



connect

Volume 22, 2018

IDEAS AT WORK

Big Data.

It's a Big Deal.

Smart Shovels. Machines that Learn.
Virtual Mine Twins. And More.

Let's Get Digital

Our People, Finding Solutions

**May the Force Field
Be With You**

Innovation Around Air Quality

Teck

THE FUTURE IS CHANGING... RAPIDLY

Visionary leaders share
their insight into the
opportunities of
tomorrow.

There's a silly notion that failure's not an option at NASA. Failure is an option here. If things are not failing, you are not innovating enough.

Elon Musk

Founder and CEO, Tesla, SpaceX



Rarely are opportunities presented to you in a perfect way. In a nice little box with a yellow bow on top. 'Here, open it, it's perfect. You'll love it.' Opportunities—the good ones—are messy, confusing and hard to recognize. They're risky. They challenge you.

Susan Wojcicki

CEO, YouTube

Google right now is all about building the world brain that will take care of every person, all the time and everywhere.

Larry Page

Google Co-Founder, CEO Alphabet Inc.



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Thank You

Many thanks to those who contributed to and participated in this issue of *Connect*:

Greg Brouwer, General Manager, Technology and Innovation, Vancouver office; Brian Bisset; Senior Mine Technician, Elkview Operations; Alannah Cervenko, Lead, Strategic Partnerships, Vancouver office; Juana Rosa Del Castillo, General Manager, Zafranal Project; Shari Lomon, Supervisor, Health and Safety, Kimberley office; Jaime Mendoza Gallardo, Engineering Geomechanic, Carmen de Andacollo Operations; Clemente Miranda, Senior Environmental Engineer, ART; Ximena Retamal, Environment Superintendent, Carmen de Andacollo Operations; Allyson Stoll; Project Metallurgist; Red Dog Operations; Janais Turuk, Manager, Community Relations, Calgary office; Michelle Unger, Manager, Environmental Compliance, Kimberley office; Carol Vanelli Worosz, Community Engagement Leader, Trail Operations



On the Cover

Jeremy Barrett
Rubber Tire Dozer Operator
Line Creek Operations



Welcome

My first job after university was with the Iron Ore Company of Canada as a supervisor at one of their mines in Newfoundland. While some of the basics of mining were the same then, it was a far less technological industry than it is today.

In fact, I remember vividly the day the first IBM PC came out in 1982. We got one, and at the time, we thought we were really leading edge. It was delivered to the engineering office and we eagerly took it out of the box. And then... we all just stared at it because we had no idea what to do with it. We had to play with it, experiment with it, and learn about it and what it could do for us. We had to generate ideas about how to apply this technology before it could help us do our jobs better.

Generating ideas takes trial and error, because not every idea works the first time. And that's okay. Finding out what doesn't work can be just as valuable as finding out what does. When it comes to innovating and exploring new ideas and technologies, there are no 'failures'. There are only learnings.

Ideas and learning has brought us a long way from that first computer I worked with in 1982. In this issue of *Connect*—"Ideas at Work"—we highlight just how far we've come by profiling some of the breakthrough ideas that are reshaping our industry. Ideas such as those described in "Tracking the Blast", about how high tech sensors help better track the movement of ore after blasting,

allowing us to improve ore recovery. Or in "Machine Learning for Maintenance", about how we are using machine learning technology in partnership with Google, to predict and avoid machinery breakdowns at our steelmaking coal operations. Or yet another example, "Digital Bird's-Eye View", about using virtual reality to build entire operations and travel through every stage of mine life, from anywhere in the world.

It's an exciting time to work at Teck. Ideas, innovation and technology are transforming our industry for the better. Markets for our products are strong, and a number of major projects are hitting key milestones.

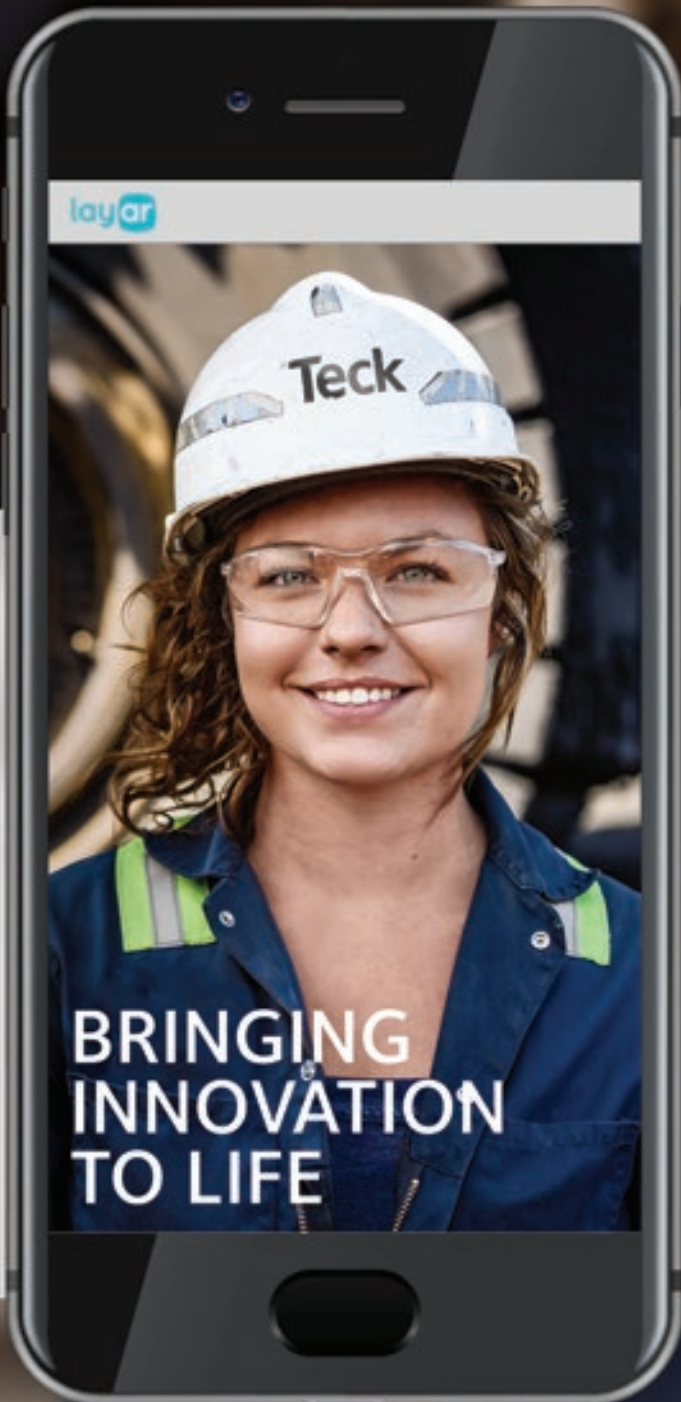
Our Fort Hills project is having a world-class start-up and adds a new pillar to our business that will generate value for decades to come. We are also very close to receiving a permit for Quebrada Blanca Phase 2 (QB2), which will be followed by a possible sanction decision as early as the second half of this year. Once built, QB2 would transform our copper business, making Teck one of the world's major producers of copper, at a time when the longer-term outlook for copper is very positive. In "Profiling Our Growth Projects" we shine a spotlight on QB2.

2018 is shaping up to be a notable year, with many things we've been working on for several years coming to fruition, alongside work on new innovations that have the potential to create a step change in our business.

However, one cannot talk about 2018 without reflecting on the loss of Pat Dwyer, a contractor at our Elk Valley Operations whose life was tragically lost at Fording River in April. Our thoughts remain with his family, friends and everyone affected by this loss. I ask for your continued support as we put in place new controls to ensure this never happens again, because there is nothing more important than every single employee and contractor going home safe and healthy every day.

As we look forward to the remainder of 2018, we know we are at the beginning of a technological revolution, one that is poised to reshape almost every aspect of how we work, for the better—and all of us have a part to play. Because it's our people who will make it happen, bringing to life ideas that will make us safer, more sustainable and a stronger Teck.

Don Lindsay
President and CEO



To bring this issue of *Connect* to life, **download the free Layar app from iTunes or Google Play to your smart device** and then look for the icon below throughout this issue. When you see the icon, simply use Layar to scan the page to launch one of a series of Teck videos.



Katelin McKibbin, Haulage Driver, Line Creek Operations

REINVENTING MINING THROUGH IDEAS AT WORK

An aerial photograph of a mountain range. The foreground shows a valley with green fields and a river. The middle ground features steep, rocky slopes with sparse vegetation. The background consists of high, rugged mountain peaks under a clear blue sky with a few wispy clouds. The text is overlaid on the image, with 'AT' underlined.

The mining industry has been reinventing itself for centuries. From the early prospectors to today's digitally-connected operations, the story of mining is a story of reinvention, one driven by new ideas for everything from how we explore for new deposits through to how we close and reclaim mines. These ideas have made our modern mining operations safer, more sustainable and more productive than ever before.

That reinvention is still happening today and doing so at an increasing pace. New advancements in automation and digitalization are increasingly being introduced across mining operations. At the same time, factors such as declining ore grades, increasing energy requirements, and rising community and regulatory expectations create commercial pressure for new technological solutions.

