# SKILLS ROADMAP PROJECT:

## CAREERS ROADMAP REPORT

*Exploring how to meet the B.C. mining sector's future skills and* training needs

CTEM

CENTRE OF TRAINING EXCELLENCE IN MINING

*Funding provided through the Canada-British Columbia Labour Market Development Agreement.*

A Sector Labour Market Partnerships (LMP) Skills Roadmap Project.
Provided by B.C. Centre of Training Excellence in Mining (CTEM).

The views and opinions expressed in this report are those of its author(s) and not the official policy or position of the Government of British Columbia.

The artwork on the front cover – The Frog – was gifted to CTEM by Dean Heron. Dean is a member of the Wolf clan of the Kaska/Tlingit Nation and is a member of the Skill Roadmap Project Team.

"The frog represents transformation and being the voice and the messenger to carry the work we are doing forward. The frog depicted here is poised to leap into the future." ~Dean Heron

For more information on this document please contact CTEM: info@bc-ctem.ca or visit www.bc-ctem.ca.



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Report Provided by BC Centre of Training Excellence in Mining (CTEM)
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# Introduction

BC's mining sector directly employs over 30,000 workers[1] and thousands more through indirect employment and contributes to the economy of local communities throughout BC due to the expenditures of mine suppliers and mine employees living there.

With one of the largest clusters of exploration and mining companies in Canada, BC is recognized as a centre of excellence in exploration and mining related fields. The Ministry of Energy, Mines and Low Carbon Innovation estimates the total value of mine production in 2020 was $9.28 billion including coal, copper, gold, industrial minerals, aggregate, molybdenum, and silver[2]. Currently, there are 18 active metal and coal mines in BC[3], 30 industrial mineral mines[4], 326 active exploration projects (providing an additional $330 million of expenditure)[5], and over 1,000 aggregate operations near every community in the province[6].

The sector is dynamic – it is sensitive to global market conditions and technology and automation are changing the nature of the work – leading to new and evolving careers. Societal expectations and markets are driving the increase of key environmental, social and governance activities, in addition to the changes in the workforce that most industries in the province are experiencing; more workers leaving the workforce than there are new workers entering it.

2020 was a challenging year– as COVID-19 created economic downturns and social uncertainty, impacting both the supply and demand sides. But as the global economy begins to recover from the pandemic, changes in technology and increased automation continue to provide pressures for the mining sector workforce to evolve its skills to stay current with new technology and innovation that is driving changes in both corporate environments and mining operations. *"Rapid advances in technology innovation, including automation, digitization and electrification, are fundamentally changing how the mining sector operates".*

Automation and robotics have been identified as having the most impact in the BC mining industry, followed by data analytics and the incorporation of electrical and battery-operated vehicles, however; new computer software, artificial intelligence, the use of drones, virtual and augmented reality, and sensors are also changing the skills workers need[7]. This and provincial policies specific to environmental, social and governance (ESG), such

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1 Ministry of Energy, Mines and Low Carbon Innovation. 2022. Ministry of Energy, Mines and Low Carbon Innovation: Featured Topics. https://www2.gov.bc.ca/gov/content/governments/organizational-structure/ministries-organizations/ministries/energy-mines-and-petroleum-resources

2 Ministry of Energy, Mines and Petroleum Resources. (2021). *British Columbia Geological Survey*, *Information Circular 2021-01*. Retrieved from http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/InformationCircular/BCGS_IC2021-01.pdf

3 Ministry of Energy, Mines and Petroleum Resources. (2020). *BC Geological Survey, Map of Regional Geologist Areas and Boundaries*. Retrieved from (https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/mineral-development-office/regional-geologists)

4 Ministry of Energy, Mines and Petroleum Resources. (2020). *British Columbia Geological Survey Information Circular 2020-01*, revised February 2020, p.7. Retrieved from (https://www.cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/InformationCircular/BCGS_IC2020-01.pdf)

5 Ministry of Energy, Mines and Petroleum Resources, Association for Mineral Exploration, EY, *The British Columbia Mineral and Coal Exploration Survey, 2019*, p.4. Retrieved from http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/EYSurvey/EYSurvey2019.pdf

6 Ministry of Energy, Mines and Petroleum Resources. (2020). *British Columbia Geological Survey Information Circular 2020-01*, revised February 2020, p.1. Retrieved from http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/InformationCircular/BCGS_IC2020-01.pdf

7 Centre for Training in Mining. June 2021. *Skills Roadmap Project Key Findings Report*. P.43.

as implementing the revised *BC Environmental Assessment Act, incorporating* the *BC Declaration on the Rights of Indigenous Peoples Act (DRIPA) with industry standards* and advancing *BC Mining Tax Incentives* provide the opportunity for new and exciting careers.

Consistent with this, mining is at the forefront of advancing reconciliation with Indigenous peoples and implementation of the *United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP*). The sector is a key employer of Indigenous people in rural and remote communities, and partner in benefit agreements and revenue sharing that provide revenue streams to advance community priorities. The mining sector has been and continues to be a leader in developing and implementing collaborative decision-making and including Indigenous communities in compliance monitoring and verification[8].

In summary, careers involving new technologies and technology-related activities, including environmental, social and governance priorities will be increasingly in-demand for skilled trades, geologists, engineers, and more.

## Opportunities for Use of the Careers Roadmap Report

The Careers Roadmap Report utilizes information gathered earlier in the project through primary and secondary research tools. Specifically, a literature review and environmental scan, along with three focus groups, 21 key informant interviews and a survey with nearly 200 responses, were conducted to deepen the understanding of the mining sector workforce. It identified gaps in the research and literature, and the economic, social, labour, technological and policy factors that are shaping and impacting the BC mining sector's skilled workforce and helps to inform this report.

This report is inclusive and representative of diverse perspectives and reflects advancements in technology, innovation, and environmental, social and governance (ESG) responsibilities. The report elaborates on key themes and findings to date in the overall scope of the Project.

The intended audiences of this report include current, potential, and future mining sector workers; communities; education and training providers; employers; local, regional, and Indigenous governments; and partnering organizations who support the mining sector.

The Career Roadmap includes:

- Overview of the jobs available in the BC mining sector, both currently and in the future.
- Focused information on current and future in-demand jobs, in these groups:
  - Technology-related jobs
  - Trades-related jobs
  - Environmental-related jobs
  - Community-related jobs
  - Management jobs

The Career Roadmap can be used for:

- Students and future workers interested in a career in mining;
- Assisting education and career advisors to inform students of opportunities in mining;
- Informing future training programming to align with in-demand jobs and their evolving skillsets;
- Highlighting career advancement opportunities for current workers;
- Informing human resource capacity, succession planning, and future recruitment needs for industry;

8 British Columbia Mining Jobs Task Force. (2018). *Mining Jobs Task Force Final Report.* Victoria: BC Government. Retrieved from https://www2.gov.bc.ca/assets/gov/business/natural-resource-industries/mineral-exploration-and-mining/memp_10535_task_force_report_final-rev.pdf

- Supporting current and future workers to manage the direction of their career, and inform the career-related skills that are needed; and
- Preparing mining sector supports services for the changing needs of industry.

Additional links to career-related information by other subject matter experts are provided in Appendix C of this report.

For those interested in more information on new and emerging skills in the sector, this project developed a corresponding Skills Roadmap Report, and for more information on training-related material, readers can refer to the Training Roadmap Report.

# Opportunities for the Mining Workforce

There are more than 30,000 workers in BC's mining industry, [9] but the workforce is aging, putting pressure on the sector to attract new workers (young workers and those transitioning from other sectors). This HR issues is not specific to mining; all sectors are feeling the effects of the Baby Boomer generation retiring. However, this pressure is felt more acutely in mining as its share of youth aged 15-24 was reported at only 8 per cent in 2018, while the overall youth in the Canadian labour force made up 14 per cent of the total workforce[10]; indicating that mining has not been able to attract its share of young people to the sector.

Research suggests that job seekers may not be aware of the many career opportunities available in BC's mining sector and/or there may be a negative public perception of the industry concerning impacts to the environment caused by mining activity, creating a challenge in recruiting new workers to the sector[11].

Women represent just 19 per cent of the total provincial mining workforce, despite representing 48 per cent of the overall provincial workforce[12]. Finding ways to attract women into current and emerging careers in mining will be an important step in creating a sector with greater diversity and inclusion.

# Careers in Mining

The range of careers in mining is vast; there are more than 120 different jobs in the mining sector[13], across five phases of the mining life cycle:

1. Exploration
2. Mine site design and planning
3. Construction
4. Production/active mine
5. Closure

9 Ministry of Energy, Mines and Low Carbon Innovation. (2022). *Ministry of Energy, Mines and Low Carbon Innovation: Featured Topics.* Retrieved from https://www2.gov.bc.ca/gov/content/governments/organizational-structure/ministries-organizations/ministries/energy-mines-and-petroleum-resources

10 MiHR (2020). *Canadian Mining Labour Market Outlook 2020.* Retrieved from https://mihr.ca/wp-content/uploads/2020/03/MIHR_National_Report_web2.pdf

11 Jennifer Lewington (March 1, 2019). *Mining jobs grow for women, Indigenous people.* The Globe and Mail. Retrieved from https://www.theglobeandmail.com/business/article-mining-jobs-grow-for-women-indigenous-people/

12 MiHR (2016). *Preparing for the Future: Mining Labour Market Outlook for British Columbia 2016-2026*. Ottawa. Retrieved from https://www.workbc.ca/getmedia/f7c01e3e-ea59-416b-90aa-2725ebb9c250/mining_labour-market-outlook-report-for-bc_feb-2017.pdf.aspx

13 MiHR (2020). *The Changing Nature of Work: Innovation, Automation and Canada's Mining Workforce*. Retrieved from https://mihr.ca/wp-content/uploads/2020/05/MIHR_Innovation_Report_EN_WEB.pdf

Occupations require many areas of expertise and education, including; science, trades, technology, environment, community and administrative, across all levels of seniority.

As the mining sector grapples with rapidly shifting technology and innovation driving changes in occupations (both in mining operations and corporate environments), identifying and predicting skills required to operate these new technologies and further drive innovation is very challenging. Relying on literature and subject matter expertise to create understanding about the careers needed we forecast that jobs central to mining activities will continue to be in demand, while new and exciting roles in technology, trades, environmental, community and management occupations will emerge and expand.

