. Histopathology and metallothionein synthesis resulting from cadmium exposure of the oligochaete *Monopylephorus irroratus*. Prepared for the Ocean Ecology Section, Department of Fisheries and Oceans.

Peter M. Chapman

- Chapman, P.M., E.R. McGreer, and G.A. Vigers. 1979. Preliminary marine baseline study and monitoring of wash down operations, Vancouver Wharves Ltd., North Vancouver, BC. Prepared for Vancouver Wharves Ltd.
- Chapman, P.M., D. Moore, and G.A. Vigers. 1979. Evaluation of METRO's experimental design and toxicant literature review. Prepared for the Municipality of Metropolitan Seattle by EVS Environment Consultants Ltd. 313 p.
- Chapman, P.M., L.M. Churchland, P. Thompson, and E. Michnowsky. 1979. Heavy metals in benthic animals and sediments in the lower Fraser River, British Columbia. Prepared for the Inland Water Directorate, Department of Fisheries and the Environment.

**Education**

*B. Sc. Environmental
Science (Chemistry),
University of Calgary, 2000*

Calgary***Senior Water Quality Specialist***

Tasha is an Associate, Senior Water Quality Specialist with Golder Associates in their Calgary office and has over 13 years experience in water quality assessment. The majority of Tasha's work since joining Golder has involved water quality assessments of mining projects and working with public sector groups in Alberta to set locally relevant water quality objectives and discharge limits. Tasha has worked as a component lead, project manager, and senior technical advisor for projects involving the design and execution of environmental baseline and aquatic effects monitoring programs, environmental impact assessments, regulatory risk management, spill response, and development of discharge limits for municipal and industrial applications.

Tasha has developed discharge limits for De Beers Canada Inc., as well as total loading management targets for both the City of Calgary and the City of Edmonton, with a focus on protecting aquatic life in the receiving environment. Over the past four years, Tasha has managed the water quality component for Snap Lake, a small lake near a diamond mine in the Northwest Territories.

Employment History***Golder Associates Ltd. – Calgary, Alberta***

Water Quality Specialist (2001 to Present)

Responsible for water quality baseline and environmental impact assessments, water quality assessments using model-based approaches, discharge limit development, project management and report preparation and presentation.

University of Calgary – Calgary, Alberta

Research Positions (1997 to 2000)

Environmental Engineering - Determination of hydrocarbon substrate utilization coefficients, nutrient uptake, and growth rates for bacterial cultures capable of degrading Alberta sweet mix crude oil.

Geology - Assisted with groundwater sampling and monitoring program to determine the effects of continuous manure application on agricultural land near Lethbridge, AB.

Chemistry - Investigation of interactions between the amino acid tryptophan and the anesthetic dibucaine using fluorescence resonance energy transfer.

Ecology - Comparison of pre- and post-season pheromones using gas chromatography analysis, and fieldwork involving plotting forest areas, introduction and maintenance of pheromone traps, and collection of data.



PROJECT EXPERIENCE – ENVIRONMENTAL BASELINE STUDIES AND ENVIRONMENTAL MONITORING

**Snap Lake Aquatic
Effects Monitoring
Program (AEMP)**

Snap Lake, Northwest
Territories, Canada

The Snap Lake AEMP is a multi-disciplinary monitoring program that began in 2004 to assess changes in Snap Lake due to project-related activities from an active diamond mine. Provide ongoing water quality support to Snap Lake AEMP in terms of refinement of field program and data analyses methods, field work coordination, statistical analysis of data and technical review.

Shell Jackpine Mine
Alberta, Canada

Responsible for the organization and completion of the environmental baseline study completed for Shell Canada Limited's Jackpine Mine – Phase 1. Also involved in the preparation of the water quality component of the environmental impact assessment. Assisted in the implementation of the Hydrological Simulation Program – Fortran (HSPF) model to determine effects of Shell Canada Limited's Jackpine Mine – Phase 1 on small streams in the Muskeg River watershed.