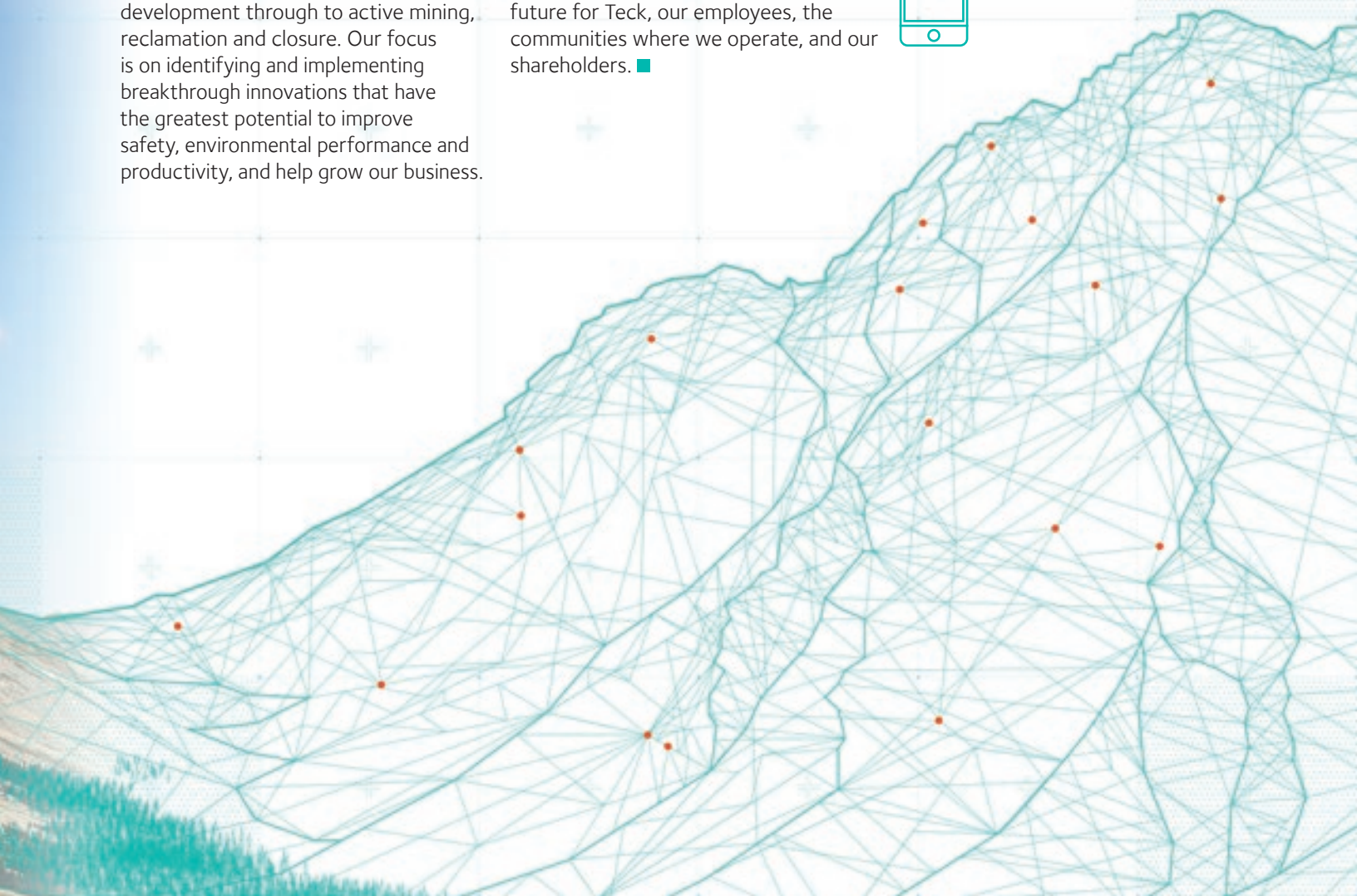
That's why Teck is putting new ideas to work across every aspect of our business—from exploration and project development through to active mining, reclamation and closure. Our focus is on identifying and implementing breakthrough innovations that have the greatest potential to improve safety, environmental performance and productivity, and help grow our business.

Ideas like those found in the following pages are just a sample of what we're working on. Teck is investing in research, development and implementation of a host of new technologies, techniques and ideas. We're also strengthening our culture of innovation, both by building upon our company's long history of ingenuity and invention, as well as by forming partnerships with leading-edge companies from within our sector and beyond.

Our continuing focus on innovation and technology will help to ensure a strong future for Teck, our employees, the communities where we operate, and our shareholders. ■



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Tracking the Blast

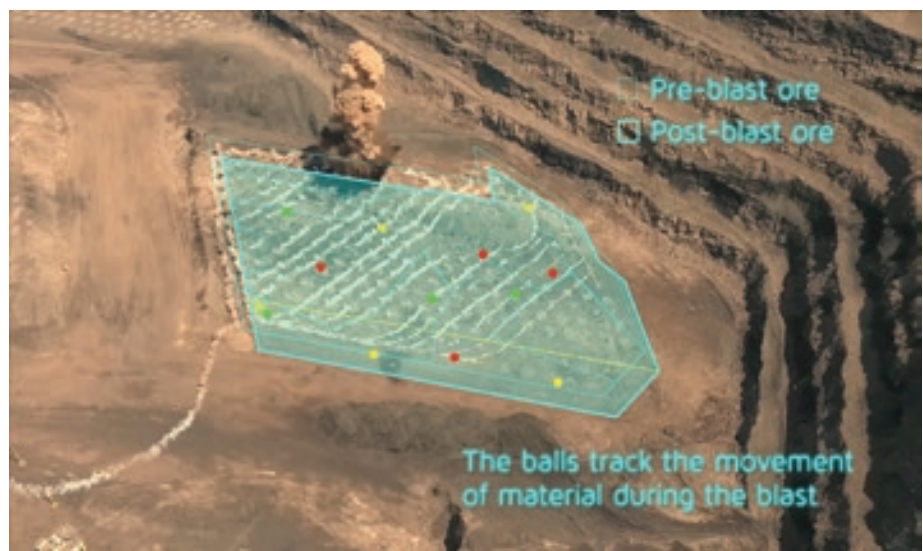
These high-tech sensors weather the blast and live to tell the tale.

At our mines, dozens of state-of-the-art, high-tech instruments are being dropped into holes and blown up—on purpose. It's part of an innovative technology that we're putting to work called blast movement monitoring that allows us to better track the ore after blasting.

In the mining process, blasting is used to break up solid rock so our shovels and trucks can get at the ore and transport it to the mill for processing. But the location of the ore can change after the blast as rock is shifted by the high explosives. That's where blast movement monitoring comes in.

Colourful softball-sized sensor balls are distributed into drill holes prior to blasting. Nestled inside each ball, protected by the durable outer casing and a shock-absorbing liquid inside, is a sensor that transmits its location. After the blast, handheld scanners are used to identify where the balls have moved, and that data paints a three-dimensional picture of how the orebody has shifted during blasting.

This information is used by our geologists to maximize the amount of valuable ore that is recovered and sent to the mill, and to reduce the amount of waste rock going into the mill. That results in reduced processing costs and improved productivity, as well as improved environmental performance through better energy efficiency. At just one mine—our Red Dog operation



in Alaska—blast movement monitoring is saving an estimated \$6.5 million annually.

“The information we get from the blast movement sensors allows us to track the movement of ore in greater detail than ever before, leading to improved productivity and sustainability at our operation,” said Brian Hall, Geologist at Red Dog Operations.

