Coal and Mineral Development in Alberta

2019 Year in Review

Metallic and industrial mineral activity • Coal mining and projects • Lithium potential • Industrial mineral and coal production and royalty

Alberta

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Introduction

Lithium continued to be the primary area of activity in 2019 for metallic and industrial mineral exploration. Companies moved away from exploring lithium resources and focused their efforts on technology development to find an economic way to recover brine-hosted lithium. There was also a continued effort to develop new sources of frac sand domestically in Alberta. With most of the frac sand used in Alberta coming from Wisconsin, a number of companies are actively looking to increase the local supply.

The coal sector was very active in 2019. Notably, a new coal mine commenced operations near Hinton. The Vista coal mine began shipping thermal bituminous coal (exported outside of Canada and used for electricity generation) and marked the first new mine in Alberta in over 30 years. The joint review panel review continued for the Grassy Mountain metallurgical coal mine project in the Crowsnest Pass, and a number of early-to-advanced coal projects continued exploration work. Current exploration work is focused on metallurgical coal potential along the front of the Mountain region of the Eastern Slopes.

The Alberta Geological Survey (AGS) published the Minerals Map of Alberta in 2019. This map brings together many years of metallic and industrial mineral data and identifies prospective areas with the geological potential to host various different minerals. The map complements the Alberta Interactive Minerals Map that was published online by the AGS several years ago.

Metallic and industrial minerals

The total land area held as metallic and industrial minerals permits increased in 2019, boosted primarily by tenure activity related to interest in lithium-rich brines (Figure 1). This represents a small, continuing recovery in the permit area from a low in 2016 after a downward trend over the preceding five years. The total area held as metallic and industrial minerals leases remained consistent from 2018 to 2019 (Figure 2). This represents a small increase from the area held as lease in 2010, and a continued flat trend over the last five years. The number of metallic and industrial minerals licences (required for recreational placer gold mining) decreased in 2019 (Figure 3). Mineral assessment expenditures filed in 2019 remained mostly flat from 2018, as were the number of assessment reports submitted. The exploration expenditures in the last five years are significantly lower than the exploration expenditures reported from 2010 to 2014 (Figure 4). The first mineral assessment reports from the 2016 staking rush for lithium tenure were submitted in 2018 and started to be released in 2019 after their reviews were finalized and the confidentiality periods ended. The distribution of metallic and industrial mineral tenure is presented in Figure 5.

2019 metallic and industrial mineral exploration highlights

Iron and vanadium

PRISM Diversified reports that it continues to assess the Clear Hills iron property in northwest Alberta. The company states that in 2020 its intention is to begin work on a feasibility report and preliminary economic assessment. This work will look at PRISM's plan for producing atomized and carbonyl iron from the oolitic ironstone deposit.

Lithium

With indicated resources calculated over much of its permit holdings**, E3 Metals Corp.** has shifted focus to technology development for the extraction of lithium from brines in 2019. The company has formed partnerships with various groups to work on this development, including the University of Alberta, GreenCentre Canada, Kingston Process Metallurgy, and Livent Corporation.

E3's proposed novel approach under development is to produce lithium concentrate from the formational brines present in Alberta. Conventional brine-sourced lithium is from salars (or salt flats) in arid regions (for example Chile). The lithium-rich water from these salars are kept in evaporation ponds for 18 to 24 months, which precipitates out less soluble salts and leaves a lithium-concentrated brine. Both types of lithium-concentrate are then turned into solid lithium salt using existing technology.

Metallic and industrial minerals permits

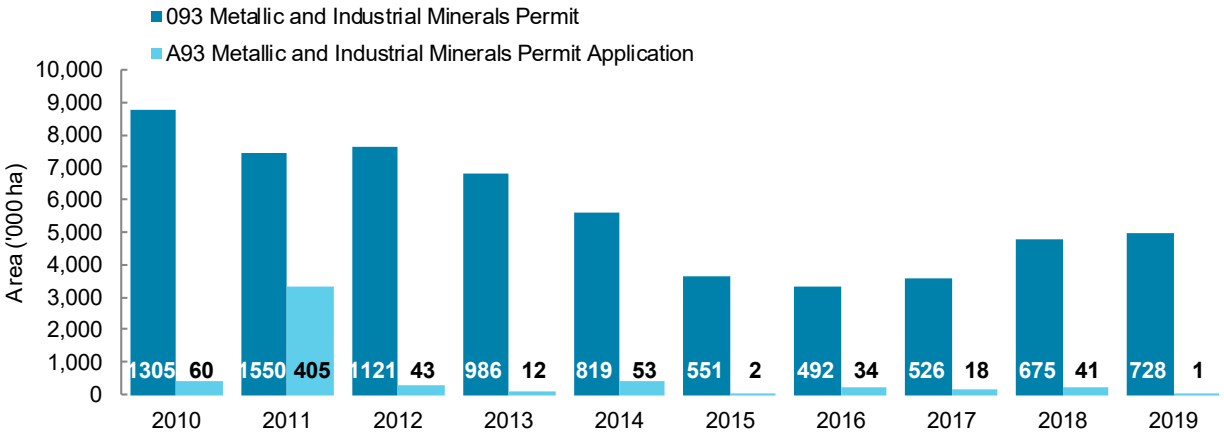


Figure 1. A bar graph with the total area of metallic and industrial minerals permits and permit applications for a 10-year period from 2010 through 2019 (the report period is October 1 through September 30). Numbers at the base of the bars indicate the number of individual permits or applications.

Metallic and industrial minerals leases

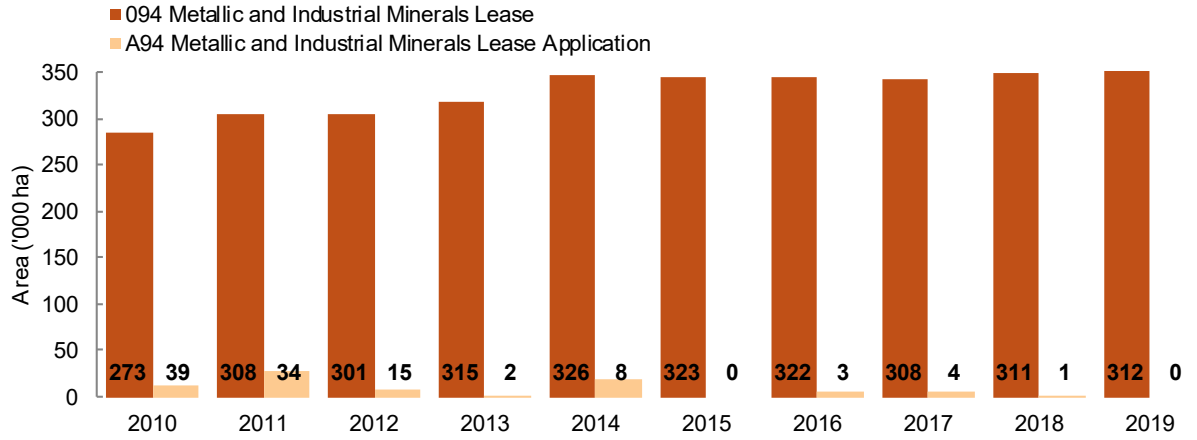


Figure 2. A bar graph with the total area of metallic and industrial minerals leases and lease applications for a 10-year period from 2010 through 2019 (the report period is October 1 through September 30). Numbers at the base of the bars indicate the number of individual leases or applications.

Metallic and industrial minerals licences

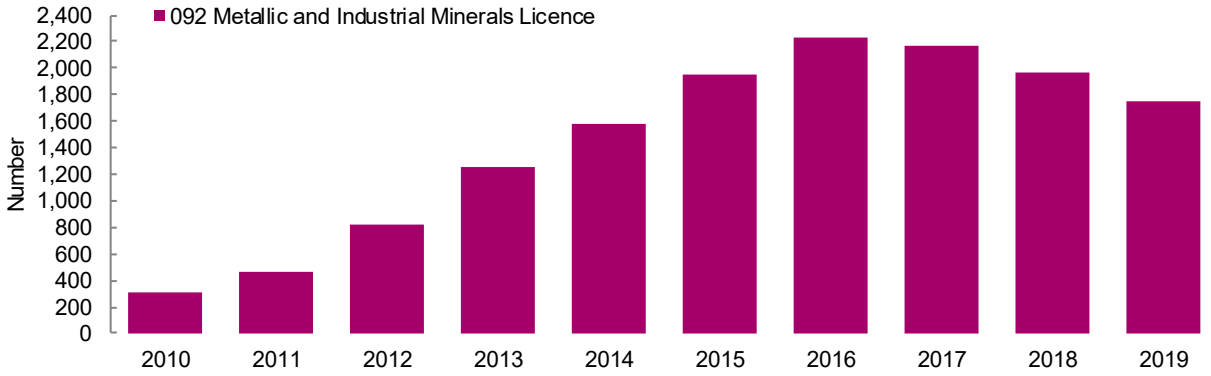


Figure 3. A bar graph with the total number of active metallic and industrial minerals licences over a 10-year period from 2010 through 2019 (the report period is October 1 through September 30). Metallic and industrial minerals licences are issued for the right to recover gold through recreational placer mining for a period of five years.

