Association for Mineral Exploration



Industrial Strategy

for Dual-Use and Defence Mineral Exploration in Canada

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A Message from Todd Stone

PRESIDENT & CEO,
ASSOCIATION FOR MINERAL EXPLORATION

Everything that Canada wants to build over the next decade begins beneath our feet, with someone finding something. The submarines, the radars, the satellites, the munitions, the aircrafts. Before any of them are manufactured, the metal must be discovered, and in this country that discovery is made possible by working the ground to find new source materials.

Canada has decided to rearm, and we need more materials to meet that demand. The Government of Canada's Defence Industrial Strategy commits our country to building rather than buying, and it names critical minerals as foundational to defence capability. It notes that of the twelve defence-critical raw materials identified by NATO, Canada produces ten. Nation-building projects are moving through the Major Projects Office. The strategy projects $180 billion in defence procurement and $290 billion in defence-related infrastructure by 2035. AME recognizes the potential with this direction.

Canada drills hundreds of thousands of metres of core every year looking for copper, zinc, nickel and gold, and assays that core for those metals alone. Yet the defence-relevant elements sitting in the same rock, like germanium, are not measured, because no one has asked for them and no one is paying to look. Some of what Canada needs for 2035 has already been drilled. It is sitting in core sheds dispersed across Canada with nobody looking for it.

There is a second reason the private market will not close this gap on its own. Exploration is financed by investors pricing a future buyer. Canada has now published a half-trillion-dollar view of what it will spend on defence by 2035 without saying which minerals it intends to buy, in what volume, or on what terms. Exploration capital follows credible buyers, and today the buyer remains uncertain.

We are asking government for four things to close the uncertainty gap.

1. **Name the minerals that matter for defence.** *A Defence and Dual-Use Minerals Designation Framework*, published as an annex to the *Critical Minerals Strategy*. Explorers cannot look for what has not been asked for.
2. **Look inside the ground we are already drilling.** Fund the expanded assaying, byproduct mapping and public geoscience that would show what defence-relevant metals sit alongside the copper, zinc and nickel Canada produces today. This is the fastest supply the country can create, because the drilling has already been paid for.
3. **Make the studies count.** Modernize the Canadian Exploration Expense by expanding the eligibility criteria to include work that turns a discovery into development is treated as the strategic investment it is.
4. **Buy what we find.** Make future demand visible through procurement commitments, offtake and stockpiling.

Two of these four asks cost nothing. A designation framework is a publishing decision. The Canadian Exploration Expense change is a tax measure rather than a program, and it pays out only after private capital has already been spent. The third,

the assaying and geoscience work, is smaller than a single line item in the Northern Operational Support Hubs allocation. The fourth is not new money at all. It is a decision about how money already committed to defence procurement gets signaled to the market.

Ottawa built a First and Last Mile Fund to connect deposits to markets, and it was the right thing to build. There is a mile before that one. It is the mile where a geologist walks ground nobody has mapped yet, and it is the only mile that creates something new to connect.

If Canada does not fund it now, the 2035 supply chain will be assembled out of the deposits the country already knows about, and everything missing from that list will be bought from someone else. That is the outcome the Defence Industrial Strategy was designed to prevent.

None of this asks government to pick winners or to replace private capital. It asks government to close the gap between what markets currently reward and what Canada's security now requires.

Canada is the world capital for mineral exploration. Four billion dollars was spent here in 2024, and roughly forty per cent of the world's publicly listed mining companies are listed on the TSX and TSX Venture Exchange. That position was built by generations of Canadians working in difficult country, and by partnerships with Indigenous Nations that make responsible development possible. Our members have the drills, the core, those relationships, and the geological knowledge of where Canada's defence-relevant minerals are stored.

Without exploration there are no mines, and without mines there is no supply chain to secure. The recommendations in this paper are set out in Annex A and Annex B with departmental leads and implementation mechanics attached. They sit inside existing federal and provincial machinery. They are deliverable this fiscal year.

This report is AME's contribution to the Team Canada approach of bringing governments and industry together to protecting Canada's sovereignty.



Todd Stone

PRESIDENT & CEO,
ASSOCIATION FOR MINERAL EXPLORATION



EXECUTIVE SUMMARY

Industrial Strategy for Dual-Use and Defence Mineral Exploration

1 The Opportunity

Canada has a competitive advantage in mineral exploration

$4.1 BILLION DOLLARS
spent on exploration in Canada in 2024[1]

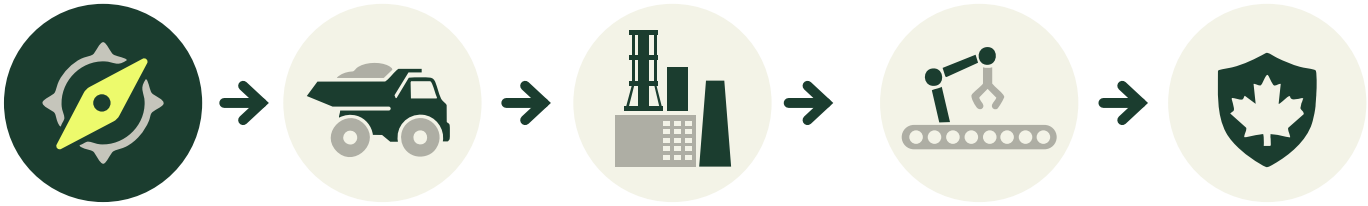
38% WORLD TOTAL
non-ferrous exploration budgets linked to companies headquartered in Canada[2]

½ WORLD TOTAL
Publicly listed exploration and mining companies are based in Canada[3]

710,000 JOBS
In the mineral and metals sector[4]

1, 2 Government of Canada (2026). *Minerals and the Economy*. NRCAN. **3** Government of Canada (2026) *Canadian Mining Assets*. NRCAN.
4 Government of Canada (2026). *10 key Facts on Canada's Natural Resources – 2024*. NRCAN.

2 Strategic Supply Chain Starts with Exploration



Exploration → Development → Processing → Manufacturing → Defence / Allied Use

3 The Market Gap

CURRENT EXPLORATION MARKET ALONE WILL NOT DELIVER THE FULL DEFENCE AND DUAL-USE

What exploration markets deliver on their own:

- Familiar commodities
- Short cycle returns
- Primary project economics

Private exploration incentives do not fully align with strategic needs

- Byproducts missed
- Weak demand signals
- Long time horizons

Canada's strategic ambition

- Defence minerals
- Secure supply chains
- Allied resilience
- Domestic capacity

Industrial Strategy is needed to address the market failures in the exploration sector

Information failure
Capital markets reward familiar commodities, causing associated defence-relevant minerals to be under-explored, under-reported, or overlooked.

Time-horizon mismatch
Defence supply chains operate on long timelines, but exploration finance is short-cycle and commodity price driven.

Coordination problem
Many strategic minerals are byproducts whose recovery depends on decisions across exploration, processing. refining, and demand for other commodities.

4 The Policy Response

Industrial strategy makes the market work better by aligning exploration decisions with Canada's long-term strategic needs.

DEFINE
Establish the opportunity

Assess defence relevance, supply-chain vulnerability, production potential, and project pathways.

1



DISCOVER
Find overlooked value

Expand the exploration lens to co-products and byproducts inside mineral systems already being advanced.

2



DE-RISK
Turn potential into credible projects

Support metallurgy, feasibility. Indigenous partnership, and project-readiness to cross the valley of death.

3



CONNECT
Link demand to exploration

Create visible downstream demand through procurement, stockpiling, offtake support, and allied partnerships.

4



5 An Industry-Government Action Plan

Industry and government need to work together to unlock the full potential of responsible mineral exploration.

	Industry	Federal Government	Provincial Government
1 **DEFINE** Establish the opportunity	• Assess defence relevance • Classify primary / byproduct / enabling systems • Avoid unsupported strategic claims	• Create the dual-use designation framework and criteria	• Align provincial strategies with federal government dual-use designation
2 **DISCOVER** Find overlooked value	• Use a mineral-systems lens • Expand assay suites • Collaborate with government on co-drilling and geoscience • Early metallurgical testing	• Invest in public geoscience	• Invest in public geoscience and prospecting
3 **DE-RISK** Turn potential into credible projects	• Integrate defence minerals early into project planning • Communicate feasibility-stage potentials with credibility	• Tax measures to support development of future mines, including CEE modernization	• Streamline exploration permitting timelines
4 **CONNECT** Link demand to exploration	• Build downstream relations with strategic off-takers • Engage defence and industrial players early	• Government and allied procurement and stockpiling	• Connect projects to provincial industrial ecosystems

1

INTRODUCTION:
Protecting Canadian Sovereignty Begins with Exploration

In February 2026, Canada published its first Defence Industrial Strategy and made a commitment no Canadian government had made before: to build rather than to buy. The strategy names critical minerals as foundational to defence platforms, advanced materials and enabling technologies, and notes that Canada produces ten of the twelve defence-critical raw materials identified by NATO. The Major Projects Office is advancing nation-building projects. The First and Last Mile Fund is connecting deposits to markets. Budget 2025 committed $81.8 billion to defence, against a projected $180 billion in procurement and $290 billion in defence-related infrastructure by 2035. The direction is set and it is the right one.

The funds, offices and approvals built to deliver it share a common design. They accelerate, finance, connect and permit projects that already exist. That leaves Canada with an inventory problem rather than a delivery problem. The deposits available to be accelerated are the deposits found over the past two decades, and they were found under different priorities, against different prices, and assayed for a different list of metals. Simply put, the supply chain Canada is asking for in 2035 is not in our current inventory.

Two paths lead out of it. The first is new discovery, which on Canadian averages takes more than a decade to reach production and is therefore a 2040 asset rather than a 2035 one. The second is faster and largely unexamined. The defence-relevant elements that occur alongside copper, zinc, nickel and rare earths, among them germanium, gallium, tellurium, bismuth and antimony, are not routinely measured, because no market has asked for them.

Both paths depend on the same missing condition. Exploration is financed by investors pricing a future buyer, and Canada has published a half-trillion-dollar view of its defence spending to 2035 without stating which minerals it intends to buy, in what volume, or on what terms. No exploration budget can be built against a signal that has not been sent.



> “Canada is confident that our economic strategy and our many strategic resources—from critical minerals to cyber—will make major contributions to NATO rearmament.”
>
> **The Right Honourable Mark Carney**
> *June 9,* 2025

BOX 1.1 **What is a Market Failure?**

Markets are powerful. But without the right conditions, they can under-invest in the outcomes that our economy needs. This occurs when:

- → Private incentives do not always match public needs
- → Prices may not capture wider social costs or benefits
- → Exploration activities create information that benefits the broader industry and public, but companies may not invest enough in it on their own

When markets fail, under-investment in exploration and critical minerals can constrain future supply, weaken economic resilience, and increase strategic vulnerability.

Addressing market failure does not replace markets, but complements them.

