



Annual Report Research, Development, and Innovation 2016

BGC Engineering Inc.

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Annual Research, Development, and Innovation Report

BGC's strategic plan and big goal help us focus our efforts to advance the science and tools used we use to solve our client's problems. We've been investing in internal projects, partnering with our clients and universities, and providing opportunities for our staff to publish and present the amazing work they do. Here's what we worked on in 2016.

Internal Projects

Our 2016 internal projects built on previous efforts to push our tools and systems to new heights. We also challenged ourselves to adopt cutting edge technology. The passion and drive of individual BGC'ers continue to be the deciding factors in the success of these initiatives. Here are some highlights from 2016:

| Project | Summary | BGC Lead(s) |
|--|---|---|
| CAMBIO / River Network Tools | BGC's flag-ship R&D project. CAMBIO™ and the River Network Tools™ are the back-bone of our pipeline services. We continue to lead the industry in no small part due to the development of these tools. In 2016, we started an exciting new phase of development under project code name "JUNO". | Sarah Newton; Eldon Wong |
| Hololens | We completed a "proof of concept" (POC) of a mine closure immersive visualization that has captured the imaginations of the mining world. | Matt Lato; Gerald Magnusson |
| Landform Design Tools | Work continued working on in-house tools to assist with the design, planning, and development of construction drawings for mine closure landforms. | Julian McGreevy; Gord McKenna |
| Snow Pack Change and Avalanche Runout | We started testing the ability to develop 3D models of snow pack from photogrammetry and the ability to model snow avalanche runout using currently available 2D and 3D runout models. | Mike Conlan |
| Open Pit Failure Database | We developed an online database for open pit failure case studies. This database has been shared with, and received contributions from, the members of the international "Large Open Pit" project consortium. | John Whittall; Warren Newcomen |
| Numerical Data Processing System | We worked toward assembling an internal tool chain and set of workflows based on open source software to streamline the acquisition, processing, and analysis of climate and topographic data. | Patrick Grover; Matthew Buchanan; Leonardo Guzman |



University Collaboration

In 2016, we collaborated with several university research groups. We contributed interesting project ideas and data. We provided funding for professors and our own staff returning to graduate school to undertake projects. Several BGC'ers sat on student committees or advisory boards. Highlights from 2016 are below:

| Project | University | University Researcher(s) | BGC Lead(s) |
|--|---|--|---|
| Rock Mass Disturbance | Dalhousie University | Dr. Andy Corkum | Andrea Regli; Derek Kinakin |
| Automated Aerial Image and Lidar Analysis | Queens University | Dr. Jean Hutchinson | Matt Lato |
| Landslide-Generated Waves | Queens University | Dr. Andy Take | Garrett Miller; Shielan Liu; Mike Porter |
| Debris Flow Mitigation | Simon Fraser University | Dr. Doug Stead | Emily Moase; Matthias Jakob; Alex Strouth |
| Radar Data Analysis for Open Pit Slopes | Simon Fraser University | Dr. Doug Stead | John Danielson; Derek Kinakin |
| Channel Scour on Alluvial Fans | Simon Fraser University | Dr. Brent Ward | Carie-Ann Lau; Matthias Jakob |
| Landslides following the 2015 Earthquake in Nepal | Simon Fraser University University of Durham University of British Columbia | Dr. Doug Stead Dr. Nick Rosser Dr. Scott McDougall | Lauren Hockin; Marc-Andre Brideau |
| Bio-Cementation | University of Alberta | Dr. Ania Ulrich Dr. Yang Liu Dr. Nick Beier | Vanessa Mann; Brent Mooder; Gord McKenna; Bill Burton |
| Trenchless Technology Chair | University of Alberta | Dr. Aliraza Bayat | Pete Barlow |
| Bank Erosion | University of British Columbia | Dr. Brett Eaton | Sarah Davidson; Matthias Jakob |
| Vortex Induced Vibrations in Pipelines | University of British Columbia – Okanagan | Dr. Joshua Brinkerhoff | Gerry Ferris |
| Landslide Impacts on Pipelines | University of Cambridge | Geoff Eichhorn | Alex Baumgard |



2017 Outlook

With 2016 just behind us, 2017 is shaping up to be another exciting year for research, development, and innovation. BGC's R&D review committee is already receiving interesting proposals related to machine learning, stream avulsion, and InSAR. Many projects from 2015 and 2016 will continue.