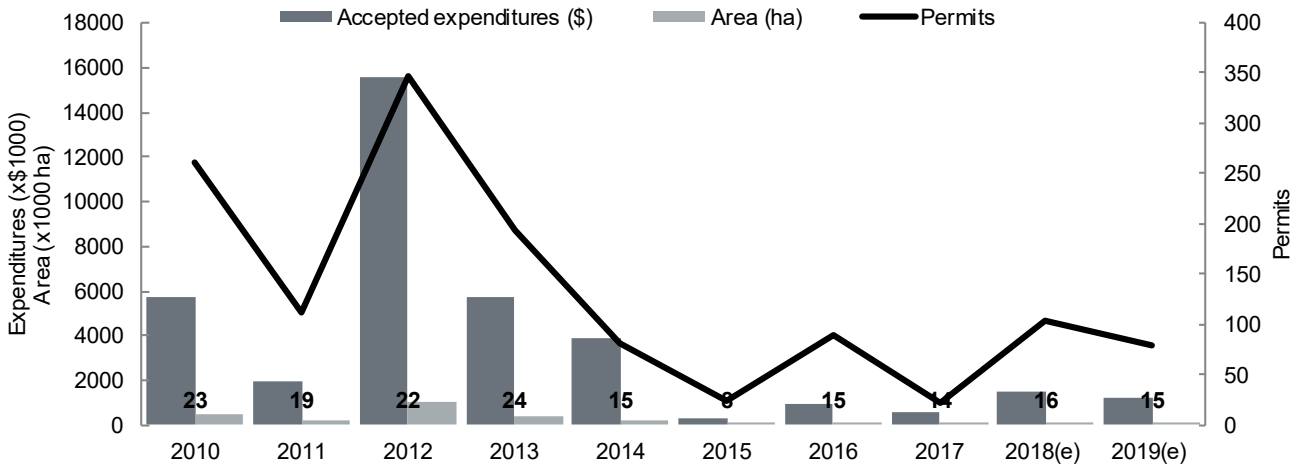
In March 2019, E3 reported an improvement to its lithium concentration process and achieved concentrations of up to 5367 mg/L lithium, compared to concentrations of 1489 mg/L in 2018. The lithium concentration in brines extracted from subsurface aquifers in Alberta typically range up to 80 mg/L. E3 reported that the process improvement has not affected lithium recoveries—98 per cent at 50 times concentration and 84 per cent at 100 times concentration—and results in low impurity concentrations. The company did not report how long the concentration process takes.

Subsequent to its concentration improvement, E3 reported that it had crystallized lithium hydroxide at a University of Alberta lab with which the company has been working. E3's goal is to develop its process to produce battery-quality lithium products on a commercial scale.

E3 also announced in 2019 that it was developing an infrastructure plan to manage its brine handling operations. The company's proposed operations would see deep wells extract brine from the subsurface, transport the brine via pipeline to its processing facility, and then send back the waste brine through a pipeline to be injected into a saline aquifer. E3 and other companies with lithium projects intend to utilize the drilling and pipeline expertise from Alberta's oil and gas sector.

In the latter part of 2019, E3 announced that it signed a joint venture agreement with Livent Corporation to advance the technical development of its lithium extraction process. Livent Corporation is a lithium chemical company based in North Carolina. They produce a variety of lithium products from a number of locations around the world, including raw production of lithium salts in South America, and high quality battery-grade lithium. Livent can earn up to 19.9 per cent ownership of E3 with a USD5.5 million investment into the project. In late 2019, E3 stated that it had collected a 20,000 litre brine sample from the Leduc reservoir that would be used to test their lithium extraction process.

Assessment report expenditures



Year	Reports	Permits	Area (ha)	Accepted expenditures ($)	Payment in lieu
2010	23	261	1,690,880	$5,772,404	$0
2011	19	112	642,758	$1,953,248	$39,712
2012	22	347	2,400,416	$15,532,731	$0
2013	24	193	1,101,370	$5,746,824	$0
2014	15	81	282,960	$3,905,340	$0
2015	8	25	116,519	$347,853	$0
2016	15	90	376,621	$987,590	$0
2017	14	23	87,254	$609,585	$0
2018(e)	16	103	394,692	$1,500,000	$0
2019(e)	15	80	476,275	$1,200,000	$0

Figure 4. A graph of mineral assessment report statistics for a 10-year period from 2010 through 2019. The number of permits and area are those reported in submitted reports. The accepted expenditures are those accepted by Alberta Energy; the total amount claimed is not reported, but is higher than the accepted expenditure value. Numbers at the base of each bar are the number of reports received. (e) Accepted values for 2018 and 2019 are preliminary because not all report reviews were completed at the time of publication.

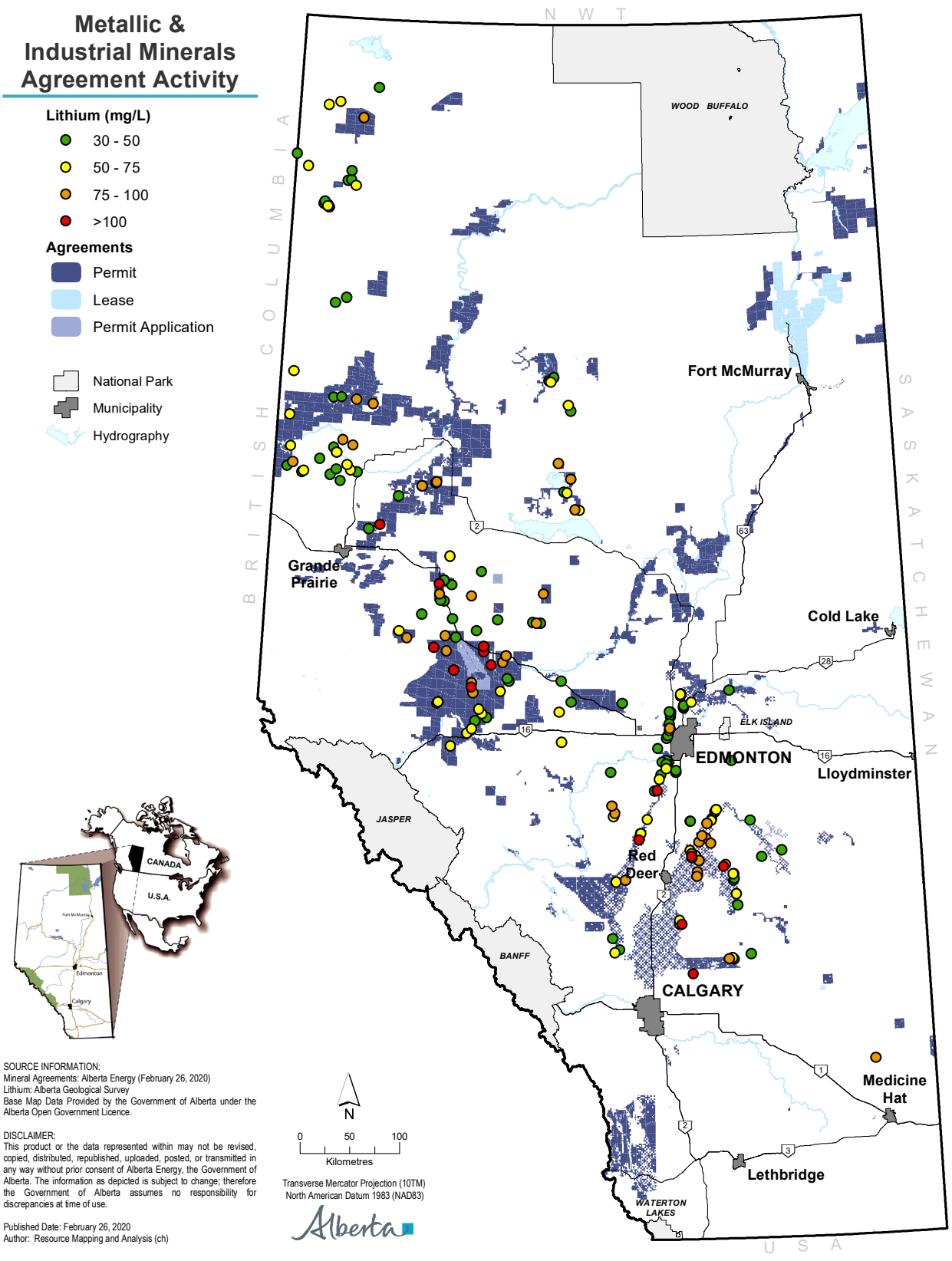


Figure 5. A map of Alberta showing metallic and industrial mineral tenure activity as of February 2020. An interactive, real-time version of this map is available at *www.alberta.ca/interactive-energy-maps.aspx.* The coloured circles show oil field brine samples with greater than 30 mg/L lithium. The lithium data is from the Alberta Interactive Minerals Map.

Aggregate

In October 2019, **Athabasca Minerals Inc.** filed a National Instrument (NI) 43-101 technical report on its Richardson property in northeast Alberta, located approximately 130 kilometres north of Fort McMurray. Athabasca's technical report is based on exploration work completed up to 2015. Athabasca intends to develop construction aggregate from both the dolostone of the Winnipegosis formation and the granite of the Precambrian basement. The technical report detailed extensive testing of the target material for suitability as a crushed aggregate material. It also reported poor metallic mineral potential on the property based on geotechnical analysis done as part of past exploration work. Athabasca sees potential to supply aggregate to oil sands mines to the south of the property. The technical report estimated a 683 million tonne inferred dolostone resource from the Winnipegosis formation and a 165 million tonne inferred granite resource from the basement. (An inferred resource is information - such as tonnage - inferred, but not confirmed, from geographical evidence.)

Athabasca agreed to relinquish a number of the metallic and industrial minerals permits that were part of the Richardson property as part of the establishment of the Kitaskino Nuwenëné Wildland Provincial Park south of Wood Buffalo National Park. The remaining property area was converted to metallic and industrial leases.