Blast movement monitoring. It's an idea at work. ■



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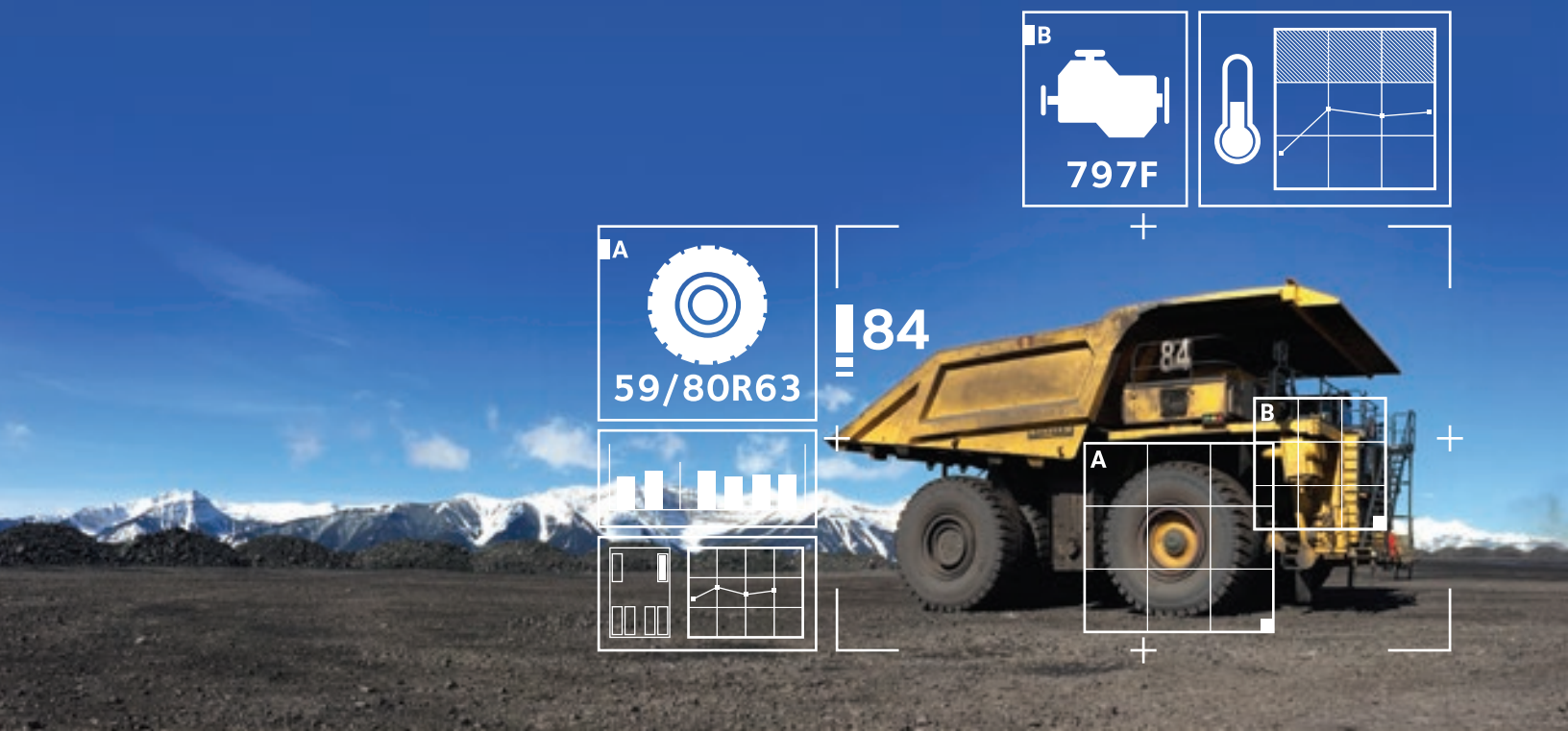
Information from the blast movement sensors allows us to track the movement of ore in greater detail than ever before.

Unearthing deeper insights.



MACHINE LEARNING FOR MAINTENANCE

Solving problems before they occur.





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A vehicle breakdown is not just a hassle—it usually ends up costing both time and money. A vehicle breakdown at a mine site is the same, but on a much larger scale—and can have an impact on productivity and efficiency.

Some breakdowns are well understood and can be prevented through proper maintenance. But some are seemingly random and can't be planned for—until now. Thanks to an innovative use of machine learning, Teck is using big data to predict the unpredictable and to fix problems before they happen.

Since 2011, we've used sensors and data to monitor the health of haul trucks at our steelmaking coal operations, and to manage repairs and preventative maintenance. Now, with the help of artificial intelligence, we're going a step further.

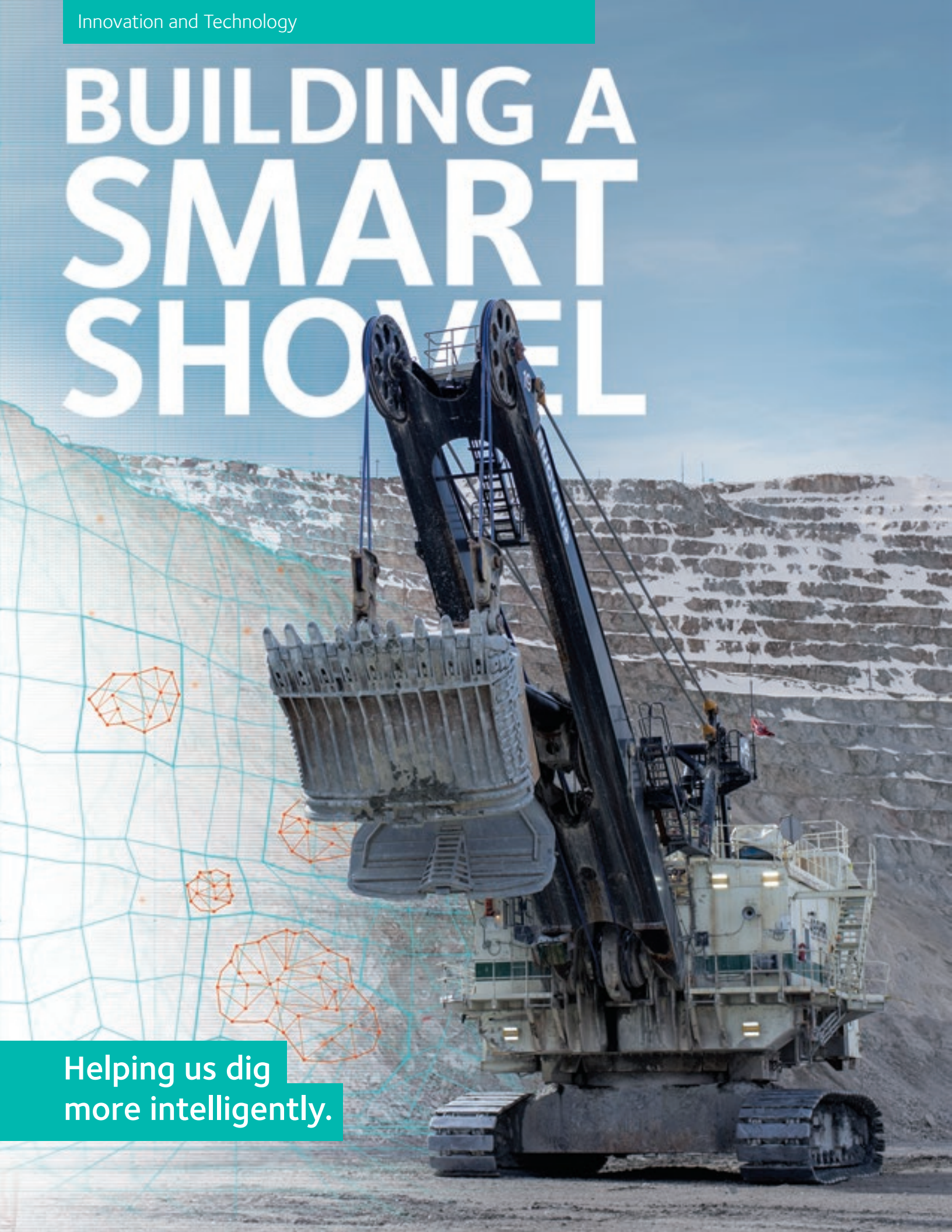
Through our partnership with Google Cloud and Pythian, we're unlocking new insights from the millions of data points generated by our mobile fleets. Issues that were previously unpredictable, such as potential electric failures, are now being identified before they happen by machine learning algorithms. We're also modelling and predicting the remaining lifespan of our trucks, determining wear and tear, identifying abnormal failures, and enhancing alarm and notification systems.

Machine learning for maintenance is helping to minimize unplanned maintenance, reduce overall maintenance costs and extend equipment life. It's estimated that, at one site alone, there's potential for over \$1 million in annual savings from implementing this program.

Machine learning for maintenance. It's an idea at work. ■

BUILDING A SMART SHOVEL

Helping us dig
more intelligently.



Most people think of a shovel as a pretty basic tool—you use it to move stuff from one place to another. But what if the shovel was smart? What if it could analyze and know exactly what it was carrying? That’s the idea behind a new mining technology Teck is pioneering to improve productivity and sustainability at our operations.

To make a shovel smart, sensors are mounted on the shovel bucket and use x-rays to tell the difference between waste rock and valuable ore, one shovel load at a time. The sensors, combined with analytics, provide real-time information to determine whether the load is worth sending to the mill for processing, or for handling as waste rock. Decisions that were once a matter of informed estimates can instead be based on real-time data, leading to improved mill productivity, reduced energy use and less water consumption.

Teck partnered with MineSense for the first full-scale trial of the bucket-mounted ShovelSense™ technology in 2017 at HVC in British Columbia. The sensors are now in use on one shovel, and additional shovels could be considered for later in 2018.

A smart shovel. It’s an idea at work. ■

Smart shovels have the potential to create hundreds of millions of dollars in value.

“We’re sorting the wheat from the chaff with more precision than ever before with these smarter shovels,” said Bryan Rairdan, Technical Services Manager at Highland Valley Copper (HVC). “This technology helps us use less energy, create fewer emissions and improve productivity. In fact, smart shovels have the potential to create hundreds of millions of dollars in value.”



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Building a Culture of Innovation

Insights from Greg Brouwer, General Manager, Technology and Innovation

In January of this year, Greg Brouwer was appointed General Manager, Technology and Innovation, responsible for advancing Teck's innovation and technology activities and strategy.

In addition to managing that pipeline of activities, Greg and his team are also doing an internal and external scan of ways we can evolve and strengthen our culture of innovation.

Here, Greg shares some observations on what that scan has unearthed and the opportunities that have been revealed.

On Harnessing Energy and Excitement...