Have a research, development, or innovation idea that you'd like to propose for funding/support? Get in touch with a Business Sector or Technical Discipline Lead, your office manager, or any CMT member to learn more about the proposal process

2016 Publication List

Journals

- Aaron, J.**, and Hungr, O. 2016. Dynamic simulation of the motion of partially-coherent landslides. *Engineering Geology*, 205: 1-11. doi:10.1016/j.enggeo.2016.02.006.
- Arenson, L. U.**, Kääh, A., and O'Sullivan, A. 2016. Detection and analysis of ground deformation in permafrost environments. *Permafrost and Periglacial Processes*. 27(4): 339-351.
- Conlan, M.**, and Jamieson, B. 2016. Naturally triggered persistent deep slab avalanches in western Canada part I: avalanche characteristics and weather trends from weather stations. *Journal of Glaciology*, 62(232): 243-255. doi:10.1017/jog.2016.1.
- Conlan, M.**, and Jamieson, B. 2016. Naturally triggered persistent deep slab avalanches in western Canada part II: weather trends from model forecasts. *Journal of Glaciology*, 62(232): 256-269. doi:10.1017/jog.2016.2.
- Devito, K.J., **Mendoza, C.**, Petrone, R.M., Kettridge, N., and Waddington, J.M. 2016. Utikuma Region Study Area (URSA) – part 1: hydrogeological and ecohydrological studies (HEAD). *The Forestry Chronicle*, 92(1): 57-61.
- Donnelly, M., Devito, K.J., **Mendoza, C.**, Petrone, R., and Spafford, M. 2016. Al-Pac Catchment Experiment (ACE). *The Forestry Chronicle*, 92(1): 23-26.
- Frauenfelder R., Isaksen K., Noetzi J., and **Lato M.** 2016. Ground thermal and geomechanical conditions in a permafrost-affected high-latitude rockslide site (Polvartinden, Northern Norway). *The Cryosphere*. In review. doi:10.5194/tc-2016-223.
- Flynn, D., Kurz, D., Alfaro, M., Graham, J., and **Arenson, L.U.** 2016. Forecasting ground temperatures under a highway embankment on degrading permafrost. *Journal of Cold Regions Engineering*, 30(4); 04016002.
- George, M.F.**, and Sitar, N. 2016. System reliability approach for rock scour. *International Journal of Rock Mechanics and Mining Sciences*, 85(May): 102-111.
- Graham, J., Solera, S., & **Sanchez, C.** 2016. Investigating rock anchorage failure at major road cut in Wales. *Proceedings of the Institution of Civil Engineers-Forensic Engineering*, 169(3): 94-102.
- Grämiger, L.M., Moore, J.R., Vockenhuber, C., **Aaron, J.** Hajdas, I., and Ivy-Ochs, S. 2016. Two early Holocene rock avalanches in the Bernese Alps (Rinderhorn, Switzerland). *Geomorphology*, 268: 207-221. doi:10.1016/j.geomorph.2016.06.008.
- Jakob, M.**, Clague, J. J., and Church, M. 2016. Rare and dangerous: recognizing extra-ordinary events in stream channels. *Canadian Water Resources Journal*, 41(1-2): 161-173. doi: 10.1080/07011784.2015.1028451.
- Jakob, M.**, **Holm, K.**, and McDougall, S. 2016. Debris-flow risk assessment. In *Natural Hazard Science: Oxford Research Encyclopedias*. Online Publication Date: August 2016. doi: 10.1093/acrefore/9780199389407.013.37.
- Ketcheson, S.J., Price, J.S., Carey, S.K., Petrone, R.M., **Mendoza, C.A.**, and Devito, K.J. 2016. Constructing fen peatlands in post-mining oil sands landscapes: challenges and opportunities from a hydrological perspective. *Earth-Science Reviews*, 161:130-139.
- Lato, M.**, Bobrowski, P., Roberts, N., Bean, S., Powell, S., McDougall, S., **Brideau, M.-A.**, Stead, D., and VanDine, D. 2016. Site investigation, analysis, monitoring and treatment – Canadian technical guidelines and best practices related to landslides: a national initiative for loss reduction. Open File Report (Geological Survey of Canada), 8114. Geological Survey of Canada, Ottawa, ON.
- Newcomen, W.**, and **Dick, G.** 2016. An update to the strain-based approach to pit wall failure prediction, and a justification for slope monitoring. *Journal of the Southern African Institute of Mining and Metallurgy*, 116(5): 379-385.