Three Market Failures in the Exploration Sector

Information Failure

PROBLEM: Capital markets reward familiar commodities with established pricing and known development pathways.

RESULT: Public geoscience and private financing decisions do not fully reflect supply-chain needs.



Time-horizon Mismatch

PROBLEM: Defence and dual-use supply chains operate on long timelines, but exploration capital is often short-cycle and commodity-price driven.

RESULT: Under-investment in early-stage exploration with projects that have high potential for strategic value.



Coordination Problem

PROBLEM: Many defence and dual-use minerals are byproducts of polymetallic deposits where recovery depends on decisions across sectors.

RESULT: No single actor has sufficient incentive or visibility to optimize the full chain.



This paper sets out what closing that gap requires, through four pillars: **Define, Discover, De-risk** and **Connect.** Each is deliverable inside existing federal and provincial machinery, and each is set out with leads, supports and implementation mechanics in Annex A and Annex B.

AME represents the sector that does this work. Four point one billion dollars was spent on mineral exploration in Canada in 2024, and roughly forty per cent of the world's publicly listed mining companies are listed on the TSX and TSX Venture Exchange. That capacity is the first mile of Canada's defence ambition, and the people AME represents are the ones who will find what the country needs.

In an increasingly uncertain world, Canada can do something few countries can: help supply the minerals that allies need while upholding high standards for environmental stewardship, Indigenous partnership, transparency and public trust.

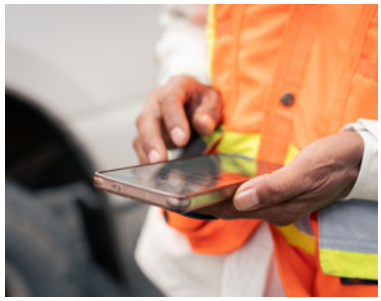
First, capital markets tend to reward familiar commodities, causing information failure. In Canada, explorers raise capital around commodities that investors understand, with established pricing and known development pathways such as gold, copper, potash, and uranium. That strength should be built upon. But it can also mean that associated defence and dual-use minerals are overlooked. This leads companies to optimize exploration programs around primary commodities while undervaluing associated byproducts and co-products such as tellurium, rhenium, germanium, indium, hafnium, and bismuth. This creates a misalignment between private financing and defence industrial policy needs.

Second, defence and dual-use supply chains operate on long timelines while exploration capital is often short-cycle and commodity-price driven, creating a time-horizon mismatch. The minerals Canada and its allies need in the future must be identified with an action plan years before they are required. But private capital is disciplined by short-term investor return expectations, causing under-investment in early-stage exploration whose strategic value may only become obvious later.

Lastly, many defence and dual-use minerals face a coordination problem. These minerals cannot always be explored for as standalone deposits. The recovery of byproducts and co-products may depend on decisions made across exploration, mining, processing, refining, procurement, and downstream manufacturing. No single actor has sufficient incentive or visibility to optimize the whole supply chain, especially when the byproducts or co-products are not the main economic driver of the project. Public policy is needed to coordinate mineral analysis, identify processing pathways, and showcase demand signals from buyers to address the coordination problem.

This is why defence and dual-use exploration requires an industrial policy. **The purpose is not to replace private capital or ask government to pick winners, but to address the market failures and correct the gap between what the market rewards and what Canada's long-term security and industrial interests require.**This strategy considers minerals relevant for defence and dual-use as meeting the following three criteria:

1. **Strong Allied Signal** (see Box 2.1 on page 15): Listed as a NATO defence-critical raw material, or a critical mineral listed by Canada, U.S. or E.U.
2. **High Concentration Risk** (see Box 3.2 on page 18): The mineral is vulnerable to high supply-chain concentration by adversarial countries (China or Russia).
3. **Canadian Geological Potential** (see Box 3.3 on page 19): Canada has high geological potential for the mineral.



This paper proposes a four-pillar strategy for Canada's exploration sector to address market failures: Define, Discover, De-risk, and Connect. The paper is written primarily for mineral explorers to help industry participate credibly in Canada's defence and dual-use minerals opportunity. But the implications are also directed at government. If Canada wants to reach its full potential of strengthened sovereignty, allied resilience, and domestic industrial capacity, it must recognize that mineral exploration has a strong role to play as the first mile of defence and dual-use supply.

Lastly, while this industrial strategy recognizes that Indigenous partnership is a condition of strategic supply, it does not attempt to provide a comprehensive framework for reconciliation in Canada's critical minerals and defence industrial policy. That work deserves dedicated treatment, developed with Indigenous leadership and expertise. This strategy paper has a narrower purpose: to identify practical industrial actions that government and industry can take to address market failures in the exploration sector. Within that scope, Indigenous rights, early partnership, and Indigenous economic participation must be treated as core conditions for responsible exploration and durable supply chains. The strategy should therefore be understood as a starting point for further work with Indigenous Nations to ensure that Indigenous participation is built into the design and implementation of Canada's defence and dual-use minerals agenda.

> "Canada's mineral sector is a strategic national asset. This strategy paper makes the important case that exploration is not peripheral to national security: it is the first phase in building the resource base that Canada and its allies may need to rely upon in a crisis."
>
> **Heather Exner-Pirot**
>
> **Director, Natural Resources, Energy and Environment**
> **Macdonald-Laurier Institute**

BOX 1.2

What is Mineral Exploration?

Mineral exploration is the early-stage, science-based work of finding and understanding hidden mineral resources. It is the R&D of the resource economy.

Exploration turns geoscience, land access, investment, technical expertise, Indigenous partnership, and community trust into the discoveries that make future mineral development possible.






$4.1 billion dollars spent on exploration in Canada in 2024

38% world total non-ferrous expenditure from Canada-based explorers

The Mining Cycle

Mineral exploration covers stages 1 – 5

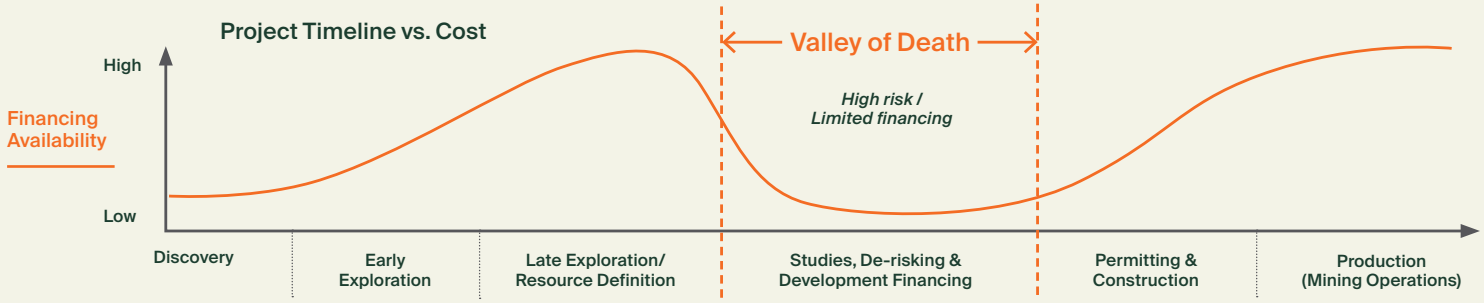
Canada is the world capital of mineral exploration, and the sector is a strategic asset for Canada.

1. **Target Generation** — Identify prospective geological settings, and prioritize high-potential areas.
2. **Prospecting** — Fieldwork, sampling and surveys narrow and rank targets.
3. **Exploration Drilling** — Drilling tests targets and confirms mineralization.
4. **Resource Definition** — Define grade, size, continuity and confidence.
5. **Studies and De-risking** — Technical studies, engineering, metallurgy and economic evaluation.
6. **Permitting and Constructing** — Secure approvals, arrange financing, and build required infrastructure.
7. **Mining and Operations** — Extract, process, and deliver minerals to supply markets.

The Valley of Death

Why Feasibility-stage projects struggle when capital runs dry

- **High Costs:** engineering, metallurgy, baseline studies
- **High Uncertainty:** permitting, recovery, market pathways
- **Limited Capital:** too advanced for exploration finance, too early for construction finance



2

Why Exploration Matters for Canada's Defence and Dual-Use Capacity

Modern defence capability begins earlier than shipyards, aircraft assembly lines, battery plants, or munition factories. It begins with the ability to identify, advance, and secure the mineral inputs that make those systems possible.

Exploration is the front-end of defence and dual-use industrial capability. Without exploration, there are no discoveries, no projects, and no allied supply chains. A defence approach that does not adequately address exploration is incomplete and does not solve the deeper problem: whether Canada and its allies have access to the raw materials needed to sustain military readiness, technological advantage, and industrial resilience.

Mineral exploration is important for defence capability planning because:

1. **Defence capability is increasingly mineral-intensive**

   Modern military systems depend on advanced materials. Aircraft, naval vessels, satellites, radar systems, secure communications, batteries, sensors, semiconductors, munitions, and precision electronics all rely on minerals that deliver specific performance characteristics: conductivity, heat resistance, hardness, magnetic strength, light weighting, corrosion resistance, and energy density. Minerals are essential to performance, reliability, or manufacturability. In many cases, substitution is difficult, slow, or technically inferior.

2. **Mineral exploration supports allied burden-sharing**

   NATO's updated defence production work includes attention to supply-chain bottlenecks, key materials, and possible multinational stockpiling of critical raw materials. That means allies are increasingly treating materials as part of defence production capacity, not just economic trade policy. This creates a clear role for Canada. Canada does not need to supply every defence-relevant mineral, but it must be able to identify where it can make a credible contribution to allied resilience. Exploration is the starting point. It shows which minerals Canada can realistically bring into the allied supply base, and where Canadian geology can reduce dependence on concentrated adversarial supply chains.

3. **Mineral supply chains are now a defence vulnerability**

   For defence and dual-use capabilities, mineral supply chains create three distinct vulnerabilities. The first is **disruption risk**. Supply can be interrupted by conflict, export controls, sanctions or transport bottlenecks, creating uncertainty for long-term defence planning and weakening the ability to produce, maintain, and scale military capability. The second is **coercion risk**. Strategic competitors can use control over minerals, refining, or processing capacity as instruments of pressure. In a crisis, access to critical inputs may become a tool of warcraft, limiting allied freedom of action. The third is **influence risk**. A dominant supplier does not need to impose a full embargo to shape outcomes. It can affect prices, investment incentives, technology access, and the commercial viability of projects in allied countries. This can weaken the allied industrial base and capability before a crisis occurs.

4. Exploration creates strategic optionality

Defence planners need options before a crisis, not after. Exploration identifies where future supply could come from, which projects can be advanced, and which materials Canada and its allies may be able to secure domestically or through trusted partners. This matters because mineral supply cannot be created quickly. Once a crisis begins, governments are largely limited to the suppliers, projects, processing routes, and stockpiles that already exist. If those sources are concentrated, unreliable, or strategically exposed, defence planners have fewer choices and less leverage. Exploration expands the set of future options available to defence planners.

