ENGINEERS AND GEOSCIENTISTS BRITISH COLUMBIA

SEPTEMBER/OCTOBER 2018

INNOVATION

TAMING SOUND

IRELAND'S PYRITIC HEAVE CRISIS

2018 PRESIDENT'S AWARDS RECIPIENTS

DO YOU NEED A DOCUMENT RETENTION POLICY?

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4 GREAT REASONS TO PURCHASE LIFE INSURANCE

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You can purchase enough life insurance to cover your entire mortgage, so your family wouldn't have to worry about making mortgage payments. In fact, using life insurance to cover your mortgage can be more cost-effective than mortgage insurance.

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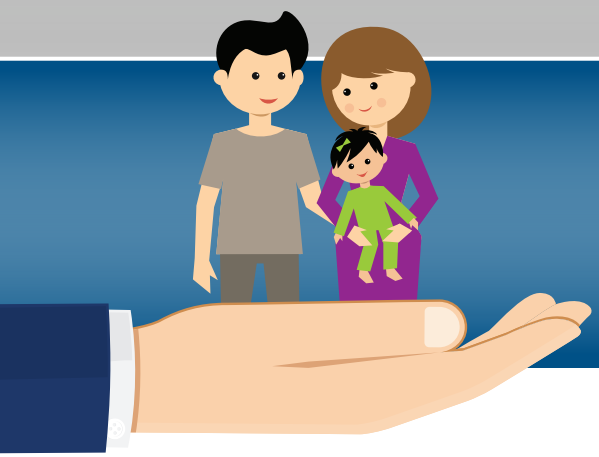

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† www.moneysense.ca, "The real cost of raising kids," April 15, 2015.
* Effective April 1, 2018.
** See full First-Time Applicant Offer eligibility and offer details at www.manulife.com/springfree.

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COVER STORY

TAMING SOUND

As a discipline, acoustic engineering is right at home next to a whole range of engineering and construction projects. But it was recently put to the test for a new autism centre—built about one kilometre from a runway that lands some of the loudest aircraft in the world.

IRELAND'S PYRITIC HEAVE CRISIS

Experts in Ireland asked for help from BC geologists to figure out why so many relatively new houses were experiencing wall cracks and foundation buckles.

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DOCUMENT RETENTION POLICIES

If an engineer or geoscientist needs a document retention policy, what would it look like, and how do they begin creating one?

NEWS / DEPARTMENTS

COMMENT

OTHER

ON THE COVER

Mark Bliss, P.Eng., and Katrina Scherebnyj, P.Eng., of Vancouver's BKL Consultants Ltd., take sound pressure measurements at the Pacific Autism Family Centre, situated just east of the Vancouver International Airport. PHOTO: MIKE CRANE

ENGINEERS & GEOSCIENTISTS
BRITISH COLUMBIA

Caroline Andrewes, P.Eng., CPA, CMA
President
president@egbc.ca

THE OBLIGATION AND PRIVILEGE OF SELF-REGULATION

We often refer to self-regulation as a privilege. But what does that mean, and why do we work so hard to protect our regulatory framework?

The concept of *regulation*—an external authority ensuring performance standards—is relatively commonplace and well-understood by the public. But the concept of *self-regulation* may be less clear. Self-regulated bodies sometimes have the reputation of being self-promoting and overly member-focused, and occasionally prone to protectionism. In some cases, this reputation is deserved.

Self-regulation, when done well, means that the people engaged in practice also commit to ensuring the practice itself is competent and ethical, and accomplishes what it's designed to accomplish. The people that follow the highest standards in their work are also the people making sure these standards are upheld across the entire profession.

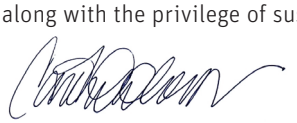
Self-regulation is ideally suited for our professions. Our practice is complex, and spans a range of sectors, regions, and technologies. Entrusting regulation to those that practice our professions means regulation can be relevant and agile. It means that we have the skills and understanding to respond to factors influencing practice, and find innovative solutions when conditions change. Self-regulation promotes a professional culture where members protect our common mandate and the public interest—not each other.

Self-regulation is also ideally suited to our membership. For us, the hard work of regulation—evaluating applicant credentials, auditing or investigating member conduct, developing new standards for emerging risks or areas of practice—is performed by our 1,200 volunteers, because they believe in the profession and take the privilege and obligations of self-regulation seriously. Our volunteers donate their time because they see the greater value it brings to their professions.

Members can feel comfortable volunteering their time with the association, because you have a voice in its direction and the governance of our profession. The task of protecting the public is placed in your care—but so is the privilege of nominating and electing Council and giving feedback and insight on the work of the association. This model of self-regulation has been the foundation of many professions, including doctors, lawyers, and accountants, for generations. And it's served engineers and geoscientists for nearly 100 years.

It's important for us to always strike this balance between obligations and our privileges. It's also important for our members to continue to have a voice in the direction of their professions and the association. Without this voice, members risk becoming detached from the path of their own professions, and the model of self-regulation weakens.

As I prepare to step down as President and hand the task to my successor, my hope is that we all continue to invest in the obligation of the best professional practices, along with the privilege of sustaining those practices for generations to come.



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ENGINEERS AND GEOSCIENTISTS BRITISH COLUMBIA
Suite 200 - 4010 Regent Street, Burnaby, BC Canada V5C 6N2
Tel: 604.430.8035 Fax: 604.430.8085
Email: info@egbc.ca Internet: egbc.ca
Toll free: 1.888.430.8035

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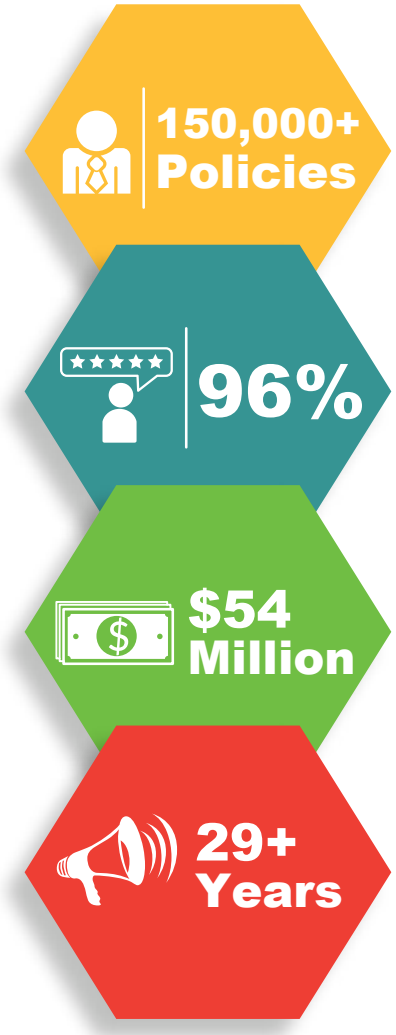
WHY DO **THOUSANDS** OF Engineers and Geoscientists **INSURE WITH PARK INSURANCE**



Power of Numbers

Over 150,000 policies issued to the Association's members since the program's inception.

Customer Service

96% claims satisfaction rating from members of Engineers & Geoscientists BC.

Claims Advocacy

Over $54 million in claims payouts to the Association's members.

Insurance Expertise

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Photo: Mike Kononov on Unsplash

TASK FORCE LAYS OUT APPROACH TO CORPORATE REGULATION

The development of a model for the regulation of organizations practising engineering and geoscience in BC has reached its next stage.

Since the Fall of 2015, Engineers and Geoscientists BC's Advisory Task Force on Corporate Practice has been leading an evaluation of engineering and geoscience practice by corporate entities, and corporate regulation as a means to enhance public protection. In Canada, the practice of engineering and geoscience by companies is regulated in every province except BC and Quebec.

In Phase 1, the task force considered whether the association should pursue regulation of organizations practising engineering and geoscience in BC. This work concluded in April 2017 with a recommendation to Council to pursue regulatory authority over corporate practice (outlined in the task force's Phase 1 report). Council accepted the task force's recommendations and directed it to proceed with the second phase of the initiative, with the goal of recommending a model for corporate regulation.

The task force concluded Phase 2 with consensus on a recommended model for corporate regulation, presenting its report to Council in June. That report is now available online.

AN APPROACH TO CORPORATE REGULATION

In developing options for corporate practice oversight, Council directed the Advisory Task Force on Corporate Practice to recommend a model which:

- demonstrates positive impacts to protect the public interest and the environment;
- provides benefit to the regulated organizations and professionals that they employ; and
- is scalable to accommodate the size and nature of organizations and be administratively efficient.

With this direction, the task force identified seven key components to their recommended approach for regulating corporate practice. The proposed model would address the following:

1. Regulatory Coverage: The corporate practice program should include all organizations in the private and public sectors that provide products or services in BC requiring the practice of professional engineering and professional geoscience.

2. Regulatory Model: A corporate regulatory model should be based on three pillars:

a. Ethics
b. Quality Management
c. Professional Development.

3. Documentation: All regulated organizations must have a Professional Practice Management Plan (PPMP) in place and available for review upon request by Engineers and Geoscientists BC.

4. Compliance and Enforcement: A range of mechanisms need to be available to the association to deliver effective and proportional compliance and enforcement of corporate practice requirements including audits, production of documents, public notices, fines, negotiated consent orders, investigations, a public complaint process, and practice restrictions.

5. Cost Recovery: The corporate practice program should be funded through a cost-recovery model that is scaled in proportion to the number of engineering and geoscience professionals that are employed by an organization and that are licensed to practise in BC.

6. Legislation: The current provisions in the *Engineers and Geoscientists Act* with respect to Certificates of Authorization should be revised as appropriate to reflect the recommendations above.

7. Organizational Quality Management Program: The Organizational Quality Management Program should continue as a value-added and voluntary certification program.

In its report, the task force recommended the implementation of a quality management focused model that is consistent with other regulatory jurisdictions, but which represents a 'made in BC' approach that reflects the province's unique situation.

NEXT STEPS

At Council's direction, the task force will proceed with Phase 3 of its work. This will include undertaking consultation with members to further examine the appropriate level of regulatory oversight for sole practitioners. It will also include developing a business plan with timelines, and identifying resource requirements to implement the regulatory model approved by Council.

For implementation of the corporate regulation model to occur, the provincial government will also first need to amend the *Engineers and Geoscientists Act* to grant Engineers and Geoscientists BC regulatory authority over corporate entities.

Full details of the regulatory model recommended by the task force are available in the Phase 2 report to Council. The report, as well as background information and other resources can be found on our Corporate Practice webpage, at *egbc.ca/About/Initiatives-and-Consultations/Corporate-Practice-in-BC*.

ANNUAL REPORT NOW AVAILABLE

The Engineers and Geoscientists British Columbia 2017/2018 Annual Report is now available by both paper copy and online PDF version.

The 2017/2018 Annual Report outlines our progress towards the goals set out for the first year in our three-year Strategic Plan. It also summarizes the work of our volunteers, Council, and staff during our reporting year, July 1, 2017 to June 30, 2018.

This report demonstrates our progress through key performance indicators, supporting our values of transparency and accountability. It includes overviews of Engineers and Geoscientists BC programs and activities, reports from the President and CEO, as well as our audited financial statements.