Nolde, N., and **Jakob, M.** 2016. Challenging the standard dike freeboard: methods to quantify statistical uncertainties in river flood protection. *Canadian Water Resources Journal*, 41(1-2): 151-160. doi:10.1080/07011784.2015.1010180.

Petrone, R., Devito, K.J., and **Mendoza, C.** 2016. Utikuma Region Study Area (URSA) – part 2: aspen harvest and recovery study. *The Forestry Chronicle*, 92(1): 62-65

Conferences

Aaron, J., Conlan, M., Johnston, K., Gauthier, D., and McDougall, S. 2016. Adapting and calibrating the Dan3D dynamic model for North American snow avalanche runout modelling. International Snow Science Workshop, Breckenridge, Colorado, 2-7 October 2016.

Aaron, J., Hungr, O., and McDougall, S. 2016. Development of a systematic approach to calibrate equivalent fluid runout models. 12th International Symposium on Landslides, Napoli, Italy, 12-19 June 2016.

Ansah-Sam, M., Hachey, L., **McKenna, G.,** and **Mooder, B.** 2016. The DBM approach for setting engineering design criteria for an oil sands mine closure plan. In Fifth International Oil Sands Tailings Conference, Lake Louise, Alberta, 4-7 December 2016. University of Alberta Geotechnical Group, Edmonton. 11 pp.

Aubertin, M. and **McKenna, G.** 2016. Tailings disposal challenges and prospects for oil sands mining operations. In Geo-Chicago 2016: Geotechnics for Sustainable Energy, Chicago, IL, 14-18-August 2016. pp. 359-371.

Bale, S., Sorensen, J., Jakob, M., and **Lato, M.** 2016. Reconstruction of debris-flood volume using LiDAR change detection on Three Sisters Creek, Canmore, Alberta. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.

Barlow, J.P., and Richmond, J.A. 2016. The Cheecham landslide event. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.

Baumgard, A., Beaupre, M., and **Leir, M.** 2016. Implementing a quantitative geohazard frequency analysis framework as a component of risk assessment of new pipelines. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.

Brideau, M.-A., Shugar, D.H., Wong, C., 2016. Preliminary investigation of the 2014 Vulcan Creek landslide, Kluane National Park and Reserve, Yukon. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.

Christiansen, C., Gauthier, D. and Oester, N. 2016. 3D monitoring of rockfall sources in Colorado. In Proceedings of the 67th Annual Highway Geology Symposium, Colorado Springs, CO, 11-14 July 2016. Arizona State University, Tempe, AZ.

Claypool, G., and **Cassie, J.** 2016. Eight years post-closure at Nanisivik Mine: lessons in success. In Planning for Closure 2016: First International Congress on Planning for Closure of Mining Operations, Santiago, Chile, 22-22 November 2016.

Cloutier, C., Locat, J., Geertsema, M., **Jakob, M.,** and Schnorbus, M. 2016. Potential impacts of climate change on landslides occurrence in Canada. In Slope Safety Preparedness for Impact of Climate Change. Edited by K. Ho, S. Lacasse and L. Picarelli. CRC Press, Boca Raton, FL, pp. 71-104.