5. Exploration strengthens deterrence by reducing coercive leverage

A country or alliance with credible mineral options is harder to pressure. Exploration helps to reduce the leverage competitors gain from controlling inputs to defence production. If adversaries know that Canada and its allies have no alternative sources, they can use mineral supply, processing capacity, or export controls as tools of pressure. But if allies have a visible pipeline of future projects, trusted supply options, and recoverable materials, that leverage is weaker. Exploration therefore supports deterrence indirectly. It gives Canada and its allies more credible supply options, more negotiating power, and greater confidence that defence production can continue under stress. In strategic terms, it turns mineral potential into resilience — and resilience reduces vulnerability to coercion.

FIGURE 2.1 **Why Mineral Exploration Matters for Defence and Dual-Use**

1 Defence capability is mineral-intensive

- Modern defence systems rely on advanced minerals.
- Function matters more than volume.
- Substitution is often difficult, slow, or technically inferior.

2 Mineral supply chains are a defence vulnerability

- **Disruption risk:** Conflict, sanctions, and bottlenecks can interrupt supply.
- **Coercion risk:** Rivals can weaponize control over minerals and processing.
- **Influence risk:** Dominant suppliers can shape prices, investment, and access.

3 Exploration supports allied burden-sharing

- Allies increasingly treat materials as part of defence capacity.
- NATO and partners are focused on bottlenecks, key materials, and possible stockpiling.
- Exploration shows where Canada can make a credible contribution.

4 Exploration creates strategic optionality

- Defence planners need options before a crisis. Exploration identifies future supply and viable projects.
- It expands trusted supply choices for Canada and allies.

5 Exploration strengthens deterrence

- More supply options mean less coercive leverage.
- A visible project pipeline improves resilience.
- Resilience strengthens freedom of action.



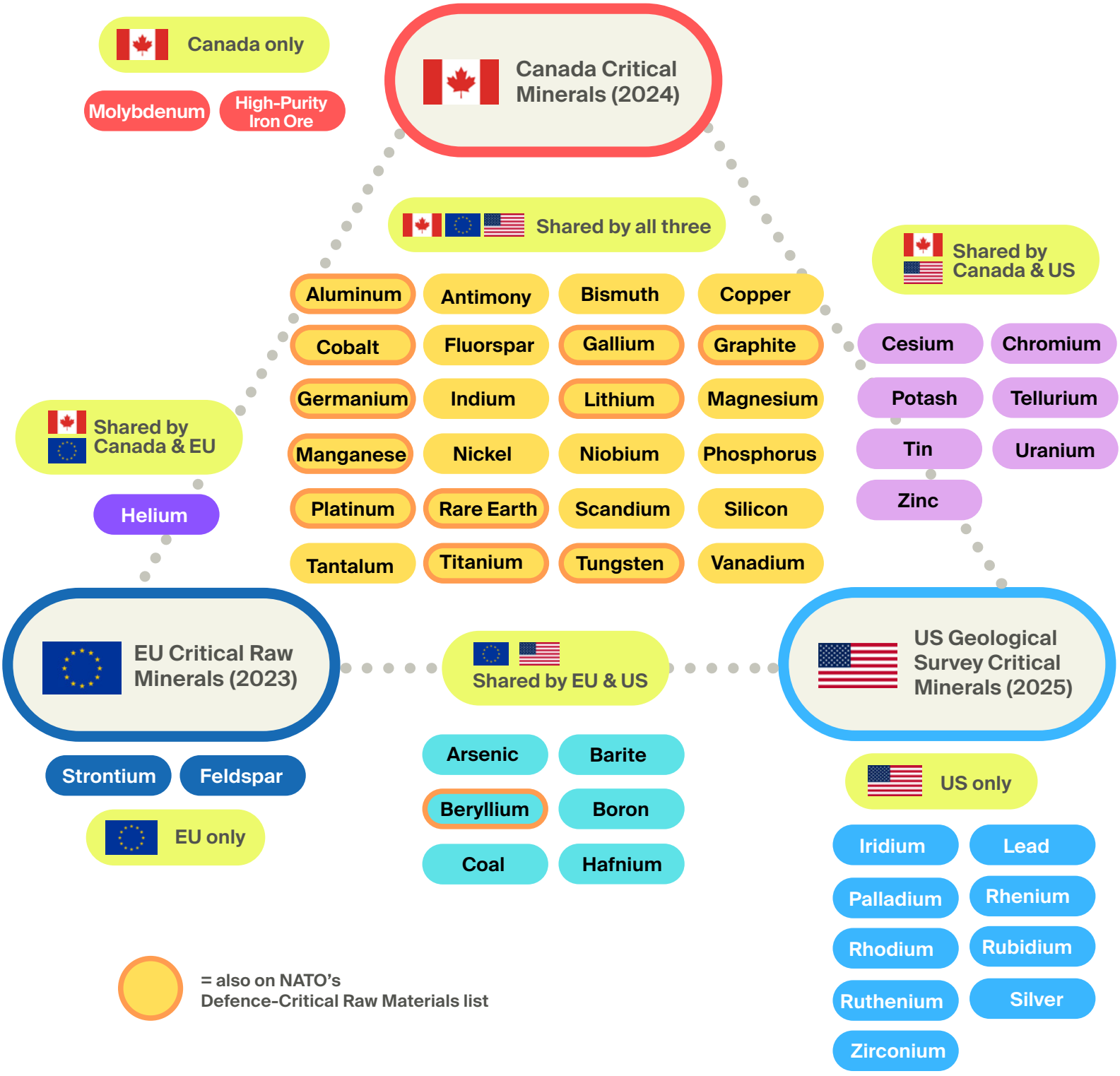
> “Canada’s recurring challenge is translating strategic ambition into projects and productive investment.
>
> This report provides a useful framework for coordinating geological knowledge, capital, infrastructure and demand so that mineral security becomes an executable national strategy, consistent with Public Policy Forum’s Build Big Things work on investment attraction and its four-point policy frame for getting projects to FID.”

Jay Khosla

Executive VP Strategy and Policy
Public Policy Forum

BOX 2.1 Which minerals are important for Canada and allies?

There is no global consensus on what exactly counts as a critical mineral. Canada (list of 34 critical minerals), NATO (list of 12 defence- critical raw materials), E.U. (list of 34 critical raw materials) and the U.S. (list of 60 critical minerals) all have individual lists. Below is a visualization of the mineral lists and how they overlap or differ.



3 The Opportunity for Canada's Defence and Dual-Use Minerals

Canada and allies face a strategic challenge. Many minerals required for modern defence and dual-use systems are concentrated in hands of States that are strategic competitors. In a crisis, this becomes an instrument of leverage.

China has already demonstrated how this leverage can be used as a tool of control and coercion. In 2025, China introduced export controls on some rare earth elements. Car manufacturers in Canada's allied countries automakers struggled to secure permanent magnets, forcing some to cut production or temporarily shut plants. Even after the control was lifted, the International Energy Agency (IEA) found that prices in Europe reached six times more than Chinese levels.

In October 2025, China also announced export control on lithium battery supply chains, impacting the supply of battery cells for high-performance applications, cathode precursors, and battery production technologies important for industrial and defence use.

Allied governments have begun to recognize that mineral supply chains are no longer a purely private market issue. NATO's work on defence-critical minerals reflects the growing awareness that supply-chain resilience is part of deterrence and readiness. The publication of NATO's list of defence-critical raw materials was important not because it solved the problem, but because it signaled that minerals are now being assessed through a defence-capability lens.

The G7 has moved in a similar direction. The emerging G7 critical minerals architecture is built around diversification, standards-based markets, investment coordination, traceability, stockpiling, recycling, and crisis response. This is a significant shift. The goal is to build trusted supply chains that are resilient against coercion, market manipulation, and deliberate disruption.

This allied movement creates an opening for Canada. Canada is not a passive participant in this agenda. It is one of the few G7 countries with a meaningful combination of geological potential, mining expertise, public geoscience capacity, exploration finance, Indigenous partnership experience, environmental standards, and alliance credibility. In a world where allies are looking for trusted supply, Canada has assets that are strategically valuable.

Canada's Response and Existing Policy Gaps

Canada has already taken important steps. The Critical Minerals Strategy recognizes that secure mineral supply chains are essential to clean energy, advanced manufacturing, economic security, and allied resilience. The Defence Industrial Strategy recognizes the need for stronger sovereign industrial capacity, clearer demand signals, and a more resilient defence production base.

But a gap remains between them.

The Critical Minerals Strategy focuses on the mineral value chain. The Defence Industrial Strategy focuses on defence production, procurement, innovation, and readiness. Neither fully addresses the exploration and project-advancement stage where future defence and dual-use mineral options are identified, tested, de-risked, and connected to demand.

BOX 3.1 What are Rare Earth Elements?

What are rare earth elements?

A group of 17 chemically similar metals: 15 lanthanides, plus scandium and yttrium. They are essential inputs for modern technologies, including magnets, electronics, clean energy systems, and defence applications.

Why the name can be misleading

Rare earth elements are not always rare in the Earth's crust. They are called "rare" because they are usually dispersed, difficult to find in economic concentrations, and technically complex to separate and process.

The 17 rare earth elements

57 **La** Lanthanum Catalytic converters, metallurgy, batteries	58 **Ce** Cerium Catalytic converters, metallurgy	59 **Pr** Praseodymium Magnets, batteries, aerospace	60 **Nd** Neodymium Magnets, industrial lasers, rubber, EV	61 **Pm** Promethium Unstable isotops, nonexistent in nature	62 **Sm** Samarium Magnets, nuclear reactor, cancer treatment	63 **Eu** Europium Nuclear control rods	64 **Gd** Gadolinium Magnets, medical imaging, steel
65 **Tb** Terbium Magnets, fibre optics, lasers	66 **Dy** Dysprosium Magnets, data storage, lasers	67 **Ho** Holmium Magnets, nuclear control rods, lasers	68 **Er** Erbium Fibre optics, optical amplifiers, lasers	69 **Tm** Thulium Lasers, x-ray, nuclear reactor	70 **Yb** Ytterbium Catalyst, laser, metallurgy	71 **Lu** Lutetium Medical imaging, electronics	
21 **Sc** Scandium Strengthen metal alloys, in fuel cells and high-intensity lighting	39 **Y** Yttrium High-performance metal alloys, lighting and display tech						

Light REEs: naturally more abundant and generally surplus supply (except Pr and Nd used in wind turbines and EVs).

Heavy REEs: Primarily produced in China and in more limited supply. Ongoing efforts to bring new resources to market.