To obtain an electronic copy of the Annual Report for this year and previous years, visit *egbc.ca/Annual-Report*. To request a paper copy of the Annual Report, email *info@egbc.ca*, or call 604.430.8035 or 1.888.430.8035 (toll-free Canada-wide).

COUNCIL APPROVES 30 BY 30 ACTION PLAN FRAMEWORK

Engineers and Geoscientists BC Council has voted to endorse a plan that asks members for feedback regarding the association's 30 by 30 strategy.

Phase 3 of the work plan provides an opportunity for members to participate in and guide the implementation of the 30 by 30 initiative. '30 by 30' is a goal to raise the percentage of newly licensed engineers who are women to 30 percent by the year 2030. Engineers and Geoscientists BC has been actively working towards this goal since 2013, and the now-underway 30 by 30 action plan further supports this goal.

At its September 7 meeting, Council endorsed the strategy and Phase 2—the consultation phase—of the three-phase work plan. This phase asks members for feedback on the strategy the association should use to reach the 30 by 30 goal. The first phase of the process focused on research and data collection.

To learn more about the strategy and provide your feedback, visit *egbc.ca/30-by-30*. Members will also have a chance to provide feedback during the annual conference on October 18 and 19.

The feedback from members is intended to help form the completed strategy and creation of an action plan. Once Phase 2 is completed by the end of October 2018, the association will continue into Phase 3, which involves identifying key actions, establishing key goals and achievements, and estimating the necessary resources needed to place the plan into action. Once this final phase is completed in November 2018, the findings will be presented to Council and the action plan itself is expected to begin in 2019.

MEMBERS EXPRESS CONCERN ABOUT PROFESSIONAL RELIANCE REVIEW RECOMMENDATIONS

Changes are coming to the regulation of a number of professions in BC, and many engineers and geoscientists are concerned about the implications these proposed changes could have on professional practice and the governance of the professions.

Last October, the BC government initiated the Professional Reliance Review to examine the legislation governing qualified professionals working in the natural resource sector, and the role their professional associations play in upholding the public interest. Engineers and Geoscientists BC was one of five professional regulators subject to the review, along with the regulators of agrology, applied science technology, applied biology, and professional forestry.

On June 28, the BC Ministry of Environment and Climate Change released its final report from the review. The report includes a number of proposed recommendations, some of which would introduce sweeping changes to the governance of regulators like Engineers and Geoscientists BC. Members have expressed concerns about the proposed changes, and what they could mean for professional practice within the natural resource sector and beyond.

WHAT CHANGES ARE BEING PROPOSED?

The report makes 121 recommendations in total, under the categories of Professional Governance; Laws, Regulations and Authorizations; First Nations Engagement; Public Confidence; Natural Resource Information; and, Ministry Staffing Levels and Resources.

While some of the proposed reforms are positive and align with the association's recommendations for improving the professional reliance model, others are much broader, and could impact Engineers and Geoscientists BC's ability to function effectively as a regulator.

Two overarching recommendations concerning professional governance are likely to have the biggest impact. The first recommends the creation of an independent Office of Professional Regulation and Oversight to oversee the five associations subject to the review. The second proposes that government standardize 10 elements of professional governance across the five associations through umbrella legislation.

Embedded within these two recommendations, the report suggests several other changes to the governance of professional regulators, including the potential elimination of Council elections. The new Office would also be given broad powers to appeal independent decisions by regulators, including registration and discipline decisions.

WHAT MEMBERS ARE SAYING

In a survey conducted by Engineers and Geoscientists BC in August, the majority of respondents (85%) said they were aware of the professional reliance review, and 79% indicated they were familiar with one or more of the specific changes being proposed.

However, when asked if they supported the proposed changes, a total of 78% of respondents indicated they opposed the changes. In feedback provided to Engineers and Geoscientists BC, members have identified several common areas of concern.

Oversight Without Technical Expertise

Under the proposed recommendations, the new Office of Professional Regulation and Oversight would research and develop best practices for professional governance, such as those related to investigations and codes of conduct; the appropriateness of contingency fee arrangements; guidance on thresholds for incompetent practice; and, guidance on determining sanctions.

WHAT'S HAPPENING?

Following a review of professional reliance in the natural resources sector, the Province is seeking to implement a number of recommendations that will result in changes to the current regulatory model for several professions, including engineering and geoscience.

WHY IS THIS IMPORTANT?

The recommendations would introduce sweeping changes to the governance of regulators like Engineers and Geoscientists BC, with impacts on how BC engineers and geoscientists are regulated, in particular, the creation of an additional layer of oversight: the Office of Professional Regulation and Oversight.

WHAT IS BEING DONE AT THIS TIME?

Engineers and Geoscientists BC is participating in a consultation process with government where we are raising concerns regarding the proposed changes, and actively working to ensure the legacy of effective self-regulation is not lost. We are also proactively engaging the other impacted regulators, government officials, MLAs, and ministers regarding this matter.

Watch our video on the Professional Reliance Review and its impacts on the regulation of BC engineers and geoscientists: *egbc.ca/professional-reliance.*

The Office would also be given broad powers to appeal independent decisions by regulators, including registration decisions. Members have voiced concerns about the unintended consequences of creating an oversight body without technical expertise. Under this model, a body without any technical expertise could potentially determine that someone should be admitted to the profession when an independent committee of peers determined that they did not meet the standard.

One-Size-Fits-All Approach

The new Office will be primarily focused on the natural resource sector, which has raised questions about its overall effectiveness for professions such as engineering. Just 20% of BC engineers and geoscientists work in the natural resource sector, but the other 80% would still be subject to the direction this office, which could create risks by marginalizing Engineers and Geoscientists BC's ability to regulate and support all members to the same extent.

Fundamental Changes to the Culture of Self-Regulation

The proposed changes suggest a new governance structure for Engineers and Geoscientists BC, and a potential elimination of Council elections in favour of a merit-based appointment system.

Members who participated in our survey voiced strong support for maintaining elections of Council members. When asked if they felt that "electing members of Council is critical to maintaining the independence of our professions," a total of 85% of respondents agreed. Conversely, when asked if they felt it was "reasonable for Council to be appointed by government, instead of being elected by members," just 7% of respondents agreed.

ACTION AND NEXT STEPS

Engineers and Geoscientists BC shares many concerns expressed by members, and is working to find the answers to a number of unanswered questions regarding the effectiveness of the new governance model proposed and possible unintended consequences of implementation. At present, the Office's mandate, funding structure, and governance structure have yet to be defined. However, what is known is that the creation of a new office has the potential to add cost and an additional layer of bureaucracy, yet no clear indication of what improvements it would contribute to the professional reliance model.

Engineers and Geoscientists BC is currently participating in a consultation process with government where we are raising concerns regarding the proposed changes. We are also proactively engaging the other impacted regulators, government officials, MLAs, and ministers regarding this matter.

Members are asked to stay informed on this issue by checking our website for the latest information, watching for updates, and staying connected with your fellow professional colleagues.

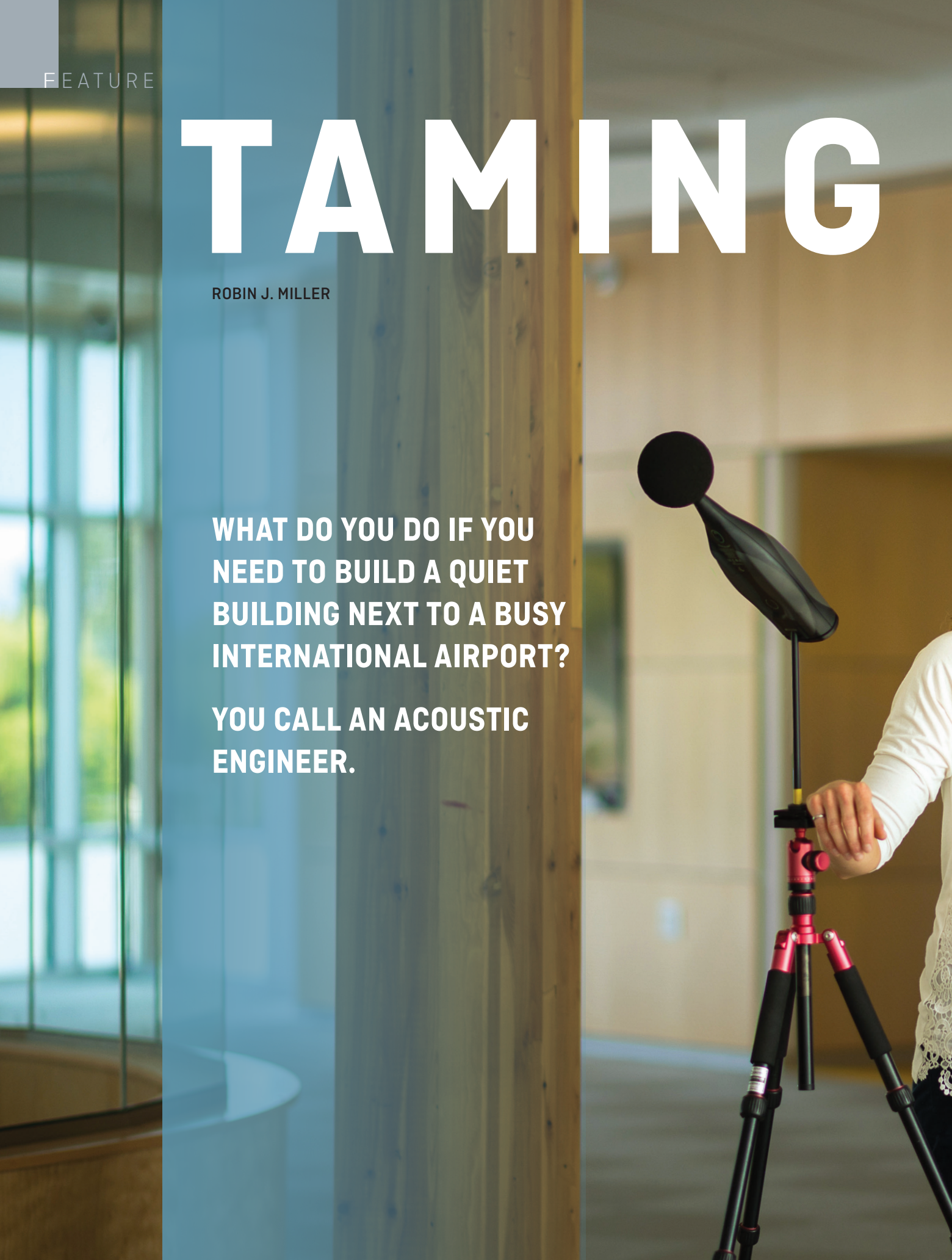
Engineers and Geoscientists BC will be advising of developments as they occur; in the meantime, more information, including an FAQ, is available through our Professional Reliance page, *egbc.ca/professional-reliance*.

TAMING

ROBIN J. MILLER

WHAT DO YOU DO IF YOU NEED TO BUILD A QUIET BUILDING NEXT TO A BUSY INTERNATIONAL AIRPORT?

YOU CALL AN ACOUSTIC ENGINEER.



SOUND

Mark Bliss, P.Eng., and Katrina Scherebnyj, P.Eng., of BKL Consultants Ltd.