For more information on the impacts to current workers, see the Skills Roadmap Report and Training Roadmap Report also from this Project.

## Jobs In-Demand

The majority of the expected job openings in BC are primarily in the northern and interior regions of the province, with the highest demand being in the following occupations across the five phases of the mine life cycle[14]:

- Heavy Equipment Operators
- Geoscientists and Oceanographers
- Truck Drivers Drillers
- Underground Production and Development Miners
- Supervisors; Mining, and Quarrying
- Land Surveyors
- Heavy Duty Mechanics
- Chemical Technicians
- Drafting Technicians
- Mining Engineers
- Geological Engineers
- Metallurgical and Materials Engineers
- Mechanical Engineers
- Civil Engineers

In addition to the occupations above, MiHR indicates a continuing high-demand for Geologists[15].

## The Impact of Technology and Innovation on Occupations in the Mining Sector

Rapid technological advancements are changing mining operations; cleaner technology and remotely operated machinery are creating safer work environments, while the ability to rapidly integrate information from the field, into the office environment is increasing the ability to utilize and rely on data to inform good decision-making.

The key technologies that are reshaping the sector are numerous and "include autonomous vehicles, remote operating centres, automated drilling and tunnel-boring systems, machine learning and more" (Corneau, 2019). In addition to autonomous vehicles, battery powered electric vehicles (BEV's) are now considered proven technology, and adoption is accelerating due to the cost benefits with regards to cooling and ventilation, and the ESG impacts from lower emissions[16].

14 WorkBC (2019). *Labour Market Outlook.* Retrieved from https://www.workbc.ca/getmedia/18214b5d-b338-4bbd-80bf-b04e48a11386/BC_Labour_Market_Outlook_2019.pdf.aspx

15 MiHR. (2016). *Preparing for the Future: Mining Labour Market Outlook for British Columbia 2016-2026*. Ottawa. p.4.

16 Canadian Mining Journal Staff. (Jan. 1, 2020). *BEV options for miners grow.* Canadian Mining Journal. Retrieved from https://www.canadianminingjournal.com/features/bev-options-for-miners-grow/

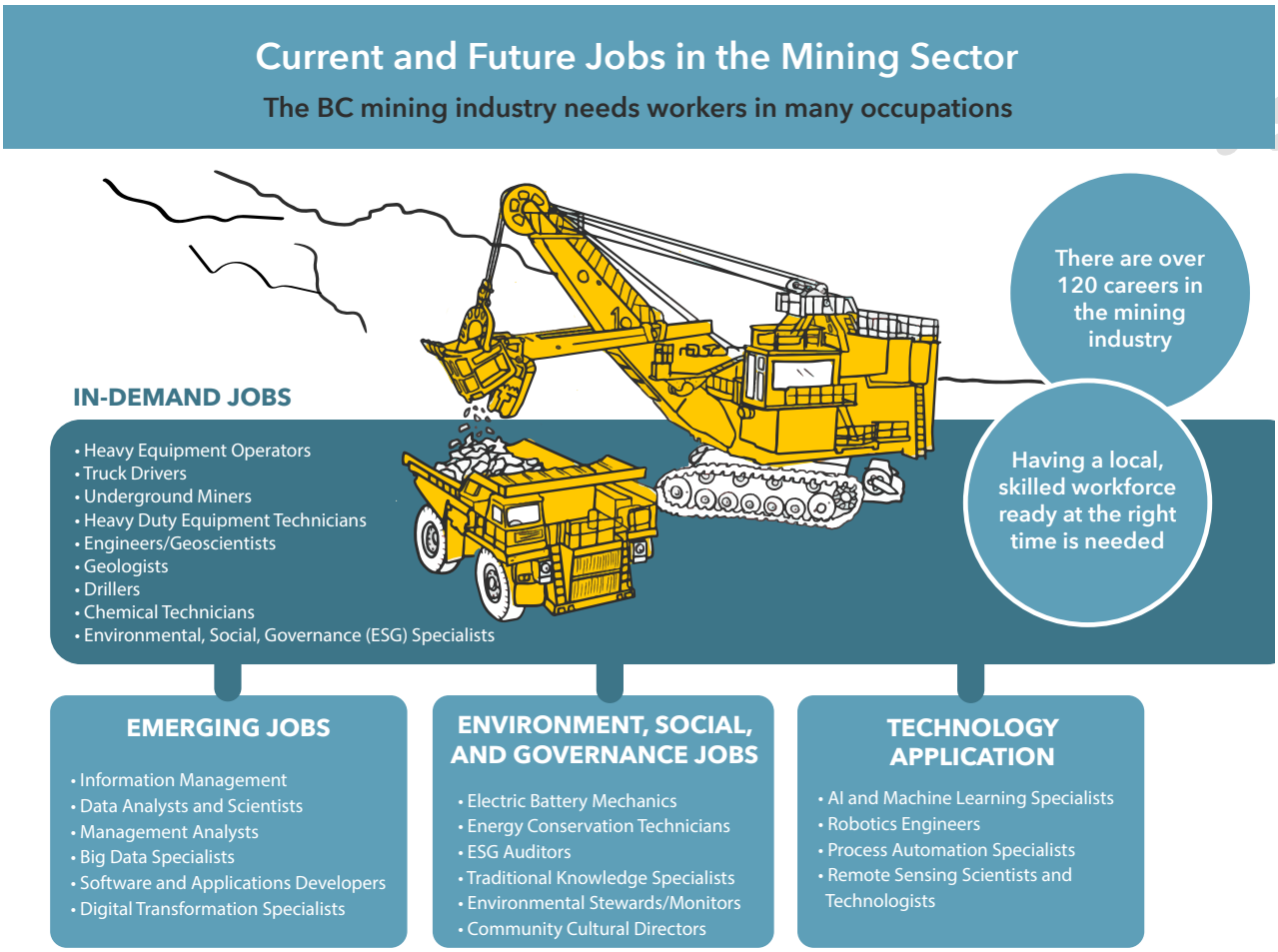



*Figure 1 – Current and Future Jobs in the Mining Sector*

## 1. Technology Jobs

According to a study done by the Workforce Information Council[17], the high-tech sector can be defined as industries having high concentrations of workers in science, technology, engineering, and mathematics (STEM) occupations. The increasing digitization and automation of work within the mining sector is creating the need for more technology-focused jobs that traditionally fall within this high-tech sector.

The World Economic Forum states the following jobs are emerging in demand due to technology and innovation shifts in the sector[18]:

- AI and Machine Learning Specialists
- Data Analysts and Scientists
- Process Automation Specialists
- Robotics Engineers
- Software and Application Developers
- Digital Transformation Specialists
- Remote Sensing Scientists and Technologists
- Management Analysts
- Internet of Things Specialists
- Big Data Specialists

17 US Bureau of Labour Statistics. (2016). *High-tech industry what is it and why it matters to our economic future.* Retrieved from https://www.bls.gov/opub/btn/volume-5/pdf/the-high-tech-industry-what-is-it-and-why-it-matters-to-our-economic-future.pdf

18 World Economic Forum. (2020). *The Future of Jobs Report.* Retrieved from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf. P.142.

The BC mining sector will experience a period of time where the in-demand skills of today and those of the future will intersect; therefore it will become increasingly important to identify those skills that will continue in demand between the current in-demand skills and emerging skills. Industry will need to develop strategies that attract and retain new talent and technology workers to the industry, and how best to gear on the job training to meet the changing skills needs in the current workforce.

## Emerging Technical Careers in Mining

As part of the technical focus group sessions, participants were asked to consider the emerging technical occupations in mining that were highlighted within previous research work and reflect on the question:

"*Which of these emerging jobs identified in research are you seeing in the BC Mining Sector?*"

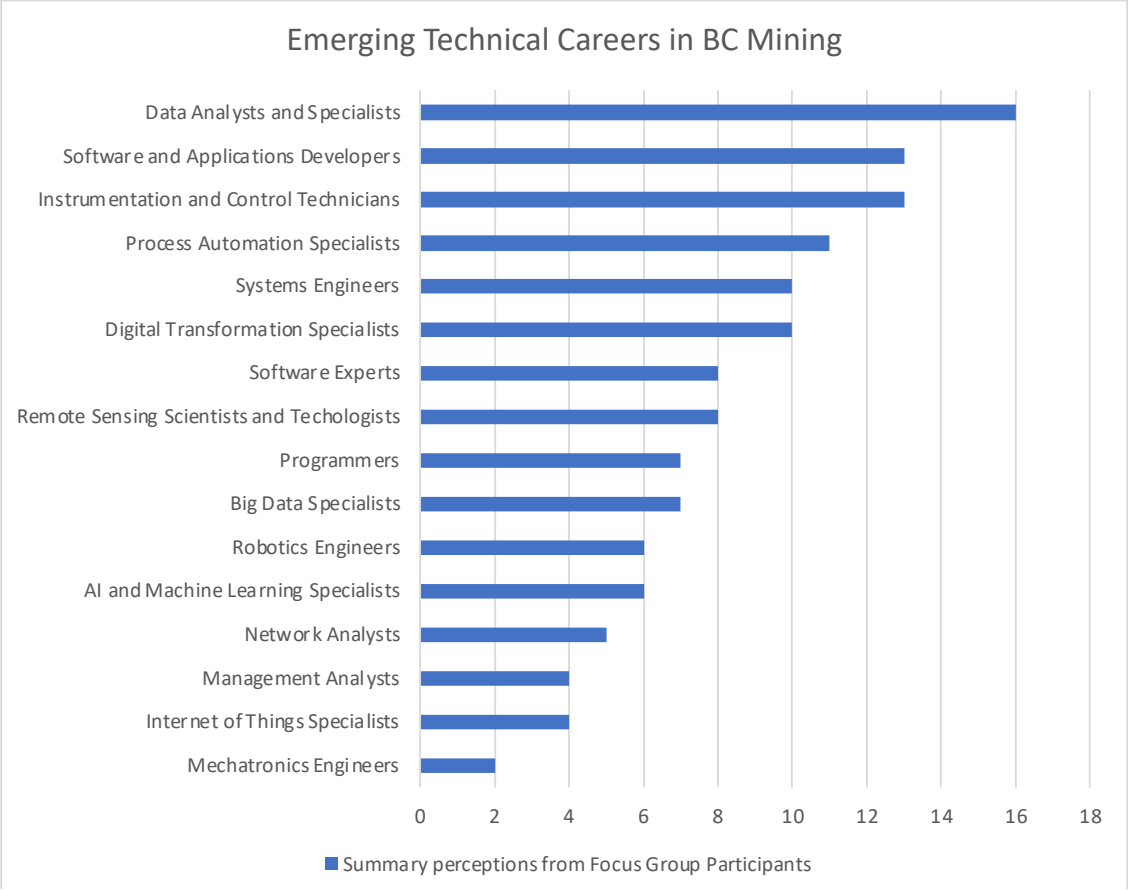



*Figure 2 - Emerging Technical Careers in BC Mining - Focus Group Perceptions (n=19)*

As shown in Figure 2, participants in the focus group collectively found that Data Analysts and Specialists, Software and Applications Developers, Instrumentation and Control Technicians, and Process Automation Specialists were perceived as the emerging jobs most commonly seen within the sector. Conversely, Mechatronics Engineers, Internet of Things Specialists, Network Analysts and Management Analysts were not as commonly recognized.