Why they matter

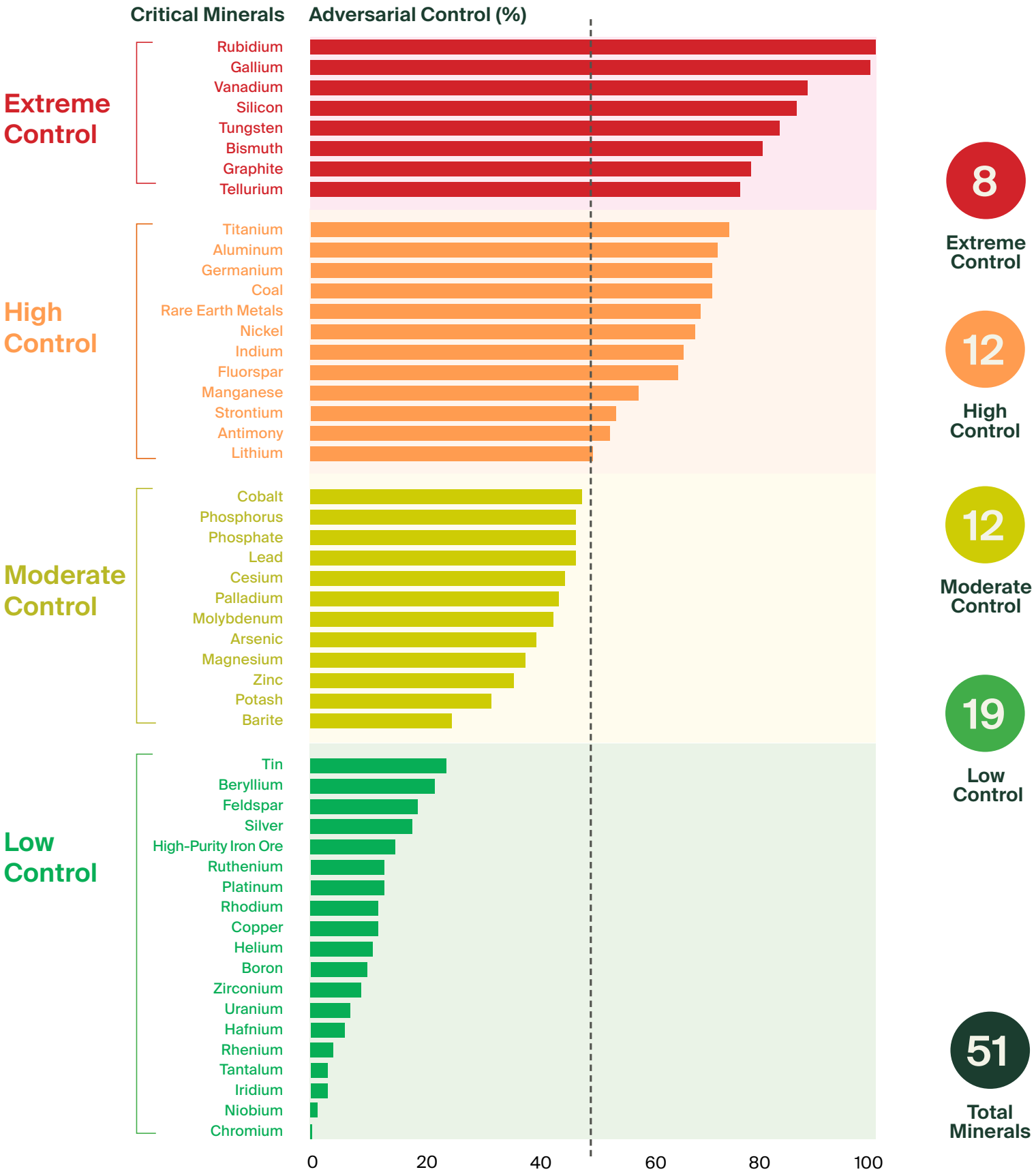
- Permanent magnets for electric vehicles, wind turbines, and defence systems
- Electronics, sensors, lasers, guidance, and communication systems
- Catalysts, alloys, batteries, and advanced manufacturing
- Strategic importance for secure and resilient supply chains

Canada's Role

Canada has geological potential for rare earth development and can play an important role in allied supply chains, from exploration and project development to processing and advanced materials. For Canada, rare earths are both an economic opportunity and a strategic supply-chain priority.

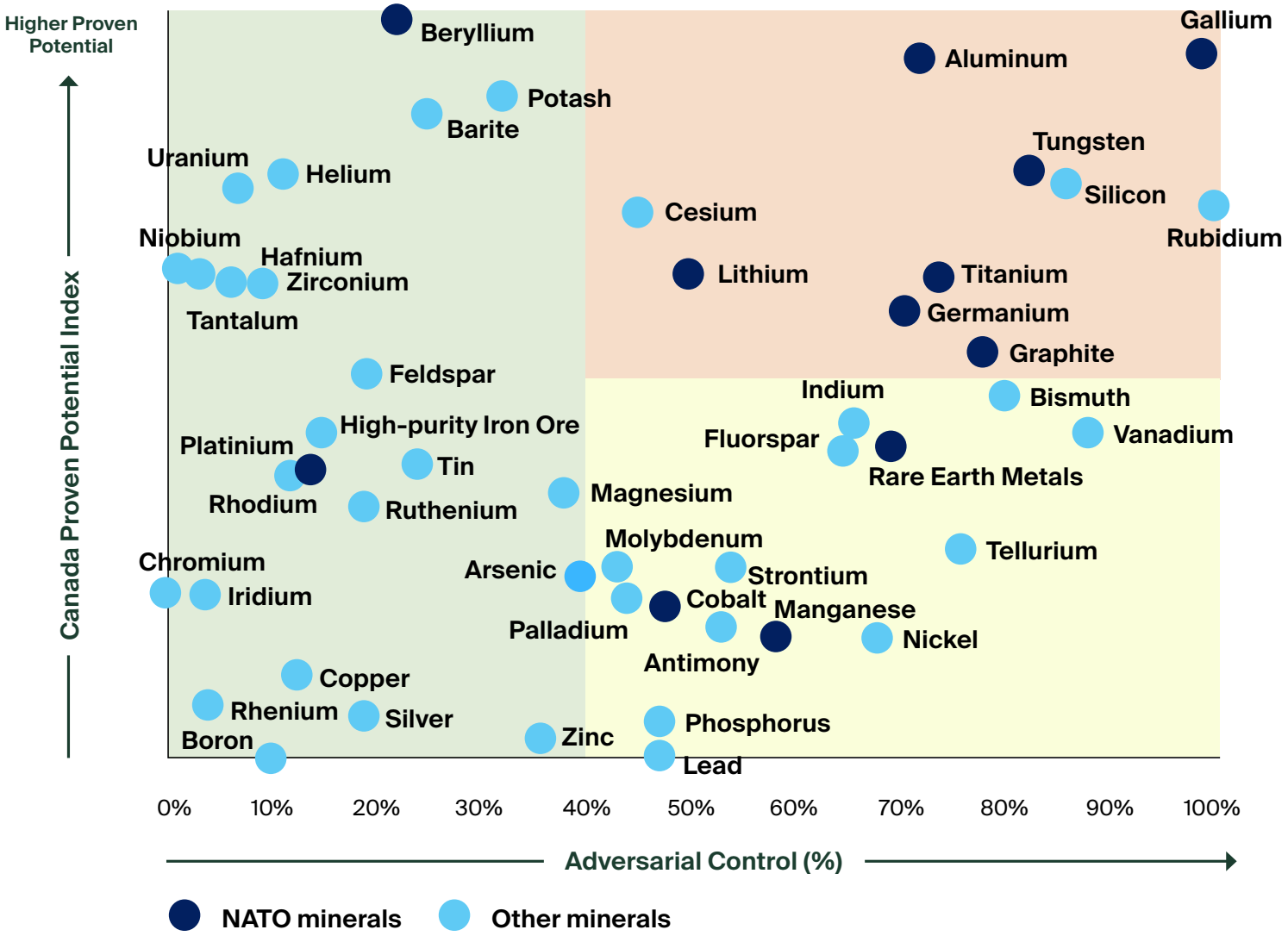
BOX 3.2 Adversarial Control of Defence and Dual-Use Mineral Supply Chains

CHINA / RUSSIA'S SHARE OF CONTROL ACROSS DEFENCE AND DUAL-USE MINERALS



BOX 3.3 Mapping Canada's Defence and Dual-Use Mineral Advantage

How Canada's geological potential lines up with allied supply chain risks



Canadian proven potential index is constructed using proven reserves in Canada normalized against annual global production. The midpoint is where Canadian proven reserve is 300% of annual global production. The index is constructed through a diminishing-returns weighting function where index = unweighted score / (unweighted score +300%). This index represents only known reserves and does not represent unknown geological potential. Adversarial control is the percentage of the mineral production controlled by China or Russia.

Scale what Canada Has

Existing strength in strategically exposed minerals (High Canadian proven potential and high adversarial control)

- Gallium
- Tungsten
- Graphite
- Lithium
- Aluminum
- Titanium
- Germanium
- Rubidium

Explore what Canada Needs

High-risk minerals with under-developed Canadian Potential (Low Canadian proven potential and high adversarial control)

- Rare Earths
- Manganese
- Cobalt
- Nickel
- Antimony
- Molybdenum
- Bismuth
- Tellurium

Watch and Maintain

Lower concentration risk maintain awareness and capability (Low adversarial control)

- Platinum
- Zirconium
- Tantalum
- Chromium
- Niobium
- Ruthenium
- Boron
- Beryllium

This matters because strategic supply does not begin when a mine opens. It begins years earlier, through geoscience, drilling, assaying, metallurgical testing, Indigenous partnership, permitting readiness, feasibility work, and early customer engagement. These early decisions determine what mineral options Canada, and its allies will have ten, fifteen, or twenty years from now.

This paper fills that missing policy space. It shows how Canada can connect its critical minerals and defence industrial strategies by treating exploration as part of industrial preparedness. The goal is not to replace private capital or have government pick winners, but to make the exploration system more strategically informed, technically complete, and connected to long-term defence and dual-use needs.







> “Canada's mineral exploration sector is a major competitive and strategic advantage. As the world competes for secure access to critical minerals, there is no country better positioned than Canada to lead. This report makes a timely case for addressing market failures in mineral exploration and better aligning exploration with demand to strengthen our economic competitiveness and national security.”

Bryan Detchou

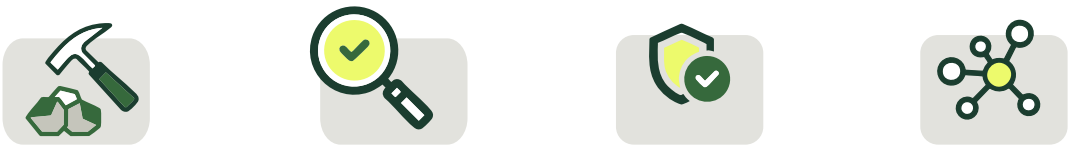
Senior Director, Natural Resources, Environment & Sustainability
Canadian Chamber of Commerce

4 AME's Industrial Strategy for Defence and Dual-Use Mineral Exploration

The industrial strategy is organized around four practical pillars: Define, Discover, De-risk, and Connect. Together, these pillars provide a roadmap for junior explorers to recognize defence and dual-use relevant opportunities, adapt exploration practices, advance credible projects, and link upstream mineral potential to downstream industrial demand.