In 2011, the World Health Organization released a report that analyzed city noise from a variety of sources, including planes, trains and automobiles, for possible links to human health and well-being. There is now no doubt that noise contributes to a range of conditions, including cardiovascular disease, sleep disruption, tinnitus, cognitive impairment in children, and just plain annoyance. In fact, the report says, in Europe alone, at least one million healthy years of life are lost each year due to noise pollution—and if you add in industrial noise, that number would be even higher. The report also ranked traffic noise second only to air pollution among environmental threats to public health, and pointed out that, unlike other forms of pollution, noise pollution is increasing.

Bottom line: noise can be more than an irritating fact of life. It can lead to disability and, in some cases, to life-threatening illness.

The Pacific Family Autism Centre in Richmond, BC, includes clinics, labs, classrooms, a daycare, observation rooms and research spaces. PHOTO: MIKE CRANE

"There is a definite correlation—denied in the past, but proven now—between noise and things like higher blood pressure and heart failure," says Mark Bliss, P.Eng., one of the principals at Vancouver's BKL Consultants Ltd., which specializes in acoustical engineering. "Studies have also shown other effects, such as the fact that students learn less in classrooms with poor acoustics." And the effects can spread even farther. The European Commission, for example, has identified that the "effects of exposure to noise impact EU economies. They lead to a loss of productivity of workers whose health and well-being are affected by noise, put a burden on health care systems and cause a substantial depreciation of real-estate value."

In response, some countries, particularly in Europe, have developed strict regulations to reduce noise pollution caused by road, rail and airport traffic, industry and construction. Regulations in Canadian jurisdictions are not nearly as well developed. "We see the success of so many projects here compromised by poor acoustics," says Bliss, "with little opportunity to remedy after construction." That does not mean, however, "that it's all negative. Regulators in BC may not be thinking about it much, but there are owners and managers who value acoustics and they may choose to design their new projects to a higher acoustical standard even than typically adopted in Europe."

The Pacific Autism Family Centre is a prime example. Finished in 2016, the centre is a three-storey, 60,000 square foot facility in Richmond purpose-built to provide a range of services, including

counselling, assessment, and treatment, to British Columbians (primarily children and youth) with Autism Spectrum Disorder.

A neurodevelopment disorder that is typically detected in early childhood, Autism Spectrum Disorder (ASD) causes impairments in communication skills and social interactions, often combined with repetitive behaviours and restricted interests or activities. According to a 2018 Public Health Canada survey, one in 51 children ages six to 18 in British Columbia currently has ASD.

Property management entrepreneurs Sergio Cocchia and Wendy Lisogar-Cocchia spearheaded the development of the Pacific Autism Family Centre in response to their own experiences trying to find services for their son, who is on the autism spectrum. "Twenty years ago," says Sergio Cocchia, "when our son was first diagnosed, it was hard to find local supports and therapies. We started talking to the BC government and to private donors because we wanted BC families to have access to the services they need."

With both government and private-sector support lined up for a Vancouver-area centre, the next hurdle was finding a suitable location—and that's where the project, now under the management of the Pacific Autism Family Centre Network, co-founded by the Cocchias, hit a snag. The non-profit found a great piece of land, but in a less-than-ideal location: along a very busy road and under the flight path of a well-used runway at the Vancouver International Airport. The level of noise produced in that location would be challenging for any new construction to deal with, but for a centre devoted to people with ASD, many of whom find noise unpleasant or distracting, and sometimes even shocking or terrifying, it could have been a disaster. Thanks to Katrina Scherebnyj, P.Eng., of BKL Consultants, however, the Centre is a resounding success. "It's fantastic," says Cocchia. "Incredibly quiet. You'd swear you're in the middle of the country somewhere."

Acoustical engineering is the branch of engineering devoted to dealing with such issues as noise control, sound isolation, vibration isolation, speech privacy or intelligibility, and reverberation control. This is especially important in places like concert halls and other performance spaces, to ensure productions sound as their creators intended, but also in places like doctors' offices or restaurants. Without acoustical engineering, any

CONTINUES ON NEXT PAGE...

space might end up sounding harsh or boomy. “A really reverberant space,” says Bliss, “can be uncomfortable and make it hard for us to understand each other. The correct selection and placement of materials can create an environment where we can enjoy having a conversation.”

Most acoustical engineers start as mechanical, civil, or electrical engineers, then later specialize in the art and science of designing, analyzing, and controlling sound, often because of a long-standing interest in listening to or making music and an appreciation of the difference the right amplification system or performing space can make onto how that music sounds. Scherebnyj’s trajectory was slightly different.

After a bachelor’s degree in engineering physics and a master’s in mechanical engineering, she realized that a fourth year acoustics class was still resonating in her brain. “I realized I like the human side of acoustics,” says Scherebnyj. “Obviously I like math and physics, too, but quantum physics is not really a day-to-day, tangible area. Noise, on the other hand, affects everyone. I like the idea that you can make a difference and people would not even know you’re making a difference.” They might live in a wonderfully quiet apartment, for example, or be sheltered from what would otherwise be obtrusive noise from a road construction project, and never make the connection between their comfort and the work of an acoustical engineer.

Scherebnyj began design work on the Pacific Autism Family Centre with NSDA Architects and consulting engineers MMM Group Ltd. in 2014. “There were no specific acoustical criteria for this project,” she says, “but there was a clear understanding that some people with ASD found noise very challenging. At the same time, there was not a lot of research about how to make spaces comfortable for people with ASD—just a bit of research available from the UK where they looked at schools for children with ASD. This research was interesting, though, because it showed that their needs were similar to people who are deaf or hard of hearing for low background noise and short reverberation time.”

Scherebnyj started by taking numerous 24-hour on-site noise measurements. “In this location,” she says, “there can be aircraft almost directly overhead. At peak periods, it’s over 85 dBA—which is *loud* —every three minutes, and the loud rumbling lasts for 30 seconds each time.” To help control that aircraft noise, plus the ongoing hum of a busy street, Scherebnyj suggested a number of general solutions

CONTINUES ON PAGE 37...

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IRELAND'S PYRITE HEAVE CRISIS

GEOSCIENCE EXPERTISE HELPS CONTRACTORS AND ENGINEERS WITH PROBLEMATIC ROCK

FIGURE 1: Distress in column and wall of heave-damaged residence.

For the past several years, government officials in Ireland have been trying to manage one of the country's most significant residential construction crises in memory. Beginning about a decade ago, many relatively new homes started to experience mysterious cracking and buckling in walls and foundations. In some cases, the damage became so severe that residents felt compelled to abandon their homes. Recent reports suggest that up to 6,000 homes may have been affected in Dublin alone, and the countrywide number could be much higher. While the number of damaged homes grew, experts struggled at first to identify the cause. Fred Shrimer, P.Geo., was part of a team of BC geologists sent to investigate.

FRED SHRIMER, P.GEO.

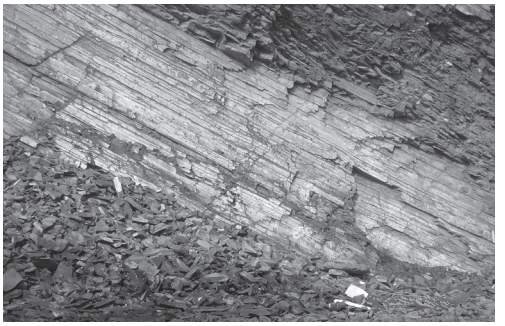


FIGURE 2: View of a portion of a quarry face. Exposure here measures about 10 metres across

FIGURE 3: Crushed rock aggregate from quarry

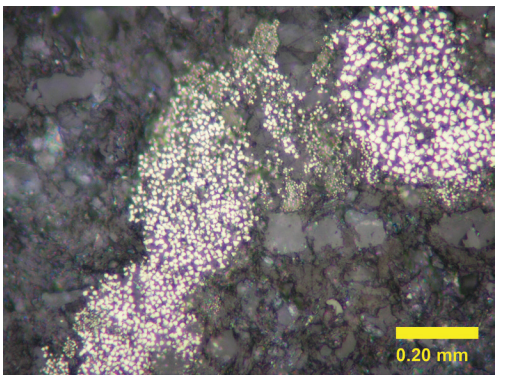


FIGURE 4: Framboidal pyrite seen in thin-section, in reflected light, magnification 500x.

Beginning in 2007, problems were being noticed in residential housing estates in Dublin, Ireland. Concrete floor slabs that had been constructed on rock fill aggregates were developing cracks, leading to wall and doorframe distortion (Figure 1). Contractors and engineers who were involved in determining what was happening were trying to understand the nature of the problems, which was affecting hundreds of homes in the Dublin area that were only a few years old.

After initial investigations ruled out slab settlement as a cause of the damage, the focus turned towards evaluating the possibility that structural fill aggregates—that is, the crushed and processed quarried rock supporting the slabs—had produced heave in the structures. (Historically, the aggregates industry was familiar with using quarried limestone within the Dublin area and had experienced no issues with heaving aggregate previously.) Golder Associates' Dublin-area office sought expertise in engineering geology relating to aggregates from its Vancouver office, which is one of its centres of excellence in the field of aggregates geology and engineering.

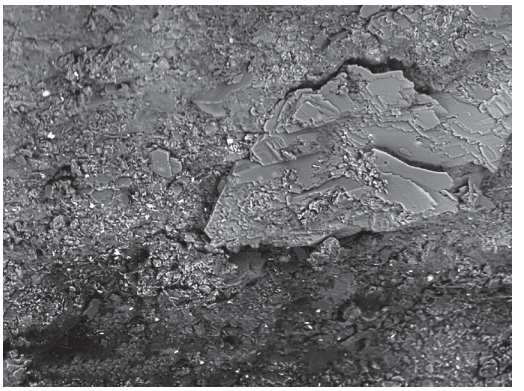
The Vancouver branch's involvement with these investigations began with a petrographic examination of samples of aggregate taken from beneath the slabs; these samples were subjected to detailed geologic characterization in a materials engineering laboratory. This was supplemented by a program of physical testing to determine the engineering properties of the rock.

GEOLOGICAL AND ENGINEERING INVESTIGATION AND CHARACTERIZATION

Golder's geological characterization of the rock determined that the aggregate was actually composed of calcareous mudstone rather than—as had been assumed—limestone. Both of these sedimentary rock types occur within the Dublin Basin, a geological structure dominated by Paleozoic strata that range from horizontal to moderately dipping beds of sedimentary rock. These formations (Figure 2) typically range from limestone to muddy limestones to mudstones and siltstones, reflecting variable depositional sequences that are normally seen in shallow basins that receive variable influxes of terrigenous sediment.

Mudstone may occur as very thin strata and fingers within many of the Dublin Basin limestone units, but dominates other units as the primary rock type. This latter case was the situation in a new quarry that had opened north of Dublin. The mudstone units that characterized the formations extracted in the quarry were found to be the source of the problematic aggregates; these rocks became the focus of numerous subsequent investigations.

Golder's Vancouver team of geoscientists, supported by laboratory staff, undertook evaluations of the crushed-rock aggregate samples that not only enabled a diagnosis of the geological nature



Left, Figure 5: Mudstone particle broken open to expose white gypsum crystals

Right, Figure 6: Backscatter image in Scanning Electron Microscope of gypsum crystals in mudstone, magnification 1000x

of the rock, but also provided a description of the mechanism of its behaviour that explained what was being observed in hundreds of homes in Dublin.