These emerging career occupations were also presented within the HR Leaders focus group session to gather perspective on which careers should be highlighted within the Skills Roadmap project. As a result, six careers

were selected and presented to the three groups to support the identification of key informant interview contacts and build introductory career profiles. The following job profiles of the future were developed from consultation with project committee members, and content captured in key informant interviews.

### *Career Highlight - Data Analyst - Emerging*

Data Analysts are at the cutting edge of innovation in the mining sector and help inform and improve business practices. A data analyst collects, organizes and studies data to help solve problems. These are important, impactful, and well-paying jobs that can be done remotely. Data analytics has greater potential to revolutionize mining than any other technology; and a chance to meaningfully contribute to the global low-carbon transition.

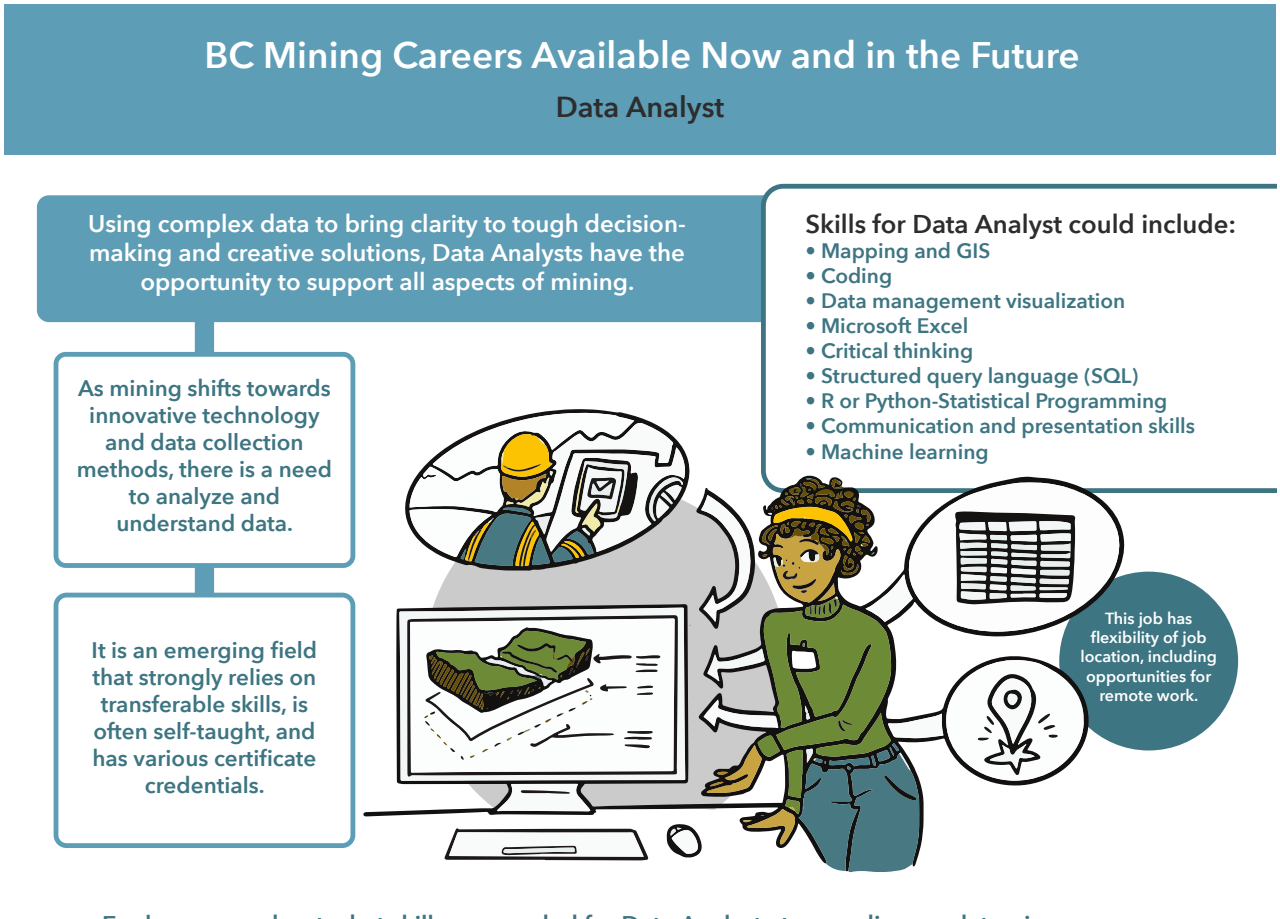



*Figure 3 – BC Mining Careers Available Now and in the Future – Data Analyst*

Data is collected in the field using GPS and tablet computers. Information is then organized and analyzed in real time to allow for faster and more effective secondary field and data collection sessions. Sharing and explaining findings is an important part of a data analyst job and allows decision-makers to make timely and informed decisions.

The job can be done from almost anywhere, as long there is internet connectivity, and this flexibility makes it particularly appealing. People in these roles usually have a degree in information technology, computer science or statistics, have an aptitude for report writing and are effective communicators. Students still in school can prepare for work in this field by taking computer programming courses.

## *Career Highlight - Energy Conservation Technician/Manager - Emerging*

This is an exciting and emerging job that will grow in demand as ways to increase or maintain a mines output with less energy are found.


*Figure 4 – BC Mining Careers Available Now and in the Future – Energy Conservation Technician/Manager*

An Energy Conservation Technician plays an important role in reducing energy consumption at mine sites to cut costs, reduce emissions, and make mining operations more productive.

This career will appeal to those who are interested in utilizing technology solutions to help mining reduce emissions and have a positive impact on climate change.

As mining companies implement energy conservation basics, the role has room to develop and add value by identifying new and innovative ways of conserving energy.

Energy Conservation Technicians may have an advanced certificate after achieving a Bachelor's degree of science in renewable energy or may have come to the profession through trades like Instrumentation and Control Technicians or Industrial Electricians. Career progression opportunities remain strong in Energy Conservation with opportunities for Technicians to move into Management.

## Other Career Profiles – Jobs of the Future


*Figure 5 – Technical BC Mining Careers Available Now and in the Future*

### *Process Automation Specialist*

- **What do they do?** - Develop processes and control systems to integrate automation in a mine site or processing plant.
- They are interested in how things are connected and using data and automation to improve processes – namely how information systems, operations equipment, and people are connected within a system.
- **Technical skills that will help you succeed in this role? -** Understanding systems with multiple variable controls, processes integration, instrumentation, computer programming, machine learning.
- **Who do they work with?** - Work with site maintenance, engineering, and operational teams to advise on process and equipment/technology.
- **Life experiences that would guide career choice** - Interest in coding, programming
- **What is the best thing about this job?** – *"operational excellence in real time - being able to run the plant to its optimization with the tools that you have is an amazing feeling".*
- *"Love the technology and the applying it at the mine - shifting the culture of mining - taking the latest*

*technologies to optimize the process and for the safety of people[19]".*

## *Remote Sensing Scientists and Technologist*

- **What do they do?** – use data from remote sensors to visualize and inform exploration, mining, and reclamation decisions. This is typically a graduate level degree and is more broadly represented by the study of geomatics and how you integrate information - remote sensing is just one stream of data and understanding how spatially things fit together.
- Bring coding, literacy in programming, data management, visualization in a meaningful way – to look for trends and processing components and systems integration.
- **Technical skills that will help you succeed in this role***:* Geomatics, digital mapping and modeling software applications, coding, scripting, and programming, data management, analysis and interpretation, and geospatial data understanding.
- **Who enjoys this work?** need to be fascinated by technology and using it for environmental good, critical about data and environmental decision making - analytical ways of looking at data sets can be used to understand our environment, passionate about technology - environment, its not just about optimizing tools
- *Life experience that would guide this career choice - gaming – "if you love gaming in environments in the 3D world - take your virtual world and impact the real world".*

## *Robotics Engineer*

- **What do they do?** design, test, integrate and maintain robotics technology into mining operations, and processing.
- **Technical skills that will help you succeed in this role:** Applying engineering and physics, mechatronics, computer science, computer programming, mechanics, electronics, automation and artificial intelligence along with advanced mathematics. Mining industry understanding, having a clear understanding of how the technology will help to solve a problem or support efficiency in operations and bridge the gap.
- **Who enjoys this work?** Someone who seeks a challenge, enjoys troubleshooting and can always balance effectiveness of design with a safety mindset.
- Designing and operating computer systems to operate robotics for the mining industry is exciting work, managing the environmental elements, difficult terrain and the challenges of underground operations.

## *Instrumentation and Controls Technician (Red Seal Trade)*

- **What do they do**? Install, repair, and maintain operations equipment within a mine site or plant.
- They use a probability perspective - most of the problems happen to the equipment that has most interaction - the control elements, sensors. Like a detective, instrumentation and controls technicians look closely at equipment and instrumentation, magnify and gather information to problem solve.
- **Technical Skills that will help you succeed in this role?**- Electrical and electronics, digital literacy, computer programming, logic and ability to sort information, mechanical aptitude, spatial awareness and systems approach.
- **Who enjoys this work? -** someone who is inquisitive, intuitive, communication skills, facilitative approach, description from the operator and equate that to the process, helps to have a customer service approach, relationship skills. Those that are successful have a willingness to learn, how the machinery forces work - the better you will understand about the process.