Conlan, M., and **Gauthier, D.** 2016. Using photogrammetry to temporally compare snowpack thicknesses and calculate volumes. International Snow Science Workshop, Breckenridge, Colorado, 2-7 October 2016.

De Guzman, E.M., Piamsalee, A., Alfaro, M., **Arenson, L.U.,** and Doré, G. 2016. Geotextile-Reinforced Fill Slope along a Highway to Canada's Arctic Coast. In GeoAmericas. 3rd Pan-American Conference on Geosynthetics. Miami Beach, FL, USA. p. 13.

Devonald, M., Hill, M., Song, P., **Weatherly, H.,** and **Vincent, L.** 2016. Real-time flood monitoring and management of a Mississippi River pipeline crossing. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.

Dickinson, S.J.E., McKane, C., Dugie, M., Savigny, W.K., and **Logue, C.** 2016. Characterization of a pre-sheared Glaciolacustrine deposit beneath a proposed tailings dam in South Central British-Columbia. In Proceedings of the 69th Canadian Geotechnical Society Conference: history and innovation, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016. Canadian Geotechnical Society, Richmond, BC. pp. 1-7.

Faber, E., Moreland, B., Gonzalez, V., Osorio, L., McDougall, S., **Hunter, S., Hockin, L.,** and **Strouth, A.** 2016. Development of a landslide risk rating system for small-scale landslides affecting settlements in Guatemala City. Second Central American and Caribbean Landslide Congress, Tegucigalpa, Honduras, 18-20 July 2016.

- Ferris, G., and Newton, S.** 2016. Screening methodology for bank erosion estimation at pipeline watercourse crossings. 8th International Conference on Scour and Erosion, Oxford, UK, 12-15 September 2016.
- Ferris, G., Newton, S. and Porter, M.** 2016. Vulnerability of buried pipelines to landslides. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.
- Gauthier, D., Strouth, A., and Vessely, M.** 2016. Selection criteria for snow avalanche mitigation measures considering other potential geohazards: examples from Colorado and Canadian highways. International Snow Science Workshop, Breckenridge, Colorado, 2-7 October, 2016.
- Hensold, G., Mitchell, A., Lato, M., McDougall, S., Porter, M., and Gaib, S.** 2017. Ten Mile Slide, British Columbia: Development of a retrogressive translational earth slide in a post-glacial earthflow deposit. 3rd North American Symposium on Landslides, Roanoke, Virginia, 4-8 June 2017.
- Holm, K., Jakob, M., and Scordo, E.,** 2016. An inventory and risk-based prioritization of steep creek fans in Alberta. 3rd European Conference on Flood Risk Management Innovation, Implementation, Integration, Lyon, France, 18-20 October 2016.
- Holm, K., Jakob, M., Scordo, E., Strouth, A., Wang, R., and Adhikari, R.** 2016. Identification, prioritization and risk reduction: steep creek fans crossed by highways in Alberta. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Jakob, M., Bale, S.,** McDougall, S., and Friele, P. 2016. Regional debris-flow and debris-flood frequency-magnitude curves. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Johnston, K., Waddington, B., Leir, M., and Kenny, C.** 2016. Re-introducing the benefits of terrain mapping for pipeline routing and design. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.
- Journault, J., Macciotta, R., Hendry, M., Charbonneau, F., Bobrowsky, P., Huntley, D., Bunce, C. and Edwards, T.** 2016. Identification and quantification of concentrated movement zones within the Thompson River Valley using Satellite InSAR. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Kromer, R., Abellan, A.I., Hutchinson, J., **Lato, M.,** and Jaboyedoff, M. 2016. Development of a TLS early warning system for landslides. Virtual Geology Conference, Trondheim, Norway.
- Kromer, R., Hutchinson, D.J., **Lato, M.,** and Abellan A. 2016. Rock slope pre-failure deformation database for improved risk management. 12th International Symposium on Landslides, Napoli, Italy, 12-19 June 2016.
- Lato, M.** 2016. From student to consultant: lessons learned in the first 10 years. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Lato, M.** 2016. Understanding slope stability through remote sensing. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Lato, M.,** Kromer, R., Hutchinson, D.J., and **Gauthier, D.** 2016. Understanding slope stability through remote sensing. LARAM School, Salerno, Italy.
- Lato, M.,** Kromer, R., **Porter, M., Hensold, G.,** Gaib, S., McDougall, S. 2016. Understanding landslide movement and kinematics with airborne lidar. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Lato, M.,** McDougall, S., **Jakob, M., Holm, K., Quinn, P.** 2016. Geohazard risk assessment and management." LARAM School, Salerno, Italy.
- Lato, M., Quinn, P.,** McDougall, S., **Strouth, A., Pritchard, D.,** and Sirois D. 2016. Probabilistic rock fall assessment: accounting for the effects of engineered mitigation. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Lato, M., Quinn, P., and Pritchard, M.** 2016. Geohazard asset and risk management system. 95th Annual Meeting of the Transportation Research Board, Joint Section Subcommittee on Geotechnical Asset Management - AFP10(2), Washington, DC, 10-14 January 2016.
- Lato, M., Quinn, P., Pritchard, M.,** and Sirois, D. 2016. Multi-geohazard risk assessment along railway corridors. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.