The crushed-rock aggregate samples were found to consist of mudstones (Figure 3) that ranged texturally from very fine-grained claystone to coarser siltstone. Almost universally, these rocks contained some calcite—about 10 percent to 40 percent. Further, the mudstones were found to transition to muddy limestones, and in rare cases, to a fairly pure limestone. The rock was generally dark grey in colour.

In addition, the mudstone typically included small amounts of pyrite, present in a very fine-grained form that was often 'framboidal' (from the French word for 'raspberry', for its appearance) in form. This aspect of the rock's nature was only able to be detected by means of examination of polished thin-section mounts (Figure 4) viewed in reflected light under a petrographic microscope.

The engineering properties of the mudstone aggregate samples were consistent with a rating of 'poor' quality, since the material exhibited excessive losses in basic durability index tests such as the Los Angeles Abrasion, Micro-Deval abrasion, soundness, degradation, and others. Its absorption was high, and it had petrographic number values that ranged from the low 200s to about 400. The rock was quite soft and easily broken with a hammer, and for samples that had been taken from in-service conditions (i.e., from under the concrete slabs), secondary gypsum was consistently found both coating the aggregate particles and on interior plane surfaces (Figure 5).

To support the evaluations described above, further in-depth analyses were undertaken, owing in part to the very fine-grained nature of these sedimentary rocks, and the 'fragile' character of some of the minerals of interest. These included Scanning Electron Microscopy (Figure 6), X-Ray Diffraction with Rietveld refinement, element mapping and other chemical analytical procedures.

The geological and engineering evaluations conducted on the aggregate samples helped to determine that the cause of the damage observed in the Dublin houses was heave (meaning upward displacement of the concrete floor slabs); this came to be known as 'pyritic heave'. The heaving of the concrete slabs, their consequent cracking, and the distortion of walls, windows, doors and embedded pipes was due to the expansion of the compacted mass of mudstone aggregate. It was found that the mudstone, a weak and fissile rock, was susceptible to moisture and air penetration, which would oxidize the fine-grained and framboidal pyrite rapidly, which in turn generated sulphuric acid. The sulphuric acid would combine with calcium ions from the calcite, also present in the rock, to produce gypsum, which expanded when it came into contact with moisture.

The net effect of the gypsum growth within the aggregate particles was to exert outward and upward pressure, which

displaced the concrete slabs. The displacement of the slabs affected the walls placed upon them, distorting door and window frames, and rendering many of them inoperable.

EXPENSIVE CONSEQUENCES

During the initial encounters with pyritic heave in Dublin, the solution for the problems in these houses consisted of removal of the concrete slabs and removal of all the structural fill aggregate, which was typically about 1-1.5 metres thick. This remediation was a time-consuming and costly effort, requiring the residents to be relocated for a few months. All told, restoration costs were the order of €60,000 to €100,000 (about C$90,000 to C$150,000) per house.

Up to 6,000 homes in the Dublin area were believed to be affected. Litigation was initiated in which the developer sued the quarry owner for damages of €60 million (about C$90 million). A series of subsequent lawsuits was brought against the quarry owners on the basis of the use (or suspected use) of the same rock from the same quarry as structural fill in numerous other buildings. Most of these were residential, although other types of structures were also involved.

The legal actions taken against the quarry owner required significant effort, time, and expenditure, as proceedings were heard before the High Court. The initial case, *Menolly Homes v Irish Asphalt*, lasted 155 days and ended with an out-of-court settlement in 2011. The second case, *James Elliot Construction v Irish Asphalt*, concluded after nearly 60 days, with a judgment rendered in favour of the plaintiff.

WHAT ARE THE IMPLICATIONS?

The implications of these events range from 'little deal' to 'big deal': 'little' in the sense that, overall, the quarries that were the subject of these issues represent only a small proportion of the aggregate supply in Ireland. However, the implications were 'big' in the sense that the people affected by this issue had to deal with stress, uncertainty, unanticipated testing, repair and legal costs, and—in many cases—received no support from insurers or others as they struggled to understand what was happening to their properties, who was responsible, and so on.

One of the seemingly obvious implications is that the application of a small amount of additional effort in the correct geologic characterization of something as ordinary as rock fill aggregate might have avoided the particular quarry being opened. Had better

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2018 PRESIDENT'S AWARDS RECIPIENTS

Our annual President's Awards recognize excellence in professional, technical and community service by Engineers and Geoscientists BC members. Here, we honour eight recipients in the following categories: the R.A. McLachlan Memorial Award, the C.J. Westerman Memorial Award, the Meritorious Achievement Award, the D.C. Lambert Professional Service Award, the Young Professional Award, and the Award for Teaching Excellence in Engineering or Geoscience Education.

DR. ELIZABETH CROFT, P.ENG., FEC
R.A. MCLACHLAN MEMORIAL AWARD

Dr. Elizabeth Croft has contributed significantly to the advancement of robotics in the field of engineering and human-robot interaction for over 25 years. Elizabeth is the Dean of Engineering at Monash University in Australia and previously held the position of Senior Associate Dean, Faculty of Applied Sciences at UBC. There, she was director of the Collaborative Advanced Robotics and Intelligent Systems Lab, where she led large-scale collaborative research projects with major industry partners to investigate how robotic systems efficiently operate in partnership with humans. She has authored numerous highly-cited peer-reviewed articles on human-robot interaction, and the application of her work has been instrumental in advancing robotics in collaborative settings.

Dedicated to her professional community, and the next generation of engineers, Elizabeth has an exceptional record of accomplishment in advancing women's representation and participation in engineering. Most recently, as Natural Science and Engineering Research Council of Canada (NSERC) Chair for Women in Science and Engineering, she worked with academic, industry, and government stakeholders on strategies to improve women's participation in STEM disciplines. Her outstanding contributions to research and education have been recognized with numerous awards, including the NSERC Accelerator Award, and the Women of Distinction Award in Education, Training, and Development from the Vancouver YWCA. Elizabeth was also recognized by the association in 2005 for her remarkable professional service contributions.

A creative visionary and inspirational role model, Elizabeth is unlocking the potential for people and robots to work together productively and safely.

MIKE MILES, P.GEO.

C.J. WESTERMAN MEMORIAL AWARD

Mike Miles specializes in hydrology and fluvial geomorphology, with experience throughout western and northern Canada. His remarkable professional career spans four decades and includes working for the Terrain Sciences Division of the Geological Survey of Canada and the BC Government Resource Analysis Branch before incorporating his own consulting firm. He has completed over 400 projects ranging from detailed hydro-technical analyses to reviewing the adequacy of provincial and national data collection programs.

Contributing to hundreds of technical reports and peer-reviewed papers, Mike has significantly advanced our understanding of how river channels evolve over time, using historical information to improve hydrotechnical design and develop river restoration strategies. Committed to giving back to the professions, he is actively involved with the Canadian Water Resources Association, River Restoration Northwest, as a guest lecturer and student mentor, and was an advocate for expanding the science knowledge base prior to the renewal of the Columbia River Treaty. He also contributed to the standard reference guide *Hydrology of Floods in Canada*, and has assisted organizations such as Fisheries and Oceans Canada and First Nations to address the downstream effects of placer mining and river regulation.

Generous in spirit and with his time, Mike gives back to his community by volunteering with many organizations over the years including the UBC Varsity Outdoor Club, Mountain Equipment Co-op, the Upper Fraser Fisheries Conservation Alliance, and the South Island Sea Kayaking Association.

Mike's unwavering commitment to high standards of practice is helping to improve river-related designs and the public's understanding of how geoscience can improve management strategies for streams and riparian areas.

MIKE WEI, P.ENG.
MERITORIOUS ACHIEVEMENT AWARD

A leader in groundwater regulation and policy development, Mike Wei has made profound contributions to the protection of groundwater resources in BC. Formerly the head of Aquifer and Watershed Science for the BC Ministry of Environment and Climate Change Strategy, Mike was a technical lead in developing essential groundwater legislation, including the *Water Sustainability Act*, as well as the Water Sustainability Regulation and Groundwater Protection Regulation. His exemplary leadership helped ensure that the regulations are practical for owners and the water well industry, while at the same time function to protect groundwater resources across our province.

Mike's technical contributions also include the development of groundwater protection tools, such as the BC Aquifer Classification System and the Well Protection Toolkit which are used by communities and practitioners across BC. In 2017 he received the Premier's Legacy Award for outstanding achievements in the BC public service. Sharing his knowledge to inspire future young professionals, Mike has taught courses in environmental science at Royal Roads University and hydrogeology at the University of Victoria.

Creating a better place for future generations, Mike has dedicated his career to raising awareness about the importance of BC's groundwater and the need to manage and protect the critical resources of this great province.

DR. SHERYL STAUB-FRENCH, P.ENG.
D.C. LAMBERT PROFESSIONAL SERVICE AWARD

The pursuit of gender diversity in her profession has been a guiding light throughout Dr. Sheryl Staub-French's career. A Professor of Civil Engineering at UBC, and the Goldcorp Professor for Women in Engineering, she was recently named the Equity, Diversity, and Inclusion Advisor for the Faculty of Applied Science.

Through her advisory role at UBC, Sheryl works to create an environment where gender equality and highly diverse populations from all backgrounds are encouraged, nurtured, and given the opportunity to thrive. Working with stakeholders, Sheryl identified key areas where knowledge and education could be improved to advance diversity, and has created programs to address the challenge. Her multi-level approach supports students, parents, teachers, and industry, and demonstrates the commitment, as well as the creative thought process needed to advance such a complex issue.

Fostering collaboration between engineering and geoscience regulators and community groups, Sheryl also supports Engineers Canada's 30 by 30 diversity initiative. An exemplary engineer with an unwavering commitment to the progression of Building Information Modelling, Sheryl is determined to not only advance the profession, but improve it.

A STEM champion, Sheryl is helping young women and kids of all ages to see engineering as a way for them to make a difference in the world.

DR. BRADLEY BUCKHAM, P.ENG.
TEACHING AWARD OF EXCELLENCE

An Associate Professor in the Department of Mechanical Engineering at the University of Victoria, Dr. Brad Buckham is the creator of the Ocean Renewable Energy research program, which attracts students from all over the world.

Using innovative teaching methods, interactive demonstrations, and an engaging communication style to inspire his audience, Brad has redesigned tutorials to place an emphasis on student-driven learning and is a champion for continuous curriculum improvements. A testament to his exceptional teaching ability, he has received the University's faculty teaching award twice. A dedicated mentor, Brad supports dozens of graduate, undergraduate, and co-op students, many of whom have gone on to successful entrepreneurial pursuits within the industry.

His work in the classroom goes hand in hand with his work on wave energy research. By applying expertise in finite element methods, computer simulation, and multi-body dynamics, Brad works with a research team to improve the designs and operating strategies for offshore energy technologies, with a current focus on identifying opportunities for a first-of-its-kind deployment in BC.

Through integrated discussion of engineering practice and its impacts on society, Brad is sharing his knowledge with students to help solve our energy problems and create sustainable solutions for the future.