This industrial strategy is intended to help explorers understand how to participate in the defence and dual-use opportunity in a credible, practical, and commercially realistic way. But it also has clear policy implications. Each pillar points to enabling conditions government must help create if Canada wants defence and dual-use mineral exploration to become a contributor to supply-chain resilience.

FIGURE 4.1 Four-Pillar industrial strategy: from mineral potential to allied supply-chain resilience



	1 Define	2 Discover	3 De-risk	4 Connect
What this Pillar Does	Create common language for defence exploration. Defines the opportunity by helping explorers to assess the minerals, mineral systems and pathways.	Makes exploration programs more defence and dual-use aware by looking for associated co-products and byproducts within existing mineral systems.	Supports the feasibility studies, Indigenous partnerships, and project-readiness to turn geological potential into credible projects.	Connects upstream projects to processors, manufacturers, defence users, stockpiles and offtake partners.
Recommended Industry Action	Assess projects by defence relevance and classifying opportunities as primary metals, byproduct/co-product, and defence-enabling mineral systems.	Expand assaying scope, and review geochemical data to identify overlooked defence and dual-use relevant minerals.	Conduct early mineral analysis and integrate co-products or byproducts into project planning before key development decisions are locked in.	Create a customer-based and downstream partners and communicate effectively how projects fit to supply chains.
Recommended Government Action	Provide clear supply-chain demand signals and work with exploration sector to define the pathways through a dual-use designation to expedite projects.	Support expanded geoscience and support exploration incentives that recognize the cost of assaying associated byproducts and co-products instead of only drilling for primary commodities.	Support tax measures that reduce uncertainty by supporting feasibility studies and enabling project-readiness work to cross the "valley of death" between exploration and development.	Create clear procurement signals, dual-use designation, stockpiling strategies, offtake support and formal channels that connect exploration with downstream partners.

PILLAR 1: Define

Define the defence and dual-use minerals potential

A credible defence and dual-use mineral strategy cannot rely only on broad critical mineral lists or generic national-security language. The opportunity is not limited in searching for new mineral deposits, it also includes recognizing strategic value within mineral systems that are already being explored. Many defence and dual-use minerals may occur as co-product or byproduct opportunities within projects primarily advanced for more familiar commodities such as copper, nickel, and gold.

Figure 1: A practical classification for defence-relevant exploration opportunities

Primary Minerals	Byproduct Minerals	Enabling Systems
The mineral can plausibly be the main economic driver of a project.	The mineral is recovered from another project and rarely supports standalone exploration.	Familiar and economic mineral systems that may host defence-relevant co-products or byproducts.
Examples: Rare earths; graphite; tungsten; titanium feedstocks; lithium	**Examples:** Gallium; germanium; indium; tellurium; hafnium; bismuth; scandium; selenium; cadmium; some vanadium pathways	**Examples:** Copper-gold; silver-zinc-lead; nickel-copper sulphide; nickel-cobalt-PGM; copper-molybdenum
Standalone project pathway	Recovery pathway	Existing exploration pathway

Why this matters: A clear definition of the potential, through dual-use designation and a pathways taxonomy, provides clear supply-chain signals to enable more projects.

This distinction matters because different mineral opportunities require different policy and industry responses. A rare earth or graphite project may need support as a primary mineral project. A germanium, gallium, indium, tellurium, rhenium, hafnium, bismuth, or scandium opportunity may require attention to host mineral systems, processing pathways, concentrate data, and recovery economics. A dual-use designation framework can help create the signal and allow defence and dual-use enabling projects to go forward.

CASE STUDY

Sudbury: Leveraging Existing Mineral Systems



Sudbury, ON

For more than a century, exploration in the Sudbury Basin has been driven primarily by its world-class nickel-copper deposits. Yet these same mineral systems contain a much broader suite of strategically important minerals, including cobalt, platinum-group metals, selenium and tellurium. Today, Sudbury's integrated mining and processing system allows multiple metals to be recovered from mineralization primarily developed for nickel and copper.

Sudbury illustrates why a defence and dual-use mineral strategy must be flexible to allow for primary minerals, byproducts, and mineral enabling systems. In Sudbury's case, continued exploration for established commodities such as nickel and copper can also reveal strategically important co-products and byproducts. Identifying these associations early—through expanded assaying, geoscience and mineral-system mapping—can help ensure that minerals such as cobalt, PGMs, selenium and tellurium are recognized before project designs and recovery pathways are established.

The lesson: Canada does not always need to explore for a defence mineral directly. It can also strengthen future supply by systematically identifying defence-relevant minerals within the mineral-enabling systems already attracting exploration investment.

This pillar requires a dual-use designation for the priority minerals that Canada needs. Industry needs a credible way to explain why a project may be relevant to defence and dual-use supply chains. Government needs a clearer way to understand where exploration activity intersects with national security, industrial, and allied supply-chain priorities. The goal is to ensure that strategically important minerals are recognized early so they are not missed inside projects and mineral systems already under exploration. AME proposes the following:

Industry Action

- Assess projects for defence application, supply-chain vulnerability, production potential
- Classify projects as primary defence minerals, byproduct defence minerals, or defence-enabling mineral systems
- Avoid generic claims of strategic potential without evidence
- Develop clear, concise defence minerals narratives for investors, government, Indigenous partners, and downstream users

Federal Action

- Priority Ask: Create a Dual-Use Designation Framework that helps to identify and target specific minerals
- Provide clear supply-chain risk driven signal to industry to identify key defence and dual-use minerals production
- Work with the exploration sector to define priority mineral systems and byproduct pathways, not just priority primary metals

Provincial Action

- Priority Ask: Support common language with federal and other provincial governments by adopting the Dual-Use Designation Framework
- Align provincial tax credits, innovation programs, and critical mineral strategies with federal incentives so explorers face a clearer pathway from discovery to development
- Provide prospector support like the Ontario Junior Exploration Program (OJEP)
- Support co-drilling

CASE STUDY

Alberta: Lithium from Oilfield Brine



Olds, AB

Identifying mineral potential can include innovation beyond traditional mine sites. In Alberta's oil fields, lithium contained in deep subsurface brines can be accessed. Alberta has established a dedicated regulatory framework for brine-hosted minerals, while companies are now advancing direct lithium extraction (DLE) projects in the province. E3 Lithium's demonstration facility near Olds is testing the production of battery-grade lithium carbonate from Alberta brines, building toward potential commercial-scale production.

The lesson: Canada can identify new strategic mineral opportunities by looking at existing industries differently. Alberta's oil and gas expertise, subsurface knowledge and infrastructure can become enabling assets for an entirely new mineral supply chain.



PILLAR 2: Discover **Make exploration more defence and dual-use aware**

Expanding assaying and ensuring that strategic assets are integrated early on to project planning will help Canada uncover more value.

Canada has long-standing exploration strengths in commodities like gold, copper, potash, and uranium. These strengths are not a distraction from the defence and dual-use minerals agenda. They are a practical pathway into it. Many defence and dual-use minerals occur as co-products or byproducts in these systems. But they may not be consistently assessed, reported, or integrated into project planning.

Figure 2: Expand the Exploration Lens

The best way to identify additional defence and dual-use minerals can often be to look carefully at mineral systems that explorers are already advancing.

What Canada Already Explores	Expand the Exploration Lens	Associated Defence and Dual-Use opportunities
• Gold & precious metals • Copper-gold porphyries • Zinc & silver systems • Base-metal systems • Other familiar commodity plays These are not a distraction from the defence minerals agenda — they are a practical pathway into it.	• Primary commodity remains the driver • Expanded assay suites • Re-assay historical core concentrate • Early metallurgical testing • Identify recoverable streams	• Zinc-focused project: Germanium, Indium • Copper-gold porphyry: Tellurium, Rhenium • Co-products and byproducts may be under-examined

Why This Matters: Canada can unlock strategic value faster by expanding the lens on familiar commodities help to uncover strategic assets hidden inside the systems explorers already look at.

Exploration programs are usually designed around the primary commodities that drive project economics and investor interest. This is rational. Explorers operate with limited budgets and must communicate a clear commodity story to capital markets. But the result is that associated defence and dual-use minerals may be under-examined. For example, a zinc-focused company may not fully assess germanium or indium. Or a company focused on a copper-gold porphyry may not prioritize tellurium or rhenium.

CASE STUDY

Metal Tech Alley in Trail, BC



Trail, BC

Teck's Trail Operations within the Metal Tech Alley demonstrates why assaying may be important to uncover smaller-volume strategic minerals. The integrated lead-zinc smelting and refining complex already processes germanium-bearing concentrates and recovers a range of specialty and precious metals alongside its primary products. In 2026, Teck and the Government of Canada announced a potential investment of up to $850 million to expand Trail's strategic-metals capacity, which could double germanium and antimony production and add new gallium production.

Germanium and gallium are particularly important to advanced technologies and defence applications, including infrared systems, semiconductors, radar and high-performance electronics. Yet both are commonly produced as byproducts rather than from mines developed primarily for those minerals. At the Teck Trail facility, only 0.01% of the volume is actually germanium (40 tonnes of germanium from a concentrate of 230,000 tonnes of refined zinc and 160,000 tonnes of refined lead).

The lesson: Expanded assaying and programs that uncover strategic assets in familiar commodities can help to deliver strategic supply. In Trail, B.C., germanium, gallium and other strategic minerals occur within existing and prospective zinc, copper, nickel and other primary mineral systems. Better assaying and mapping of these associations can reveal new sources of defence-critical supply while improving the economics and strategic value of Canada's broader mineral supply chain.

A discover-centric approach would expand the exploration lens. This may involve expanded assay suites, evaluating historical core, and identifying whether minor elements are part of recoverable streams. Innovative methods of recovery such as from concentrates, residues, tailings, mine waste and recycling streams should also be considered. For example, lithium from oil field brine or helium as a byproduct of drilling and extracting conventional natural gas. AME is proposing the following:

Industry Action

- Apply a mineral-system lens to gold, copper, silver and polymetallic projects
- Adopt a defence and dual-use aware approach in early assaying
- Expand assay suites for overlooked co-product or byproduct potential

Federal Action

- Priority Ask: Investments in public geoscience to help expand discovery beyond primary commodities
- Government should give targeted incentives that recognize the cost of assessing associated defence and dual use-relevant minerals
- Government should support public geoscience to help explorers identify where byproducts and co-products are most likely to occur

Provincial Action

- Priority Ask: Investments in public geoscience to help expand discovery beyond primary commodities
- Direct provincial geological surveys to map byproduct and co-product potential in existing mineral systems

CASE STUDY

Nova Scotia: Finding Potentials in Historic Mine Tailings



Nova Scotia

In 2024, Nova Scotia launched a project to examine historical mine tailings to build provincial inventory of tin and tungsten deposits. The project is supported by $500,000 in federal funding.