**Regional Aquatics
Monitoring Program
(RAMP)**

Alberta, Canada

Member of a multi-disciplinary team monitoring the effects of oil sands development in the Athabasca River watershed. Responsibilities included the execution of the water and sediment monitoring program, data analysis and preparation of annual reports and budgets. This work includes the RAMP Five-Year summary report which required detailed statistical and trend analyses.

**Suncor Project
Millennium 35(2)**

Alberta, Canada

Data analysis and interpretation of water quality information collected from Shipyard Lake and McLean Creek diversion, as part of fish habitat compensation and monitoring activities as specified in the Fisheries and Oceans Canada (DFO) Fisheries Act Authorization No. AB97-051-2 for Project Millennium.

**Special Areas Water
Supply Project**
Central Alberta, Canada

Developed a surface runoff monitoring charting tool using Microsoft Excel and Visual Basic Programming. On-going monitoring information is stored within this tool, which conveniently automates charting, guideline comparisons, and summary statistics.

**Suncor South Tailings
Pond Project**
Alberta, Canada

Involved in the organization and completion of the environmental baseline study completed for Suncor's South Tailings Pond Project.



PROJECT EXPERIENCE – SETTING DISCHARGE LIMITS

Snap Lake Project
Snap Lake, Northwest
Territories, Canada

Responsible for guiding the development of effluent quality criteria (EQCs) for the Snap Lake Mine. Project involved identifying parameters of potential concern for which EQCs should be developed; defining site-specific water quality objectives for Snap Lake for the parameters of potential concern; deriving water quality-based EQCs; producing a study report documenting the water-quality based EQCs, along with recommendations with respect to their implementation; and appearing at a public hearing as an expert witness to present the study findings. Developed effluent quality criteria for consideration during the water licence permitting phase in 2003, 2011 and 2014.

Gahcho Kué Project
Kennady Lake,
Northwest Territories,
Canada

As above. Developed effluent quality criteria for consideration during the water licence permitting phase in 2013/2014.

Battle River
Calgary, Alberta,
Canada

Assisted AENV in developing reach-specific water quality objectives for identified reaches in the Battle River in 2011. Golder worked with AENV and an Advisory Committee to define the overall approach for setting objectives and work through the process of setting objectives for a sub-set of water quality indicators.

PROJECT EXPERIENCE – WATER QUALITY MODELLING AND ASSESSMENT

**City of Calgary Bow
River Impact Study**
Calgary, Alberta,
Canada

Ongoing member of the project team devoted to the water quality modelling study that characterizes existing and future conditions in the Bow River, downstream of The City of Calgary. Project involves implementing a water quality model capable of representing the complex aquatic plant - nutrient - dissolved oxygen interactions that occur in the Bow River within and downstream of the City of Calgary.

**Town of Drayton Valley
WTP Impact Study**
Alberta, Canada

Project manager for an impact study on the North Saskatchewan River. Assessed the potential impact of the Town of Drayton Valley's water treatment plant effluent on water quality in the river. Tasks included field coordination, communication with the Town, data analysis and interpretation, completing a dilution factor analysis and reporting results.

Alberta Infrastructure
Alberta, Canada

Assessment of dissolved oxygen and ammonia concentrations in the tailwaters of the Little Bow Reservoir. Assisted in making recommendations regarding possible improvements in ammonia concentrations due to a revised diversion plan. Used a steady-state stream water quality model (Qual2E) to predict changes in ammonia concentrations with distance downstream of the Little Bow Reservoir.



**Keephills Thermal
Power Plant
Expansion, Centennial
Project**
Alberta, Canada

Used a mass balance approach to predict water quality in TransAlta's Keepphills cooling pond during various development scenarios and assessed impacts of cooling pond discharge to the North Saskatchewan River.

**Burnco Industrial Pit
Closure Plans**
Calgary, Alberta,
Canada

The impacts of closure options for a gravel extraction operation were evaluated using BATHTUB, a water quality model developed by the USACE Waterways Station.