- Lato, M., Quinn, P., Strouth, A.,** McDougall, S., and **Pritchard, M.** 2016. Probabilistic rockfall hazard assessment. Invited presentation at 95th Annual Meeting of the Transportation Research Board, Subcommittee on Rockfall Management - AFP 10(1), Washington, DC, 10-14 January 2016.
- Lau, C.A.** 2016. The August 6, 2010 Mount Meager landslide. 5th Canadian Young Geotechnical Engineers & Geoscientists Conference, Whistler, BC, 29 Sept – 1 October 2016.
- Leir, M., Baumgard, A., and Johnston, K.** 2016. A staged approach for managing terrain and geohazards on new pipeline projects. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.
- McClarty, D.** 2016. Cheekeye River Fan debris flow hazard. 5th Canadian Young Geotechnical Engineers & Geoscientists Conference, Whistler, BC, 29 Sept – 1 October 2016.
- McGonigal, D., Hill, M. C., **Guzman, L.,** and Hagen, D. 2016. Ice drift in the Beaufort Sea from tracking beacons, winter 2009-2010. In Arctic Technology Conference, St. John's, NL, 24-26 October 2016. Offshore Technology Conference. doi: 10.4043/27474-MS.
- McKenna, G., and Cassie, J.** 2016. Mine closure planning, design and implementation: From hand-waving to reality. In Planning for Closure 2016: First International Congress on Planning for Closure of Mining Operations, Santiago, Chile, 22-22 November 2016.
- McKenna, G., Mann, V., Fisseha, B., Beier, N., and Olmedo, N.** 2016. The geotechnical vane strength of soft tailings compared to soft foods. In Fifth International Oil Sands Tailings Conference, Lake Louise, Alberta, 4-7 December 2016. University of Alberta Geotechnical Group, Edmonton. 11p.
- McKenna, G., Mooder, B., Burton, B., and Jamieson, A.** 2016. Shear strength and density of oil sands fine tailings for reclamation to a boreal forest landscape. In Fifth International Oil Sands Tailings Conference, Lake Louise, Alberta, 4-7 December 2016. University of Alberta Geotechnical Group, Edmonton.
- McKenna, G., Straker, J., and O'Kane, M.** 2016. Custodial transfer of reclaimed mines: barriers and opportunities. TRCR 40th Annual BC Mine Reclamation Symposium, Penticton, BC, 18-21 September 2016. 12p.
- Miller, G.,** McDougall, S., **Liu, S., Porter, M.,** and Watson, A. 2016. Validation of a hybrid empirical-numerical model for simulating landslide generated waves. 12th International Symposium on Landslides, Napoli, Italy, 12-19 June 2016.
- Mulligan, R.P., Take, W.A., and **Miller, G.S.** 2016. Propagation and runup of tsunamis generated by gravitationally accelerated granular landslides. Coastlab16: 6th International Conference on the Application of Physical Modelling in Coastal and Port Engineering and Science, Ottawa, ON, 10-13 May 2016.
- Pike, E., **Claypool, G., and Cassie, J.** 2016. The new normal: lessons learned from ten years of post-closure monitoring at Discovery Mine, Canada. In Planning for Closure 2016: First International Congress on Planning for Closure of Mining Operations, Santiago, Chile, 22-22 November 2016.
- Porter, M., Ferris, G., Leir, M., Leach, M.,** and Haderspock, M. 2016. Updated estimates of frequencies of pipeline failures caused by geohazards. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.
- Roberge, L., Ferris, G. and Weatherly, H.** 2016. Past bank erosion as a guide for bank erosion prediction at pipeline crossings. 11th International Pipeline Conference, Calgary, Alberta, 26-30 September 2016.
- Ruksys, A., Dickinson, S.J.E., Logue, C., Dufault, D., and Savigny, W.K.** 2016. Development of a geological model and interpretation of soil engineering properties at the site of a tailings impoundment area in Northern British Columbia. In Proceedings of the 69th Canadian Geotechnical Society Conference: history and innovation, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016. Canadian Geotechnical Society, Richmond, BC. pp. 1-10.
- Sharma, J., Francioni, M., Stead, D., Onsel, E., Clague, J., **Brideau, M.-A.,** and Busler, J., 2016. Monitoring landslides in pipeline corridors using a combined satellite-based InSAR geomechanical modelling approach. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Spross, J., Johansson, F., Uotinen, L. K. T., & **Rafi, J. Y.** 2016. Using observational method to manage safety aspects of remedial grouting of concrete dam foundations. Geotechnical and Geological Engineering, 34(5): 1613-1630.
- Strouth, A.** 2016. An example of mapping geotechnical assets for Alberta Transportation. 95th Annual Meeting of the Transportation Research Board, Engineering Geology Committee Meeting (AFP10), Washington, DC, 10-14 January 2016. Invited presentation.