19 Human Resources Expert Key Informant Interview. CTEM Skills Roadmap Project. January 2022.

- **Life experience that would guide this career choice** – puzzle solving, tinkering around with a car, mechanical aptitude
- What is the best thing about this job? *"Get to work face to face with the latest technology and equipment".*

## 2. Trades Jobs

Skilled trades are occupations that require a particular manual/applied skill, knowledge or ability which is most often obtained at a college, technical school or through specialized training. Trades continue to be in high demand across sectors, including mining. As in other sectors, the skilled trades workforce is aging, with more workers leaving than entering. Yet trades continue to provide a good source of well-paid work that is also adapting to new technologies and innovation.

The top 11 skilled trades in the mining sector (as defined by number of apprenticeships) are[20]:

1. Heavy Duty Equipment Technician
2. Industrial Mechanic (Millwright)
3. Industrial Electrician
4. Parts Person
5. Truck and Transport Mechanic
6. Welder
7. Construction Electrician
8. Carpenter
9. Machinist
10. Power Line Technician
11. Steamfitter/Pipefitter

Throughout the primary research (in committee participation, survey responses and key informant interviews), BC mining subject matter experts reinforce the consistent demand for the skilled trades in mining; there is an ongoing need for Red Seal Trades and the technical and operational skills required for equipment operation and underground mining and exploration. In-demand occupations for rural and remote communities are commonly trades and technical roles – often transferable amongst heavy industry (such as mining and oil and gas). The Golden Triangle region in Northwestern BC, for instance, the occupations in demand there include millwrights, heavy duty mechanics, pipe fitters, gas fitters, welders, and carpenters.[21]

The trades will also evolve as new technologies and innovation – such as electric vehicles, become integrated into the mining environment. People in or entering trades occupations will need to be agile, adapting to new skills and technologies as required.

People interested in the mining trades can improve their access to trades programming by focusing on computer skills and digital literacy in addition to more traditional trades-related skills like mechanics, machining, carpentry, and welding, etc.

### *Career Highlight - Heavy Duty Equipment Technician – High Demand*

Heavy Duty Equipment Technicians troubleshoot and are responsible for the overhaul, and repair of various types of heavy mining equipment, such as haul trucks, dozers, graders, and excavators. It is an exciting job within the mining industry and is responsible for, and contributing to, a safe work environment. This is a Red Seal trade; for more information, visit the Industry Training Authority Website at: www.itabc.ca.

As mining begins to increase use of new technologies like battery operated vehicles (BEVs), current and new workers will need to learn new skills on the job. Training in the workforce will include onsite, remote, and virtual learning, expanding the workers skills and confidence in this new area of technology.

20 Data from Mining Association of BC (MABC), Association for Mineral Exploration (AME), and Sand, Gravel, and Aggregate Association in February 2020.

21 Centre for Training Excellence in Mining. June 2021. *Skills Roadmap Project Key Findings Report*. P.26

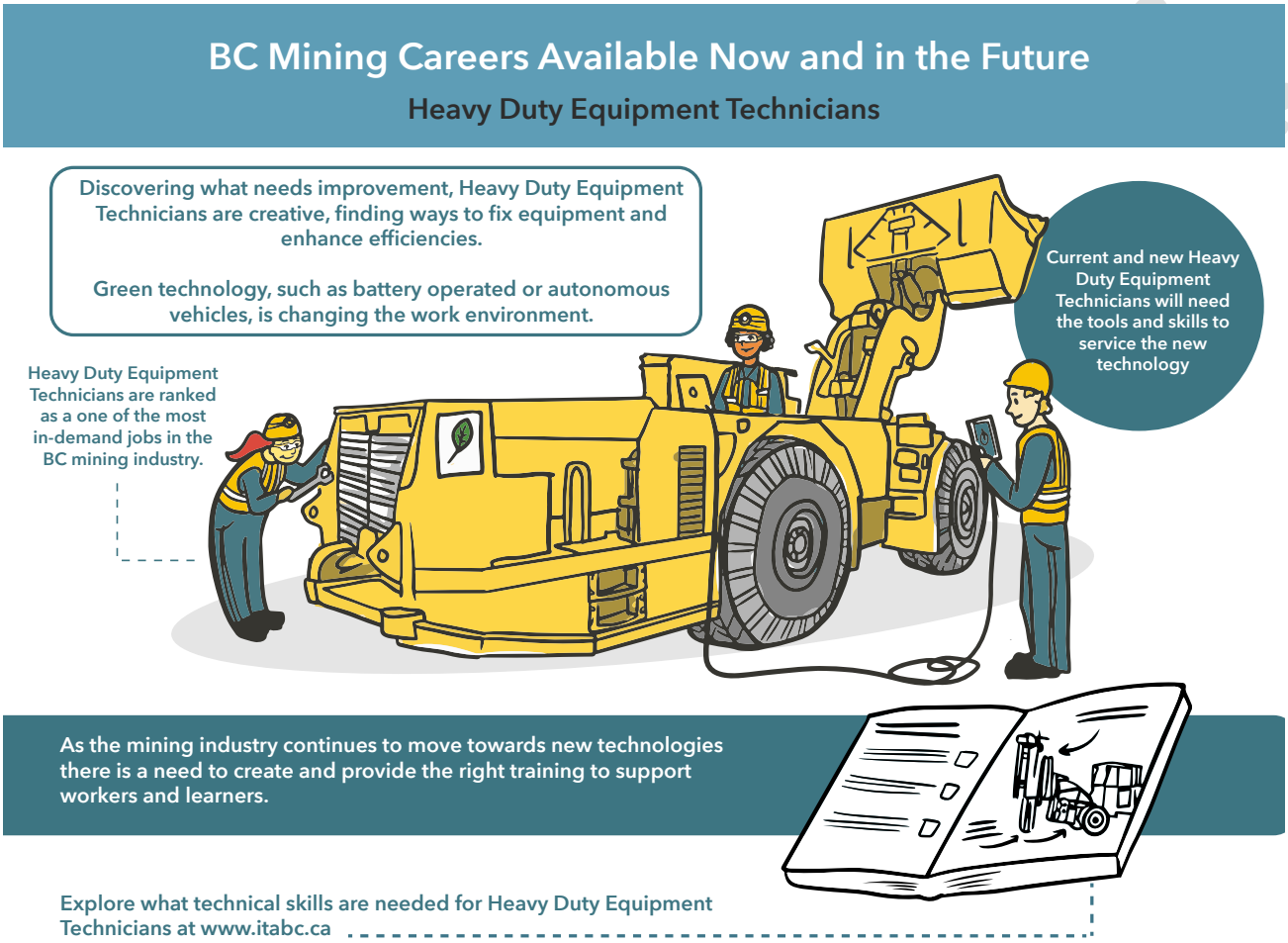



*Figure 6 – BC Mining Careers Available Now and in the Future – Heavy Duty Equipment Technicians*

### *Electrical Battery Technician - Emerging*

This job focuses on a variety of mechanical and electrical duties. They include building, testing, and dismantling and reassembling mining vehicles, installing complete battery-electric drive systems, and servicing and maintaining equipment. As mining begins to increase use of new technologies like battery operated vehicles (BEVs), current and new workers will need to learn new skills on the job. Educators are preparing for new workers to learn the skills needed, so that they are ready for these new BEVs through course material that includes battery basics, safety, and troubleshooting.

## Environmental, Social and Governance (ESG) Responsibilities and the Impact on Occupations in the Mining Sector

Increasing regulations on the environmental and social impacts (ESG) of resource projects places new skills and occupational requirements on the mining industry, requiring more people to do the work of translating activities on the land to the boardroom and within a community setting. Individuals that possess the skills, knowledge, and the aptitude to navigate complex regulatory environments and effectively engage with the public and Indigenous communities within consultation and assessment processes will be workers that are in-demand in the sector.

An integrated and robust ESG program is important from a regulatory and compliance standpoint. This will increase the demand for inspectors and auditors of mines and mining activities.

There are also indications that a robust ESG program can serve as an important factor in the ability to retain top talent[22]. A recent study examining the link between ESG performance and workforce sentiment found that employers with highly satisfied employees score higher on ESG performance[22]. These organizations are also more attractive to younger and more diverse workers, who place high value on aligning work with their personal values on social and environmental responsibility[23].

## 3. Environmental Jobs

Environmental jobs continue to be a sub-set of mining occupations that are essential. And as the mining industry sees an increase in ESG priorities and further integration of these into daily operations, environmental sciences will continue to play a significant role in mining.

People who have a natural curiosity for the natural environment and enjoy working both outdoors and in office and laboratory settings will be well suited for these roles.

Many environmental jobs require degrees in applied sciences. Individuals wanting to pursue these jobs can get an early start by focusing on sciences, technology, engineering, and math (STEM) courses in school.

Technology is also heavily shaping the tools available to those in the environmental sciences, and so workers will need to have a natural curiosity and ability to adapt to new workplace tools. Advancements in this realm are providing increased access to data in a timely manner, allowing for improved decision-making that is grounded in sound evidence.

As ESG priorities evolve and grow, professional requirements are also shifting to require a broadening understanding of governance structures and managing ethical responsibilities for those working in this field.

### *Career Highlight – Geologist – High-Demand*

Geology is the science that deals with the earth's physical structure and substance, as well as its history and the processes that act on it. Geologists, therefore, have a deep curiosity about how the earth works. They are detectives - uncovering clues to determine what is in the earth.

Geologists generally have a degree in earth sciences and carry out a diverse range of work - usually in the exploration phase of mining development. They often work in the field - travelling to remote locations and interacting with Indigenous and remote communities. Geologists also work in office environments – on computers and doing mapping work.

Geologists can work alone as well as with a team of scientists and engineers and get to use cutting edge technology. This career has growth potential and career laddering opportunities.