**Suncor South Tailings
Pond Project**
Alberta, Canada

Responsible for completing the small streams modelling, End Pit Lakes assessment and Athabasca River modelling for this Oil Sands project. Major tasks included: configuration of the water quality components of the models, calibration of selected water quality parameters, and simulation of water quality in McLean Creek and the Athabasca River.

**Special Areas Water
Supply Project**
Central Alberta, Canada

Salinity modelling for the proposed Special Areas Water Supply Project. 30 year simulation of salinity in an interconnected system of over 40 interconnected reservoirs using a user-developed GoldSim model. Responsible for all of the modelling quality in the system, major tasks including: configuration of the water quality model, calibration of selected water quality parameters, simulation and study of water quality effects; work also involved result and report generation, and conveying results to the stakeholders.

**Coke Leachate
Assessment**
Alberta, Canada

Assessed the potential environmental impacts associated with the weathering of coke stockpiles at an oil sands mine in Northern Alberta.

**Suncor Voyageur
Project**
Alberta, Canada

Responsible for assessing potential surface water quality impacts resulting from the development of the Suncor Voyageur Project. Project involved using a combination of computer models to accurately assess potential changes to water quality in the North Steepbank Pit Lake, Unnamed Creek, and the Steepbank and Athabasca rivers. Both local and cumulative effects were considered.

Suncor FGD Study
Alberta, Canada

Project manager for the water quality monitoring program and Athabasca River Model (ARM) component for the application for approval of discharge of flue gas desulphurization (FGD) waters to the Athabasca River. Modelling results were used to develop discharge limits, where appropriate.

PUBLICATIONS

Other

D.T. Cramb, A. Carnini, T.M. Duchscherer, A. Ha, S.C. Wallace. 2001. Dibucaine-ion-channel Interactions in Model Systems: A Study Using Fluorescence Resonance Energy Transfer. *Journal of Photochemistry and Photobiology A: Chemistry* 2001, 138(1): 41-49.

J.E. Wong, T.M. Duchscherer, G. Pietraru, and D.T. Cramb. 1999. Novel Fluorescence Spectral Deconvolution Method for Determination of Critical Micelle Concentrations Using the Fluorescence Probe PRODAN. *Langmuir*. 15(19): 6181-6186.

**Education**

M.Sc Zoology , University of Alberta, Edmonton, AB, 1995

B.Sc Biology , University of Regina, Regina, SK, 1992

Golder Associates Ltd. – Whitehorse**Employment History****Golder Associates Ltd. – Whitehorse, YK**

Senior Fisheries Biologist (1997 to Present)

Project Manager and Aquatics Discipline Lead for small to large-scale projects and manager for large multi-discipline projects. Plans, oversees and carries out investigation, analysis and design and report preparation for a wide variety of mining and community and government programs as well as oil and gas. Participates in environmental assessment projects in the North with emphasis on fisheries, fish habitat and water quality components. Advises clients with regulatory and permitting processes and preparation of regulatory packages for submission. Technical Specialist involved in aquatics program design and review, sampling plan preparation, conducting field sampling, data analysis, report preparation, and presentation of results at hearings, technical sessions, public, university, and regulatory liaison.

SELECTED RELEVANT PROJECT EXPERIENCE

**DeBeers Canada
Mining Inc.**
Northwest Territories

Technical manager for Aquatic Effects Monitoring Program for the Snap Lake Mine. Lead a multidisciplinary team focussed on remote field work, health and safety, design and implementation of an extensive field program, including special studies with university and government partnerships. Regulatory support for Environmental Assessment, Water License, on-going technical support for upcoming joint Environmental Assessment and Water License process.,

Giant Mine
Northwest Territories

Project manager and biologist for design and implementation of the Giant Mine Environmental Effects Monitoring (EEM) Study Designs and interpretative reports submitted to Environment Canada from 2003 to 2010 as well working on the upcoming 2013 Phase 3 report. Included water, sediment, effluent, benthic invertebrate, toxicity and fisheries components to evaluate risk of effluent to fish and fish habitat. Contracted by AANDC, PWGSC and Miramar Northern Mining Ltd. Project manager and biologist for habitat compensation monitoring at Baker Creek for Arctic Grayling restoration.