Industrial mineral quarries

Mine/Quarry	Commodity	Location	Operator
Bay Tree	Shale	Grande Prairie	WK Ventures Ltd.
Calling Lake*	Salt	North of Athabasca	Calcium Inc.
Clearwater	Limestone	Rocky Mountain House	Burnco Rock Products Ltd.
Cougar Ridge	Limestone	Rocky Mountain House	Fish Creek Excavating Ltd.
Edco Hill	Shale	Grande Cache	Ro-Dar Contracting Ltd.
Exshaw	Limestone	Exshaw	Lafarge Canada Ltd.
Fish Creek	Limestone	Nordegg	Fish Creek Excavating
Gap	Limestone	Exshaw	Graymont Western Canada Inc.
McLeod	Limestone	Cadomin	Lehigh Hanson Materials Ltd.
Mitsue*	Salt	Slave Lake	Tiger Calcium Services Inc.
Muskeg	Limestone	North of Fort McMurray	Hammerstone Corporation
Oldman River	Sandstone	Cowley	Darren Taylor Harvesting Ltd.
Parson's Creek	Limestone	Fort McMurray	Graymont Western Canada Inc.
Peace River Silica	Silica Sand	Peace River	Contractors Leasing Corp.
Riverview*	Salt	Riverview	K+S Windsor Salt Ltd.
Rundle Stone	Dolomitic Siltstone	Canmore	Kamenka Quarries Ltd.
Seebe	Shale	Kananaskis	Lafarge Canada Ltd.
Sheep Creek	Sandstone	Grande Cache	CST Coal Canada Ltd.
Sprayfalls	Sandstone	Exshaw	Thunderstone Quarries Ltd.
Steepbank	Limestone	North of Fort McMurray	Hammerstone Corporation
Summit Lake	Limestone	Coleman	Graymont Western Canada Inc.
Sunnynook*	Salt	Drumheller	Jarodon Resources Ltd.
Yamnuska	Sandstone	Kananaskis	Lafarge Canada Ltd.

Table 1. A table of the active industrial mineral quarries in Alberta that produced in 2019; there are no metallic mines.
*Salt is produced through in situ leaching or from subsurface brines.

Frac sand

At the end of October 2019, Athabasca Minerals released a NI 43-101 technical report on its White Rabbit property in its Duvernay frac sand project area, in northwest Alberta. The technical report examined the suitability of sand on the property for use as a hydraulic fracturing proppant. Athabasca Minerals reported favourable results. The company completed a drill program on the property in 2019 to further work for potential mine development.

At the beginning of 2020, Athabasca Minerals reported that it entered into a purchase agreement with Shell Canada to sell frac sand from its Duvernay property. The agreement sets the first delivery of frac sand in the middle of 2021.

Athabasca Minerals also released a NI 43-101 technical report on their Firebag property, in northeast Alberta, in November 2019. The technical report assessed the extent of the sand deposit and suitability for use as a proppant for hydraulic fracturing.

Firebag is Athabasca Minerals' most developed frac sand project, with a reported indicated resource of 38.2 million tonnes of frac sand over various size fractions. Athabasca's initial exploration on the Firebag began in 2009. The company was granted a surface material lease for an 80 acre parcel in 2014. Athabasca began exploration in the area looking for metallic and industrial minerals. Athabasca shifted its focus after high purity surface sand was discovered at this location.

Sil Industrial Minerals continued to explore for frac sand potential at a number of properties throughout central Alberta.

Source Energy Services and **Canadian Silica Industries** both continued to explore for additional frac sand sources but did not publicly report any work in 2019.

Heavy Minerals

In the summer of 2019 **Titanium Corporation Inc.** received the final installment of a grant from Emissions Reduction Alberta for the purpose of completing front end engineering design work for a froth tailing processing plant. Titanium also announced that it received additional funding from the federal government's Low Carbon Economy Fund (Environment and Climate Change Canada) and Clean Growth Program (Natural Resources Canada) to begin the next phase of development of their project with Canadian Natural Resources Ltd. at the Horizon oil sands mine.

Titanium aims to commercialize its technology and recover heavy minerals (zircon and titanium-bearing minerals), solvent, and residual bitumen from the froth tailings of oil sands mining operations.

Uranium

GoldMining Inc. reported no new work on its Rea uranium property in northeast Alberta. The Rea property is a joint venture project with **Orano Canada**. The property surrounds the Maybelle River uranium deposit held by Orano. A technical report was published on the Rea project in 2014.

Phosphate

Fertoz International Organics Inc. has interests in metallic and industrial mineral permits in the Crowsnest Pass area (south of Highway 3) and are interested in phosphate potential. The company received approval to take a bulk sample on the property and completed exploration in 2019. Fertoz is exploring for phosphate-rich shales for use as agricultural fertilizer, sometimes referred to as rock phosphate.

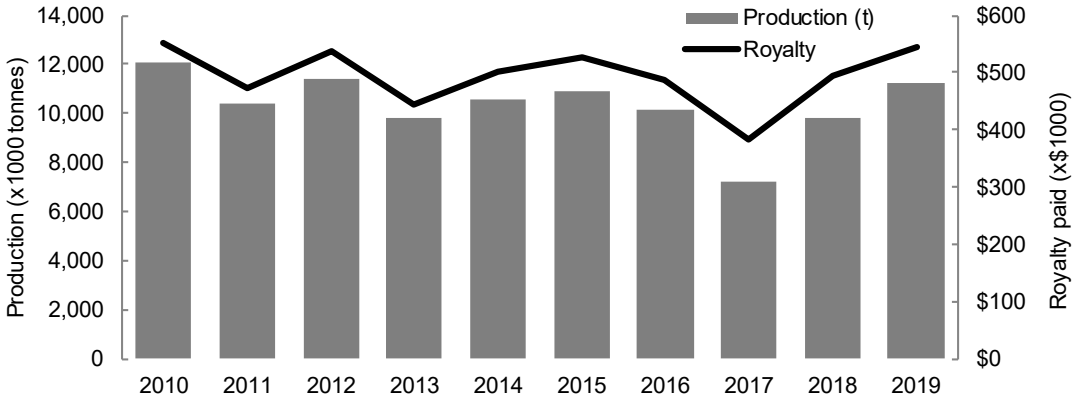
2019 industrial mineral quarry activities

Production and royalty. The production of quarriable minerals (including limestone, dolomitic siltstone, sandstone, and silica sand) increased in 2019, which represents a continued increase from a low in 2017 (Figure 6). Over the past 10 years, (2010 through 2019) the trend for quarriable mineral production has been fairly flat. Limestone represents the bulk of quarriable minerals produced in Alberta during the last 10 years.

Salt production dropped year over year from 2018 (Figure 7). The 10-year trend for salt production shows an overall decrease. Salt production, primarily from the Devonian Elk Point Group, is derived from in-situ leach and brine extraction operations (rather than traditional mining methods).

Table 1 lists all operating industrial mineral quarries in Alberta.

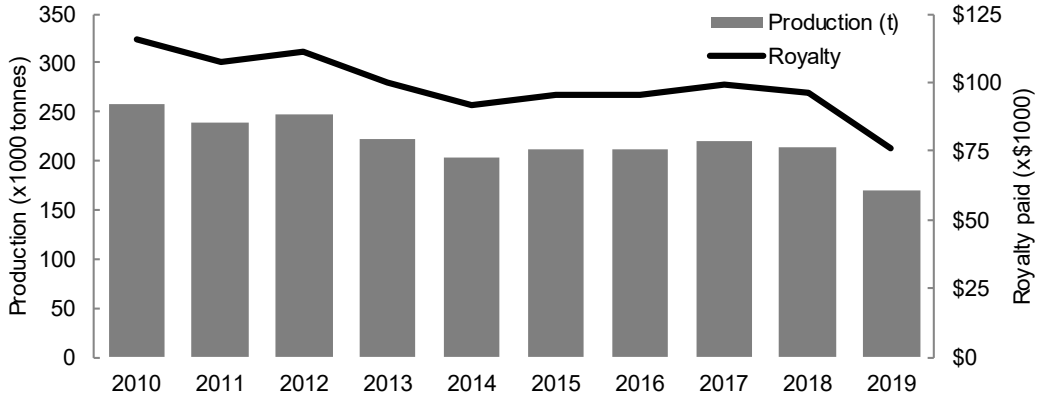
Quarriable mineral production



Year	Production (t)	Royalty	Year	Production (t)	Royalty
2010	12,078,733	$551,439	2015	10,934,343	$527,966
2011	10,423,433	$471,404	2016	10,121,480	$486,514
2012	11,399,983	$537,621	2017	7,244,297	$382,601
2013	9,794,655	$445,496	2018	9,811,775	$495,163
2014	10,583,127	$500,671	2019	11,234,180	$544,713

Figure 6. The total quarriable mineral production and royalty collected over the 10-year period from 2010 through 2019. The report period is from October 1 to September 30. Quarriable minerals include dolomitic siltsone, limestone, sandstone, shale, and silica sand (produced from sandstone).

Salt Production



Year	Production (t)	Royalty	Year	Production (t)	Royalty
2010	257,935	$116,071	2015	213,004	$95,852
2011	239,061	$107,577	2016	212,826	$95,772
2012	246,968	$111,136	2017	221,067	$99,480
2013	222,631	$100,184	2018	214,751	$96,638
2014	203,659	$91,647	2019	169,724	$76,376

Figure 7. The total salt production and royalty collected for the 10-year period from 2010 through 2019. The report period is from October 1 to Septeber 30. Salt production comes from in situ leaching of subsurface salt formations or precipitation from deep brines. Salt production does not include any salt extracted during the production of salt caverns.

Coal

The area held as coal leases and coal lease applications remained at the same level from 2017 and 2018 (Figure 8). Looking at the last 10 years, these levels peaked in 2014. The rise in leases and applications from 2010 through 2014 was driven by interest in bituminous (primarily metallurgical) coal in the Eastern Slopes and a number of coal sales in category 4 areas increased coal leases in 2012. Post-2014 the number of coal leases have decreased, in part due to the phase-out of coal-fired electricity generation. The area held as coal leases and distribution of coal lease applications is presented in Figure 9.

2019 coal exploration and advanced project highlights

Riversdale Resources' regulatory application for the **Grassy Mountain** metallurgical coal mine project (being developed by its subsidiary, **Benga Mining Ltd.**) continues to proceed through the joint review panel process. A six-week public comment period was open in September and October 2019, for submissions on the sufficiency and technical merit of the ninth and 10th addenda to the environmental impact assessment (EIA) for the project. The joint review panel conducted an aerial and site tour of the project area in September 2019.