"There's a lot of buzz and excitement in the innovation and technology space, so near-term, one of our focus areas is how to harness that energy and excitement and derive value in the most efficient and effective way."

"An important part of that is looking at how we can embed a culture of innovation at Teck, which means each of us feeling a responsibility to innovate and also having the mechanisms in place to share ideas."

"This can be a challenge; how do you unleash the energy in a workforce of 10,000+ and manage that properly so that we're evaluating ideas efficiently, always with a view of driving real and material value."

"To help improve that process, we're doing some benchmarking work to see how other companies have done this really well, and we're also looking internally, getting feedback from a cross section of business and functional units, to get their views on ways we can effectively harness this energy and drive Teck's culture of innovation forward."

On Being Ready for Change...

"A lot of our workforce is very comfortable using powerful technology in their day-to-day lives—it's actually quite amazing; the mobile phones we carry in our pockets today are millions of times more powerful than the computing technologies NASA used to first land humans on the moon in 1969."

"At the same time, the cost of those powerful technologies has decreased dramatically."

"Together, this makes it much easier, and an opportune time, to bring new technologies to Teck and leverage the benefits; we're excited to see where that will take us over the coming years."

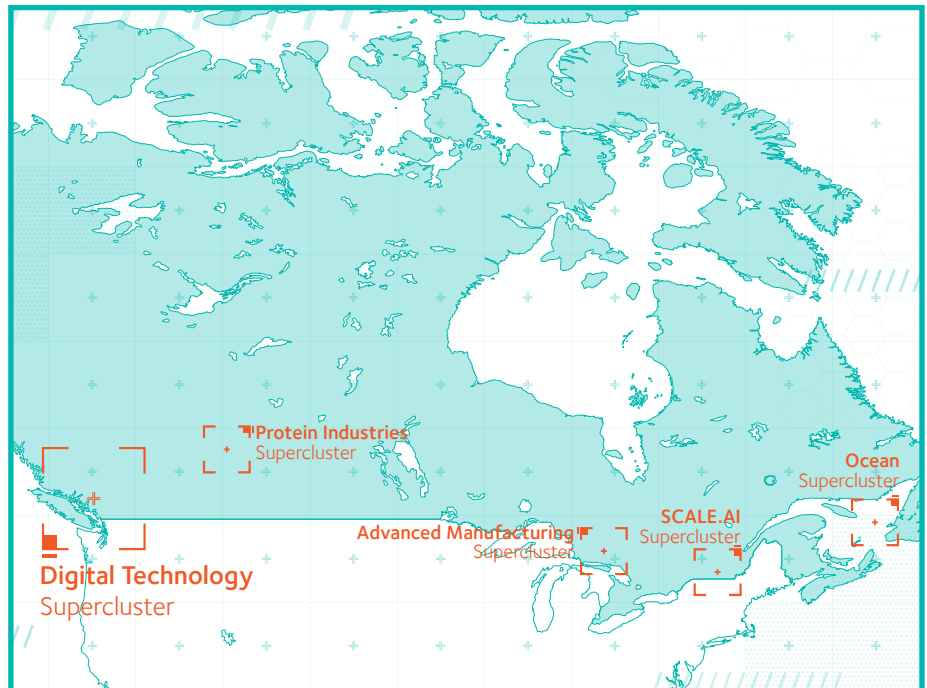


Tomorrow is our greatest resource.

On Opportunities and the Digital Technology Supercluster...

“Teck’s involvement in Canada’s Digital Technology Supercluster has great potential to involve our employees in exciting innovation projects in a completely new way, and also to pilot groundbreaking technology at Teck sites.”

“As a founding member of the Digital Technology Supercluster, Teck is operating in an ecosystem that’s very different than groups we normally interact with; from start-ups to medium-size tech companies, we’ll have tremendous opportunities to work closely with other companies, non-profits and academia on really big, ambitious goals that have the potential to fundamentally change mining and other industries, in really positive ways.” ■



Canada’s Innovation Superclusters Initiative

Announced in February of this year, Teck is a founding member of the Digital Technology Supercluster, one of five Superclusters formed by the Government of Canada as part of their Innovation Superclusters Initiative.

Through the initiative, the Government of Canada is investing up to \$950 million—to be matched by the private sector—to support business-led innovation superclusters through high-value, strategic investments with the greatest potential to accelerate economic growth. It’s projected that over the next 10 years, the initiative will generate 50,000 jobs and grow Canada’s gross domestic product (GDP) by \$50 billion.

The Digital Technology Supercluster is based in B.C. and will advance projects that are guided by defined industry needs. The chosen projects will advance solutions using virtual, mixed and augmented reality, data analytics and quantum computing, to help solve some of the most pressing productivity, health and sustainability challenges facing Canada and the world today.

Opposite: Greg Brouwer, General Manager, Technology and Innovation

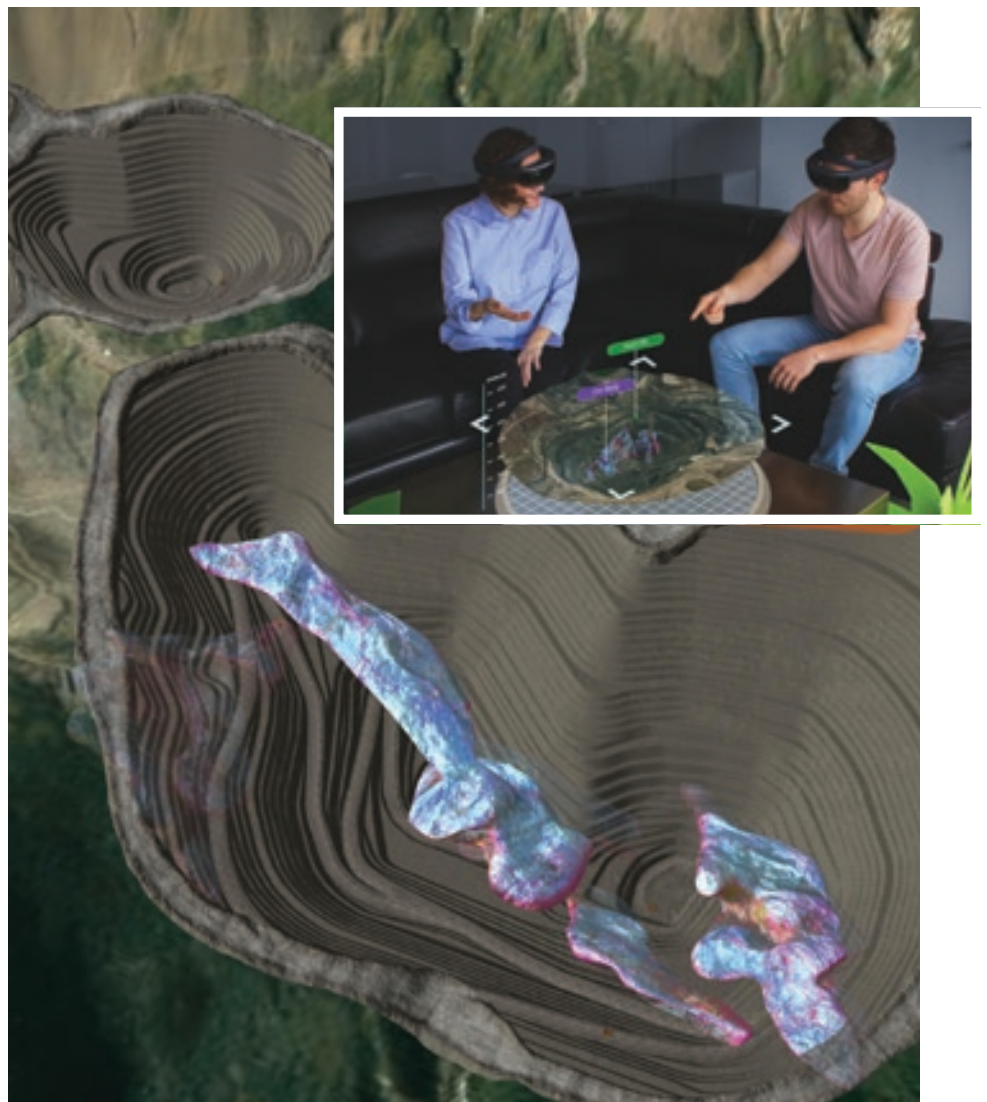
Digital Bird's-Eye View: Virtual Mines Create Real Value

Exploring and planning for a new mine generates enormous amounts of data—geology, drill hole information, infrastructure plans, social and environmental baselines, and much more. Normally, that data exists mostly on paper and spreadsheets until actual development begins. But now, we're using virtual reality to build entire operations and travel through every stage of the mine life without even leaving the office.

Teck has partnered with Vancouver technology company LlamaZOO to create “virtual twins” for mine planning and community engagement for our projects. The immersive virtual reality experience brings people to the site without having to travel there and allows them to see aspects of the proposed mine that you couldn't otherwise see.

During a virtual tour, users can fly over the site to view orebodies in the ground with different minerals highlighted, the infrastructure required and the scale of it, and the weather and topography of the mine site and surrounding area. Users can also advance through the different phases of mine development during the virtual tour, including the post-closure and reclamation landscape. And the orebody itself—hidden deep underground—can be fully viewed in three dimensions.