This approach turns historical mine waste into new opportunity. Rather than beginning with entirely new greenfield exploration, historical production records help to identify where strategically important minerals may already be concentrated in material that has been mined and processed.

The lesson: Canada's defence-mineral inventory should extend beyond deposits still in the ground. Systematically mapping and evaluating historical mine tailings can identify overlooked sources of strategic minerals and potentially turn yesterday's mining waste into tomorrow's mineral supply.

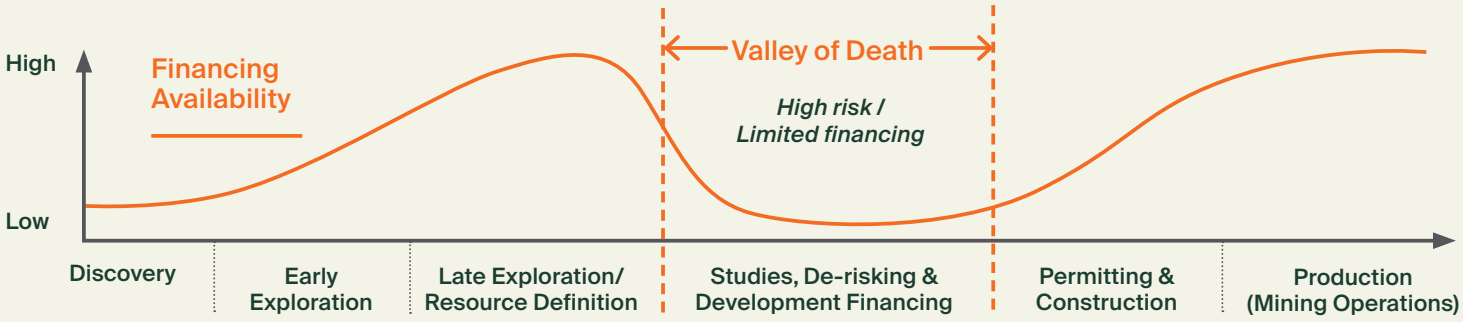
PILLAR 3: De-risk **Turn strategic potential into credible projects**

Identifying and discovering a defence and dual-use mineral is not enough. A mineral is not a supply-chain solution unless it can be technically and economically recovered, responsibly advanced and connected to future demand. The third pillar is therefore about de-risking and advancing an exploration project to mine development stage.

For primary commodities, de-risking may involve feasibility studies, permitting, supporting Indigenous partnership capacity, and project financing. For byproduct and co-product, the challenge can be even more complex. Strategic value depends not only on geological presence, but also on whether the project can match the economics of the host minerals.

Graph: The "Valley of Death" in Mineral Exploration
Why Feasibility-stage projects struggle when capital runs dry

- **High Costs:** engineering, metallurgy, baseline studies
- **High Uncertainty:** permitting, recovery, market pathways
- **Limited Capital:** too advanced for exploration finance, too early for construction finance



Why This Matters: Markets heavily discount early discovery value because of long time and development risks. Targeted policies can reduce uncertainty and advance strategic projects.

This matters because mineral projects can take 10-15 or more years to reach the shovel-ready stage of mining development, as companies move through technical studies, permitting, financing, consultation and project feasibility design. During this period, markets heavily discount early discovery value because of long timelines, technical uncertainty, and development risk. As a result, projects with real strategic value can lose momentum before they reach development. Public policy can help close this gap to move promising discoveries across the "valley of death".

Canada should expand Canadian Exploration Expense (CEE) eligibility to better support targeted feasibility studies for defence and dual-use minerals. Early feasibility work helps to advance viable projects before designs are locked in and before strategically important minerals are overlooked. Making this work eligible for stronger tax support would help explorers test recovery potential earlier, reduce uncertainty for investors, and create a clearer pathway from discovery to development. This would be a practical way for government to help promising projects cross the "valley of death" without picking winners or guaranteeing project success.

The Mineral Exploration Tax Credit (METC) is another example. The tax credits are an effective way to mobilize capital to fund mineral exploration. However, between 2000-2027, the Canadian government made 19 short-term expansions to the METC. The continued renewals show that METC is an effective system. By providing a long-term renewal of 10 years or more, Canada can improve policy efficiency and avoid uncertainty.

This pillar is where government involvement in industrial policy becomes crucial. Governments cannot guarantee discoveries or project success, but they can reduce uncertainty around the enabling conditions that make projects investable. AME proposes the following:

Industry Action

- Integrate defence and dual-use minerals into project planning early, before technical feasibility decisions are locked in
- Clearly communicate the potential for defence and dual-use minerals in feasibility stage

Federal Action

- Priority Ask: Provide feasibility support to help dual-use projects escape the "valley of death" through measures such as modernizing the Canadian Exploration Expenditure (CEE)
- Government should provide targeted feasibility incentives especially for projects with byproducts or co-products that are defence and dual use-relevant
- Government should continue to provide Indigenous partnership capacity funding at the exploration and early feasibility study stage

Provincial Action

- Priority Ask: Streamline permitting timelines
- Ensure land-use planning processes recognize the strategic importance of minerals needed for clean energy, defence, and allied supply chains
- Establish clear service standards for exploration, bulk sampling, and early development permits
- Utilize tools like critical minerals office to help move designed projects toward permitting process in more organized fashion

CASE STUDY

MacTung: Using Defence Funding to De-risk Project



MacTung, YK

MacTung, near the Yukon–Northwest Territories border, is one of the world's largest high-grade tungsten deposits. Yet strategic geology alone does not make a project investable.

In 2024, the U.S. Department of Defense awarded US$15.8 million under the Defense Production Act to advance MacTung toward a final investment decision. The funding supports feasibility-stage work.

However, strategically important Canadian projects cannot rely on one-time government grants—or on foreign governments—to bridge this development gap.

The lesson: Public policy should provide predictable tools that help promising projects cross the "valley of death" without guaranteeing project success. Expanding Canadian Exploration Expense (CEE) eligibility to targeted feasibility work, alongside other project-advancement incentives, could reduce technical uncertainty, mobilize private capital and move defence-relevant discoveries closer to development.

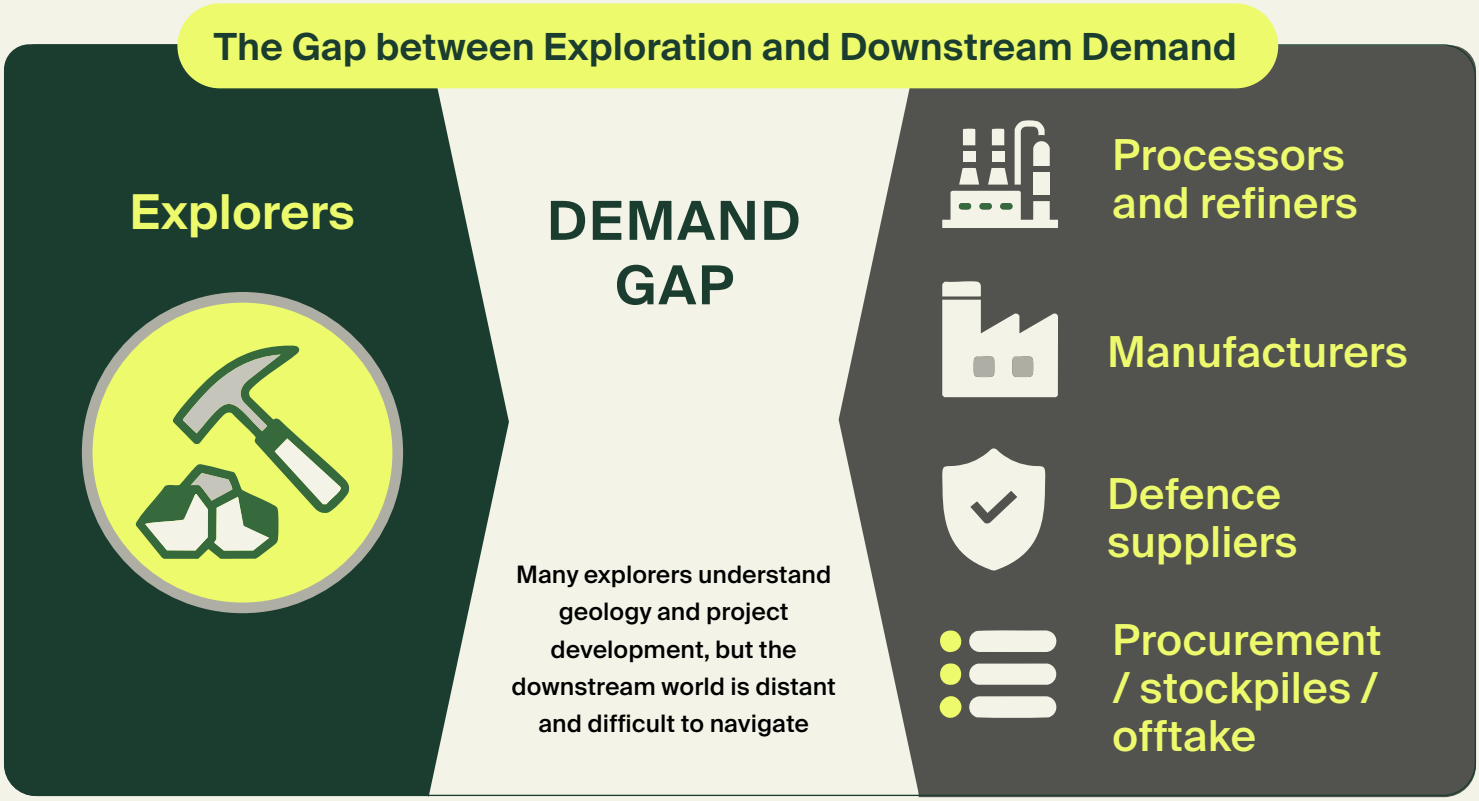


PILLAR 4: Connect

Link exploration to defence and dual-use strategic demand

The final pillar connects exploration to downstream demand. Exploration projects need to connect to processors, refiners, manufacturers, defence suppliers, allied governments, stockpiles, and offtake partners.

For many explorers, this downstream world can be distant and difficult to navigate. Companies may understand geology and project development, but explorers are not necessarily experts on defence procurement, allied supply-chain planning, or industrial demand from aerospace, electronics, and advanced manufacturing. At the same time, downstream defence and industrial actors may not always understand how early-stage exploration pathways are generated.