In November 2019, the joint review panel informed Benga Mining that there was insufficient information to proceed with a public hearing at that time. The panel made 28 information requests as part of the notice relating to various subjects, including air quality, land use and management, socio economics, Indigenous rights and land use, wildlife, hydrogeology, hydrology, fish and habitat, and human health. Once Benga Mining submits responses to the information requests,

Joint Review Panel

If a mining project requires both provincial and federal environmental assessment as part of the regulatory approval process, the regulatory review of the project will often occur by a joint review panel. Once a project is identified, the two levels of government will negotiate an agreement to set out the process and terms of reference for the panel. Members on the panel will be appointed by the federal and provincial environment ministers. The purpose of a joint review panel is to reduce regulatory duplication by having a single review for a single project.

The joint review process will include document submission and review, a public comment period, and often a public hearing phase. This provides opportunity for public input into the environmental review process that will inform the work and decision of the joint review panel. The panel will develop a recommendation on whether or not a project should go ahead.

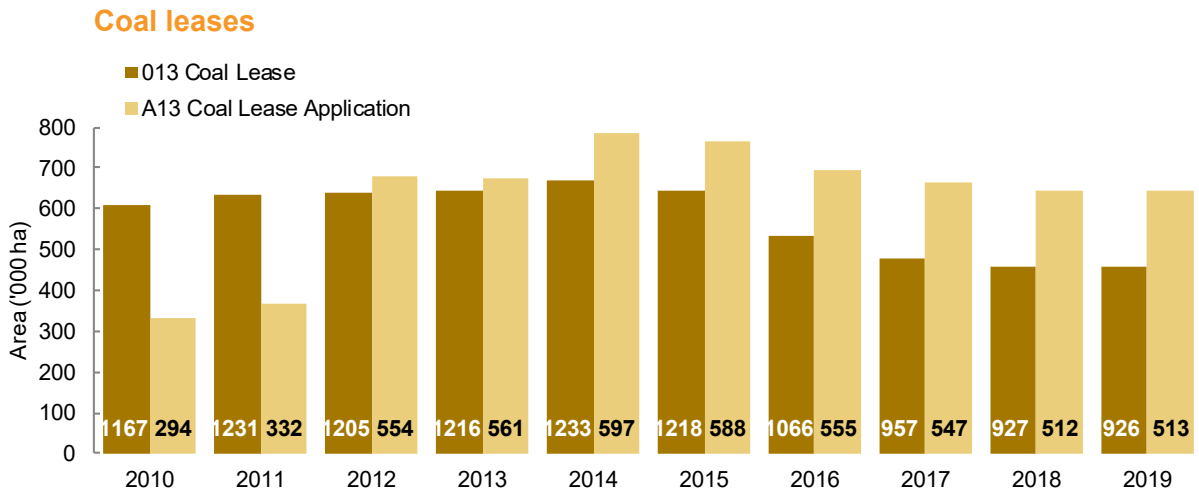


Figure 8. A bar graph with the total area of coal leases and lease applications for a 10-year period from 2010 through 2019 (the report period is October 1 through September 30). Numbers at the base of the bars indicate the number of individual leases or applications.

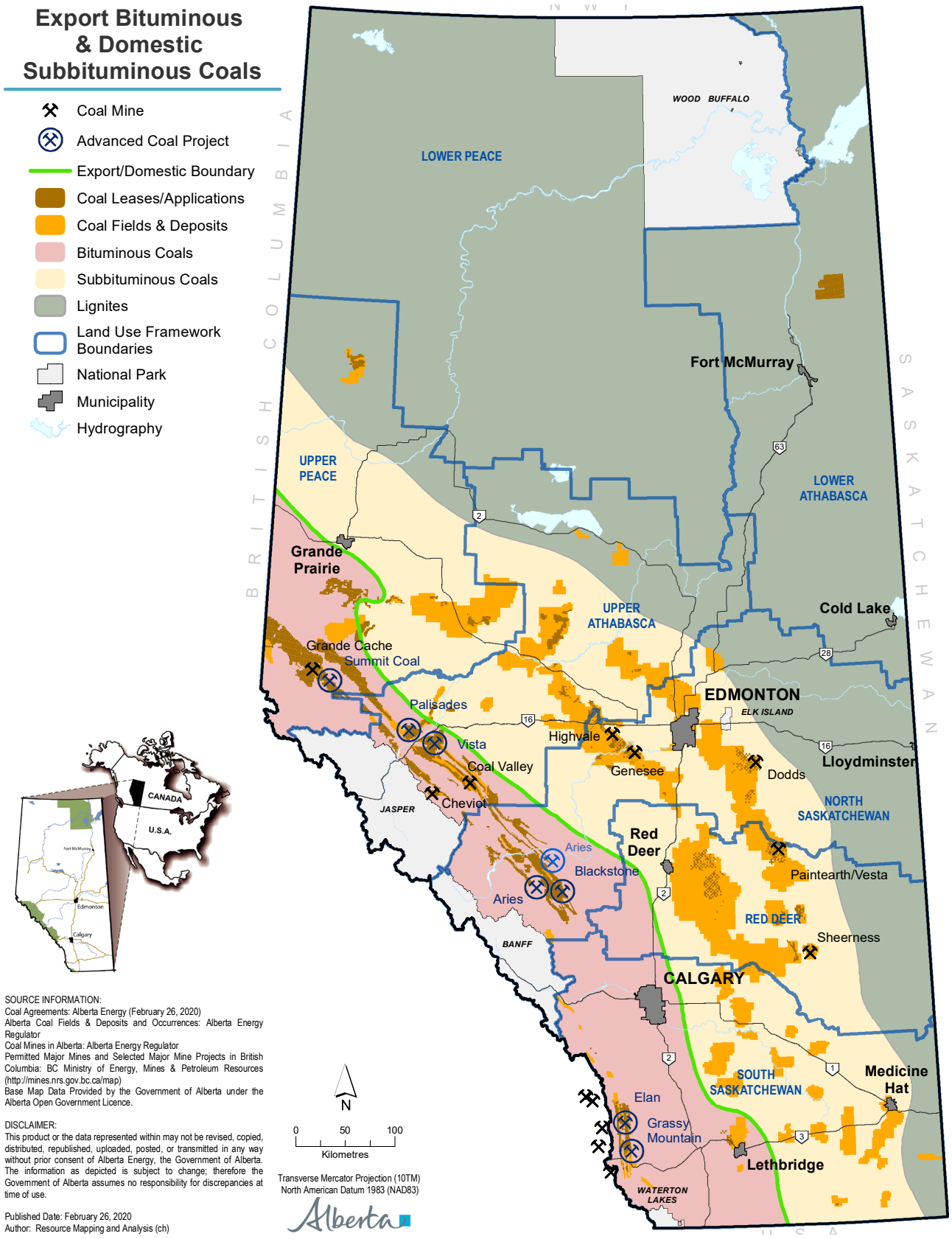


Figure 9. A map of Alberta showing coal tenure activity (dark brown), and coal mines and projects, as of February 2020. Coal fields (light brown) and approximate coal rank distribution (coloured bands) are also shown. An interactive, real-time version of the coal tenure on this map is available at *www.alberta.ca/interactive-energy-maps.aspx*.

the panel will set dates for another public comment period on those submissions. When the panel is satisfied that Benga Mining has provided all of the required information they will move to a public hearing phase. As of the publication of this report, no timeline expectations were established for this.

During spring 2019, **Hancock Prospecting Pty Ltd.** acquired all of the interest in Riversdale Resources through its subsidiary, Hancock Corporation Pty Ltd. Hancock's interest in Riversdale is 99 per cent as of May 21, 2019 when the offer closed. After the initial recommendation from Riversdale directors to reject the offer proposed by Hancock for the acquisition, the offer was eventually recommended and accepted with an offer price of AUD2.70 per share (resulting in a purchase price of approximately AUD700 million).

Hancock Prospecting Pty Ltd. is a private Australian company whose primary interests are in iron ore mining in Australia. The company holds significant iron ore leases in the Pilbarra region of Australia. Hancock also has interests in a coal mine in Australia and exploration activities related to iron ore, base metals, gold, diamonds, and petroleum in Australasia. The purchase of Riversdale Resources' and its Canadian assets is one of Hancock's first major acquisitions outside of Australia.

If the project receives regulatory approval, the Grassy Mountain mine will employ 385 people and produce 4.5 million tonnes of metallurgical coal per year over a 24-year mine life. The clean coal would be shipped by rail to the Westshore coal terminal in Vancouver, B.C. for export to international customers.

Riversdale intends to continue exploration work on the project site through 2019 and 2020. The AER issued a deep drill permit for 44 rotary and core holes up to 700 metres in depth.

Ram River Coal Corp. did not report any new work on its **Aries** metallurgical coal project in 2019. The company previously completed a NI 43-101 technical report and prefeasibility study on the property. Over the past several years, Ram has conducted baseline environmental monitoring work.

Altitude Resources Ltd. changed their name to **Horn Ridge Resources Inc.** In 2019, Horn Ridge Resources completed a surface mapping and sampling program on its **Targa** metallurgical coal property near the Grande Cache coal mine. The Targa property was formerly called Altitude North when the company was Altitude Resources.

Historical work on the property includes drill holes from the 1960s. Altitude Resources completed a short field program in 2015 to confirm previously mapped coal seams. Mapping in 2019 focused on the coal seams in the Grande Cache member of the Gates formation (part of the Luscar group). Horn Ridge Resources also identified the locations of adits (horizontal passages to access an underground mine) throughout the property. The next step for the company is to obtain approval for a drilling program on the property.

Horn Ridge Resources did not report any work in 2019 on its Palisades property in the Hinton area.