Virtual reality is helping our stakeholders better understand proposed projects and the associated reclamation and mitigation measures. It's also helping to enhance mine planning, from productivity to environmental measures, and support reclamation planning. ■





MEET TECK'S INNOVATORS MOHAMMAD BABAEI

In this first of a series profiling innovators across Teck, we meet Mohammad Babaei, Lead, Digital Mining Innovation.



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It started with rocks. Growing up, Mohammad Babaei was fascinated with geology. His favourite toy was a hammer, which he used to test the hardness of rocks. Mohammad’s hobby turned into a passion and today, he holds a PhD in mining engineering from the University of British Columbia.

“I didn’t want to become a conventional mining engineer,” said Mohammad. “I wanted to invent, to explore the mechanical and analytical side of mining, to create something new.”

During his studies at UBC, Mohammad worked in a biomedical and control lab and then in the field on shovel technology, which led him to Teck, where today he is the Digital Mining Innovation Lead at our Vancouver office.

Since he joined Teck, Mohammad has pioneered a diggability model and heads up display to enhance shovel operator performance and improve productivity at our operations. Thanks to his groundbreaking work, Mohammad recently won the CIM–Bedford Canadian Young Mining Leaders Award. We sat down with Mohammad to ask what inspires him about innovation and technology at Teck.

I wanted to invent, to explore the mechanical and analytical side of mining, to create something new.

What inspired you to get into this work?

When I was working at Elkview Operations during my PhD, I spent a lot of time in the shovels. There was a member of the digital operations team, Kevin Urbanski, who was modifying the code used in the shovel computers to optimize performance. It was a totally new way of thinking about the system and it made me realize that working for a big company like Teck could be fertile ground for innovation.

Which project are you most excited about?

I am currently collaborating with tech company Finger Food Studios to create a heads-up display for shovel operators. The display will vastly improve communications with operators, which will not only help improve productivity and save millions of dollars in operating expenses, but also make the experience of using a shovel more interesting and engaging for the operators.

Blue sky thinking. Real world action.



When you imagine the future of mining, what do you see?

Mining has become like science fiction. Take the heads-up display we're working on. Five or six years ago, people would have laughed at it and said it was impossible. Now, it's real and we're just getting started. Five to ten years from now, autonomous equipment will be everywhere and machine learning will be running operations. Things are changing and I'm excited to be part of it.

What are people surprised to learn about you?

I'm an avid reader—right now, I'm reading *Collective Genius: The Art and Practice of Leading Innovation*. I inherited my love of reading from my father, who is a professor of English Literature. In fact, he was the one who inspired me to get a PhD. Between my father, my brothers and I, there are four PhDs in our family. We love to learn. In my spare time, I write papers for journals. I was most recently published in *International Journal of Mining Science and Technology* on "Rock fracture density characterization using measurement while drilling (MWD) techniques".

Who are the mentors or heroes you look up to?

Outside of Teck, it would be Jonathan Peck, President and CEO of Peck Tech Consulting Ltd. and an adjunct professor at Queen's University. He has so many connections in the industry and a long history of developing cool technologies. Inside Teck, there are many people who encourage grassroots innovation, like Peter Cunningham, Director, Digital Operations and Kal Ruberg, Vice President, Teck Digital Systems and Chief Information Officer. Plus I've always wanted to collaborate with MIT, so working with Kal, who is an MIT alumnus, is very inspiring and exciting. ■

PEOPLE & PLACES



Allyson Stoll

**Project Metallurgist
Red Dog Operations**

When did you start at the company, and at which site/office?

I started with Red Dog Operations in June 2011.

Could you provide a brief description of what you do in your role?

I currently work on mill improvement projects, such as grinding circuit optimization, utilizing acoustic monitoring and advanced process control systems, and I provide technical support to other projects like the VIP2 mill expansion at Red Dog Operations.

What is your favourite part about your job?

I love that I get to make visible, felt improvements to operations through assisting in the training of operators and other engineers, and completing projects to make processes and tasks safer and more efficient.

What is your most memorable moment working at Teck to date?

I was given the opportunity to participate in the MOP mill expansion commissioning at Highland Valley Copper in 2014. The whole experience was challenging, but everyone on the team was very welcoming and helpful. I learned a lot and had a chance to not only contribute to another operation but also to prove myself technically.

What is your favourite activity outside of work, and why?

Right now, it's listening to records with my husband. We've recently started collecting and have been listening to everything we've found or been recommended. I'm constantly looking for suggestions.



Brian Bisset

**Senior Mine Technician
Elkview Operations**

When did you start at the company and at which site/office?

I began at Line Creek in 2010 in operations before moving to my current role at Elkview.

Could you provide a brief description of what you do in your role?

I work in engineering as a long range planner, but part of my education was the study of photogrammetry so—35 years later—when I saw that drones were being used for video work on site, I thought why not introduce photogrammetric surveying to our sites.

What is your favourite part about your job?

The future of the technology we are working with is exciting. New hardware and software costs less than its predecessor and can be used the majority the time to produce the same or better results—it really doesn't get any better than that.

What is your most memorable moment working at Teck to date?

I introduced Teck Coal to the use of drones for surveying, and since that time, the use of drones has quite literally taken off. Teck's willingness to develop and ultimately embrace innovation is phenomenal, and to be a part of this culture of change is very gratifying.

What is your favourite activity outside of work?

Photography mostly [see some of Brian's work in 'A Picture is Worth 1000 Words']. I also enjoy watching rugby, and a bit of strategic gaming to keep the mind and reflexes sharp.



Calgary, Alberta

Janais Turuk

**Manager, Community Relations
Calgary office**

What is the city’s point of pride?

For me, the area’s point of pride are the Rocky Mountains, which are approximately one hour drive west of Calgary. Winter or summer, there are many alpine activities and the scenery still takes my breath away.

Is there anything the city is famous for?

The Calgary Stampede, of course—the largest outdoor show on earth!

What is the city’s best-kept secret?

Village Ice Cream; it’s made locally in small batches.

What is your favourite restaurant in the city?

Char Bar, in East Village. It specializes in local, sustainable ingredients.

What is a typical weekend like there?

A typical weekend in Calgary and region is active—summer or winter, we’re an outdoor city and we take advantage of many different activities throughout the city and in the region. Calgary does a great job of supporting many festivals, arts, cultural and recreation activities—there is an activity for any taste and for any budget.



Arequipa, Peru

Juana Rosa Del Castillo

General Manager, Zafranal Project

What is the area’s point of pride?

In 2000, UNESCO declared the Historical Centre of Arequipa a World Heritage site. As described by UNESCO, the Historical Centre of Arequipa was built using volcanic sillar rock and represents the integration of European and native building techniques. This combination of influences is illustrated throughout the city’s robust walls, archways and vaults, courtyards and open spaces, and the intricate Baroque decoration of its facades.

Is there anything the area is famous for?

Arequipa is famous not only for its ancient heritage but also for its natural landscape, such as the Colca Canyon, a deep river canyon and a habitat for the giant Andean condor.

What is the best-kept secret in the area?

Arequipa is one of the best places in Peru to eat guinea pig; it is one of the area’s delicacies.

What is your favourite restaurant in the community?

The cuisine of Arequipa is very rich in flavour and is a fusion of Peruvian and Spanish food. La Benita in the Characato district is a traditional Peruvian “picanterías” restaurant.

What is a typical weekend like there?

Locals have strong religious beliefs, so attending mass early on Sundays is part of a typical weekend, along with lunching with family or camping in the countryside.

In the Know: Zafranal is a copper-gold porphyry deposit located in Arequipa, Peru. It is one of five projects that comprise Project Satellite, an initiative focused on significantly growing the value of our key base metal development assets.

A PICTURE IS WORTH 1,000 WORDS

1. Victoria Sterritt, Lead, Technology and Innovation, Vancouver office, spoke on a panel with Bryan Cox, President and CEO of the Mining Association of BC, on mining and technology during the BCTECH Summit in Vancouver in May 2018.

2. Employee photography spotlight: A Chilean harrier, spotted by Jaime Mendoza Gallardo, Engineering Geomechanic, on the peripheries of Carmen de Andacollo Operations.

3. When he's not using a drone to capture the landscape, Brian Bisset, Senior Mine Technician, Elkview Operations, enjoys spending time behind the lens of his own camera. An avid employee photographer, Brian's work features the local region, from mountains to mine equipment. "I live and work in one of the most beautiful places on the planet and I'm a photographer. What's not to like?"

4. President and CEO Don Lindsay, pictured here with Mohammad Babaei, Lead, Digital Mining Innovation, Vancouver office, tests out the heads-up display simulator at Teck's 2018 Annual General Meeting on April 25 in Vancouver.