22 Ibid.

23 Marsh & McLennan. (2022). *ESG as a workforce strategy. Retrieved from* https://www.mmc.com/esg-interactive.html

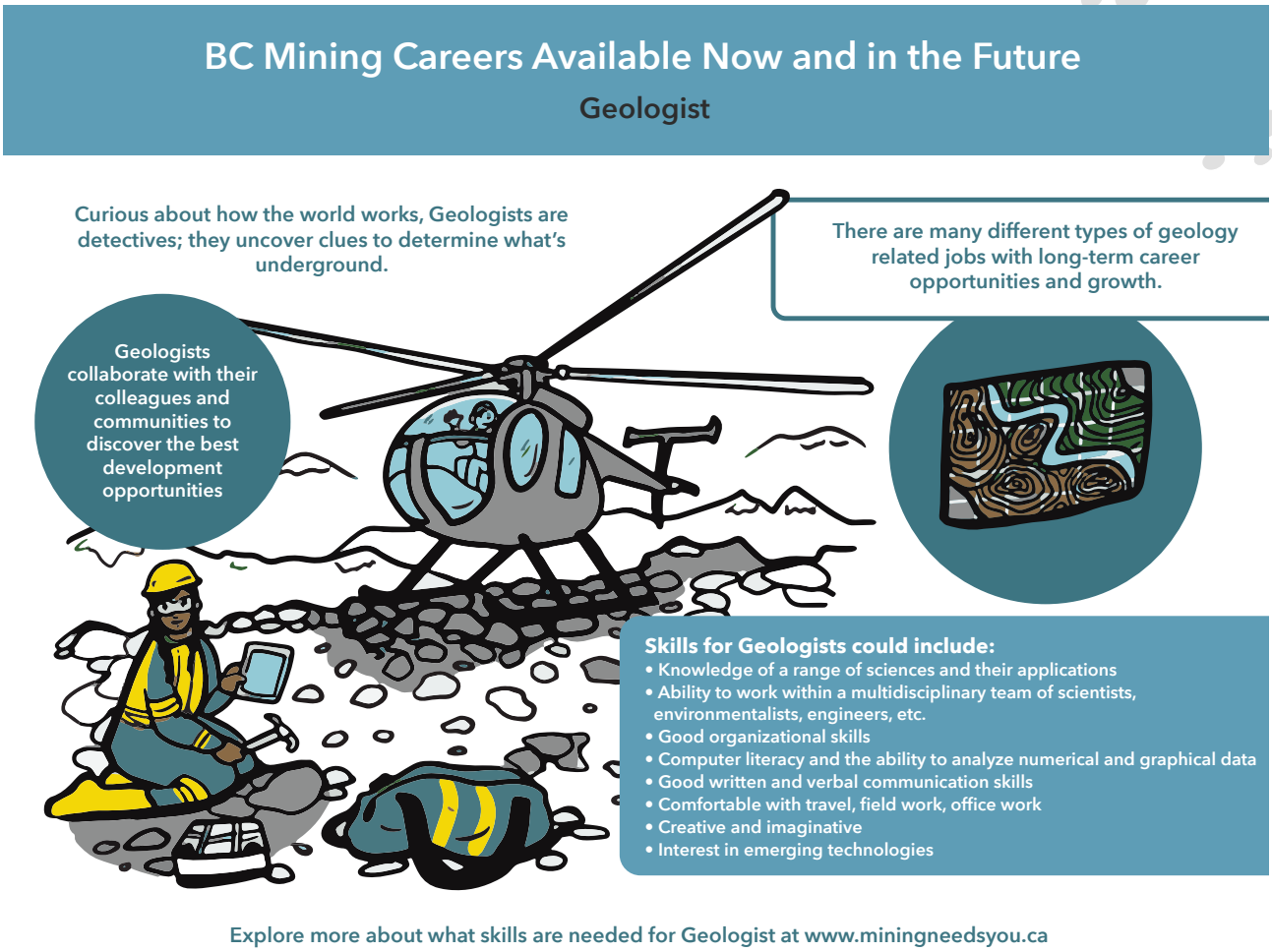



*Figure 7 – BC Mining Careers Available Now and in the Future – Geologist*

## *Career Highlight - Environmental Monitor – High-Demand*

Environmental Monitor is an ideal role for those who want to focus on environmental responsibility and enjoy working outdoors while also gathering and analysing data and using technology in their job.

Telemetry and remote sensing and monitoring systems are examples of technologies that will continue to play an increasing role in the work of an environmental monitor. This role is integral to ensuring a mine operates within legislated environmental parameters, including those agreed to with local Indigenous communities.

People in this role analyze and make sense of the data collected and share findings with communities and other workers to help with informed decision-making. Helping to incorporate traditional, local, and scientific knowledge is another key aspect of this job.

This career requires a diverse skillset and will appeal to those who have a strong commitment to environmental stewardship and like to analyze and make sense of technical data.
Mining employers who can demonstrate environmental policy that goes beyond mandated requirements will be able to better attract and retain talent in this role, and in the broader workforce.


*Figure 8 – BC Mining Careers Available Now and in the Future – Environmental Monitor*

## *Career Highlight - Water Quality Monitor/Technologist/Engineer – High-Demand*

A Water Quality Monitor/Technologist/Engineer provides objective evidence that enables industry to make informed decisions on managing water quality today and in the future. The monitoring of water quality is used to ensure mines operate within set environmental parameters and alerts industry and community to current, ongoing, or emerging problems. Monitoring is an integral element of gaining knowledge about environmental conditions.

This role appeals to those who have a deep respect for the land and want to contribute to mitigating environmental impacts.

Often this role starts with on-the-job training and can lead to career development in environmental and engineering professions.

Water Quality Monitors work in a variety of settings – both in the field and in a laboratory. This work adds practical value to mine site decision-making and helps ground good environmental practices in day-to-day operations.

These positions can work directly for a mine, or within Indigenous and other local communities. Sharing and communicating the data gathered during the course of work is an important element of the job.

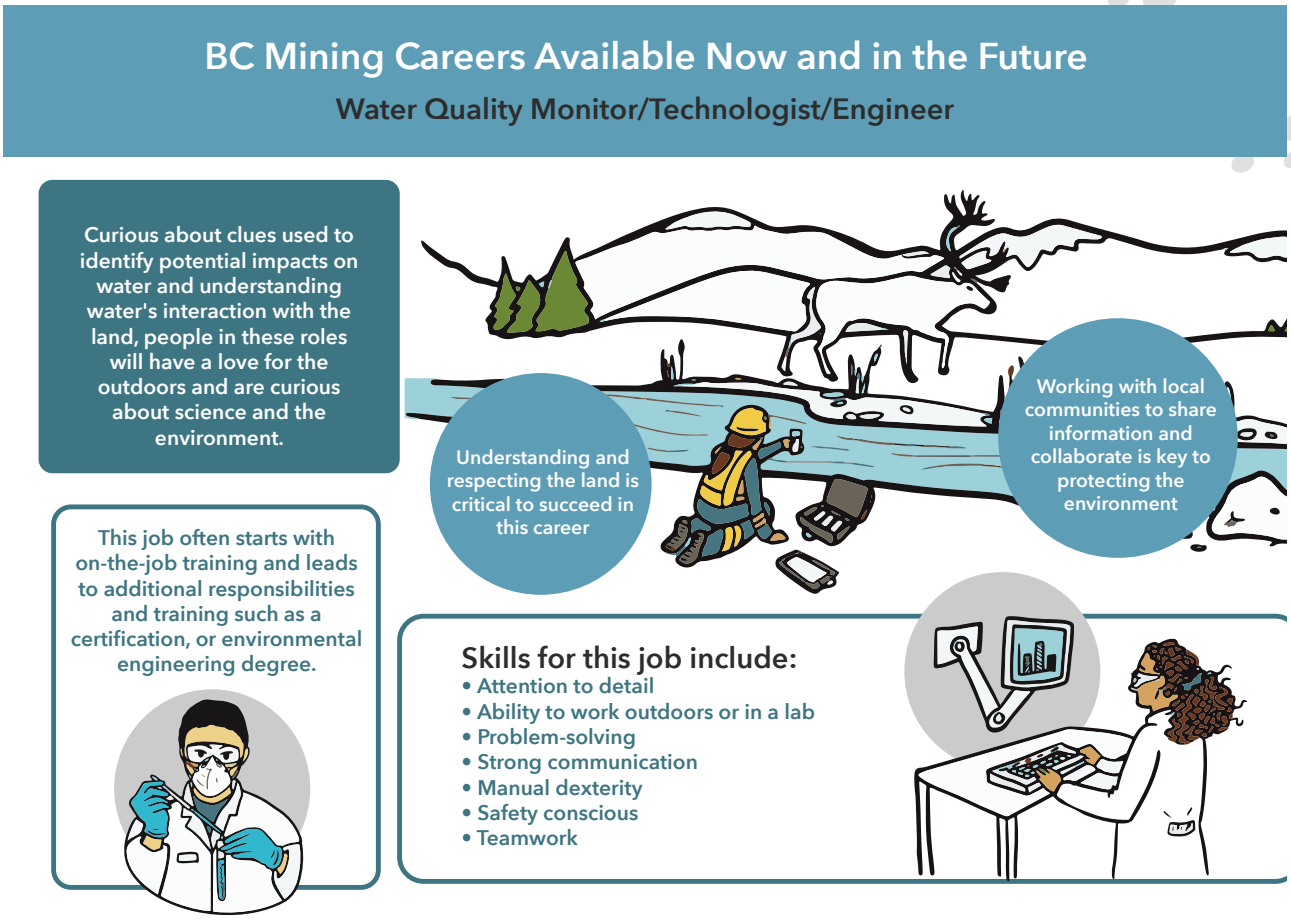



*Figure 9 – BC Mining Careers Available Now and in the Future – Water Quality Monitor/Technologist/Engineer*

## *Career Highlight – Land Management and Compliance - Emerging*

Land management and compliance includes a range of careers such as land administration, regulatory compliance officer, mines inspector, auditor, and permitting manager. The careers analyze the environment to support sustainable projects that last, protecting wildlife and habitat.

Inspectors are specialists who have broad experience in regulating health, safety, and environmental requirements at mine sites. A Bachelor's degree is required for this role - with expertise such as geotechnical engineering, reclamation, environmental geoscience, mechanical engineering, electrical engineering, occupational health, or mine emergency planning.

These jobs will increase in demand as environmental, social and governance priorities become more and more integrated into the sector.