Elan Coal Ltd. (a wholly-owned subsidiary of Atrum Coal) received approval for coal exploration programs on three of its projects: **Isolation South**, **Cat Mountain**, and **Elan South**. Elan also received deep drill permits for all three projects authorizing rotary and core holes up to 400 metres in depth. The work on Elan South is a continuation of Elan's coal exploration program from 2017.

The Elan South, Cat Mountain, and Isolation South properties are located on coal lease applications that are north and adjacent to the leases that make up the Grassy Mountain property. The primary target of these exploration projects are coal seams within the Mist Mountain formation of the Kootenay group.

Elan indicates that approved drilling exploration activities will continue through 2024 in order to assess the location and quality of metallurgical coal in the three properties.

Elan also received a number of other approvals from the AER for coal exploration and drilling as well as for environmental work related to baseline monitoring.

Black Eagle Mining was acquired by **Valory Resources** in 2019 with the intent of restarting work on the **Blackstone** metallurgical coal property south of Rocky Mountain House. The last major drilling on this property was completed in 2012. In 2018, the NI 43-101 compliant resource was converted to a Joint Ore Reserves Committee (JORC) compliant resource. Valory has raised funds and it has planned new exploration work and will recommence baseline environmental monitoring. Planned work includes 20,000 metres of drilling and 100 kilometres of 2D seismic surveys over the property in order to expand the Indicated and Inferred Resources for a future pre-feasibility study.

The primary target of the Blackstone project are two of four coal seams within the Gates formation of the Luscar group.

Montem Resources continued work on their **Tent Mountain** metallurgical coal exploration project.

Montem expects that a definitive feasibility study will be completed in the first quarter of 2020. It completed a preliminary feasibility study in mid-2019 that assessed the economic potential of a 15-year mine. Since it purchased the property in 2016, Montem has completed environmental monitoring and drilling programs.

The pre-feasibility study from 2019 published a 17 million tonne reserve of clean mid-volatile bituminous coal. The proposed mine plan is for a surface operation producing 1.2 million tonnes per year of exported coal with a 15-year mine life. The company reached an agreement for 1.2 million tonnes per year capacity at Westshore Terminals in Vancouver through 2022, and will transport coal via the CP rail line that runs through the Crowsnest Pass.

Montem currently holds an active coal mine permit for the mine project; the permit was approved prior to 1978. The company holds a coal mine permit from B.C. for the portion of the project that lies across the provincial border, and it holds an *Environmental Protection and Enhancement Act* approval for the project in Alberta. Montem submitted an application for a mineral surface lease in early 2019, and plans to submit applications for the required *Water Act* licences and coal mine licences in the first quarter of 2020. If all of the required regulatory approvals are received, Montem plans to begin construction on the potential mine as early as the end of 2020, with the first coal shipped by mid-2021.

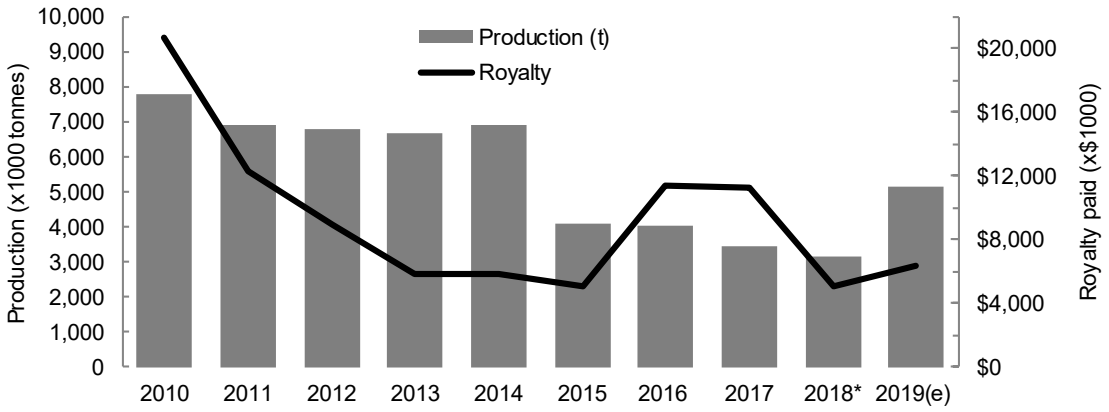
Montem's coal resources at Tent Mountain are within the Mist Mountain formation of the Kootenay group.

The Tent Mountain property is located on the Alberta-B.C. border; part of the property is located in B.C. It is within the Crowsnest Pass approximately 16 kilometres from Coleman.

2019 coal mine activities

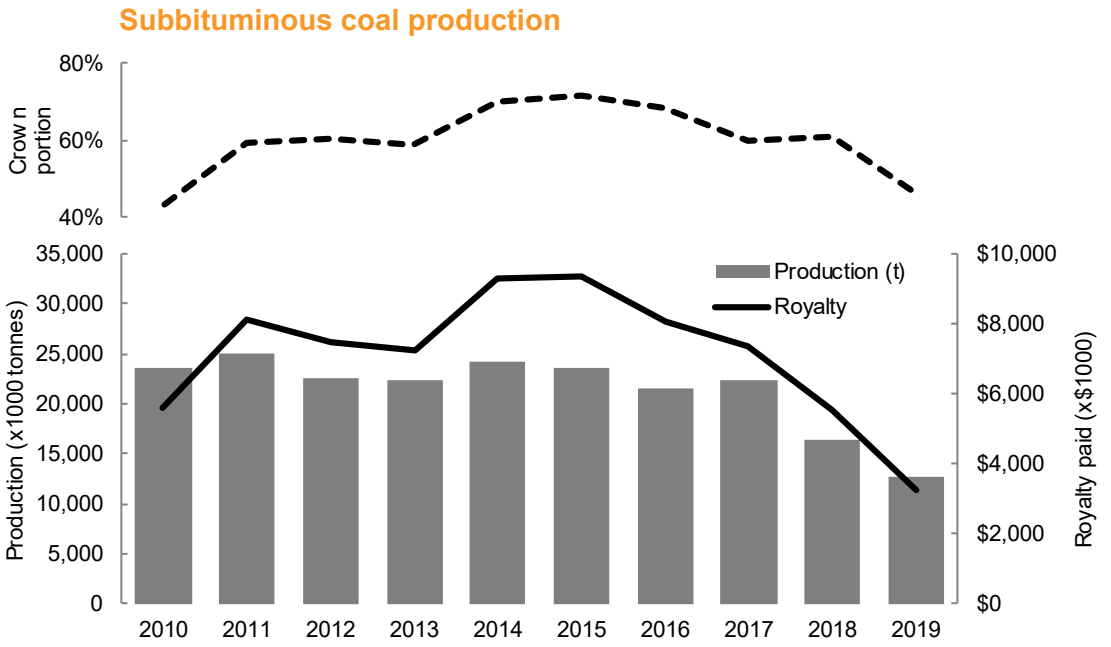
Production and royalty. Bituminous coal production increased almost 40 per cent from 2018, due to the new Vista mine coming online and the Grande Cache mine returning to normal production

Bituminous coal production



Year	Production (t)	Royalty	Year	Production (t)	Royalty
2010	7,808,400	$20,628,221	2015	4,066,285	$5,107,884
2011	6,898,123	$12,325,969	2016	4,060,223	$11,372,650
2012	6,805,148	$8,892,626	2017	3,474,228	$11,285,563
2013	6,653,820	$5,775,640	2018*	3,181,867	$5,118,232
2014	6,915,435	$5,826,830	2019(e)	5,164,316	$6,394,399

Figure 10. The total bituminous coal production and royalty collected for the 10-year period from 2010 through 2019. The report period is from October 1 to September 30. *2018 royalty is adjusted from the 2018 report because of year end reconciliation in April 2019. (e) 2019 royalty and production is an estimate until final reconciliation in April 2020.



Year	Production (t)	Crown %	Royalty	Year	Production (t)	Crown %	Royalty
2010	23,583,193	43%	$5,604,637	2015	23,613,875	72%	$9,324,471
2011	24,938,975	59%	$8,124,111	2016	21,422,954	68%	$8,061,524
2012	22,483,777	60%	$7,463,258	2017	22,303,049	60%	$7,331,674
2013	22,288,559	59%	$7,209,349	2018	16,452,990	61%	$5,508,152
2014	24,230,326	70%	$9,314,753	2019	12,647,038	46%	$3,218,416

Figure 11. The total subbituminous coal production and royalty collected for the 10-year period from 2010 through 2019. Alberta Energy only collects royalty on coal production from Crown-owned coal rights. The report period is from October 1 to September 30.

levels in 2019. This resulted in a small increase to the bituminous coal royalty reported (Figure 10). Bituminous coal royalty reported in the 2018 *Coal and Mineral Development Year in Review* was adjusted slightly up due to higher reported royalty owing at year end reconciliation in April 2019. Coal production is expected to increase in 2020 as mining at the Vista coal mine ramps up toward full capacity and should offset the reduced production from Cardinal River ceasing operations.

Subbituminous coal production continued to decrease in 2019; there was an associated decrease in subbituminous coal royalty collected due to the decreased production, and a decrease in the portion of Crown production from subbituminous coal mines (Figure 11).

Table 2 lists all operating coal mines in Alberta.

Grande Cache Coal Mine

CST Canada Coal Ltd. produced coal at the **Grande Cache mine** through 2019, returning the mine to normal production levels.

On December 4, 2019, the AER approved the abandonment of the No. 7-4 Underground Mine after it determined that CST completed the required abandonment activities for the underground mine portals.

Cardinal River Coal Mine

Teck Resources Ltd. announced on May 30, 2019 that it would not proceed with the planned MacKenzie-Redcap expansion and will close operations in the second half of 2020. The AER granted approval for the expansion of the **Cheviot mine** into the MacKenzie Redcap phase on April 1, 2019, which would have allowed for production at the mine to continue until 2027.

The current mine operation was expected to be mined out in 2020. The approved expansion would have continued operations at the Cardinal River site. In the last quarter of 2019, Teck was granted several approvals to backfill pits and move toward closing operations.