Greywolf Resources
Northwest Territories

Aquatics lead and regulatory advisor for environmental assessment process and water license applications for oil and gas project in the NWT.

Fortune Minerals
London, Ontario

Technical manager of design of the preliminary Aquatic Effects Monitoring Program for the proposed NICO mine in the NT. Worked with multidisciplinary team on water quality, sediment quality, benthic invertebrates, and fish. Support for regulatory meetings prior to Environmental Assessment and Water License hearings.



Résumé

HILARY MACHTANS

**Department of
Fisheries and Oceans
Canada**

Yellowknife, NWT

Conducted annual cisco creel surveys at Tartan Rapids, Yellowknife River, NWT. Trained and worked in conjunction with members of the Yellowknives Dené First Nation. Survey consisted of collection of information from anglers, fish collection and dissection, fish health assessments, statistical data analysis, and report writing.

AANDC

Yellowknife, NT

Project manager and scientist for study of water quality in historic tailings ponds at the abandoned Colomac Mine in the Northwest Territories.

**Miramar Northern
Mining Ltd., Con Mine**

Yellowknife, NT

Project Manager and technical lead for the development of the Phase 3 Environmental Effects Monitoring 'Investigation of Cause' Study Design field program and Phase 4 program for Con Mine, Yellowknife, NT. Led the scientific design and implementation of program with scientists and university partnerships.

**DeBeers Canada
Mining Inc.**

Northwest Territories

Technical fish habitat assessment and fish compensation planning for Arctic Grayling stream and Lake Trout artificial reef involving remote field work, health and safety, design and implementation of an extensive field program, including special studies with government partnership.

**Public Works and
Government Services
Canada**

Northwest Territories,
Canada

Technical assessment of the abandoned Rayrock mine for water, sediment and fish quality. Included work at remote site, transportation of samples from remote site, reporting and interpretation. Required speciality analyses for radionuclides.

**Public Works,
Giant Mine**

Northwest Territories

Manager and technical lead for design and Implementation of technical sampling program and reporting on sediment release at Giant Mine in 2011. Included water and sediment sampling program, analysis of risk to environment, liaison with government and regulators and public on sampling results.

**Public Works,
Giant Mine**

Northwest Territories

Project Manager for a study to assess sediment quality in Baker Creek on the Giant Mine site. This included review of historical information for a data gap analysis report, and development of a problem formulation and sampling plan. A field program was conducted in 2011 to collect samples of water, sediment, benthic invertebrates, and fish tissue, for chemistry, toxicity testing, and other analyses. Both ecological and human health risks were considered in the sediment assessment.

AANDC

Yellowknife, Northwest
Territories

Project Manager and fisheries biologist for Arctic grayling investigations at Baker Creek, Giant Mine, NT. Includes fish and habitat monitoring in relation to Reach 4 realignment from 2006 to 2010.

**Det'on Cho/Nuna Joint
Venture**

Yellowknife, NT

Project Manager for the data collection and reporting of the out-migration of Arctic grayling from Baker Creek in 2009. The study was designed to determine if effluent discharge has an impact on the timing of the out-migration and mortality rates on the Arctic grayling young-of-the-year (YOY).

Miramar Mining Inc.

Northwest Territories

Technical biologist for the design of the Miramar Con Mine Environmental Effects Monitoring Study Design submitted to Environment Canada. Conducted field program and analysis and reporting of the Con Mine Environmental Effects Monitoring study in 2004-2013.



**Indian and Northern
Affairs Canada**
Yellowknife, NT

Analyzed sediment and benthic invertebrate data from Yellowknife Bay, Great Slave Lake. Part of a program to determine the aerial extent of the tailings from Giant Mine and the effects of the tailings on the benthic community.

**Diavik Diamond Mines
Inc.**
Northwest Territories

Biologist for Fish-out Study of four dewatered lakes near the proposed diamond mine belonging to Diavik Diamond Mines. Involved performing population estimates of multiple species from four lakes and post-de-watering habitat surveys and liaison with aboriginal community staff.