People who are adaptable and like to work with evolving legislation and wise practices are suitable for this job. Talking with partners, community experts and regulators is a substantial part of this role.


*Figure 10 – BC Mining Careers Available Now and in the Future – Land Management and Compliance*

## 4. Community Jobs

Another occupational sub-grouping that is expanding due to increased ESG priorities is that of community jobs. Engagement and consultation with local and Indigenous communities is becoming an increasingly important task in ensuring mining operations are established and operate consistent with local values, understanding and input. People in these roles will be drawn to meeting and talking with local communities to understand potential impacts and benefits to mining operations in the region.

### *Career Highlight - Community Liaison Officer – High-Demand*

This job collaborates with local communities to ensure Indigenous traditional knowledge is valued, understood and part of all phases of the mine life cycle. Workers in this role create documents, processes, and systems that includes data on plants and animals, and incorporates the lessons learned from past social, economic, and environmental changes that occur during the mining cycle.

The Community Liaison Officer bridges and establishes innovative ways of partnering with local communities and Elders for regular, open communication and consultation to ensure traditional, current, and future knowledge are part of the mine operations. Workers in this role, are from, or have experience working with and in, Indigenous communities; and usually require high school completion and training in natural resource development or stewardship, or community/government relations.

Integral to this role is the ability to build a trusting, mutually beneficial relationship between the mine, government, and First Nations communities. First Nations communities need to know their knowledge will be used responsibly and consistent with their values.

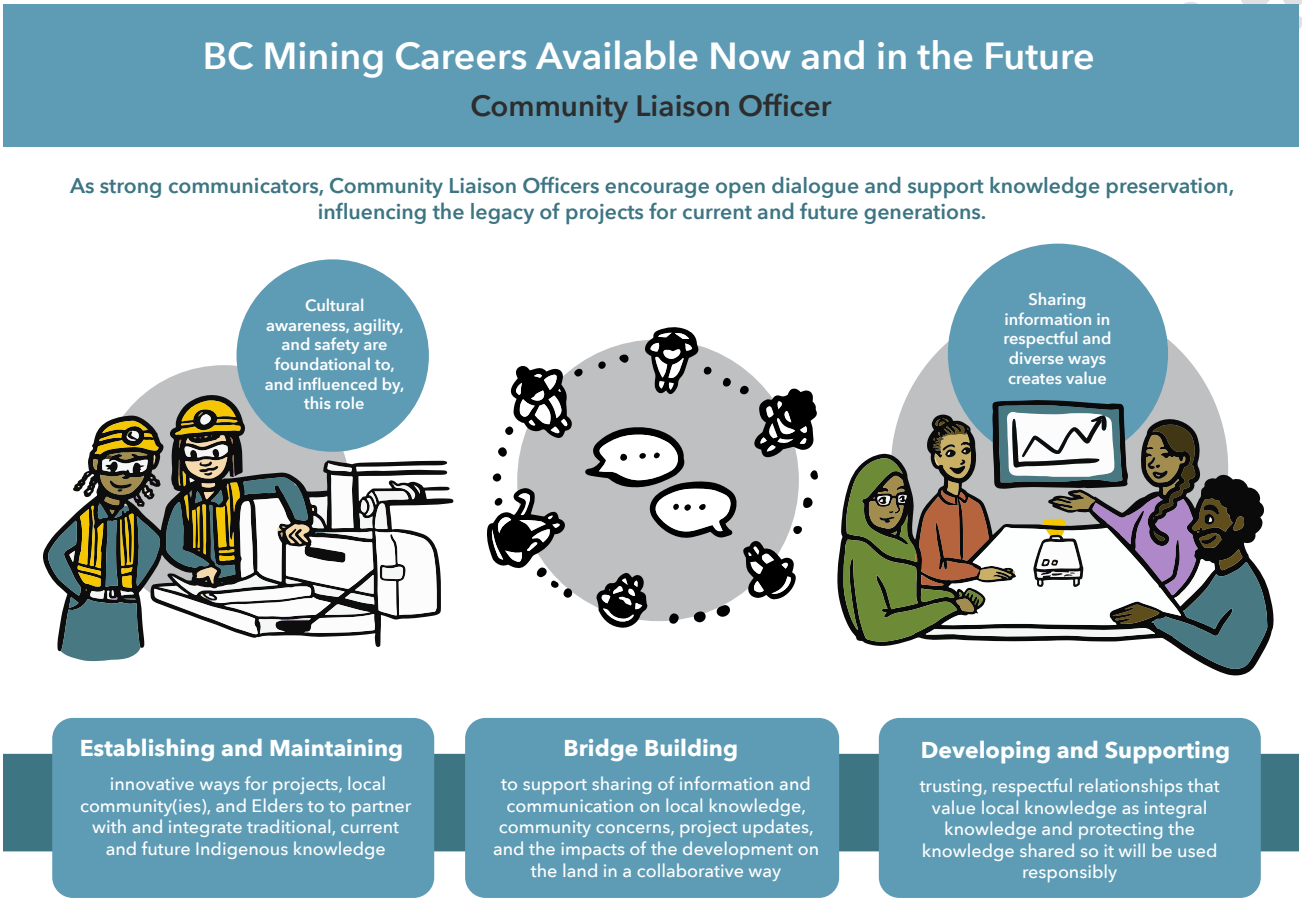



*Figure 11 – BC Mining Careers Available Now and in the Future – Community Liaison Officer*

## 5. Management Jobs

Management jobs are evolving in the mining industry. Managers of the future need to have innovative approaches to both technology integration as well as engagement and partnership development.

Emerging technologies, such as Artificial Intelligence (AI), will enable ongoing improvement of development initiatives, and evolving training will help workers to develop competencies and innovations in cost-effective ways. Managers will play an integral role in the successful implementation and integration of these new technologies into the existing workforce and work with current employees to learn new skills as they keep up with the evolving nature of the sector.

Other anticipated developments in management roles includes increased engagement and participation with Indigenous communities, including on matters of health, mine safety and reclamation protocols, as policy and legislation evolves and environmental, social and governance priorities evolve and are further implemented.

Engagement with Indigenous communities will be an integral part of collaboration to ensure standards for ethical governance, regulations, and processes.

Managers will need to focus on developing and utilizing key environmental, social, governance skills, including:

- Effective communication
- Community collaboration skills
- Ability to work with diverse perspectives and peoples
- Understanding and adhering to government regulations
- Sound environmental stewardship to eliminate negative impacts on other land users
- Environmental understanding, policy development, technical skills (science and computer).

Cultural awareness and cultural agility will be key skills to have and practice in the workplace; managers will play an integral role in ensuring these values are integrated and lived in the working culture of the mine.

Management roles will also play an integral role in developing recruitment and retention strategies. Building partnerships with community-based organizations that support local people is a practical solution to build good engagement and retention strategies; similarly, building partnerships with education institutions to further support both Indigenous and non-Indigenous learners and their transition into the workforce will be key.

Two management occupations are highlighted in this report:

1. Engineers; and
2. Community Cultural Directors.

Engineers are not a new position but continue to be in high-demand now and well into the future, whereas Community Cultural Directors are a direct result of increased engagement and consultation with Indigenous governments and communities as ESG continues to increase in scope and activity.
Both are exciting careers and an opportunity to have an impact on the way a mine operates and works with local communities.

## *Career Highlights – Engineers – High-Demand*

Engineers plan, coordinate and oversee the technical and engineering activities of an organization. There are many, many different types of engineers, including (but not limited to): civil, environmental, mining, geological, mechanical, and electrical.

People in this role like to solve problems and understand how things work. They are highly motivated, like challenging work and appreciate the opportunity to utilize new technologies (such as AI) and processes.

Engineers in management in roles are responsible for leading diverse teams and often engage with Indigenous and remote communities around the mine footprint.

Writing technical reports and briefings, and preparing designs, specifications and plans are another part of an engineer's role.

Engineers will have a degree in Mining or Engineering, and those in management roles will have at least five to 10 years of experience.


*Figure 12 – BC Mining Careers Available Now and in the Future – Engineer*

## *Career Highlights - Community Cultural Director - Emerging*

Community Cultural Director is a new and emerging job in the mining sector. People in this role focus on implementing and driving equity, diversity and inclusion programs and initiatives. They are responsible for providing a safe and respectful workplace that values and honors cultural diversity and brings the strength of differing perspectives to the work at hand and support in the integration of the work done by community liaison officers out in the field, into mining operations and planning.

People in this role look for ways to promote Indigenous peoples' perspectives and facilitate community consultation on mining projects. This is an exciting role that attracts workers who want to have a positive impact on mining and further expanding environmental, social and governance (ESG) priorities.

Community Cultural Directors play an important role in furthering two-eyed seeing, an approach that means, "*To see from one eye with the strengths of Indigenous ways of knowing, and to see from the other eye with the strengths of Western ways of knowing, and to use both of these eyes together*"[24].

24 Bartlett, Marshall, & Marshall, 2012 p.335 as cited in Peltier, 2018.


*Figure 13 – BC Mining Careers Available Now and in the Future – Community Cultural Director*

Incorporating Indigenous knowledge of, and connection to, the land; recognizing the value of people's lived experiences; honouring cultural knowledge-sharing and decision-making practices; understanding historical legacies and impacts; and creating awareness of Indigenous cultures and values in relation to natural resource development, are all important aspects of a community cultural director's role.

# Recognized Career Barriers and Potential Solutions

## Identified Barriers

Women, Indigenous peoples, and people living in rural and remote communities are generally underrepresented in the mining sector, despite being an excellent source of local labour.
In fact, Canada's Indigenous population continues to rapidly outpace the growth of the rest of the country according to stats Canada. Particularly in the 18-35 age group. They represent a large source of labour and many live in the communities where mining activity occurs.

There are many reasons for this – systemic barriers, such as "situations, policies and/or practices, which

results in some people receiving unequal access or being excluded from benefits and opportunities.[25]"

Recognizing and removing these barriers is essential to increasing diversity and inclusion, providing great value to the broadening work within the sector, while also being a tangible and practical solution to the demand for these and other jobs in the mining sector, both now and in the future. There simply are not enough workers to meet the demand in mining, especially with the current landscape where more people are leaving the workforce (retiring) than there are those entering.