Coal mines

Mine	Coal rank	Location	Owner/Operator	Main use
Cheviot (Cardinal River)	Bituminous	Hinton	Teck Coal Ltd.	Export: metallurgical
Coal Valley	Bituminous	Hinton	Westmoreland Coal Co.	Export: thermal
Dodds	Subbituminous	Ryley	Dodd's Coal Mining Company Ltd.	Small-scale sales
Genesee	Subbituminous	Warburg	Capital Power LP / Westmoreland Coal Co.	Electricity: Genesee generating stations
Grande Cache	Bituminous	Grande Cache	CST Canada Coal Ltd.	Export: metallurgical
Highvale	Subbituminous	Wabamun	Transalta Corp / SunHills Mining LP	Electricity: Keephills and Sundance generating stations
Paintearth/Vesta	Subbituminous	Forestburg	Westmoreland Coal Co.	Electricity: Battle River generating stations
Sheerness/ Montgomery	Subbituminous	Hanna	Westmoreland Coal Co.	Electricity: Sheerness generating stations
Vista	Bituminous	Hinton	Bighorn Mining Ltd.	Export: metallurgical

Table 2. A table of the active coal mines in Alberta.

The Cardinal River mine operates under two coal mine permit areas: the Luscar mine, which is the location of the coal processing plant and is otherwise under active reclamation; and the Cheviot mine, which is the site of current mine operations.

Vista Coal Mine

The **Vista** bituminous thermal coal mine began commercial operations in April 2019. The first coal shipment left the mine on May 11, 2019, headed for the Ridley coal terminal in Prince Rupert. Vista is the first new mine to begin operations in over 30 years in Alberta. Located approximately 10 kilometres east of Hinton, the mine produces high volatile bituminous coal that is sold as thermal coal for use in coal-fired electricity generating stations overseas. The coal is transported by rail to ports on the west coast of British Columbia for seaborne travel to international destinations.

The Vista mine received permits to operate over 35 years. The coal mine permit was initially issued to McLeod River Coal Limited, who held the permit until 2007. From 2007 to 2011 Mancal Coal Incorporated held the permit before transferring their interest to **Coalspur Mines Ltd.** In February 2014, the AER issued the final coal mine licences for the Vista mine, authorizing Coalspur to start mine construction and operations. Delays in securing financing for the project, low global prices for thermal coal, and longer than anticipated regulatory approvals resulted in the company's decision to delay construction. In February 2015, Coalspur entered into an agreement for acquisition by **KC Euroholdings S.a.r.l.** The acquisition was completed in June 2015. The mine operates, and the related coal leases are held, under the name Coalspur Mines (Operations) Ltd.

Coalspur has applied to the AER for approval to move forward with Phase II of Vista to expand operations to the west of Phase I and to continue surface mining operations to access the same Val d'or, McLeod, and McPherson seams that are currently being mined. In June 2019, the AER announced the final terms of reference for the EIA that is required for this review. The federal government announced that the Phase II expansion will not require a federal environmental review, which means the only regulatory decision will be from the AER.

If the regulatory review is successful, Coalspur plans to start construction on the expansion at the start of 2022. This would expand production at Vista by an average of 4.2 million tonnes (6.0 maximum) per

year and would create an additional 200 to 250 new jobs to support this increase. The increased production will almost double the allowed coal production from the mine—currently 6.5 million tonnes of coal is exported per year—to over 10 million tonnes per year. At full production Vista would be the largest producer of export coal in Alberta.

Energy and Mines Ministers' Conference

Alberta participated in the Energy and Mines Ministers' Conference (EMMC) in Cranbrook, B.C., in July 2019. The EMMC is an annual gathering of federal, provincial, and territorial ministers responsible for energy and mining portfolios.

Canada's energy and mines ministers concluded their annual conference with a shared vision aimed at leveraging Canada's natural resource advantage to attract investment and create jobs for Canadians, develop new natural resource products, and expand global market access. To that end, ministers acknowledged the need for jurisdictions to work together to get Canada's resources to market while enhancing environmental sustainability, improving Canadian competitiveness through timely, predictable, and transparent regulatory processes, and securing public trust.

The ministers committed to continuing to advance Indigenous partnerships through strong relationships and economic opportunities. Ministers discussed the importance of working together to develop cleaner power sources across Canada, modernize infrastructure, strengthen collaboration on cyber-security to ensure safety, security, and reliability of Canada's energy systems—as well as improve coordination of energy data collection and sharing to enhance effective communication and decision making—and investment attraction.

The **Canadian Minerals and Metals Plan** (CMMP), jointly developed by the federal, provincial and territorial governments and released in March 2019, is a plan to position Canada as the leading mining jurisdiction globally. Energy and mines ministers advanced this vision by discussing six pan-Canadian actions under the CMMP:

1. a pan-Canadian geoscience strategy;
2. workshops aimed at increasing Indigenous and local procurement;
3. an improved reclamation and remediation initiative;
4. programming to support an effective innovation ecosystem;
5. a mineral literacy campaign; and
6. the establishment of a Canada brand for mining.

The first in a series of action plans was released

History: Cardinal River

The Cardinal River area has had a long history of active coal mining for over 50 years.

Mining at the Luscar mine site began underground in 1921 through to 1958, and produced 7.8 million tonnes of coal. The mine was operated by Luscar Coals Ltd. Mining restarted at Luscar in 1968 with the start of surface mine operations as the Luscar mine and continued until 2004. The Luscar mine produced over 84 million tonnes of metallurgical coal during its 36 years in operation. In 1980, an underground mining operation was approved at the mine. The AER described this phase of mining as an experimental mine, using slope rock tunnel and crosscut methods. This operation ended in 1983 after producing 23 thousand tonnes of coal. Although most of the mine site is under active reclamation, the coal processing plant is still in operation and processes coal from the adjacent Cheviot mine site.

The Mount Cheviot Mining Co. operated the underground Cheviot Creek coal mine through the 1930s. Surface mining in its current form began at the Cheviot mine in 2004 and continues today. Mining began with the Cheviot Creek phase in 2004. This initial mine area was operated until 2010; it is now under active reclamation, including backfilling mine pits and replacing soil to establish vegetation. In 2008, the mine expanded to the Prospect phase, which continued to 2014. McLeod and Harris phases then began in 2011 and 2014, respectively, and are being mined to this day. The last two of six phases planned for the mine—Redcap and MacKenzie—were approved but Teck cancelled the expansion work to mine coal from these areas.

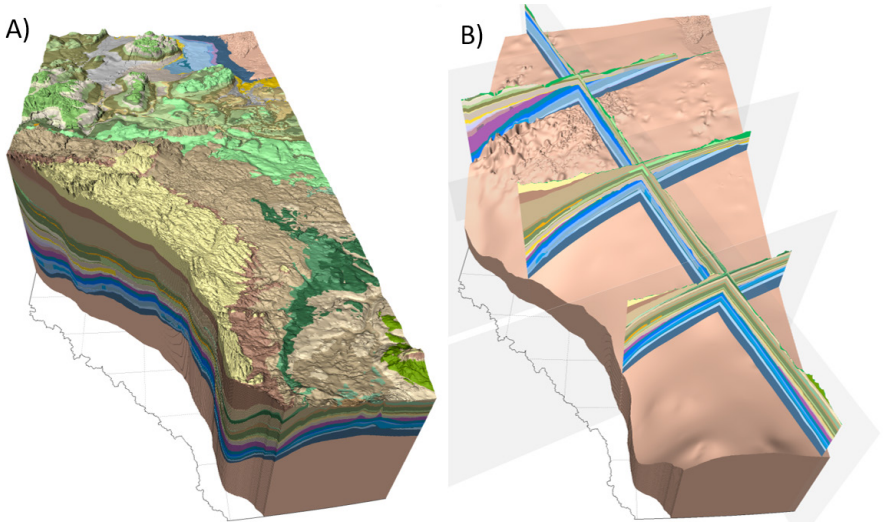


Figure 12. 3D Geological Framework of Alberta (version 2) showing the A) full 3D model, and B) cross-sections showing the internal structure of the zones within the 3D model.

in early 2020 *(www.minescanada.ca/en/content/action-plan-2020-introducing-pan-canadian-initiatives-march-2020)*. The CMMP can be downloaded at *www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/CMMP/CMMP_The_Plan-EN.pdf*.

Driving competitiveness, innovation, sustainability and Indigenous partnerships in Canada's natural resource industries will remain a focus of federal, provincial, and territorial energy and mines ministers as they work toward the 2020 EMMC in Whitehorse, Yukon.

Publications from the 2019 EMMC and previous years can be viewed on Natural Resources Canada's website: *www.nrcan.gc.ca/publications/11102*.

Alberta Geological Survey

The Alberta Geological Survey (AGS) is part of the Alberta Energy Regulator (AER) and is the official provincial geological survey of Alberta. It operates under the guiding principles of the Canada Intergovernmental Geoscience Accord, which identifies the provincial survey as being the principal steward, resident authority, and principal investigator for public geoscience. The AGS is responsible for the systematic description of the geology and resources within the province. It also provides geoscience information to help inform regulatory decisions and provides information and knowledge to the Alberta Government and the public to help resolve land use, environmental, public health, and safety issues related to geosciences.

The AGS delivers geoscience in several key areas, including surficial mapping, bedrock mapping, geological modelling, resource evaluation (hydrocarbons and minerals), groundwater, and geological hazards. The AGS is also responsible for maintaining the Alberta Table of Formations, and for providing outreach and information to stakeholders and the public.

The AGS website (*ags.aer.ca*) offers a wide range of information and products on the geology of Alberta, including over 2,500 reports, 400 maps, and 1,300 datasets (digital data, shapefiles, and digital imagery). Much of AGS data is incorporated into an interactive digital environment, which includes geographical information system (GIS) maps and three-dimensional (3D) geological models. This environment enables the visualisation of surface and subsurface features and allows users to incorporate their own information within the maps and models. Current projects and activities are also highlighted, along with additional geoscience information about Alberta.