DAVID NELLES, P.GEO.
TEACHING AWARD OF EXCELLENCE

Exploring the Earth's complex geological structure and sharing it with his students is a passion that guides David Nelles in his work as Senior Lab Instructor in the School of Earth and Ocean Sciences (SEOS) at the University of Victoria.

Responsible for teaching and coordinating many of the undergraduate Earth science labs, field trips, and field schools, David's instruction outside of the classroom environment is vitally important to geoscience students in developing a true understanding of Earth science and the practical knowledge and skills required for a successful career. Students often note that the reason they pursued Earth science was the example David set with his enthusiasm for the subject and his intuitive but rigorous approaches to observing and seeking to understand and interpret Earth structure and processes in the field.

Committed to supporting student development and education outreach, David routinely attends Student Information Nights, and works with SEOS's student society to inform undergraduates of scholarship and job opportunities. He also makes time to give back to his profession, volunteering with Engineers and Geoscientists BC's Geoscience Academic Advisory Sub-Committee for many years, and performing regular geoscience reviews of GIT applications for the association. David is inspiring the next generation of geoscientists, ensuring that the future of the profession continues to thrive.

DAVID DESROCHERS, P.ENG.
COMMUNITY SERVICE AWARD

David Desrochers has a talent for building exceptional teams to achieve tremendous results, whether it's on the job or on the road, giving his all for his favourite cause, the BC Ride to Conquer Cancer.

Seeing progress in patient care and recovery has motivated David to recruit over 500 cyclists to Team Brainiacs, creating one of the largest teams in the history of the Ride, which for the past nine years has seen riders make the 250-kilometre journey from Vancouver to Seattle. Collectively, the Brainiacs have raised well over $2.5 million dollars for cancer research. This remarkable achievement was formally recognized by Vancouver City Council. Since joining the team eight years ago, David remains an integral member, ensuring new riders are supported with road bikes, training, and fundraising. As a team co-captain, he also secures and maintains relationships with important team sponsors.

In the office, David supervises staff for project coordination and delivery of engineering infrastructure in his role as Manager of Engineering Projects and Planning with the District of North Vancouver. An active volunteer for his profession and community, David has organized the association's annual curling bonspiel for over 25 years and has fully supported the United Way.

Forging lasting relationships and community bonds, David has been a catalyst for advancing cancer care and research in BC.

NATHAN OZOG, P.ENG.
YOUNG PROFESSIONAL AWARD

With international cyber-attacks representing a growing threat in today's world, professional engineers like Nathan Ozog are working at the forefront to help keep the public safe. A Project Engineer and Team Lead with BC Hydro, Nathan has taken on a challenging project leadership role that requires securing the utility's cyber devices against external intrusion as part of the Critical Infrastructure Protection program to meet new regulatory standards. Nathan is responsible for all technical aspects of the project and coordinating substantial engineering resources to develop innovative strategies, procedures, and solutions.

Sharing his expertise with the next generation, Nathan has also served for eight years as an Adjunct Professor at UBC in the department of Electrical and Computer Engineering. An enthusiastic volunteer with Engineers and Geoscientists BC, Nathan has been giving back to the professions for over 10 years, providing leadership to the Vancouver Branch and encouraging other young professionals to become involved with the association.

With a remarkable career at an early age, Nathan has made time for community engagement, serving on the board of the Vancouver Squash League and having volunteered with Big Brothers and Big Sisters Canada. Dedicated to his career, profession, and community, Nathan is leading by example and setting the standard for aspiring professionals. ◆

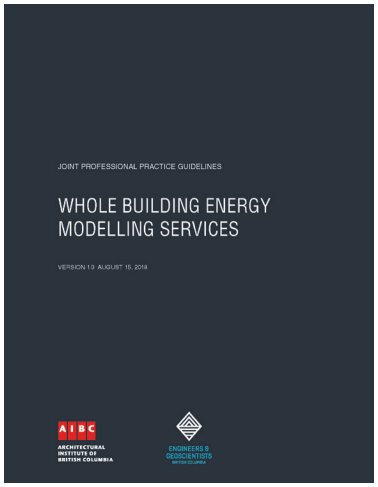
RELEASE OF THE JOINT ARCHITECTURAL INSTITUTE OF BC AND ENGINEERS AND GEOSCIENTISTS BC PROFESSIONAL PRACTICE GUIDELINES—WHOLE BUILDING ENERGY MODELLING SERVICES

The joint Architectural Institute of BC and Engineers and Geoscientists BC *Professional Practice Guidelines—Whole Building Energy Modelling Services* have been released by the two associations on August 15, 2018.

The purpose of these guidelines is to standardize professional practice for architects and engineers working on projects that use whole building energy modelling, which is the use of computer software to estimate the energy use of a building over a time under certain conditions. These guidelines apply to architects and engineers who are providing, procuring, contributing to, and/or coordinating building energy modelling services on new and existing buildings of all types and sizes, regardless of the requirements for professional design and review within building codes.

The document provides guidance on the provision of building energy modelling and analysis services, such as the responsibilities of members of a design team providing building energy modelling services. They also address considerations that apply when hiring or evaluating the qualifications of a Qualified Modeller, which is defined in these guidelines. In addition, they address the importance of quality assurance for projects that involve whole building energy modelling.

These guidelines will be an important means by which engineers and architects can demonstrate that they have followed industry standard practice when delivering building energy modelling services, which is expected to be in greater demand with increased use of the BC Energy Step Code.



Professional Practice Guidelines—Whole Building Energy Modelling Services is available for download at *egbc.ca/guidelines*.

PHOTO: LUIS TOSTA ON UNSPLASH

BRITISH COLUMBIA IS MOVING TOWARDS WATER SYSTEM RISK MANAGEMENT PLANS—AND BC ENGINEERS ARE PLAYING AN IMPORTANT ROLE

The complexity of water systems management, including water and wastewater treatment and distribution, has traditionally been based on a compliance model that focused on the technical risks associated with water supply and wastewater treatment systems. But the provincial government has been working with a range of organizations to design a way to help communities build their own Water System Risk Management Plan (WSRMP)—and the participation of BC engineers is expected to grow.

The BC Ministry of Health has been working for a number of years with local governments, other ministries, and relevant technical organizations (including Engineers and Geoscientists BC), to establish a systems approach to managing water—from source to tap to drain and back to the watershed.

The BC Ministry of Health is now conducting province-wide dialogue sessions with experts and practitioners across the province with the intention of developing a framework for WSRMPs for communities.

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While the current regulatory reliance model in BC relies solely on Certified Operators in the water sector, it does not recognize the role of other technical, financial and human resource professionals who play an important role in managing water 'system' risks. The creation of the professional engineer role is expected to help improve the water management system, empower this broader cross-section of professionals to develop a 'collective voice' to provide assurance to the regulator and public that system risks are being identified, evaluated and managed.

In 2017, Engineers and Geoscientists BC developed draft guidelines that provide the categories of systems risk and general questions that an organization may consider in developing a WSRMP. With the help of these guidelines, a senior professional engineer with experience in water, wastewater, and local government, and trained in systems analysis, will have the ability to provide a valuable oversight role.

To date, four pilot WSRMP workshops have already been conducted. The input from these workshops and the province-wide dialogue sessions are expected to solidify the standard of practice in developing WSRMP in BC. If you are interested in attending an upcoming presentation or participating in a dialogue session, please contact BC Water and Wastewater Association's Communication and Engagement Manager, Jodi Garwood, at *jgarwood@bcwwa.org*.

LEGISLATED FLOOD ASSESSMENT GUIDELINE UPDATED

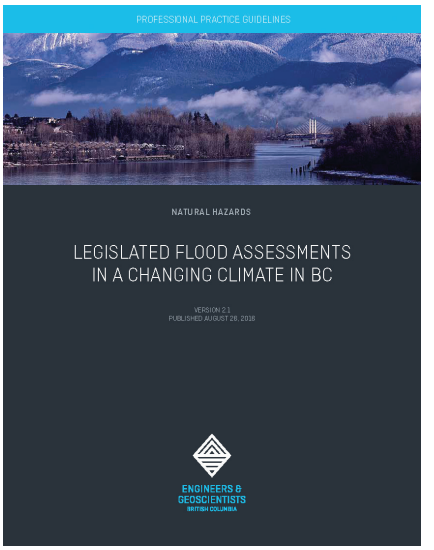
Engineers and Geoscientists BC has updated the *Professional Practice Guidelines—Legislated Flood Assessments in a Changing Climate in BC*. Published August 28, 2018, version 2.1 of the guidelines is now available on the association's website.

The updates to these guidelines were introduced to ensure consistency with Engineers and Geoscientists BC's *Professional Practice Guidelines—Flood Mapping in BC*, and include general improvements such as wording and updating of technical components.

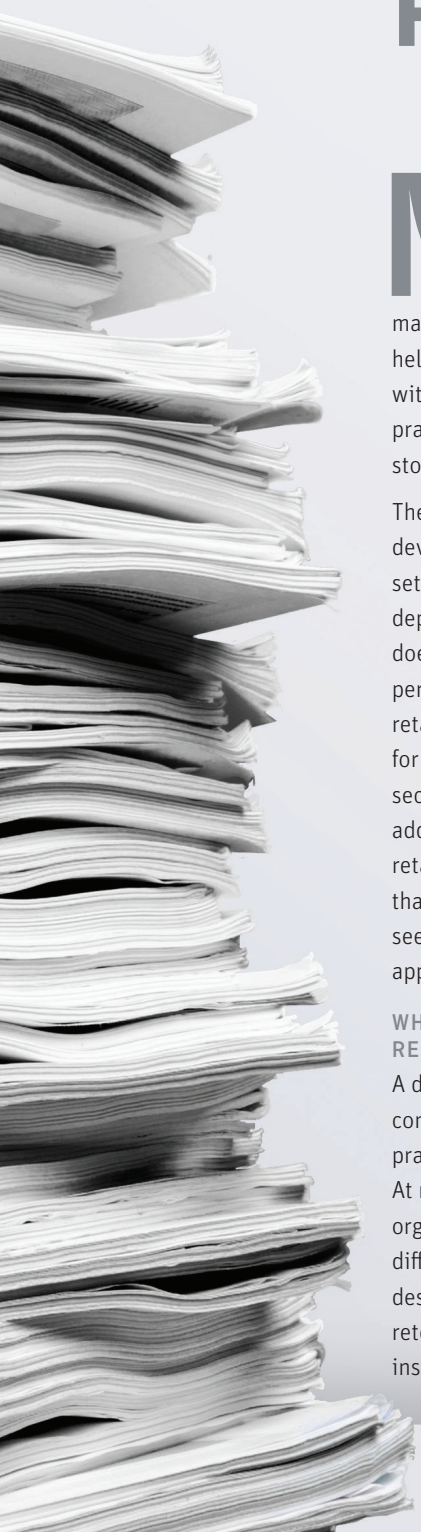
These guidelines were commissioned by the Ministry of Forest, Lands, Natural Resource Operations, and Rural Development. They guide professional practice for flood assessments, identify circumstances when risk assessments are appropriate, and emphasize the need to consider climate change and land use changes in such assessments. The goal is that application of guideline principles will result in consistent and comprehensive flood assessment reports being submitted to government authorities.