Some barriers are faced particularly by one group of people, while other barriers are common to women, Indigenous peoples and those living in rural and remote communities. More needs to be understood about how these barriers intersect with one another – for instance, the barriers and solutions required for a worker who identifies as female, Indigenous, and living in a rural and remote community.

Both women and Indigenous peoples cite these distinct barriers to training and career access in mining:

- Lack of career awareness;
- Lack of opportunity or inequity in career advancement opportunities;
- Lack of diversity within leadership, resulting in fewer role models and mentors, networks;
- Problematic workplace and training culture – unconscious bias, micro-aggressions; and
- Location and remoteness.

Lastly, rural, and remote communities cite the disparity between training and infrastructure accessibility in northern communities compared to urban centres as a distinct barrier to workforce participation. One example provided was students entering post-secondary with courses from high school may not have equal access to prerequisites. For example, high school physics is commonly required to enter an engineering program, but many high schools in northern British Columbia do not offer Physics 12.

According to members of the Project Careers Sub-committee, the barriers most impacting career development (in order of ranking) are:

1. Location and remoteness;
2. Training access and education gaps*;
2. Social, health and economic factors* ;
2. Lack of career awareness* ;
3. Historical legacy of legitimized gender and racist discrimination**; and
3. Lack of Diversity within leadership resulting in fewer roles models and mentors, networks**.

** ranked with the same importance; ** ranked with same importance.*

## Potential Solutions

This Project has been instrumental in engaging subject matter experts across the mining industry, training providers, Indigenous communities, workforce development and other service providing agencies, government, and rural and remote communities to understand the potential solutions to the barriers experience by women, Indigenous peoples and people living in rural and remote communities.

According to these experts, the following are key enablers:

- **Increasing Career Awareness** – Providing information on careers in the mining sector to potential new workers or workers transitioning from other industries, will provide an important step to ensuring women, Indigenous peoples and people living in rural and remote communities know about

25 Centre for Training Excellence in Mining. (Feb. 2021). *Skills Roadmap Project Research Methodology and Tools*.

the sector and the opportunities it provides for well paying, long-term careers.

- **Inclusive Screening Practices** – Ensuring that recruitment data and screening processes are reviewed against cultural and gender-biases can be an important tool. For example – some screening tools will have built in algorithms that are based on historical data and may inadvertently screen out female or Indigenous applicants.
- **Industry and Training Provider Partnerships** - These collaborations can support new workers make the successful transition from the educational setting into the workforce and can help new workers become confident in their new skills as they apply them to the job. These partnerships can also help close training gaps as providers and employers work more closely together in ensuring new standards and innovative and technological practices are incorporated into the training curriculum.
- **Diversity and Inclusion Practices** – Hiring trainers from rural/remote and Indigenous communities can increase success for students as they see themselves reflected in the trainers, and provide safety, inclusion, and effective knowledge transfer to new entrants into the mining workforce.
- **Mentorships** – Providing new workers with access to seasoned workers to guide and mentor them, ensures successful knowledge transfer and employee success. Ensuring women, Indigenous peoples and people living in rural and remote areas have mentors like themselves, will increase the successful inclusion of these individuals into the workforce and increase their chances of long-term employment.
- **Retention Strategies** – Create employment and recruitment strategies with community organizations that support Indigenous peoples, women and those living in rural and remote communities to build awareness, engagement and create recruitment and retention strategies together.
- **Cultural Awareness/Cultural Safety Training** – Providing training to promote awareness and understanding of historical legacies and differing cultural practices normalizes diversity and inclusion in the workforce and provides all workers with the knowledge of how to incorporate diversity and inclusion practices into the work environment and will work to remove/undo problematic workplace cultures and micro-aggressions.
- **Opportunities for Career Growth and Promotion** – Providing mentoring supports, on-the-job training and career advancement opportunities for all workers will help to increase the number of women, Indigenous peoples and people from rural and remote communities participating in senior level positions within the sector. This will further improve diversity and inclusion practices in the workplace and support new entrants in seeing themselves as a part of the future workforce.
- **Flexibility in Training Delivery and Workforce Participation –** Recognizing and accommodating family and personal commitments (childcare, care for aging parents, etc.) in training formats and work scheduling can increase accessibility for current and potential workers, and minimize the disruptions felt by families. Possible solutions include shorter work rotations, completing apprenticeships over a longer period with more time spent at home or in community, additional supports when providing on site accommodation for learners, and childcare.
- **Transportation, Accommodation and Childcare** – Lack of drivers' training, affordable housing/ accommodation and childcare services are key barriers to workforce participation in rural and remote communities. Investing in these key supports will work to remove these barriers and ensure workers can participate in both training and employment regionally.

# Appendix A – Project Background

The Ministry of Energy, Mines and Low Carbon Innovation (previously Ministry of Energy, Mines and Petroleum Resources) established the BC Mining Jobs Task Force (Task Force) in February 2018 as part of the Province's focus to create and sustain good jobs throughout BC. The Task Force worked with First Nations, the mining industry, and communities to develop recommendations on possible actions government could take to bring more certainty to the mining sector and create good jobs for people today, tomorrow, and beyond. The Task Force looked at all aspects of mineral exploration and mining in BC and its Final Report[26] provided 25 recommendations to government on measures it might implement to achieve the Task Force's vision of making British Columbians proud of its growing mining industry as the backbone of an inclusive, progressive, and low carbon economy. In January 2019, the Office of the Premier issued a News Release saying the provincial government is "moving forward with" the Task Force's recommendations[27].

One of the Task Force's recommendations was to collaborate with the Ministry of Advanced Education and Skills Training (AEST) on the development and implementation of a cohesive roadmap for enhanced mine sector training to meet the mining sector's future skills and labour needs through a collaborative, inclusive, innovative, and geographically focused approach.

In November 2020, the BC Centre of Training Excellence in Mining (CTEM) was successful in its proposal to oversee the Skills Roadmap Project (the Project) to help understand how best to meet the mining sector's future skills and training needs. This project is a collaboration between representatives from across the BC mining industry – and will support the development of a forward looking and responsive strategy for enhancing mining sector training.

The Project is funded by the Province of British Columbia and Government of Canada through the Sector Labour Market Partnerships (SLMP) Program through the Ministry of Advanced Education and Skills Training (AEST) and brings together diverse perspectives from across British Columbia who have an interest in the training and workforce outcomes within the BC mining industry. The mining industry is inclusive of the full life cycle (exploration, extraction, processing, closure, restoration) and includes the suppliers and contractors side of the industry.

The Skills Roadmap Project consists of primary and secondary research guided by consultation and collaboration with 141 participants from industry, organized labour, professional associations, post-secondary institutions, government, and Indigenous communities. This research provides the foundation for the development of skills, career, and training roadmaps (contained in this and two other Roadmap Reports) to support individuals, communities, post-secondary training providers, and industry to meet the mining sector's future skills and training needs.

## About the BC Centre of Training Excellence in Mining

The B.C. Centre of Training Excellence in Mining (CTEM) is a province-wide virtual hub that facilitates collaborative and innovative training solutions for the mining industry and B.C. communities. Its mission is to connect industry, students, communities, and training providers to meet their respective employment needs by playing a leading role in determining industry skills requirements, facilitating related training,

26 British Columbia Mining Jobs Task Force. (2018). *Mining Jobs Task Force Final Report.* Victoria: BC Government. Retrieved from https://www2.gov.bc.ca/assets/gov/business/natural-resource-industries/mineral-exploration-and-mining/memp_10535_task_force_report_final-rev.pdf

27 Office of the Premier. (January 28, 2019). *Government acts on Mining Jobs Task Force recommendations.* https://news.gov.bc.ca/releases/2019PREM0006-000099

and supporting partners. It was announced by the Ministry of Advanced Education in November 2012 and became operational in May of 2013. It is funded primarily through grants from the government of British Columbia with additional support from partners.

Guided by the values of collaboration, inclusivity, innovation, support, responsiveness, and respect, CTEM works to bring together all parties interested in mining training to:

- foster innovation to improve outcomes;
- build partnerships to create more effective programs;
- enhance the competitiveness of British Columbia's mining sector;
- build awareness of all the training options for careers in mining;
- match students/job seekers and employers; and
- support other appropriate initiatives that will continue to build on a provincial reputation for producing highly skilled workers.

More information on CTEM can be found in Appendix B.

## About the Skills Roadmap Project

The Project creates a set of deliverables that respond in full to the BC Task Force recommendation to *create a cohesive roadmap for enhanced mine sector training to meet the mining sector's future skills and labour needs* and support the recommendations to focus on women and Indigenous representation in the mining sector.

It has two primary objectives:

1. Establish and provide an analysis of labour market information from a literature review, environmental scan, and primary data collection to identify gaps between current skills and training in the BC mining sector workforce and the skills and training that will be required to meet the sector's future needs; and
2. Develop skills, career, and training roadmaps (in report and graphic form) to support individuals, communities, post-secondary training providers, and industry that will assist them in adapting to meet the mining sector's future skills and training needs.

To accomplish these objectives, the Project has relied on guidance and expertise of a wide range of subject matter experts who have provided context and feedback on the research collected. Over 120 subject matter experts participated in the meetings. Committees included:

- Project Governance Committee
- Training Providers Sub-Committee
- Regional, Golden Triangle Sub-Committee
- Indigenous Sub-Committee
- Women Sub-Committee

Input has also been gathered from 197 survey participants, three focus groups and 21 key informant interviews. Participants in these activities included workers, trainers and educators, employers, governance, partnering organizations and community members.

# Appendix B - BC Centre of Training Excellence in Mining

## BC CENTRE OF TRAINING EXCELLENCE IN MINING

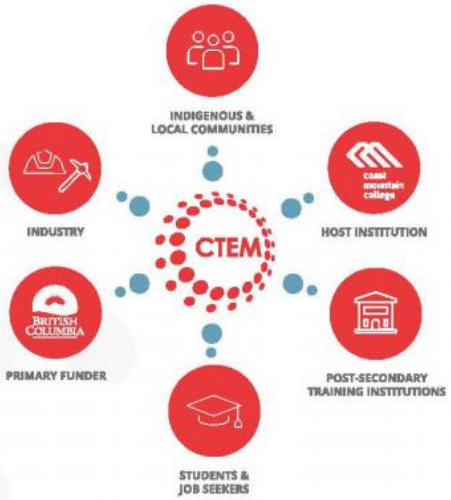
*Facilitating collaborative and innovative training for BC's mining industry.*

**CTEM connects industry, students, job seekers, training providers, and communities to meet their respective needs by:**

- playing a leading role in understanding industry skills requirements,
- facilitating industry driven training, and
- building alliances and supporting partners.