- Strouth, A., Lato, M., Zaleski, M., and Holm, K.** 2016. Probabilistic geohazard assessment: accounting for engineered mitigation. 67th Highway Geology Symposium, Colorado Springs, CO, 11-14 July 2016.
- Sturzenegger, M.,** Keegan, T., and Simoes, T. 2016. Kettle Falls Railway ground hazard relative risk assessment. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- Take, W.A., Mulligan, R.P., Stevenson, E.P., and **Miller, G.S.** 2016. Physical modelling of landslides into reservoirs: Effect of capillarity on rheology of granular landslide at impact. 12th International Symposium on Landslides, Napoli, Italy, 12-19 June 2016.
- Van Hove, H.** 2016. Debris flow effects on steelhead trout habitat in Shovelhead Creek. 5th Canadian Young Geotechnical Engineers & Geoscientists Conference, Whistler, BC, 29 Sept – 1 October 2016.
- van Veen, M.,** Hutchinson, D.J., **Gauthier, D., Lato, M.,** and Edwards, T. 2016. Classification of rockfall patterns using remote sensing data for hazard management in Canadian rail corridors. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.
- van Veen, M.,** Hutchinson, D.J., **Lato, M., Gauthier, D.,** and Edwards T. 2016. Building a rockfall database using remote sensing: applications for hazard management in Canadian rail corridors. 5th Canadian Young Geotechnical Engineers & Geoscientists Conference, Whistler, BC, 29 Sept – 1 October 2016.
- Whittall, J.,** McDougall, S., and Eberhardt, E. 2016. Landslide risk management in operating open pit mines. 1st International Conference on Risk and Resilience Mining Solutions, Vancouver, BC, 14-16 November 2016.
- Zaleski, M., Roberge, L., Scordo, E., and Lee, R.** 2016. Identification and risk-based prioritization of flood hazards on highways in Alberta. 69th Canadian Geotechnical Society Conference, GeoVancouver 2016, Vancouver, BC, 2-5 October 2016.