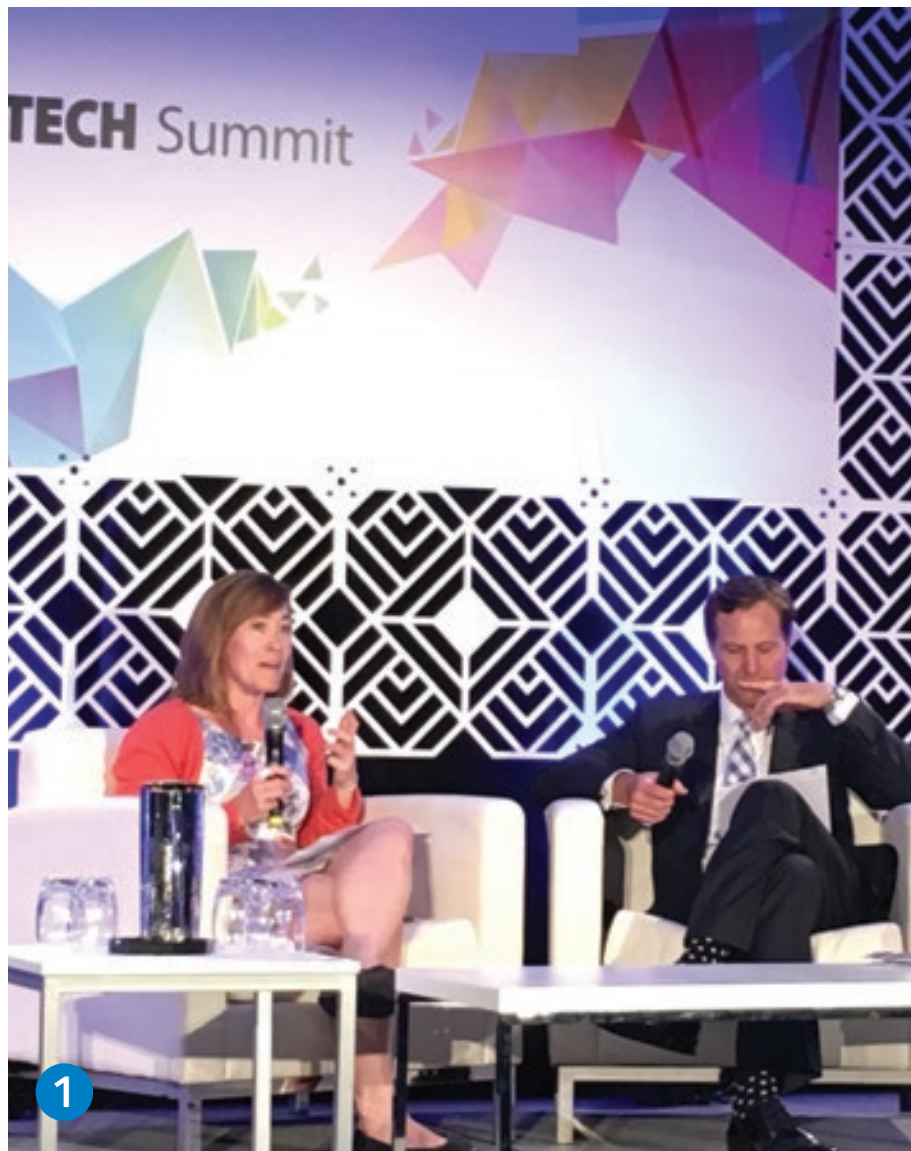


Photo submissions are welcome from employees across Teck and may be sent to connect@teck.com





Mine Rescue Roundup

Teck's mine rescue teams once again demonstrated true skill, dedication and excellence in achieving top rankings in recent mine rescue competitions.

At the 2018 Alberta Provincial Surface Mine Rescue Competition held in Spruce Grove on June 15–16, Cardinal River won Best Written Exam, placed second overall, and Best Captain was awarded to Shane Taylor.

At the 2018 B.C. Provincial Mine Rescue and First Aid Competition held in Kimberley on June 9, Teck mine rescue teams achieved the following:

- Highland Valley Copper won Best Overall Surface Mine Rescue, Best Practical Bench Skills, Best Surface Rope Task, Best First Aid, Best Fire, and Highest Non-Aggregate Points.
- Line Creek won Best Three-Person First Aid and Best Written. Coach Sandra Duncan was awarded the Kathie Lofstrom Memorial Trophy for Best Three-Person Coach.
- Sullivan Mine Captain Dave Heathfield was awarded Best Underground Bench Technician.

Teams from Greenhills, Fording River, Elkview and Line Creek Operations also competed in the 97th annual mine rescue competition hosted by the East Kootenay Mines Industrial Safety Association (EKMISA) in Sparwood on May 12. Elkview was named the winner of both the three- and six-person events, while Line Creek placed second.

Mine rescue competitions are important events that provide an opportunity to test emergency response and rescue skills, and share best practices. Members of these teams are to be commended for their hard work, safety leadership, and commitment to helping ensure everyone is going home safe and healthy every day.

Congratulations to all the teams and participants who recently took part in competitions on their impressive performances, and thank you for exemplifying our core value of safety. ■





MINING FOR MIRACLES

Also participating in competition was Team Miracle, a mine rescue exhibition team formed to help raise awareness of health and safety in the mining sector and support the Mining for Miracles campaign. Mining for Miracles is the BC mining community's longstanding fundraising campaign in support of the BC Children's Hospital Foundation.

This year, Team Miracle were also promoting diversity in the workplace with an all female team, including three women from Teck, to encourage more women in the mining sector to participate in their respective mine rescue teams on site.

For more information, visit:
www.teammiracle.ca



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“If there’s any way to make our lives more efficient, I’m game.”

Shari Lomon, Supervisor, Health and Safety,
Kimberley office

Let's Get Digital

Our people are finding innovative solutions and putting ideas at work in motion.

"You always have a phone on you—why not turn it into a tool?"

So that's precisely what Shari Lomon, Health and Safety Supervisor for Teck's legacy properties in B.C., did.

Ideas...

Maintaining closed and reclaimed mine sites involves tasks like environmental assessments, remedial projects and decommissioning of properties. Activities are often carried out by small teams, and it's important that work processes safely maximize available resources.

With the initial goal of improving the on-site employee tracking system at the Sullivan Mine, Shari's research led her to the discovery of a simple log-in/out app. With the successful use of the app, Shari began to research other mobile safety apps and discovered GoCanvas a platform that allows users to develop custom mobile apps that can be used for data collection and sharing.

Apps are created using software on a desktop computer, no coding necessary. Once they're ready and uploaded, users can complete forms on their personal mobile devices and then submit or email the forms directly to recipients, all in real time, eliminating redundant data entry.

...at Work

"It's changed our lives," says Michelle Unger, Manager, Environmental Compliance, based out of Teck's Kimberley office. "Shari's idea to get this initiative going opened the door for everyone in our office. Everyone jumped on board and found it really useful."

Seeing the potential to expand beyond the platform's initial use to other processes, Shari's driven the initiative to move to digital reporting for everything from field level risk assessments, to vehicle safety checks, to 'Take 5' workplace inspections.

"We branched out and started using the system for environmental applications one day after a colleague shared his frustration with inputting data (photos and written field notes) into dam safety inspection forms," she explains. "I approached him with the idea of making 'an app for that', and things took off from there."

In the last year, Shari's created 27 apps and has 30 employees working with the user-friendly digital tool, which can be easily accessed from a smartphone or tablet. Shari's innovation has garnered interest from others working on Teck legacy sites as well the broader Environment team, with growing interest from other groups as they learn about the benefits of the innovation.

Her idea is just one example of how employees are looking for new ways to continuously improve all areas of our work—in this case, leveraging mobile app technology to streamline work processes related to health, safety and environment.

"I would like to make an app for everything," Shari laughs. "If there's any way to make our lives more efficient, I'm game." ■

Trail's Pioneering Spirit: How Invention and Industry Shaped a Town

For many, Trail Operations is synonymous with the City of Trail—the smelter, established in the late 1800s, followed by the incorporation of the city in 1901—share a deep history that is now on display in the city's new Riverfront Centre, a state-of-the-art integrated library and museum facility that opened this spring.

"Industry is the overarching theme: it's why people came to Trail, it's why people stayed, and it's what's sustaining us today," explains Trail Museum and Archives Manager Sarah Benson-Lord, who also facilitates Trail Operations' After Hours magazine. "We can't ignore industry as the primary factor for the creation and the sustainability of this town."

Natural light beams into the Riverfront Centre like a spotlight on the Teck Commons area, designed as the community gathering space in the building. Old industry photographs run alongside the staircase as a prelude to the museum, located on the second floor.

A showpiece of the museum is the original machine draft drawings outlining differential froth flotation, a groundbreaking new method for the separation of zinc and lead ore invented at Trail Operations by Ralph Diamond between 1917 to 1920. Today, a standard process for ore recovery used worldwide, differential froth flotation was a radical departure at the time.

"Differential flotation not only unlocked the treasures of the Sullivan Mine's rich zinc-lead-iron sulphide ore that was refined at Trail Operations, it also ensured the future of the smelter," explains Carol Vanelli Worosz, Community Engagement Leader for

Teck's Trail Operations. "It was the first successful large-scale differential flotation operation anywhere in the world, and it added a significant weapon to the metallurgists' arsenal for mineral recovery."

The Riverfront Centre also celebrates the long line of past Trail Operations' employees, through photographs and memorabilia like tiny zinc tools and gold medallions given out as company anniversary gifts. Memories may be further jogged by the display of the Cominco Magazine, which was started as a wartime publication that was sent to employees on active service overseas.