2019 Geological Framework

The AGS continues to develop the 3D Geological Framework of Alberta, which includes a provincial-scale representation of Alberta's subsurface geology covering 602,825 square kilometres, but excluding the Rocky Mountains and approximate

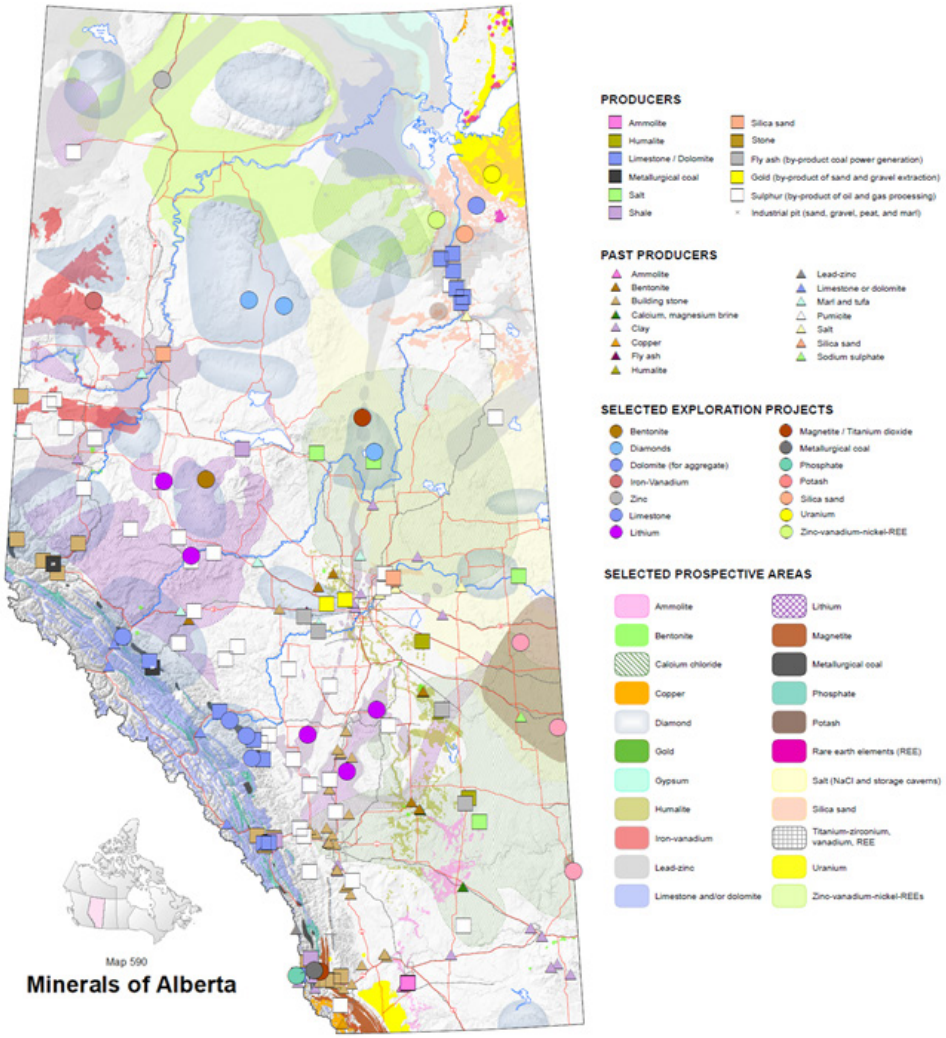


Figure 13. Simplified version of Map 590, Minerals of Alberta. To download this map, or find the digtal data on the Alberta Interactive Minerals Map, please visit www.ags.aer.ca.

area affected by Cordilleran deformation (Figure 12 A and B). It also includes multiple higher resolution geomodels within specific areas of Alberta. In 2019, the AGS published the second version of the 3D Geological Framework of Alberta model, which includes 62 geological zones (*ags.aer.ca/3D_PGF_model.html*), and it is currently working on a third version that will enhance the geospatial representation to include more than 90 geological zones. The Geological Framework acts as a repository for subsurface data and forms the geological foundation for much of the work at the AGS. The framework is increasingly being leveraged to provide a consistent and reliable geological context to support evidence-based decision making regarding the subsurface because it facilitates the integration of multi-disciplinary geospatial data such as mineral, groundwater, geothermal, and hydrocarbon resource data.

Minerals of Alberta Map 590

The Minerals of Alberta map (Figure 13**)** provides the location of current and past mineral production as well as the locations of selected exploration projects that have the potential to become mineable in the future. The map presents prospective areas to explore for undiscovered resources. Materials included are metallic and industrial minerals, diamonds, ammolite, metallurgical coal, humalite, sand and gravel, and minerals that may be recoverable as by-products of the energy industry. The intent of the Minerals of Alberta map is to inform industry, government, and the public of Alberta's mineral deposits and potential, and raise awareness of economic development opportunities. The Minerals of Alberta map is a cartographic view of more detailed digital files that include additional mineral occurrences and commodities, and provide

details within the prospective areas for mineral exploration.

Lithium

The AGS released two publications on lithium-rich oilfield brines in 2019: a chemical dataset of lithium-rich oilfield brines collected from a number of oil and gas pools in west-central Alberta, and a report on the origin of those oilfield brines that occupy both the pre-Cretaceous and post-Jurassic regional groundwater flow regimes within the Alberta Basin. The report shows that pre-Cretaceous central Alberta brines show differing properties and have differing evolutionary histories than those lying to the west. Lithium-enrichment of western brines probably does not represent evaporative processes or interaction with evaporite minerals like the central brines but, rather, reflects the contribution of hydrothermal fluids.

Alberta Interactive Minerals Map and Open Data Catalogue

The AGS provides web-based interactive maps which allow users to visualize geological maps and data. The Alberta Interactive Minerals Map (AIMM) allows viewing and querying of mineral data and other relevant geological data to inform government, industry, and the public. These data are accessible through an open data portal which directs users to the AGS Open Data Catalogue. The catalogue includes all data displayed in AIMM for free access and download.

To explore the AIMM site, please visit the interactive geology map page on the AGS website (*ags.aer.ca/data-maps-models/interactive-maps*).

The open data catalogue is available at *geology-ags-aer.opendata.arcgis.com* or can be accessed through the AIMM application.

Mineral Core Research Facility

The AGS assists Alberta Energy to administer the collection of mineral core under the Metallic and Industrial Minerals Tenure Regulation. Under this regulation, the Crown can collect mineral core and rock samples from companies working on mineral permits and make these materials publicly available to prospectors, mineral exploration companies, and academic institutions for mineral exploration and research purposes. Core and rock samples are stored at the AER/AGS Mineral Core Research Facility (MCRF). Currently, the MCRF contains 60,671 metres of mineral core, 12,857 metres of coal core, and nearly 17,000 rock samples from various mineral exploration projects in Alberta. Information on the AGS' core holdings can now be found on the Alberta Interactive Minerals Map (AIMM).

For other inquiries regarding coal and minerals, please contact *AGS-Info@aer.ca*.

Selected new publications

Alberta Geological Survey

All reports, maps, and digital datasets are available for free from the AGS website: *www.ags.gov.ab.ca*. Selected releases in 2019 are listed below:

3D geological model of coal zones in central and southern Alberta (methodology, model, dataset, multiple files). Atkinson, L.A., and Pana, C. (2019). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Model 2017-04.

3D geological model of west-central Alberta (dataset, multiple files). Babakhani, M., MacCormick, K.E., Playter, T.L., Corlett, H., Hathaway, B., and Peterson, J.T. (2019). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Model 2019-03, 2019.

3D Provincial Geological Framework Model of Alberta, Version 2 (methodology, model, dataset, multiple files. Alberta Geological Survey (2019). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS PGF Model v2.

Bouguer Gravity Anomaly, Airborne Gravity Survey of the Patterson Lake Area, Athabasca Basin, Alberta and Saskatchewan, Parts of NTS 74-E, F, K and L. Boulanger, O., Kiss, F., and Tschirhart, V. (2019). Geological Survey of Canada, Open File 8533; Alberta Geological Survey, AER/AGS Map 591; Saskatchewan Geological Survey, Open File Report 2019-1; Scale 1:250 000. https://doi.org/10.4095/313525

Calgary-Lethbridge Corridor geophysical survey: ground time domain calibration survey data and report for AeroTEM airborne data and inversion. Groom, R.W. and Davis, L. (2018): Alberta Energy

Regulator, AER/AGS Special Report 111, 25 p.

First Vertical Derivative of the Bouguer Gravity Anomaly, Airborne Gravity Survey of the Patterson Lake Area, Athabasca Basin, Alberta and Saskatchewan, Parts of NTS 74-E, F, K and L. Boulanger, O., Kiss, F., and Tschirhart, V. (2019). Geological Survey of Canada, Open File 8534; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 592; Saskatchewan Geological Survey, Open File Report 2019-2; Scale 1:250 000. https://doi.org/10.4095/313526

Glacial flowsets in the lower Athabasca and Clearwater region. Norris, S.L. (2019). Alberta Geological Survey, AER/AGS Map 595, scale 1:750 000.

Gold grain, kimberlite indicator mineral, magmatic massive sulphide indicator mineral, and heavy mineral analyses from till sampling in northern Alberta (2011, 2012, 2016). Utting, D.J., Pawley, S., Atkinson, N., Pawlowicz, J.G., and Weiss, J.A. (2019). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Open File Report 2018-14, 37 p.

Industrial Mineral Occurrences of Alberta (tabular data, tab-delimited format). Lopez, G.P., Budney, H.D., Weiss, J.A., and Jean, G.M. (2020). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Digital Data 2019-0027.