Why the gap exists:

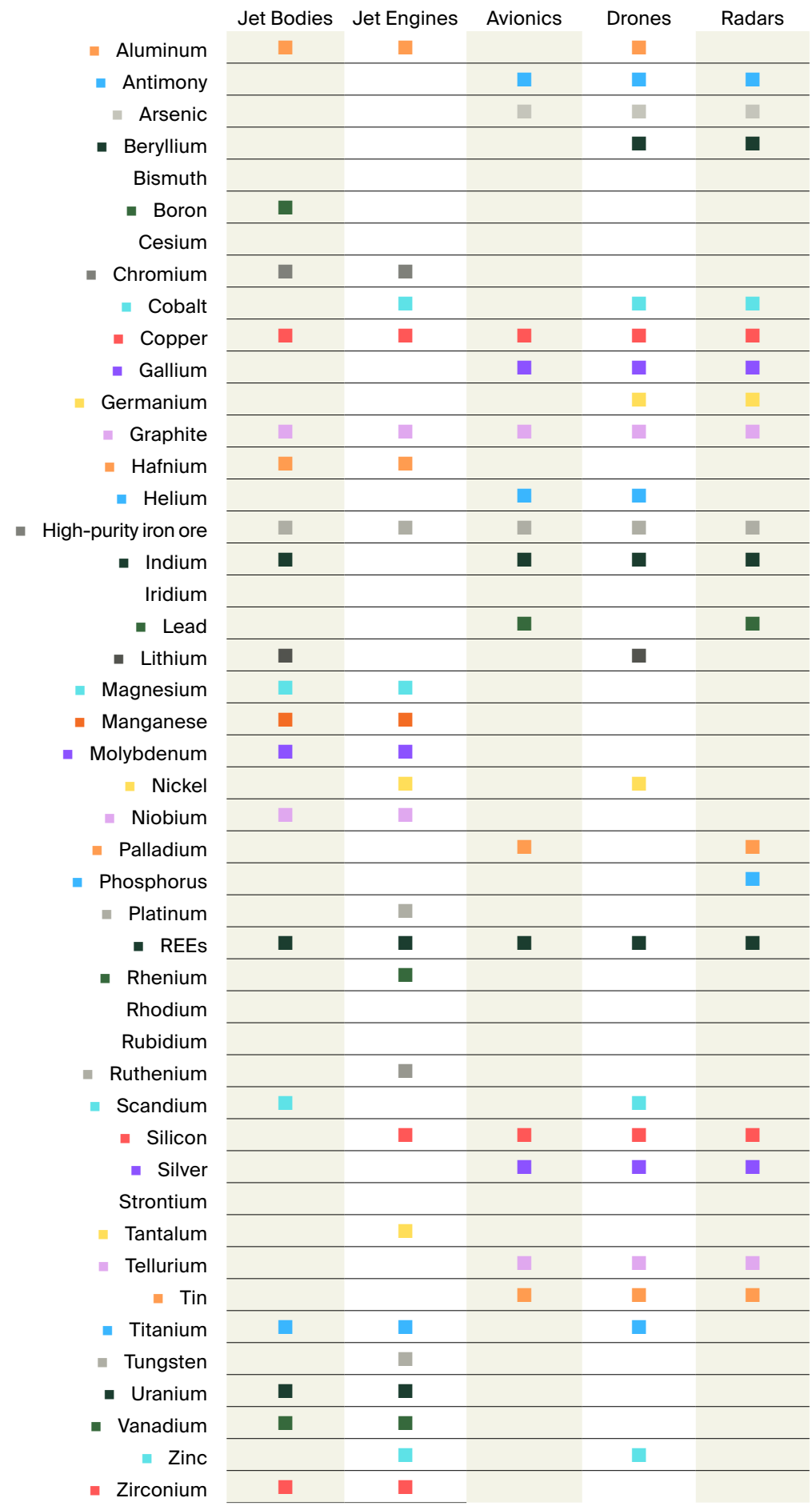
- **Knowledge gap:** Explorers know geology, not procurement or industrial demand
- **Coordination gap:** No single actor connects the full chain
- **Weak demand signals:** Future demand is too uncertain or invisible

How Government can help:

- **Convene partners**
- **Procurement signals**
- **Stockpiling strategy**
- **Offtake support**
- **Allied partnerships**

Why This Matters: Exploration capital follows credible demand. Canada can make demand visible through procurement, stockpiling, offtake and allied partnerships.

INDUSTRY CASE STUDY **Minerals used in Aerospace Manufacturing**



Mineral Exploration and Canada's Aerospace Industry

According to the Aerospace Industries Association of Canada (AIAC), Canada ranks among the world's top five producers of aircraft, engines and flight simulators, exporting more than 70% of aerospace manufacturing output to over 170 countries. Quebec anchors the sector, accounting for 61% of aerospace employment, followed by Ontario at 23%, Western and Northern Canada at 12%, and Atlantic Canada at 4%.

Canada's strength in mineral exploration reinforces this aerospace advantage. A stronger domestic pipeline of critical minerals improves supply-chain security, supports integrated offtake relationships, and helps sustain Canada's competitiveness in aerospace manufacturing.

> “Canada's aerospace and defence manufacturing sector relies on highly specialized materials embedded throughout aircraft, engines, avionics, sensors and space systems. Building stronger connections across Canada’s industrial value chain — from exploration and processing through to advanced manufacturing and downstream users — can help strengthen supply chain resilience and ensure Canadian industry has secure and reliable access to the materials it depends on. ”
>
> **Aerospace Industries Association of Canada**

An industrial policy needs to convene explorers, government officials, investors, Indigenous partners, processors, manufacturers, defence suppliers, and allied stakeholders to provide clear demand signal and offtake pathway.

The federal and provincial governments could also designate a small number of regional defence and dual-use mineral hubs, with coordinated support for supply-chain mapping, project advancement, infrastructure, applied research, workforce development, permitting and procurement connections. For example, the Metal Tech Alley around Trail, B.C. brings together metallurgical expertise, advanced materials, recycling, manufacturing and technology capabilities. A hub-based approach would help connect mineral deposits with downstream capabilities and defence demand, while concentrating public support where Canada already has industrial strengths and the potential to build complete supply chains.

FIGURE 1 How defence demand signals reach exploration

1 Defence capability need

- Aircraft
- Ships
- Sensors
- Munitions
- Satellites
- Electronics

2 Material requirement

- Specific minerals and metals
- Gallium, germanium, graphite
- Titanium, tellurium, tungsten
- Rare earths and other dual-use inputs

3 Demand signal

- Procurement priorities
- Strategic stockpiles
- Offtake support
- Allied partnerships
- Defence industrial programs

4 Industrial pull

- Processors and refiners
- Manufacturers
- Defence suppliers
- Aerospace and electronics firms

5 Capital market response

- Stronger financing case
- Lower market uncertainty
- Clearer path to customers
- More investor confidence

6 Exploration response

- More assaying
- More drilling
- More metallurgical testing
- More feasibility work
- Faster project advancement

Government has an important role in creating market pull. Exploration capital follows credible future demand. If governments want more defence and dual-use relevant mineral projects, they must make demand more visible through procurement signals, stockpiling strategies, offtake support, allied partnerships, and defence industrial programs.

CASE STUDY

Nouveau Monde Graphite: Creating Demand Certainty



Matawinie, QC

Nouveau Monde Graphite's Matawinie project in Québec shows why connecting mineral projects to credible buyers matters. In 2026, the Government of Canada committed to purchase 30,000 tonnes of graphite concentrate annually for seven years on a take-or-pay basis, creating a predictable source of demand.

The project has also attracted an investment intention from the Government of Japan as part of broader G7 efforts to diversify critical-mineral supply chains. Canada has complemented the demand signal with approximately C$459 million in project debt from EDC and the Canada Infrastructure Bank, helping move Matawinie toward construction and production.

Graphite projects face a particular financing challenge because graphite products vary by grade, flake size and end-use specification, while battery customers require lengthy qualification. Without committed buyers, lenders face significant uncertainty over whether future production can actually be sold. Long-term offtakes reduce this risk by providing demand and pricing visibility, helping projects secure financing and reach construction.

The lesson: Government and allied offtakes can help turn strategic demand into bankable projects by providing the market certainty needed to unlock financing and move mines toward construction.

This does not mean government should pick every project or guarantee every market. However, it does mean that government should help create clearer demand conditions for minerals that are strategically important but commercially difficult to advance under normal market conditions. AME proposes the following:

Industry Action

- Build relationships with government, defence and industrial actors, and allied supply-chain partners
- Communicate how exploration projects could fit into Canadian or allied supply chains

Federal Action

- Priority Ask: Create clear demand signals through procurement, stockpiling, offtake support, and allied partnerships
- Government should include upstream mineral exploration as part of supply-chain planning
- Create a dedicated procurement and stockpiling mechanisms to create a stable demand environment

Provincial Action

- Priority Ask: Connect projects to provincial industrial ecosystems and regional clusters
- Support regional supply-chain mapping so projects can see potential customers, infrastructure gaps, and partnership pathways earlier







> “Mining and manufacturing are deeply interconnected. Manufacturers need secure mineral supplies to produce critical goods, including defence equipment, while mining depends on manufacturers for the equipment and technology needed to develop those resources. This report highlights why strengthening Canada’s defence industrial base requires us to think about the entire supply chain, from exploration and extraction through to manufacturing.”

Alan Arcand

Chief Economist
Canadian Manufacturers & Exporters

5

Policy Conditions Required for Success

Companies alone cannot deliver this industrial strategy for defence and dual-use mineral exploration. Explorers can define, discover, de-risk, and connect projects. But government must create the enabling conditions that make those projects more likely to become credible future supply options.

Federal Policy Architecture by Pillar

1



Define

Define strategic minerals

Create a dual-use mineral designation framework

Provide a supply-chain-risk signal on which defence and dual-use minerals, mineral systems, and byproduct pathways matter most.

LEAD: NRCan + DND **SUPPORT:** ISED; GAC; PSPC; TBS; Defence Investment Agency

2



Discover

Recognize strategic value inside existing mineral systems

Support expanded assaying and public geoscience

Help explorers assess defence-relevant co-products and byproducts beyond the primary commodity story.

LEAD: NRCan/GSC **SUPPORT:** Critical Minerals Centre of Excellence; CanmetMINING; CanmetMATERIALS; NRC; ISED; provincial and territorial geological surveys

3



De-risk

De-risk and advance strategic projects

Create targeted feasibility and de-risking incentives

Support metallurgy, recovery testing, feasibility studies, project-finance readiness, and Indigenous partnership capacity.

LEAD: NRCan+ISED **SUPPORT:** CIRNAC; ISC; IAAC; CIB; EDC; regional development agencies

4



Connect

Connect exploration to downstream demand

Create demand signals through procurement, stockpiling, offtake, and allied partnerships

Make future demand visible and credible so exploration capital can respond to defence-industrial and allied supply-chain needs.