There's a distinct thread of company presence in nearly every part of the museum, spanning topics from wartime to immigration, which helps tie all sections of the area's history together.

The last exhibit in the museum, titled The Hill—a parochial term used by locals to reference the smelter—especially represents Teck's relationship with the City of Trail.

"If we hadn't had that one discovery—differential flotation—you wouldn't have seen the immigration boom and you wouldn't have seen the development of zinc processing in Trail," reiterates Sarah. "We're trying to show

people that, without these brilliant minds, we wouldn't have seen people flock here in waves like they did."

Along with the industrial boom came a cultural movement, as people from around the world came to the area for work. As they laid their roots in Trail, it helped further shape the city. Those varied cultures are still represented at community functions today with music by the Trail Pipe Band and the Trail Maple Leaf Band. And Italian flavours are apparent in establishments like the Colander Restaurant—an all-you-can-eat spaghetti Trail tradition—and Star Grocery, a deli known for its fine meat, cheese and Italian delicacies.

For some, touring the new museum is like flipping through old family photos, as donated family treasures and company prized possessions jog their memory.

"I think almost every Trail family has a story or two that identifies the relationship between Teck and the community," says Carol, a third-generation Teck employee. "This facility is a beautiful, modern showcase that stands out as an anchor for the community, a key draw for downtown, and a place that will become a focal point and gathering place as intended." ■



Above: Carol Vanelli Worosz (left), Community Engagement Leader, Trail Operations and Sarah Benson-Lord (right), Trail Museum and Archives Manager, in the Teck Commons area of the Riverfront Centre.



Below: The Riverfront Centre, a state-of-the-art integrated library and museum facility, is located in downtown Trail.

May the Force Field Be With You

Carmen de Andacollo Operations (CDA) is at the forefront of developing new and innovative ways to improve air quality, including a new pilot project that uses an electrostatic “force field” to combat dust. While it may sound like science fiction, it has the potential to achieve real-world results.

Background

In 2015, CDA launched a detailed Atmospheric Decontamination Plan, with a goal of lowering dust emissions by 65% over two and a half years.

CDA exceeded those targets and achieved a 78% reduction in particulate matter (PM10) over 2010 levels, reaching this milestone a year earlier than expected. The operation has sustained those results through a variety of techniques including: application of dust suppressants on equipment and roads; using a filter vacuum sweeper truck; stockpile domes; environmental monitoring courses; and, implementation of double-layer test blasting.

Now, to build on those improvements, CDA is evaluating a new approach to dust suppression, using an electrostatic “force field” to suppress dust inside the mine. The pilot project also aims to further evaluate different atmospheric variables and conditions across various mining activities and areas of the operation, that may be affecting air quality.

How It Works

Electrostatic waves are used to charge dust particles within a 20-metre radius of the antennas located in the pilot project test area, with the radius increasing in subsequent stages of evaluation.

Once charged, the dust particles increase in mass—they get heavier—and that causes them to fall to the ground.

CDA was selected as an ideal site to pilot the project because of the tremendous amount of work and success already achieved with dust suppression and air quality improvement.

The pilot project is expected to conclude by the first quarter of 2019, at which time test results will be analyzed and the overall system evaluated for viability.

A Collaborative Approach

“Work on this project has been a true collaborative effort involving several groups at CDA, working alongside industry partners and research organizations,” notes Ximena Retamal, Environment Superintendent, CDA. “Finding and implementing innovative solutions requires bringing together many different perspectives, experiences and expertise.”

Also supporting the project is Teck’s Applied Research and Technology group (ART), which is evaluating the scope of study from a technical point of view. “We’re helping evaluate the viability of this innovative approach to dust suppression,” says Clemente Miranda, Senior Environmental Engineer, ART. “We’re also closely monitoring to see if there are potential applications elsewhere at Teck, like the Elk Valley. ■



Introducing Copper & Health

Improving health outcomes for people and raising awareness about the importance of mining and metals in our everyday lives is at the heart of Teck's new program, Copper & Health.

Healthcare-acquired infections are one of the leading causes of death in Canada and the U.S. Copper is an innovative preventative solution, and around the world, copper surfaces are being installed in healthcare facilities to keep patients safe and healthy.

How Does Antimicrobial Copper Work?

Copper has unique antimicrobial properties—when installed on high-touch surfaces, copper eliminates 99.9% of harmful bacteria. It's proven to continuously kill bacteria that cause infection, is safe for people and the environment, and is the only solid metal touch surface registered as a public health product by Health Canada and the U.S. Environmental Protection Agency.

Antimicrobial copper requires no new processes, staff training or special maintenance, and it supplements standardized hospital cleaning by killing bacteria around the clock.

To date, antimicrobial copper has been installed in more than 90 healthcare facilities in 26 countries in Europe, South America, Africa and Asia.

What is Copper & Health?

Through our new Copper & Health program, Teck is raising awareness, building partnerships and the evidence base in Canada, and improving health outcomes for patients, visitors and healthcare workers.

Work towards these goals is already underway. With Teck's support, Vancouver General Hospital (VGH) recently opened its newly expanded Intensive Care Unit, which included the installation of antimicrobial copper on all horizontal surfaces, the first such use of copper in a Canadian hospital.

To learn more about the innovative work being done through Teck's new Copper & Health program, visit: www.coppersaveslives.com ■

Zinc & Health: What's Next?

Since our Zinc & Health program launched in 2011, Teck has helped make significant progress in reducing preventable deaths of children: child mortality rates have decreased in every one of our Zinc & Health project countries. Today, more children are reaching their fifth birthday than ever before.

In 2018, Teck will continue work to help solve the global health issue of zinc deficiency through new partnerships and updated program pillars.

Visit www.zincsavestives.com for more information, and watch for an update on our WE Day campaign in future issues of *Connect*.

Finding new and innovative ways to reduce healthcare-acquired infections will not only help save patients' lives, it will keep visitors, nurses, doctors and others from getting sick when visiting a loved one or doing their job.

*Don Lindsay,
President and CEO*

COPPER & HEALTH
HAS THE POWER TO SAVE LIVES



Learn more:
www.coppersaveslives.com

**NUMBERS
WE CAN'T
IGNORE**




250,000



patients will contract an infection while receiving healthcare in Canada every year; **14,000** of those patients will die

\$1 BILLION

is the estimated annual cost to the Canadian healthcare system to combat healthcare-acquired infections

99.9% 
of bacteria killed within two hours of contact with antimicrobial copper

50%



of healthcare-acquired infections are resistant to at least **one antibiotic**



Copper + Health

Teck

100 Years of Progress Through **Advances in Technology**

Throughout our history, Teck has changed the way the mining industry operates by developing new technologies and the introduction of new processes. Here are just a few examples of how...

Differential Froth Flotation

In 1917, we helped to develop the method of mineral processing known as differential froth flotation, which significantly improved mineral recovery, increased the efficiency of our operations and became an industry standard. The technology allowed separate recovery of lead and zinc concentrates. This technology has become the industry standard used around the world for various types of orebodies.

Aeromagnetic Surveying

In 1946, Dr. Norman Keevil Sr. introduced aeromagnetic surveys to Canada, based on technology developed during World War II to detect submarines. Using a geophysical technique called Self Potential, Dr. Keevil and his associates found the high-grade copper deposit that became the Temagami Mine. The effect of this discovery completely altered the face of mining exploration, and the technology is still widely used today.

Water Treatment

In 1979, at our Sullivan Mine, we pioneered a groundbreaking water treatment technology known as high-density sludge water treatment, and installed one of the first operating plants in the world to treat acidic mine drainage water. This technology is now widely used in the industry, especially for the treatment of mine-affected waters.

Drill Navigation System

In 1994, the Aquila drill navigation system was developed at Fording River Operations. As the first deployment of high-precision GPS, it allowed operators to navigate within +/- 10 cm, regardless of weather and visibility. The highly improved accuracy enabled smoother benches and blasted to a constant elevation and more consistent fragmentation. Combined with rock recognition, this navigation system improved blast designs and recovery. Today, Aquila, or Terrain as it is now known, is still the industry standard.

The CESL Process

In 1994 at our CESL facility, a specialized hydrometallurgical process known as the CESL Process was developed and patented. The process is capable of unlocking value from large, long-life copper sulphide resources that produce concentrates with high levels of impurity elements, such as arsenic, while minimizing the environmental costs of doing so. The CESL Process is also applicable to bulk, lower grade or impurity challenged copper-nickel sulphide concentrates that would otherwise be problematic and uneconomic to process using traditional technologies. Teck is actively pursuing opportunities to take advantage of this proprietary and commercial-ready technology.