Engineers and Geoscientists BC produces professional practice guidelines to increase clarity and provide guidance regarding the standards of practice that engineering and geoscience professionals should follow in carrying out specific activities and providing professional services.

The *Professional Practice Guidelines—Legislated Flood Assessments in a Changing Climate in BC*, v.2.1, can be found on the association's website.



THE FUNDAMENTALS OF DOCUMENT RETENTION POLICIES



Most engineering and geoscience professionals would benefit from a document retention policy to guide their document management. Document retention policies help professionals manage risks, comply with legal obligations, and achieve other practical aims such as reducing the cost of storing documents.

The issues that must be considered when developing a document retention policy and setting retention periods are very context-dependent. Engineers and Geoscientists BC does not provide advice regarding retention periods, except that professionals must retain complete project documentation for a minimum of 10 years as required by section 14(b)(1) of the bylaws. However, additional considerations may warrant retaining documents for significantly longer than this timeframe. Professionals should seek advice from legal counsel regarding an appropriate retention period.

WHAT IS A DOCUMENT RETENTION POLICY?

A document retention policy establishes consistent document management practices for an organization or individual. At minimum, it defines how long an organization or individual will retain different categories of documents before destroying them. However, document retention policies may also include instruction on related topics such as preferred methods for destroying documents.

WHY CREATE A DOCUMENT RETENTION POLICY?

Establishing consistent document management practices helps organizations and individuals meet a variety of requirements and objectives. Generally, these requirements and objectives include managing risks, complying with legal obligations, and meeting other practical needs; these can differ depending on the context. Therefore, when creating a document retention policy, an organization or individual must consider the document retention requirements and objectives that are relevant to their situation.

Because these various retention requirements and objectives may be in tension with each other, creating a retention policy provides organizations and individuals with an opportunity to thoughtfully balance and prioritize those requirements and objectives. For example, the objective of reducing the cost of storing documents may make a shorter retention period attractive, while the objective of being prepared to defend against negligence claims may make a longer retention period more attractive. Creating a retention policy can help organizations and individuals identify these sometimes-competing objectives and ensure that their retention choices reflect their priorities.

PHOTO: MIKE KONONOV ON UNSPLASH

WHAT REQUIREMENTS AND OBJECTIVES MAY INFORM A RETENTION POLICY?

Professionals must identify the retention requirements and objectives that are relevant to their unique context. Engineers and Geoscientists BC recommends that professionals seek legal advice from a lawyer to assist with identifying relevant retention requirements and objectives.

Generally, professionals may consider various elements when establishing a document retention policy. These include limitation periods (for example, those established in the former and current provincial *Limitations Acts*), the requirements of Engineering and Geoscientists BC bylaws (as outlined in Section 14(b)(1) of the bylaws), and relevant privacy and other legislation.

These general considerations are only a subset of the considerations that impact document retention policies; professionals will likely have many other reasons for retaining or destroying documents, such as contractual obligations, statutory requirements, and practical business considerations. It is essential that professionals identify the considerations that are relevant to their unique situation.

BYLAWS

According to section 14(b)(1) of Engineers and Geoscientists BC's bylaws, members and licensees must retain complete project documentation for at least 10 years. Complete project documentation includes a wide variety of documents: correspondence, investigation, surveys, reports, data, background information, assessments, designs, specifications, field reviews, testing information, quality assurance documentation, and other engineering and geoscience documents.

While the bylaws establish a minimum retention period for engineering and geoscience related project documentation, at least two retention decisions are left up to the professionals: whether to retain project documentation for more than 10 years and, if so, for how long; and how long to retain documents that are unrelated to engineering and geoscience project documentation.

LIMITATION PERIODS

When deciding how long to retain documents, professionals will benefit from considering relevant limitation periods.

A limitation period is a time limit placed on the right to begin a legal claim, after which a court or tribunal can deny a claim regardless of its strength. Limitation periods provide potential defendants with some peace of mind by reducing the likelihood that they will be held accountable for obligations from the distant past. They also help potential defendants identify a time when they will likely no longer have to maintain documents that could potentially become evidence. Finally, they encourage potential plaintiffs to act promptly. Retention policies generally take relevant limitation periods into account.

In BC, different statutes establish limitation periods for different types of claims, and some types of claims do not have limitation periods. It is therefore not possible to identify a single limitation period that will be relevant to all circumstances.

However, the limitation period for many claims is established by a general provincial statute called the *Limitation Act*. The current version of the *Limitation Act* came into force on June 1, 2013, and replaces the former *Limitation Act*.

The current *Limitation Act* establishes shorter limitation periods than the former act. The current *Limitation Act* creates a basic two-year limitation period that begins at discovery of a claim, and a 15-year ultimate limitation period that begins when the act or omission on which the claim is based took place. However, complex rules inform which *Limitation Act* applies to a particular circumstance, when a claim was discovered and when the conduct giving rise to a claim occurred. Accordingly, professionals should seek legal advice on how limitation

period considerations should factor into their development of a document retention policy.

PRIVACY LAWS

Various privacy laws will apply to different organizations and individuals, and impact the length of retention periods that will be appropriate for them. Professionals working for private sector organizations in BC may be subject to the *Personal Information Protection Act* or the *Personal Information Protection and Electronic Documents Act*. Professionals working for public bodies in BC may have to manage documents in a manner that complies with the *Freedom of Information and Protection of Privacy Act*. Professionals should seek advice from a lawyer to determine which act, or acts, apply to their organization and how this impacts their retention of documents.

HOW DO I CREATE A DOCUMENT RETENTION POLICY?

A document retention policy may have many benefits, such as managing risks, meeting legal obligations, and achieving practical objectives. Professionals may wish to refer to the Engineers and Geoscientists BC *Quality Management Guidelines – Retention of Project Documentation,* Organization Quality Management (OQM) Manual Section 3, or attend an OQM training session (*egbc.ca/Events*). These resources provide guidance about how to meet the requirement for retaining complete project documentation established by the bylaws, including specific topics such as who is responsible for retaining project documentation after a professional leaves an organization (see Section 2.3 of the *Quality Management Guidelines – Retention of Project Documentation)*. Since choosing appropriate retention periods requires consideration of context-specific legal obligations, Engineers and Geoscientists BC also recommends that professionals to seek legal advice when preparing a document retention policy. ◆

COMMEMORATING MINING HISTORY

Several years ago, Dr. Jeff Wilson, P.Geo., started getting accustomed to the idea of wearing two hats: one as a professional geologist and mining regulatory expert, and one as a semi-professional artist and painter. More recently, he's had a chance to combine the two by rendering abandoned mining equipment in rural Yukon on canvas before it's gone forever.

Wilson has been commissioned by Alexco Resource Corp. to complete eight paintings of old mining equipment around Keno City, Yukon, most of which was abandoned after a long stretch of silver mining activity between 1919 and 1989. The equipment, ranging from rusty minecars and tramways, ore shacks, dorms, railroad tracks, and underground adits, is part of the remaining evidence of one of the richest silver deposits in Canadian history. Mining activity once sustained the economy of Keno City, whose population today sits at about 20.

Top: Dr. Jeff Wilson, P.Geo., and a self-portrait.

An adit from the former Hector-Calumet Mine, located near one of the richest-ever vein deposits of its type.

In recent years, the region—known as the Keno Hill Silver District—attracted interest from Alexco, who purchased the claims from the Government of Canada in 2006. Alexco plans to bring four properties into production but, as part of the claim purchase, Alexco also agreed to spearhead a massive environmental cleanup of the area, and try to apply modern environmental standards to project work sites that were abandoned long ago.

Alexco President Brad Thrall says the company has already committed about $20 million—a figure he expects to rise substantially. "The whole thing is very community minded," he says. "We've been working very closely with the community and First Nations on this project. The old Elsa Mine [about 12 kilometers west of Keno City] is one of the biggest closure pieces, so we're consolidating historic tailings spread out on the ground. Some of the underground adits are still producing zinc, so we're building a water treatment plant," he says.

But Alexco also wanted to find a way to memorialize the mining legacy in the area before it was mothballed for good. Alexco thought they could use Wilson's skills—as a painter, not a geologist—to help commemorate the mining work in the area that began more than a hundred years ago.

Wilson's connections to the mining industry came through his work as a professional geologist and regulatory specialist, overseeing regulatory reports for mining clients. Around 2010, Wilson toyed with art on the side by signing up for night classes to "learn how to put paint on canvas." He continued to become progressively more serious about

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CLOCKWISE FROM TOP LEFT: Log load-out from the Ruby Mine.

An old mine car from a mine in use until about 1978, and then abandoned.

A series of old mine cars in the Husky Southwest Mine area.

Members celebrate International Women In Engineering Day at a breakfast and networking event on June 22, in Victoria, BC. Photo: Bridget Cassidy, P.Eng.

A REBOOT FOR WOMEN IN ENGINEERING AND GEOSCIENCE

Women in engineering and geoscience in BC who are hoping to make connections with each other and make a difference in their industries now have an updated home at Engineers and Geoscientists BC: the new Women in Engineering and Geoscience Division, with a complete reboot of the goals and mandate.

Thanks to the determination and vision of a handful of leaders, the new Women in Engineering and Geoscience Division has rebooted and rebranded with a fresh 12-member executive board, new website space, and a new strategic mission and work plan. The division is ready to welcome new members—and it will waive its membership fee until the end of 2019.

The division's vision is to develop community that encourages and promotes women at all levels in engineering and geoscience. Part of this vision is to build community by connecting with members through networking, professional development, and social events; strengthening the division's network; and good governance and advocacy.

The division's new website, which outlines upcoming events, membership information, a newsletter, and other resources, can be found at *egbc.ca/About/Our-Team/Divisions/Women-in-Engineering-and-Geoscience-Division*.

Council approved the division's Terms of Reference on February 9, and its first Annual General Meeting was held on April 19. The group has been hard at work ever since, recruiting leaders and volunteers, honing its strategy and work plan, and organizing its first events. The division is planning its first major networking event for Wednesday, October 17, at the Pan Pacific Hotel in Vancouver, just ahead of Engineers and Geoscientists BC's annual conference. Guests will have a chance to meet some division executive members and hear about division activities and the strategic plan.

Dr. Selina Tribe, P.Geo., Chair of the division, says the refreshed division is all about building connections internally and advocating for diversity. "We see our division as bridging group between the technical side and the teamwork side [of engineering and geoscience]," says Tribe. "Everyone benefits from more diversity and a broader network."

Tribe says the division has plans for a series of networking opportunities, including social events and outings, breakfast meetings, and guest speakers. But Tribe also says the division wants to offer professional development to

members across the province. They're planning to host Mr. Eli Mina, respected BC registered parliamentarian, to discuss meeting protocol and parliamentary procedure to help prepare members for organizational leadership roles. The division also has plans for a new sponsorship program designed to help corporate partners promote diversity within their own organizations, and for outreach initiatives to form connections with other organizations.

Tribe is enthusiastic about the reboot. "[Over time,] so much has changed yet so much is the same," she says. "I am proud of the women who have stepped up to take the division forward into the future."

CAREER AWARENESS BOOKENDS SCHOOL YEAR

Engineers and Geoscientists BC engaged more elementary and high school students than ever before this summer, delivering presentations and activities to inspire the next generation of engineers and geoscientists.