Kimberlite and Ultrabasic Intrusions of Alberta (tabular data, tab-delimited format). Lopez, G.P., and Weiss, J.A. (2020). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Digital Data 2019-0028.

Lithium Content in Groundwater and Formation Water in Alberta (tabular data, tab-delimited format). Lopez, G.P., Weiss, J.A., and Pawlowicz, J.G. (2020). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Digital Data 2019-0029.

Metallic Mineral Occurrences of Alberta (tabular data, tab-delimited format). Lopez, G.P., Pawlowicz, J.G., Weiss, J.A., and Jean, G.M (2020). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Digital Data 2019-0026.

Minerals of Alberta. Lopez, G.P., Budney, H.D., Weiss, J.A., and Pawlowicz, J.G. (2019). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 590, 2020.

Origin and Li-enrichment of selected oilfield brines in the Alberta Basin, Canada; Alberta. Huff, G.F. (2019). Geological Survey / Alberta Energy Regulator, AER/AGS Open File Report 2019-01, 29 p.

Prospective Areas for Mineral Exploration in Alberta (GIS data, polygon features). Lopez, G.P., Budney, H.E., Weiss, J.A., and Pawlowicz, J.G. (2020). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Digital Data 2019-0025.

Water geochemistry of selected formation brines in the Alberta Basin, Canada (tabular data, tab-delimited format). Huff, G.F., Lopez, G.P., and Weiss, J.A. (2019). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Digital Data 2019-0002.

Land-use planning

South Saskatchewan Regional Plan and the Castle Parks

In 2019, Alberta Energy completed the cancellation and compensation process for the remaining coal and mineral lessees impacted by the expansion or designation of new conservation areas in the South Saskatchewan region. The cancelled rights were located in the new or expanded Don Getty, High Rock, Bow Valley and Castle Wildland Provincial Parks, and the Castle Provincial Park. All Crown coal and metallic and industrial mineral rights within these conservation areas, and others designated under the South Saskatchewan Regional Plan, have been reserved from disposition.

More information about the South Saskatchewan planning area visit *www.alberta.ca/south-saskatchewan-regional-planning.aspx*

Lower Athabasca Regional Plan and the Kitaskino Nuwenëné Wildland Provincial Park

Kitaskino Nuwenëné Wildland Provincial Park (WPP) was designated as a new wildland provincial park south of Wood Buffalo National Park. Designation of the WPP was the result of collaboration among Indigenous groups, industry, and the federal and provincial governments. The WPP will help protect the Peace-Athabasca watershed and preserve habitat for two notable species at risk, woodland caribou and wood bison.

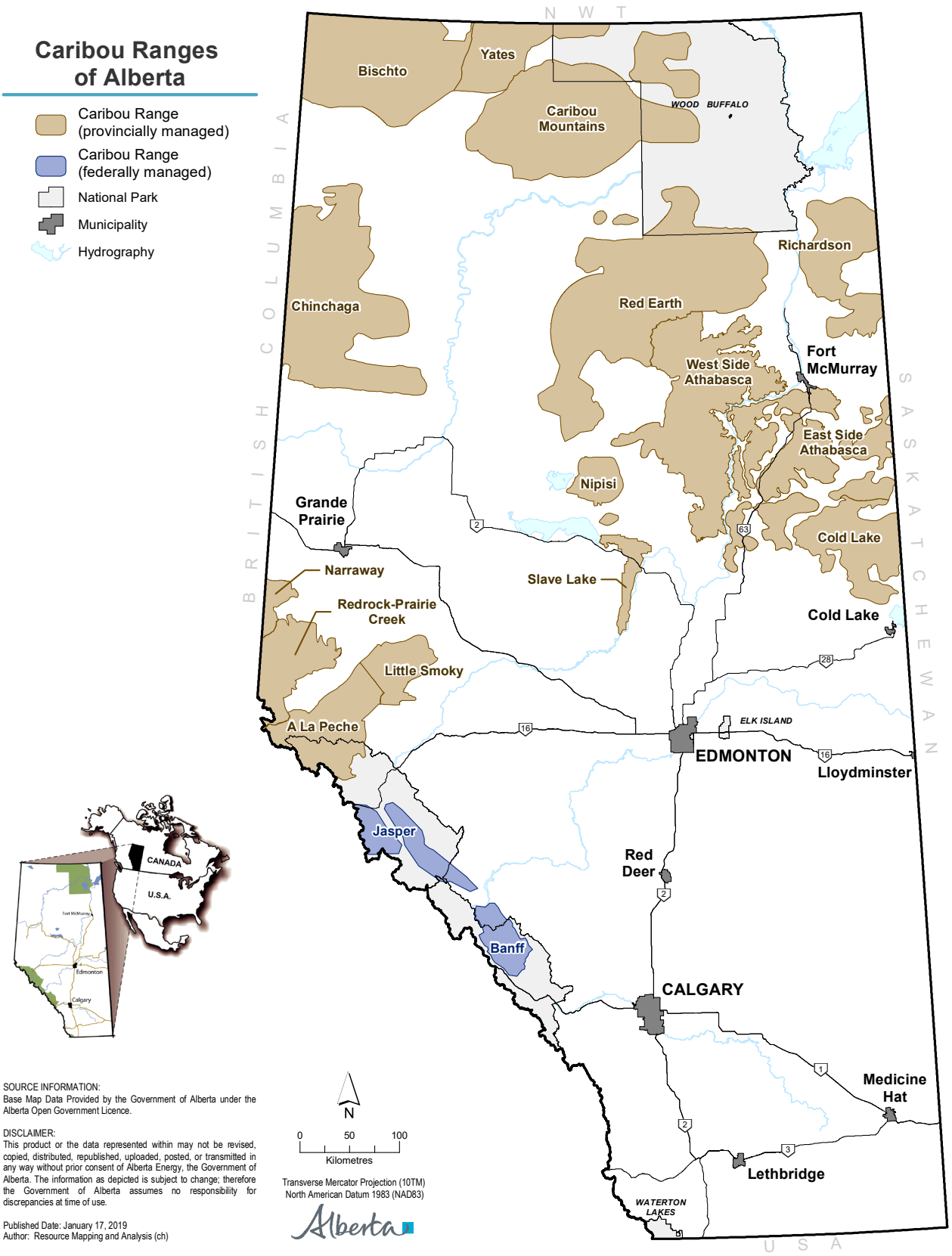


Figure 14. A map showing the caribou ranges within Alberta.

In addition to designation of the WPP, the Government of Alberta applied a protective notation and temporary restrictions on the disposition of Crown mineral rights in a potential expansion area. In this area, Crown mineral rights for ammonite shell, coal, and metallic and industrial minerals are reserved from disposition. Crown agreements for petroleum and natural gas, oil sands, and pore space may be issued subject to a no surface access addenda.

For more information about the North Saskatchewan region visit *www.alberta.ca/north-saskatchewan-regional-planning.aspx*.

Caribou Range Planning

In November 2019, the Government of Alberta announced the creation of three sub-regional task forces that will advise government on land-use planning at a local scale; this will include advice on caribou recovery actions. Sub-regional plans will be developed on a foundation of scientific evidence and socio-economic assessments, which help government to understand how sub-regional plans work within local and regional economies. Recommendations for the Cold Lake sub-regional plan are expected to be drafted by the end of March 2020, with the Bistcho sub-region following in the summer of 2020 and Upper Smoky sub-region in the fall. The task forces will provide advice on the development of the remaining sub-regional plans and affected caribou ranges after work on the initial three areas is complete. The caribou ranges are presented in Figure 14.

Mineral sales restrictions and tenure extensions

To support range planning activities, a Crown mineral sales restriction was applied to the Little Smoky and A La Peche caribou ranges in April 2013. The restriction was extended to all ranges in September 2016 and remains in place.

In November 2016, the Government of Alberta offered the option for existing agreement holders to apply for extensions until March 31, 2019 for petroleum and natural gas agreements, metallic and industrial minerals permits, and oil sands leases that fall in whole or in part within caribou ranges. For further details see Alberta Energy Information Letter 2016-34. In April 2018, Alberta Energy approved an additional two-year extension for qualifying Crown mineral agreements in caribou ranges when circumstances have prevented the continuation or validation of an agreement. Extended agreements will now expire on March 31, 2021. For further details, please see Alberta Energy Information Letter 2018-14.

For more information about caribou range planning visit *www.alberta.ca/caribou-range-planning.aspx*.

Metallic and industrial minerals royalty rates

Metallic	Pre-Payout:	1% mmr[a]
	Post-Payout: greater of	1% mmr or 12 % nr[b]
Placer	5% of value after the first troy ounce	
Quarriable	Bentonite:	$0.11/t
	Volcanic ash:	$0.131/m^3
	Limestone, shale, granite, slate, gypsum, sandstone, dolomitic siltstone, building stone:	$0.0441/t
	Silica sand obtained by processing sandstone on the location of a sandstone lease:	$0.37/t
Salt	Dry salt, solute salt	$0.45/t

[a]mmr: mine mouth revenue

[b]nr: net revenue

Coal royalty rates

Subbituminous coal	$0.55 per tonne	
Bituminous coal	Pre-payout	1% mmr[a]
	Post-Payout: sum of	1% mmr and 13% nr[b]

[a]mmr: mine mouth revenue

[b]nr: net revenue

About Alberta's regulatory system

The Crown owns 81 per cent of the mineral rights in Alberta. The other 19 per cent are freehold mineral rights and are owned by individuals, companies, or the federal government on behalf of First Nations and as National Parks. The Coal and Mineral Development unit is responsible for the administration of the Crown's mineral rights for metallic and industrial minerals, and coal.

The mineral rights for coal, and metallic and industrial minerals are managed using a variety of agreements, depending on the specific substance and/or activity a client wishes to pursue. Each agreement type is defined and governed through the Alberta's *Mines and Minerals Act*, and the Metallic and Industrial Minerals Tenure Regulation. Fees and rentals are set out in the Mines and Minerals Administration Regulation.