Water Management

Teck is taking action to address the challenge of substances related to mining in water, such as selenium, and to protect the health of the Elk River watershed in B.C., through our Elk Valley Water Quality Plan. As part of this work, in 2016, we commissioned the West Line Creek Water Treatment Facility, which is designed to remove selenium, nitrate and other elements, using a biological water treatment process that relies on micro-organisms to convert selenium to its particulate form and then remove it through filtration. Construction is also underway of the Active Water Treatment Facility at our Fording River Operations, which will use the same treatment process and recent additional design enhancements as our West Line Creek facility. ■



Differential Froth Flotation
1917



Aeromagnetic
Surveying
1946

A version of this article first appeared in *Connect*, Volume 4. For more from the *Connect* archives, visit teck.com/connect



The CESL Process
1994



Drill Navigation System
1994



Water Treatment
1979



Water Management
Present Day



Profiling Our Growth Projects: QB2

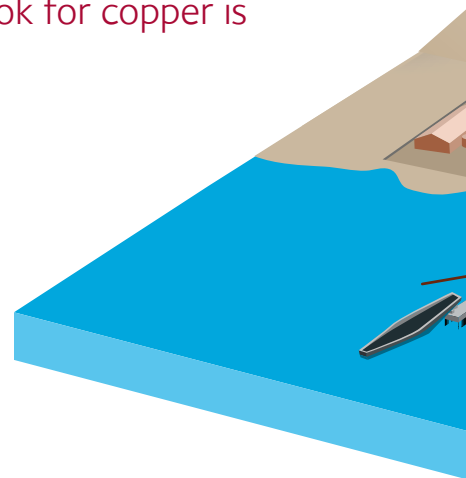
Quebrada Blanca Phase 2 (QB2) is Teck's highest priority growth project. Once built, QB2 would transform our copper business, making Teck one of the world's major producers of copper, at a time when the longer-term outlook for copper is very positive.

With a project permit expected mid-2018, and a possible sanction decision as early as the second half of this year, the QB2 project aims to develop the sulphide resource underlying the existing Quebrada Blanca Operations in Chile.

QB2 has a large resource, with an anticipated 300,000 tonnes of annual copper equivalent production over the first five years. Once in production, QB2 will be a multi-generational asset that is expected to be a cornerstone for Teck for decades to come.

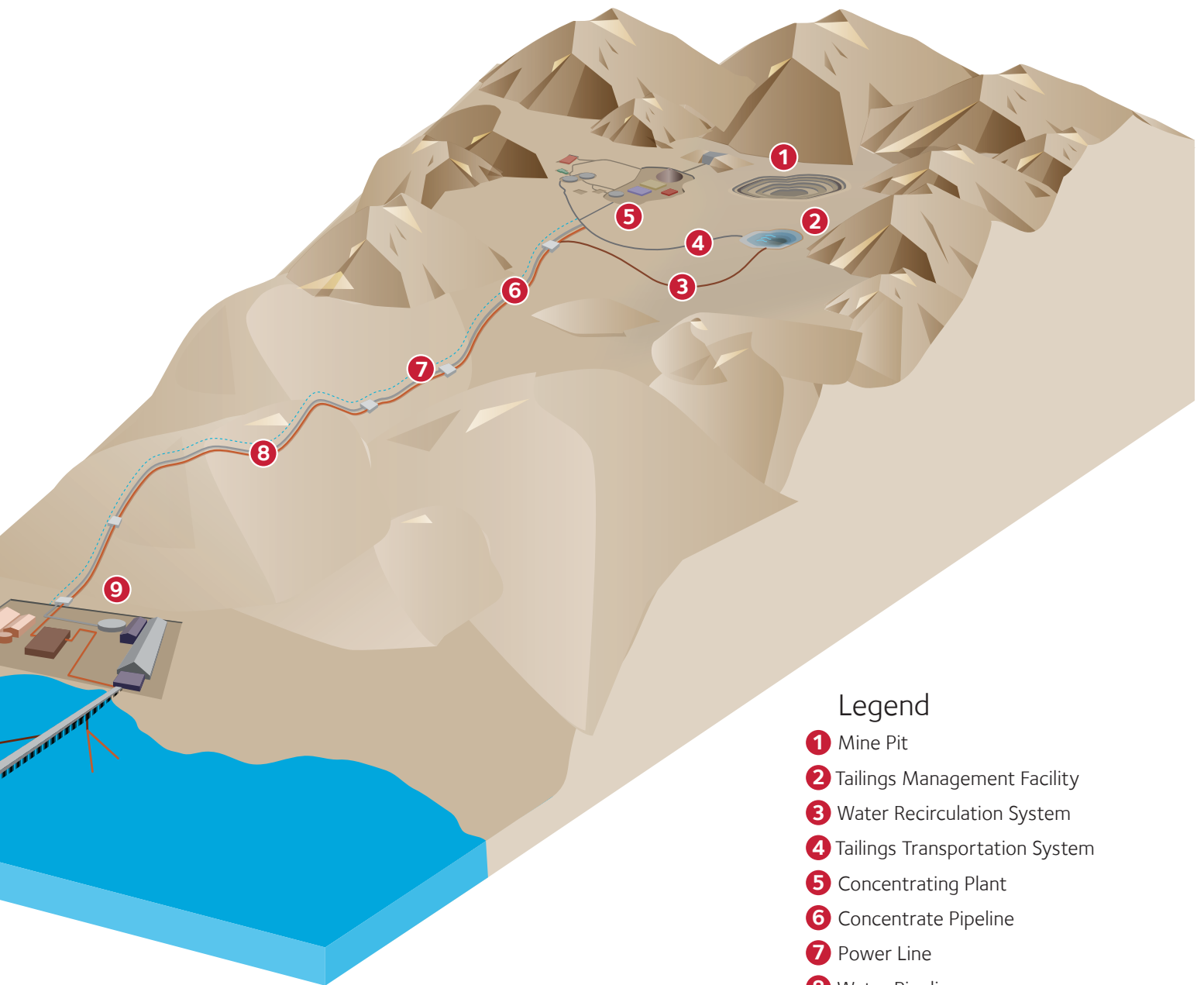
Interesting Extras

- If it were in production today, QB2 would be within the top 15 copper producers in the world.
- QB2 (the sulphide resource) is located under the existing Quebrada Blanca operation (the supergene resource). As a result, QB2 is effectively pre-stripped, which greatly reduces the cost and effort required to access the valuable ore.
- The anticipated 25-year mine life represents only about 25% of the known reserves and resources; there's potential for a much longer mine life, or optionality for future expansion. ■



Development Plan

Development of QB2 is expected to include the construction of a new concentrating plant, a tailings facility, major infrastructure installations for transporting concentrate and sea water, and facilities to receive, filter and ship concentrate in the North Patache sector south of Iquique. Desalinated sea water—which will be taken from the coast and pumped through a pipeline to the mine—will be the primary source of water for the QB2 project.



Legend

- 1 Mine Pit
- 2 Tailings Management Facility
- 3 Water Recirculation System
- 4 Tailings Transportation System
- 5 Concentrating Plant
- 6 Concentrate Pipeline
- 7 Power Line
- 8 Water Pipeline
- 9 Port Facilities and Desalination Plant

At A Glance: Teck's Technology Centres

In addition to Teck's technology teams throughout our sites and offices, our technical expertise is also organized and operated out of three separate centres: CESL, Applied Research and Technology (ART), and the Product Technology Centre (PTC). Learn more about the role each one plays in providing technical expertise across our business and beyond:



CESL Limited (CESL)

Location: Richmond, British Columbia

Number of employees: 46

Manager: Keith Mayhew

Focus areas:

- Providing technical support to our operations including managing, constructing and operating bench and pilot-scale plants
- Working on corporate and site initiatives to evaluate technical initiatives, develop operational strategies, inform cost estimates, and reduce scale up risks
- Overseeing development of proprietary hydrometallurgical technology, offering an environmentally superior method for treating concentrates

Applied Research and Technology (ART)

Location: Trail, British Columbia

Number of employees: 40

Manager: Rob Stephens

Focus areas:

- Working with business units to characterize orebodies, develop and test processing options
- Identifying, evaluating, and supporting the implementation of technologies to improve performance and decrease operating costs
- Designing and testing innovative solutions to potential environmental impacts

Product Technology Centre (PTC)

Location: Mississauga, Ontario

Number of employees: 8

Manager: Graeme Anderson

Focus areas:

- Supporting Toronto metal sales in securing and maintaining customers for Trail metal products through technical services related to metal end uses, including: material selection, expert analysis of customer product or process-related problems, and the application of technologies for product/process improvement
- Addressing technical issues of concern or interest to refined metal customers and end use industries through a research and development programs ■

For more on these facilities, visit teck.com



SEEN ON SOCIAL



Record. Breaking. Total. Teck's Celebrity Pie Throw raised a record-breaking \$1,606,594.00 for BC Children's Hospital Foundation. Thank you to everyone who participated. #MiningforMiracles

We're sharing Teck's stories on social media. Visit us online to find these and more.

-  /TeckResourcesLtd
-  /TeckResources
-  @TeckResources
-  Teck Resources Limited



March 8 marked International Women's Day, a day that celebrates the social, economic, and cultural achievements of women while also focusing world attention on areas requiring further action. Watch an inspiring video featuring a few of the inspiring women of Teck.



#DidYouKnow headphones were invented in 1910? And they've always used mined materials. Check out the #miningwithprinciples website to see how we attain these materials ethically: miningwithprinciples.com



Celebrating the 50% completion of the Trail Operations No.2 Acid Plant with Michelle Mungall, MLA and Katrine Conroy, MLA. The new plant is an important investment to further improve operational and environmental performance.

INNOVATIVE THINKING

is driving our
industry forward.



Ideas at work.

Teck