## Quick Facts

- Provincial organization, established in 2012
- $1.5M of grants complements $1M of in-kind industry support
- Project successes have been used in other jurisdictions nationally and internationally




## Impact

- Resources provided to 200 communities across BC
- Projects are strategic, collaborative, and specific in scope
- Organizational values are: collaborative, inclusive, innovative, supportive, responsive, and respectful

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FACEBOOK: @CTEMBC

# Appendix C – Career Links

1. Data Analyst – Discover Data Science: www.discoverdatascience.org
2. Energy Conservation Technician – BC Institute of Technology: www.bcit.ca
3. Heavy Duty Equipment Technicians - Industry Training Authority: www.itabc.ca
4. Geologist – Mining Industry Human Resources Council: www.mihr.ca - geologist
5. Environmental Monitor – Eco Canada: www.eco.ca
6. Water Quality Monitor/Engineer – Eco Canada: www.eco.ca
7. Permitting, Inspectors, and Auditors – Mining North Works: www.miningnorthworks.com
8. Community Liaison Officer – www.eco.ca
9. Community Cultural Director -
10. Engineering Manager - Mining Industry Human Resources Council: www.mihr.ca - engineer

# Appendix D - Additional Resources

1. Mining Industry Human Resources Council: www.mihr.ca
2. WorkBC: www.workbc.ca
3. Centre of Training Excellence in Mining: www.bc-ctem.ca
4. Association of Mineral Exploration BC: www.amebc.ca
5. Mining Association of BC: www.mining.bc.ca
6. Industry Training Authority: www.itabc.ca
7. Canadian Apprenticeship Forum: www.caf-fca.org
8. Skills Canada BC: www.skillscanada.bc.ca
9. Engineers and Geoscientists BC: www.egbc.ca
10. The Canadian Mining Certification Program: www.mihr.ca

# Appendix E – Careers in Mining

| Human Resources and Financial Occupations | | |
|---|---|---|
| **Occupations** | **Code** | **NOC Title** |
| Management | 0013 | Senior managers - financial, communications and other business services |
| | 0111 | Financial managers |
| | 0112 | Human resources managers |
| Professionals in business and finance | 1111 | Financial auditors and accountants |
| | 1112 | Financial and investment analysts |
| | 1121 | Human resource professionals |
| Administration and Finance Supervisors | 1223 | Human resources and recruitment officers |
| Finance, insurance, and business administration | 1311 | Accounting technicians and bookkeepers |
| Office Support | 1431 | Accounting and related clerks |

Source: MiHR. (2020). *Canadian Mining Labour Market Outlook 2020*. Retrieved from https://mihr.ca/wp-content/uploads/2020/03/MIHR_National_Report_web2.pdf

| Production Occupations | | |
|---|---|---|
| **Occupations** | **Code** | **NOC Title** |
| Maintenance and Equipment Operation | 7371 | Crane operators |
| | 7372 | Drillers and blasters- surface mining, quarrying and construction |
| Other installers, repairers, and servicers | 7452 | Material handlers |
| Transport and heavy equipment operation | 7511 | Transport truck drivers |
| | 7521 | Heavy equipment operators (except crane) |
| Trades helpers and labourers | 7611 | Construction trades helpers and labourers |
| | 7612 | Other trades helpers and labourers |
| Supervisors and technical in natural resources | 8231 | Underground production and development miners |
| Workers | 8411 | Underground mine service and support workers |
| Harvesting, landscaping and natural resources labourers | 8614 | Mine labourers |
| Processing, manufacturing, and utilities supervisors | 9231 | Central control and process operators, mineral and metal processing |
| | 9241 | Power engineers and power systems operators |
| | 9243 | Water and waste treatment plant operators |
| Processing, manufacturing, and utilities operators | 9411 | Machine operators, mineral and metal processing |
| | 9412 | Foundry workers |
| | 9416 | Metalworking and forging machine operators |
| | 9417 | Machining tool operators |
| | 9418 | Other metal products machine operators |
| | 9423 | Rubber processing machine operators and related workers |
| Labourers | 9611 | Labourers in mineral and metal processing |
| | 9612 | Labourers in metal fabrication |
| | 9619 | Other labourers in processing, manufacturing, and utilities |

| Professional and Physical Sciences Occupations | | |
|---|---|---|
| **Occupations** | **Code** | **NOC Title** |
| Professionals in natural and applied sciences | 2112 | Chemists |
| | 2113 | Geoscientists and oceanographers |
| | 2115 | Other professional occupations in physical sciences |
| | 2121 | Biologist and related scientists |
| | 2131 | Civil engineers |
| | 2132 | Mechanical engineers |
| | 2133 | Electrical and electronics engineers |
| | 2134 | Chemical engineers |
| | 2141 | Industrial and manufacturing engineers |
| | 2142 | Metallurgical and materials engineers |
| | 2143 | Mining engineers |
| | 2144 | Geological engineers |
| | 2145 | Petroleum engineers |
| | 2147 | Computer engineers (except software engineers and designers) |
| | 2148 | Other professional engineers, n.e.c. |
| | 2152 | Landscape architects |
| | 2153 | Urban and land use planners |
| | 2173 | Software engineers and designers |
| | 2174 | Computer programmers and interactive media developers |
| Technical related to natural and applied sciences | 2271 | Air pilots, flight engineers and flying instructors |
| | 2274 | Engineer officers, water transport |
| Professionals in law and social, community and government services | 4161 | Natural and applied science policy researchers, consultants, and program officers |

| Supervisors, Coordinators, and Forepersons | | |
|---|---|---|
| **Occupations** | **Code** | **NOC Title** |
| Management | 0016 | Senior managers - construction, transportation, production, and utilities |
| | 0113 | Purchasing managers |
| | 0211 | Engineering managers |
| | 0711 | Construction managers |
| | 0714 | Facility operation and maintenance managers |
| | 0811 | Managers in natural resources production and fishing |
| | 0911 | Manufacturing managers |
| | 0912 | Utilities managers |
| Administrative and finance supervisors | 1215 | Supervisors, supply chain, tracking and scheduling coordination |
| Technical | 2264 | Construction inspectors |
| Industrial, electrical and construction | 7201 | Contractors and supervisors, machining, metal forming, shaping, and erecting trades and related occupations |
| | 7203 | Contractors and supervisors, pipefitting trades |
| | 7204 | Contractors and supervisors, carpentry trades |
| | 7205 | Contractors and supervisors, other construction trades, installers, repairers, and servicers |
| Maintenance and equipment operation | 7301 | Contractors and supervisors, mechanic trades |
| | 7302 | Contractors and supervisors, heavy equipment operator crews |
| Supervisors and technical in natural resources | 8221 | Supervisors, mining, and quarrying |
| Processing, manufacturing, and utilities supervisors | 9211 | Supervisors, mineral and metal processing |
| | 9212 | Supervisors, petroleum, gas and chemical processing and utilities |

| Support Workers | | |
|---|---|---|
| **Occupations** | **Code** | **NOC Title** |
| Administrative and Finance Supervisors | 1221 | Administrative officers |
| | 1225 | Purchasing agents and officers |
| | 1241 | Administrative assistants |
| Office Support | 1411 | General office support workers |
| | 1452 | Correspondence, publication, and regulatory clerks |
| Distribution, tracking and scheduling co-ordination | 1521 | Shippers and receivers |
| | 1523 | Production logistics coordinators |
| | 1524 | Purchasing and inventory control workers |
| | 1525 | Dispatchers |
| | 1526 | Transportation route and crew schedulers |
| Technical related to natural and applied sciences | 2234 | Construction estimators |
| | 2261 | Non-destructive testers and inspection technicians |
| | 2262 | Engineering inspectors and regulatory officers |
| | 2263 | Inspectors in public and environmental health and occupational health and safety |
| Paraprofessionals in legal, social, community and education services | 4212 | Social and community service workers |
| Service supervisors | 6322 | Cooks |
| Service representatives | 6521 | Travel counsellors |
| | 6541 | Security guards and related security service occupations |
| Service support | 6733 | Janitors, caretakers and building superintendents |
| Processing, manufacturing, and utilities operators | 9415 | Inspectors and testers, mineral and metal processing |

| Technical Occupations | | |
|---|---|---|
| **Occupations** | **Code** | **NOC Title** |
| Professionals in natural and applied sciences | 2154 | Land surveyors |
| | 2171 | Information systems analysts and consultants |
| Technical related to natural and applied sciences | 2211 | Chemical technologists and technicians |
| | 2212 | Geological and mineral technologists and technicians |
| | 2221 | Biological technologists and technicians |
| | 2223 | Forestry technologists and technicians |
| | 2231 | Civil engineering technologists and technicians |
| | 2232 | Mechanical engineering technologists and technicians |
| | 2233 | Industrial engineering and manufacturing technologists and technicians |
| | 2241 | Electrical and electronics engineering technologists and technicians |
| | 2243 | Industrial instrument technicians and mechanics |
| | 2253 | Drafting technologists and technicians |
| | 2254 | Land survey technologists and technicians |
| | 2255 | Technical occupations in geomatics and meteorology |
| | 2281 | Computer network technicians |
| Retail sales supervisors | 6221 | Technical sales specialists- wholesale trade |

| Trades Occupations | | |
|---|---|---|
| **Occupations** | **Code** | **NOC Title** |
| Industrial, electrical and construction | 7231 | Machinists and machining and tool inspectors |
| | 7235 | Structural metal and platework fabricators and fitters |
| | 7236 | Ironworkers |
| | 7237 | Welders and related machine operators |
| | 7241 | Electricians |
| | 7242 | Industrial electricians |
| | 7251 | Plumbers |
| | 7252 | Steamfitter, pipefitter, and sprinkler system installer |
| | 7271 | Carpenters |
| Maintenance and equipment operation | 7311 | Construction millwrights and industrial mechanics |
| | 7312 | Heavy-duty equipment mechanics |
| | 7321 | Automotive service technicians, truck and bus mechanics and mechanical repairers |

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