From hands-on activities building structures that can withstand a simulated earthquake, to explosive chewing gum demonstrations, students got a chance to explore the exciting side of science and engineering through our Career Awareness Program. Our volunteers talked to nearly 600 students about engineering and geoscience in classrooms and at Girl Guide events around the province.

The Career Awareness Program encourages and empowers students to become more involved in science and math, and to consider science-based careers. Promoting these professions is one of the objectives of the association as outlined in the *Engineers and Geoscientists Act*.

This program is supported by association members who volunteer their time to develop presentations and activities that inspire the next generation of engineers and geoscientists. Members also ask us to support their outreach efforts to interest students in engineering and geoscience careers, by providing them with access to giveaways activity materials, and other volunteer resources.

June Career Awareness events included school presentations in Greater Vancouver, Prince George, Abbotsford, Victoria, Chilliwack, and Kelowna.

This fall, Engineers and Geoscientists BC's Career Awareness Program celebrated Science Literacy Week, September 17 to 23, 2018. Science Literacy Week highlights outstanding scientists and science communicators across Canada. In addition to presentations at some local libraries in BC, this year the association held a science-themed book draw for libraries, through Twitter. To find out more about Science Literacy Week, visit *egbc.ca/Science-Literacy-Week*.

VOLUNTEER WITH US

Engineers and Geoscientists BC's Career Awareness Program encourages students to pursue a career in the professions.

As a volunteer with the Career Awareness Program, you could give presentations at schools or libraries in your region, judge a science fair competition, or represent the engineering and geoscience professions at career events. Volunteers are typically association members, either actively working or retired, who have some flexibility with their schedule for events. To learn more about volunteering, visit the *egbc.ca/career-awareness-volunteer*.

CONTACT US ABOUT YOUR EVENTS

If you have any questions, or if you or your company is organizing events that engage students in our professions and would like our help to inspire the next generation of engineers and geoscientists, please contact email *careerawareness@egbc.ca*. ◆

DISCIPLINARY NOTICE: ERIC CHRYSANTHOUS, VANCOUVER, BC

Disciplinary Panel finds former member sent unprofessional and threatening communications, and failed to appear for an interview. The Panel ordered his membership cancelled.

Engineers and Geoscientists BC issued a Notice of Inquiry to Eric Chrysanthous in April 2017, regarding his unprofessional communications with professional engineers and members of the public. The communications in question were threatening in nature and related to transit matters in the Lower Mainland.

In addition, the Notice of Inquiry related to Mr. Chrysanthous' failure to attend an investigative interview by a subcommittee of the Investigation Committee.

A disciplinary inquiry concerning the Notice of Inquiry allegations against Mr. Chrysanthous was scheduled for and held on May 17, 2017. Mr. Chrysanthous was served notice of the inquiry, but did not attend. A panel of the Discipline Committee (the Panel) heard evidence that Mr. Chrysanthous had been properly served notice, and proceeded with the inquiry, which heard from witnesses regarding the allegations.

In June 2017, Mr. Chrysanthous, through legal counsel, requested that the disciplinary inquiry be reopened as Mr. Chrysanthous alleged that he had not been served with the Notice of Inquiry ahead of the disciplinary inquiry.

On August 30, 2017, the Panel issued a decision with regards to the application to reopen the disciplinary inquiry. In its decision, the Panel stated that its decision to proceed with the hearing on May 17, and the decision that Mr. Chrysanthous was adequately served with the Notice of Inquiry, would not be revisited and the disciplinary inquiry would not be reopened. The Panel allowed Mr. Chrysanthous to make written submissions on the merits of the Notice of Inquiry allegations.

On March 12, 2018, the Panel issued a decision with regards to the allegations set out in the Notice of Inquiry. The Panel found that the content of Mr. Chrysanthous' communications included threats of violence, allegations of dishonesty, and professional impropriety that are a significant departure from the standard of professional conduct. The Panel found that the threatening tone of the communications caused harm to the individuals named in the communications, and caused harm to the integrity of the profession. The Panel stated that the allegations set out in the Notice of Inquiry were proven on the balance of probabilities and that Mr. Chrysanthous demonstrated unprofessional conduct contrary to the *Engineers and Geoscientists Act* and acted in a manner contrary to Principal 7 of the Code of Ethics. Further, the Panel found that by failing to appear for an interview with the subcommittee of the Investigation Committee, Mr. Chrysanthous failed to comply with section 30(4) of the *Engineers and Geoscientists Act*. The Panel withheld judgment on sanctions and asked for written submissions from the association and Mr. Chrysanthous.

On August 16, 2018, the Panel issued a Decision and Order on Penalty and Costs. The Panel ordered that Mr. Chrysanthous' membership in the association be immediately cancelled. The Panel ordered that Mr. Chrysanthous pay reasonable costs of the disciplinary proceedings. The Panel directed the association and Mr. Chrysanthous to make submissions related to appropriate costs.

The full text of the decisions can be found on our website. ◆

*Engineers and Geoscientists BC's website (*egbc.ca*) contains information on the complaint, investigation and discipline process. You can contact us at 604.558.6647 or toll-free at 1.888.430.8035 ext. 6647 or by email at* complaints@egbc.ca.

ORGANIZATIONAL QUALITY MANAGEMENT PROGRAM

The following organizations have recently received OQM certification. To find out more, visit *egbc.ca/oqm*.

Hub Engineering Inc.
March & Associates Engineering Ltd
Trinitas Engineers Inc.
Site Power Engineering Consultants Ltd.
Chalten Engineering Ltd.
NDY Management Canada Inc.
SR Engineering Ltd.

...Continued from page 14

for the building as a whole, and specific solutions to match the activities going on inside. "It's kind of like a school in some areas, and a health centre in others," she says. "There's a dentist's office, a gym, a library, consulting rooms and private calm rooms, each with slightly different requirements. The calm rooms must be really quiet inside, for example, while with a consulting room you have to ensure conversations remain private."

Solutions for controlling external noise included multi-layer roofs and façades, and moderate-high performance glazing ("windows are always the weakest link in a building envelope," says Scherebnyj) for most spaces, with high-performance glazing installed in the very sensitive spaces, such as the calm rooms, which serve as a retreat for children who become agitated or upset during their time at the Centre. Solutions for controlling noise and vibration inside included a hydronic HVAC system, with in-floor radiant heating and cooling, to reduce background air noise, along with sound-absorbing acoustic finishes, such as carpeting, fabric-covered wall panels, and t-bar ceilings. In high-traffic areas, like corridors, Scherebnyj proposed backing a slotted wood ceiling with duct liner for further sound absorption. Clinical spaces needing full privacy were equipped with perimeter and drop-down door seals.

"When you walk in now," says Scherebnyj, "it feels calm. I think we did a good job there. It was rewarding because it's a space for children, but also because the people involved really wanted our feedback. They wanted to make sure we got this right."

Of course, acoustical engineering projects intended to limit the adverse effects of noise on health and well-being are not limited to new construction. They also include projects to ensure existing systems and structures continue to control noise as completely as possible.

Eric de Santis, P.Eng., is a founding partner of BAP Acoustics Ltd. in Vancouver. Two years ago, his company contracted with British Columbia Rapid Transit Company (BCRTC), which operates the SkyTrain system, to evaluate track conditions (or 'rail roughness') on the Expo and Millennium Lines. Rail roughness—irregularities on the running surfaces of train rails—is one of the most significant sources of noise from any heavy or light-rail passenger transit system, and can have a significant impact on the comfort of passengers and people living or working in surrounding communities. BCRTC wanted the data to compare track conditions on the two lines with other passenger rail networks, and to assess whether there was any room for improvement.

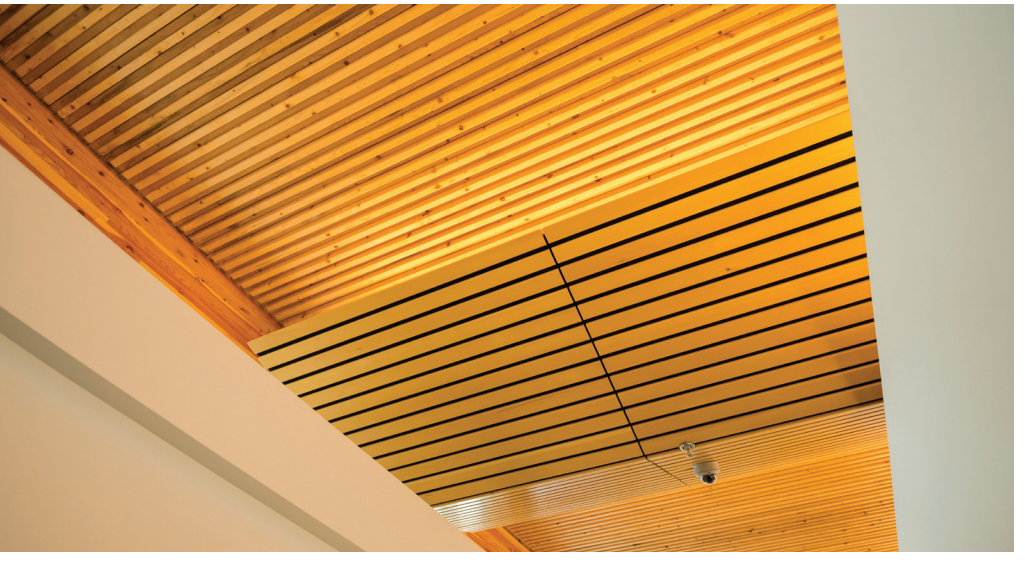
"BCRTC had already been using acoustic monitoring to evaluate track conditions to some degree," de Santis says, "to get an idea of noisy spots, places where there could be significant corrugation on the rails. But the procedure they were using involved monitoring noise levels *inside* a test car. For this project, BAP Acoustics proposed evaluating track conditions by monitoring noise *outside* the cars, at the wheel-rail interface, for both left and right rails."

The only problem was that this kind of rail measurement had never been done in North America.

"It was probably one of the most technologically challenging projects we've done," says de Santis, who was responsible for finding a workable method for doing measurements on the two lines, which together add up to about 135 kilometres of total track. One of the first difficulties the engineer had to overcome was the SkyTrain schedule: the system only stops operating for one four-hour period each day during which the track would be clear for evaluation. This immediately eliminated a simple but effective one-rail-at-a-time method where a technician runs a specially equipped trolley along a rail at an average walking speed of three to four kilometres an hour. This was simply too slow for that brief window of time.

Continues on page 38...

BAP Acoustics' unique approach combined an instrument designed to measure rail roughness, GPS data, track GIS data, and actual noise measurements from precision microphones carefully attached to near the wheels of a train. The rail roughness instrument—called 'CAT'—is designed to operate at walking speed. BAP's solution involved finding a way to acquire the rail measurements and all the data at 40 kilometers per hour. Photo: BAP Acoustics



To help absorb sound without ruining the décor, the hallways of the Pacific Autism Family Centre are outfitted with wood slats, which have a 38-millimetre-thick layer of fibrous glass duct liner installed behind them. The fibrous material absorbs sound and controls the build-up of reverberation. The amount, thickness, location, and type absorptive material is precisely calculated to create a quiet, calm interior. Photo: Mike Crane

...Continued from page 37

Instead, de Santis built a whole new solution, beginning with specialized software called RailInspector, developed by M+P|MBBM Consultants of the Netherlands to analyze twice-yearly acoustic rail roughness monitoring data collected on the Dutch High Speed Line Zuid. "Regular rail condition monitoring," says de Santis, "tracks rail roughness and rolling noise emission changes over time, and enables rail operators to identify when and where they need to periodically grind the rail to reduce noise." However, choosing the software turned out to be the easiest part.