**DeBeers Canada
Mining Inc.**
Northwest Territories

Seconded to De Beers Canada Mining as an Environmental Specialist on the Snap Lake Diamond Project. Implemented the on-going fish, habitat, water and sediment survey of lakes and streams in the Snap Lake Diamond Project area. Prepared water license and land use permit applications for submission to territorial regulators. Contributed to technical report and environmental impact assessment of proposed diamond mine project in Northwest Territories. Performed fish habitat work for a fish compensation program in 2003. Design of water quality database for extensive mine sampling. Liaison with local government, community and regulatory agencies.

**Yellowknives Dené
First Nation**
Yellowknife, NT

Project Manager for study with Yellowknives Dené First Nation to document local traditional knowledge on cisco in general and the Shortjaw Cisco in particular in support of data collection regarding Species at Risk Act knowledge gaps.

**Department of
Transportation,
Government of the
Northwest Territories**
Northwest Territories

Biologist for field assessment of selected stream crossings along the existing winter road from Wrigley to Fort Good Hope, NT. Responsibilities included field work involving fish, fish habitat, and water quality survey of rivers and stream crossings; writing a technical report on fish habitat assessment, recommendations and mitigation strategies for crossings potentially undergoing construction.

**Det'on Cho/Nuna Joint
Venture**
Yellowknife, NT,
Canada

Project Manager for the data collection and reporting of the out-migration of Arctic grayling from Baker Creek in 2009. The study was designed to determine if effluent discharge has an impact on the timing of the out-migration and mortality rates on the Arctic grayling young-of-the-year (YOY).

**Nahanni Butte Dené
Band**
Nahanni Butte, NT,
Canada

Project Manager for the review of the a Water Licence application for a Winter Road in the Nahanni Butte Dené Band Traditional territory and to help develop a list of community concerns with the project and application.

SELECTED RELEVANT PUBLICATIONS

Golder Associates. 2013. 2011 Baker Creek Assessment, Giant Mine. Prepared for Public Works Government Service of Canada, Yellowknife, NWT, Canada

Miramar Mining Inc. 2013. Environmental Effects Monitoring Final Interpretative Report for the Con Mine. Submitted to Environment Canada.



Vecsei, P., C.T. Blackie, A.M. Muir, H. M. Machtans, and J.D. Reist. 2012. A Preliminary Assessment of Cisco (*Coregonus* spp.) Diversity on Yellowknife Bay, Great Slave Lake, Northwest Territories. *Advances in Limnology*, vol. 63 299-322.

Aboriginal Affairs and Northern Development Canada. 2013. Environmental Effects Monitoring Final Interpretative Report for the Giant Mine. Submitted to Environment Canada.

De Beers Canada Mining Inc. 2003. Artificial Reef Report, Snap Lake Diamond Project.

De Beers Canada Mining Inc. 2002. Artificial Reef Report, Snap Lake Diamond Project.

Golder Associates & GeoNorth. 2000. Technical Report: Environmental Information Update for Selected Stream Crossings along the Mackenzie Valley Winter Road. Prepared for the Government of the Northwest Territories, Department of Transportation, Yellowknife, Northwest Territories.

Golder Associates. 2000. Summary Report on Algal Blooms in Fisherman Lake, Northwest Territories. Prepared for Chevron Canada. Calgary, Alberta.

Golder Associates & GeoNorth. 1999. Description of the Regulatory Regime and Environmental Impact Assessment Process for an Extension of the Mackenzie Valley Highway. Prepared for the Government of the Northwest Territories, Department of Transportation, Yellowknife, NT.

Jones, Hilary M and C.A. Paszkowski. 1997. Effects of northern pike on patterns of nest use and reproductive behaviour of male fathead minnows in a boreal lake. *Behavioral Ecology* Vol. 8 No. 6: 655-662.

Jones, Hilary M. and C.A. Paszkowski. 1997. Effects of predatory cues on territorial behaviours of male fathead minnows. *Environmental Biology of Fishes* 49: 97-109.