RailInspector software was designed to work directly with M+P|MBBM's own proprietary hardware system, which is not supported in North America. To solve that problem, BAP Acoustics developed an in-house program that was able to import acoustic and GPS data collected from a locally supported, multi-channel data acquisition system directly into RailInspector.

The company then worked closely with BCRTC personnel to safely wire cables between the data acquisition system and four precision-measurement microphones mounted near the wheels of a test car. Each line sweep in the test car took about two hours, travelling at a fixed speed of 40 kilometres an hour. Combined with detailed GIS information for the Expo Line and Millennium Lines, the custom solution was then able to map noise and GPS information to specific points along the track, and to identify 'hotspots'—track sections with significant corrugation. Those hotspots were then visually inspected by de Santis and BCRTC.

"With the system we developed," says de Santis, "we can map roughness profiles in intervals as fine as one metre across a large network from data collected in a relatively short period of time. It wasn't easy, but it was an extraordinary learning experience. We learned that you *can* do a rapid estimate of rail roughness on a running rail system, properly and accurately, while covering large distances of track for both left and right rails. And that can translate to benefits for the operator and, in turn, passengers and communities."

As an acoustical engineer, says BKL's Mark Bliss, "you enhance the good sounds and reduce the noise to levels that make sense for each situation. When done right, good acoustics often don't get noticed"—but they may just help us live happier and healthier lives. ◆

...CONTINUED FROM PAGE 19

geological characterization and description been carried out, a determination could have been made that the rock in question was not 'just another dark grey limestone' but rather, a low-quality calcareous mudstone that contained easily degradable framboidal pyrite. Based on such geoscience information, the quarry operator might have changed tack and developed a quarry elsewhere.

Another 'big deal' piece of the story is the recognition that sometimes a problem posed by a client, an owner, or a contractor can require more than the usual investigation and due diligence sufficient to develop and test the current concepts and perhaps propose a new outside-the-box solution.

A positive outcome of these cases was that where previous Irish standards had been weak with respect to the engineering geological quality of fill aggregates, as a direct result of the litigations that were based on the use of these aggregates, the National Standards Authority of Ireland has now developed standards that specifically address the pyrite issues of rock fill materials. This new Standard serves to protect the public by providing guidelines for the assessment of pyrite heave potential.

At the time these investigations began, Ireland had no experience with pyritic heave. However, in Canada and in the eastern US, geoscientists and engineers had amassed significant experience with pyritic heave. Familiarity with these cases and experience in such assessments enabled Golder's geoscientists to provide assistance to a region with no previous experience in this issue. The narrative above should serve as a reminder to think holistically about problems, and to carefully consider possible solutions. ◆

Fred Shrimer, P.Geo., is Senior Geologist and Associate in Golder Associates, Vancouver. He is a Fellow of the Geological Association of Canada, a member on the Canadian Standards Association Technical Committee on Concrete, the American Society for Testing and Materials Committees Concrete and Aggregates and Soil and Rock, and the National Stone, Sand, and Gravel Association Technical Committee on Aggregates.

...Continued from page 32

painting and, when the mining industry cooled in the following years, Wilson found himself increasingly relying on his artistic work to make a living.

Wilson now keeps busy with commissions and art shows, primarily painting urban features and occasional landscapes using acrylic paints on canvas in a style known as 'painterly realism.' He's also still an active professional geologist: he maintains his P.Geo. license, consults with mining companies on governance and regulation, and sits on Engineers and Geoscientists BC's Geoscience Committee.

Thrall says Alexco is still thinking through how to best use Wilson's completed paintings, but he speculates that limited edition prints or cards could help fundraise at local community events. ◆

A series of series of stanchions from a 4,400-metre aerial tramway, once used to transport ore and supplies across the Keno Hill Silver Camp.

IN MEMORIAM

The association announces with regret the passing of the following members:

J.A. Forrest, P.Eng.
P. Graystone, P.Eng.
L.R. Horne P.Eng.
A. Jezierski, P.Eng.
L. Kokan, P.Eng.
J.A. Mackie, P.Eng.
D.F. Martin, P.Eng.
D.L. McKay, P.Eng.
A.G. Shugg, P.Eng.
D.H. Smith, P.Eng. ◆

ENGINEERS & GEOSCIENTISTS
BRITISH COLUMBIA

AD INDEX SEPTEMBER/OCTOBER 2018

CONTINUING PROFESSIONAL DEVELOPMENT

PERSONAL INVESTMENT. PROFESSIONAL COMMITMENT.

FIELD REVIEW RESPONSIBLITIES OF DESIGN CONSULTANTS

November 1, 2018 – Vancouver, BC or Webinar

Not all clients understand the limited scope of field review by a design consultant. In addition, not all professional engineers appreciate the potentially wide scope of responsibility under a letter of assurance relating to field review. What are the duties encompassed in a field review retainer and under a letter of assurance, and when will they be expanded beyond your expectations?

TIME MANAGEMENT FOR ENGINEERS AND GEOSCIENTISTS

November 1, 2018 – Webinar

Feeling caught between a clock and a hard place? You are not alone. We are in a 'stripped-down-every-job-counts-more-with-less' workplace, creating ever greater productivity pressure on all of us. The 'time management' challenges of the 21st century workplace are very different than the industrial age, and that means old solutions do not work anymore! In this leading-edge webinar, you will gain a new mind-set and skill-set that will optimize your personal productivity, through learning how to produce greater results in less time.

LEADING PROFESSIONALS TO PEAK PERFORMANCE

November 1, 2018 – Webinar

Through this interactive, high-energy, and thought-provoking webinar, participants will deepen their understanding of leadership, motivation, engagement, communication, delegation, and empowerment. Participants will also learn proven, powerful, and practical strategies and techniques that will last a lifetime, and can be applied the next day.

MICROSOFT EXCEL CORE TRAINING

November 6, 2018 – Vancouver, BC

Learn to use Excel to create budgets, track costs, and generate quotes. Learn tools and ideas that will save time and create professional looking proposals and plans. Participants with only a very basic knowledge of Excel will quickly progress to create basic databases, budgets, graphs, reports, and the fundamentals of building equations.

MEMBRANE SYSTEMS FOR DRINKING WATER TREATMENT

November 6, 2018 – Vancouver, BC

The course covers theory and applications of membrane technologies for drinking water treatment. Other applications (i.e., wastewater treatment and reuse) are also introduced. The course is structured to provide opportunities to learn the fundamental principles governing the performance of membrane systems, and to apply this fundamental theory to optimize the performance of membrane systems and to address operational challenges.

MICROSOFT PROJECT TRAINING

November 7 & 8, 2018 – Vancouver, BC

This hands-on workshop will give you a comprehensive understanding of Microsoft Project using a practical approach to project management. You will participate in various hands-on exercises and develop confidence in creating and managing single as well as multiple projects. It will provide you with the skills to effectively track and analyze projects with a better understanding of the schedule and impact of changes.

DESIGN AND ANALYSIS OF RETAINING STRUCTURES AND SHALLOW FOUNDATIONS

November 8 & 9, 2018 – Vancouver, BC

This course is a comprehensive foundation engineering course dealing with retaining structures, shallow foundations, and excavations. Major emphasis will be on the analytical methods and the problem solving aspects as related to retaining structures and shallow foundations. This course provides the participants with an opportunity to apply the design procedures to a 'real life' challenging geotechnical design projects.

CREATING HEALTHY CONFLICT IN THE WORKPLACE

November 9, 2018 – Surrey, BC

There is no such thing as a conflict-free work environment, as that is where growth happens. Participants will learn how to engage in conflict in healthy, productive, and proactive ways. Participants will be equipped with collaborative skills to move an organization forward and grow.

MICROSOFT EXCEL EXPERT TRAINING

November 14, 2018 – Vancouver, BC

Learn to manage data through databases and pivot tables which will simplify complex reporting and tracking requirements for projects. Learn advanced functions and tools like Goal Seek and creating scenarios useful for providing variations on quotes.

OUTLOOK STRATEGIC MANAGEMENT

November 15, 2018 – Vancouver, BC

Learn key setting changes in Outlook and a handful of keyboard shortcuts that can eliminate 100's of mouse clicks per day. These tips will keep you more focused on what is most important in your day and help you better manage and delegate work. Learn how to manage small projects of 5 - 20 tasks directly from Outlook. Learn how Microsoft OneNote integrates with Outlook and can be used as a powerful tool to manage meeting agendas and minutes and also how OneNote can help manage the documents, emails, and notes that need to be shared with a Project Team.

TECHNICAL WRITING: SOLUTIONS FOR EFFECTIVE WRITTEN COMMUNICATION

November 19, 2018 – Burnaby, BC

How do I learn to write more effectively? How can I write for both technical and non-technical audiences? This seminar provides practical, applicable solutions and techniques for how to express your thoughts succinctly in written format. Through a series of hands-on workshops, you will learn to write effective emails, technical memos, letters, reports, and other documents.

COASTAL HAZARDS AND SEA LEVEL RISE SEMINAR

November 20, 2018 – Vancouver, BC

We review the science that underpins damaging coastal processes, discuss impacts to infrastructure, review risk assessment methods, and examine potential mitigation measures and their advantages and disadvantages.

HANDS-ON PHYSICAL MODELLING OF HYDROTECHNICAL PHENOMENA: APPLICATION AND INTERPRETATION

November 22 & 23, 2018 – Vancouver, BC

The course offers engineering fundamentals of physical modelling for hydrotechnical projects with the following objectives: to get familiar with the applied theories of scale modelling for hydrotechnical projects; to determine when scale modelling should be performed compared to field, analytical, and numerical methods; to interpret the results of physical modelling; and to avoid common pitfalls in physical modelling of hydrotechnical phenomena involving interaction of water with sediment and/or structures.

For a complete listing of events or for more information, visit *egbc.ca/Events/Seminars* or contact us at 604.430.8035 or 1.888.430.8035.

CALL FOR PRESENTERS

Are you an expert in your field who would like to contribute to engineering and geoscience practice?

Engineers and Geoscientists BC is actively seeking members to present on a variety of topics. For more information, please visit *egbc.ca/Events/Seminar*.

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

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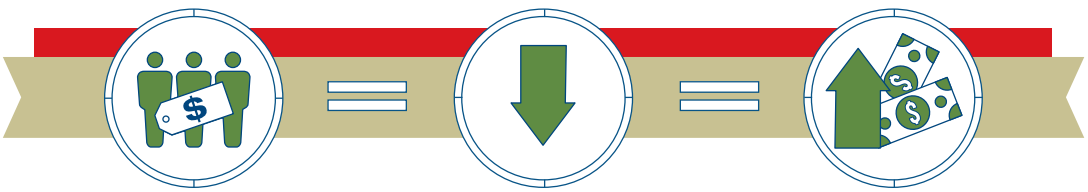

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