**Education**

*M.A.Sc.
Biological/Environmental
Engineering, Dalhousie
University, Halifax, NS,
2007*

*B.Eng. Environmental
Engineering, Dalhousie
University, Halifax, NS,
2005*

*B.Sc. Biology, Cape Breton
University, Sydney, NS,
2002*

Languages

English – Fluent

Calgary***Water Quality Specialist***

Alison Snow joined Golder Associates Ltd. in May 2011, as a Water Quality Specialist. Her educational background includes a Bachelor of Science from Cape Breton University, a Bachelor of Environmental Engineering from Dalhousie University, and a Master of Applied Science in Biological/Environmental Engineering from Dalhousie University. Her responsibilities include developing models that simulate surface water flow and quality, summarizing large datasets containing water quality for input into water quality models, and preparing modelling reports and presentations.

Employment History***Golder Associates Ltd. – Calgary, AB***

Water Quality Specialist (2011 to Present)

Responsibilities include developing models for surface water flow and quality summarizing large datasets containing water quality for input into water quality models, and preparing modelling reports and presentations.



PROJECT EXPERIENCE – WATER QUALITY MODELING

**Dominion Diamond
Ekati Corporation
Jay Project
NWT, Canada**

Hydrodynamic and water quality modeling lead; modeled the water quality of Lac du Sauvage and Lac de Gras using GEMSS to predict the impacts of future mine developments on lake water quality as part of the Dominion Diamond Ekati Corporation Environmental Assessment. Constituents modeled included total dissolved solids, temperature, nutrients, major ions, and metals.

**De Beers Canada Inc.
Snap Lake Mine
NWT, Canada**

Updated the Snap Lake water quality model that was developed in GEMSS to predict the impacts of mining on lake water quality as part of the De Beers Canada Inc. Snap Lake Mine water licence amendment. Constituents modeled included total dissolved solids, temperature, oxygen, nutrients, major ions, and metals.

**Seabridge Gold Inc.
Courageous Lake
Project
NWT, Canada**

Modeled the water quality of Courageous Lake using GEMSS to predict the impacts of future mine developments on lake water quality. Constituents modeled included total dissolved solids, temperature and water velocity.

**De Beers Canada Inc.
Gahcho Kué Project
NWT, Canada**

Modeled the water quality of Kennady Lake using GEMSS to predict the impacts of future mine developments on lake water quality as part of the De Beers Gahcho Kué Environmental Assessment. Constituents modeled included oxygen and nutrients.

TRAINING

GoldSim Workshop

GoldSim Technology Group, June 26-28, 2012

CE-QUAL-W2 Version 3.7 Workshop

Portland State University Professional Development Center, June 11-15, 2012

**3-Dimensional Hydrodynamic and Water Quality Modeling Using
GEMSS**

ERM Inc. - Surfacewater Modeling Group, May 23-25, 2011

PUBLICATIONS

**Refereed Journal
Articles**

Snow, A., B.C. Anderson and B. Wootton. Flow-through land-based aquaculture wastewater and its treatment in subsurface flow constructed wetlands. *Environmental Reviews*, 20 (2012), p54.

**Refereed Conference
Proceedings**

Snow, A., B.C. Anderson and B. Wootton. 2010. *Treatment performance of a cold climate hybrid subsurface flow constructed wetland receiving land-based aquaculture wastewater during the first 2 years of operation*. 12th IWA International Conference on Wetland Systems for Water Pollution Control, October 4 - 8 . Venice, Italy.

Anderson, B.C., B. Husk, B. Wootton, C. McClure and A. Snow. 2010. *Watershed approaches for nuisance algae control in small freshwater lakes: Field investigations*. CSCE 11th International Environmental Specialty Conference, June 9 - 12. Winnipeg, Canada.

**Conference
Presentation**

Snow, A., J. Vandenberg, S. Prakash, V. Chisholm, and A. Hood. 2014. Water Quality Modelling in Northern Canada. Canadian Conference for Fisheries Research & Society of Canadian Limnologists, January 3-5. Yellowknife, NWT, Canada.