LEAD: DND + PSPC + NRCan **SUPPORT:** ISED; GAC; TBS; Defence Investment Agency; EDC; BDC; CIB; allied government partners

Provincial Policy Architecture by Pillar

1



Define

Define strategic minerals

Adopt and align the Dual-Use Designation Framework

Use common language with federal and provincial partners. Align provincial tax credits, innovation programs, and critical mineral strategies with federal incentives so explorers face a clearer pathway from discovery to development. Provide prospector support, such as the Ontario Junior Exploration Program (OJEP), and support co-drilling.

LEAD: Provincial mines and energy ministries **SUPPORT:** Economic development ministries; geological surveys

2



Discover

Recognize strategic value inside existing mineral systems

Invest in public geoscience and by-product mapping

Expand discovery beyond primary commodities. Direct provincial geological surveys to map by-product and co-product potential in existing mineral systems and strengthen public geoscience to support new discovery.

LEAD: Provincial geological surveys **SUPPORT:** Mines ministries; federal geoscience partners

3



De-risk

De-risk and advance strategic projects

Streamline permitting and organize project advancement

Establish clear service standards for exploration, bulk sampling, and early development permits. Ensure land-use planning recognizes the strategic importance of minerals needed for clean energy, defence, and allied supply chains. Use critical minerals offices or similar tools to move designated projects through permitting in a more organized way.

LEAD: Provincial permitting and mines ministries **SUPPORT:** Critical minerals offices; land-use planners

4



Connect

Connect exploration to provincial industrial ecosystems

Map regional supply chains and partnership pathways

Help projects identify potential customers, infrastructure gaps, and partnership opportunities earlier. Connect projects to provincial industrial ecosystems so exploration can better respond to downstream demand.

LEAD: Provincial industry and economic development ministries
SUPPORT: Regional partners; infrastructure and cluster agencies

These recommendations should be implemented as a coordinated federal-provincial package. See Annex A and Annex B for the full list of decision-repeated policies that can be implemented.

The federal government should define national defence and dual-use priorities, provide demand signals, support strategic project advancement, and coordinate with allies. Provincial governments should align their exploration incentives, geoscience programs, permitting systems, and regional industrial strategies with those priorities.

Together, these actions would create a practical policy architecture. This is the missing link between Canada's Critical Minerals Strategy and its Defence Industrial Strategy. Strategic supply does not begin when a mine opens. It begins years earlier, with exploration, assaying, geoscience, Indigenous partnership, technical testing, permitting readiness, and demand visibility.

Different levels of government in Canada need to build the market architecture that allows strategic mineral options to emerge. That is how Canada can convert geological potential into defence readiness, industrial resilience, and allied supply-chain security.

> "Critical minerals now sit at the intersection of economic security, national defence and geopolitical competition. Canada has extraordinary geological assets, but resources in the ground do not automatically translate into strategic advantage. This paper makes an important case for putting exploration at the heart of Canada's critical minerals strategy and connecting it more deliberately to our defence, industrial and economic-security priorities. Doing so is not only a matter of resource development; it must also form an essential part of modern Canadian statecraft."

Vina Nadjibulla

Co-Founder & CEO
Centre for Strategic Statecraft

6

Conclusion

In an increasingly uncertain world, Canada is already a safe and responsible supplier of the minerals that like-minded countries need. The alternative is continued reliance on opaque or uncertain supply chains, often in jurisdictions with weaker environmental standards, and labour protections.

The question is not whether Canada has the mineral potential. It is whether Canada has the domestic industries, supply chains, infrastructure, partnerships, and public trust needed to turn that potential into a secure supply. Responsible Canadian exploration is the first step toward building secure, democratic, and allied supply chains, built on high environmental standards, Indigenous partnership, transparent land-use decisions, and public trust.

However, the current exploration markets are not designed to produce this outcome on their own. Capital markets often reward familiar commodities and near-term catalysts. Associated minerals may be under-assayed, underreported, or left out of project planning. Strategic minerals may need to be identified years before demand becomes visible. Byproduct recovery may require coordination across exploration, mining, processing, refining, procurement, and downstream manufacturing. These are not failures of industry ambition. They are structural market failures that justify a targeted industrial policy response.

The central message is simple: Canada's defence and dual-use industrial strategy must begin before production. ***It must begin with exploration.*** If Canada wants to strengthen sovereignty, build allied resilience, support domestic industrial capacity, and reduce dependence on vulnerable supply chains, it must recognize mineral exploration as a strategic national capability. With targeted leadership, Canada can enable responsible exploration, and turn geological potential into long-term security, prosperity, and allied advantage.

With targeted leadership, Canada can enable responsible exploration, and turn geological potential into long-term security, prosperity, and allied advantage.

Recommendation 1:
Create a Defence and Dual-Use Minerals Designation Framework

The federal government should create a **Defence and Dual-Use Minerals Designation Framework** to identify which minerals, mineral systems, and byproduct pathways matter most for Canada's defence and dual-use industrial capacity.

This should go beyond the general critical minerals list. It should provide a clear federal signal on which minerals are most relevant to defence readiness, supply-chain vulnerability, allied resilience, and Canadian geological opportunity.

Lead: NRCAN and the DND
Support: ISED, GAC, PSPC, TBS, Defence Investment Agency

Implementation mechanics:

- Publish a *Defence and Dual-Use Minerals Annex* to the Critical Minerals Strategy.
- Rank minerals by defence relevance, substitution difficulty, China/Russia exposure, Canadian potential, and byproduct dependence.
- Include both individual minerals and mineral systems, such as zinc-lead-silver, copper porphyry, nickel-copper sulphide, rare earth, lithium-cesium-tantalum, and heavy mineral sand systems.
- Use the Critical Minerals Centre of Excellence as the federal secretariat.
- Update the annex regularly to reflect defence needs, allied demand, technology change, and market risk.

Use the designation to guide federal funding, tax incentives, public geoscience, procurement, and allied critical minerals partnerships.

Recommendation 2:
Launch a Defence Minerals Assay and Byproduct Mapping Program

The federal government should launch a *Defence Minerals Assay and Byproduct Mapping Program* to identify strategic minerals that may already exist inside Canadian mineral systems.

Many defence-relevant minerals are not mined as primary commodities. They may occur as byproducts or co-products in existing projects, drill core, concentrates, mine waste, tailings, or historical samples. Without expanded assaying, Canada may miss minerals that are strategically important but commercially hidden.

Lead: NRCan and the Geological Survey of Canada
Support: Critical Minerals Centre of Excellence, CanmetMINING, NRC, ISED, provincial and territorial geological surveys

Implementation mechanics:

- Create federal assay vouchers or grants for designated defence and dual-use minerals.
- Fund expanded multi-element assaying of drill core, historical samples, concentrates, tailings, and mine waste.
- Prioritize byproduct-rich systems, including zinc-lead-silver, copper porphyry, nickel-copper sulphide, heavy mineral sand, and lithium-cesium-tantalum systems.
- Support concentrate characterization and recovery testing for strategic byproducts.
- Feed non-confidential results into public geoscience databases after an appropriate confidentiality period.
- Provide higher support for Indigenous-partnered projects and advanced projects with clear defence or dual-use relevance.

Recommendation 3:
Create a Byproduct Recovery and Project Advancement Stream

The federal government should create a **Byproduct Recovery and Project Advancement Stream** to help strategic mineral projects move from geological potential to financeable supply.

Identifying a mineral is not enough. Companies must still determine whether it can be recovered, processed, permitted, financed, and sold into a reliable supply chain. This is especially important for byproducts such as gallium, germanium, indium, tellurium, rhenium, hafnium, scandium, bismuth, cobalt, and platinum group metals.

Lead: Finance, NRCan and ISED
Support: CIRNAC, ISC, IAAC, CIB, EDC, regional development agencies

Implementation mechanics:

- Modernize the *Canadian Exploration Expenditure* (CEE) to include feasibility and engineering studies in the CEE eligibility criteria.
- Include Indigenous partnership capacity as an eligible project-advancement cost.
- Prioritize projects containing designated defence and dual-use minerals.
- Focus on projects where targeted technical work could unlock byproduct recovery or accelerate supply-chain readiness.
- Modernize *Canadian Exploration Expense* eligibility or create a *Mineral Project Advancement Tax Credit* for feasibility, engineering, metallurgy, recovery testing, environmental baseline work, and Indigenous partnership capacity.

Recommendation 4:
Create a Strategic Offtake and Stockpile Pilot for Defence Minerals

The federal government should create a **Strategic Offtake and Stockpile Pilot for Defence Minerals** to connect exploration and project advancement to downstream demand.

Exploration capital responds to credible demand signals. If future demand from defence, aerospace, semiconductors, energy systems, secure communications, and advanced manufacturing remains invisible, capital will continue to prioritize conventional commodity markets. This leaves strategically important minerals underexplored and underdeveloped.

Lead: DND, PSPC, and NRCan
Support: ISED, GAC, TBS, Defence Investment Agency, EDC, BDC, CIB, allied government partners

Implementation mechanics:

- Identify short list of defence and dual-use minerals for offtake, stockpiling, or procurement demand signals.
- Use conditional offtake agreements for projects that meet technical, environmental, Indigenous partnership, and security milestones.
- Create small strategic stockpile contracts for minerals where disruption would create defence or industrial risk.
- Use price floors, price collars, or contracts-for-difference where allied projects are vulnerable to market manipulation.
- Pool demand with trusted allies through G7, NATO, and bilateral partnerships.
- Issue letters of strategic interest for projects aligned with allied supply-chain needs.
- Require major defence and Coast Guard procurements to include a Critical Minerals Supply Chain Annex.
- Update the Industrial and Technological Benefits Policy so prime contractors receive credit for investing in Canadian critical mineral supply chains, including byproduct recovery, processing, recycling, offtake, and supplier development.

Recommendation 5:
Align Provincial Critical Minerals Strategies with the Federal Defence and Dual-Use Framework

Provincial governments should adopt and align with the federal **Defence and Dual-Use Minerals Designation Framework**. Provinces do not need to duplicate federal defence policy, but they should use common language so that provincial tax credits, exploration grants, geoscience programs, and permitting systems are aligned with national and allied supply-chain priorities.

Lead: Provincial mines and energy ministries
Support: Economic development ministries and provincial geological surveys

Implementation mechanics:

- Formally recognize the federal *Defence and Dual-Use Minerals Annex* in provincial critical minerals strategies.
- Align provincial exploration incentives with designated defence and dual-use minerals.
- Expand prospector and junior exploration support for targeted mineral systems.
- Support co-drilling, shared data collection, and regional exploration partnerships.
- Use provincial tax credits and grant programs to encourage exploration for byproducts and co-products.
- Coordinate with federal departments so companies face a clearer pathway from discovery to development.

Recommendation 6:
Invest in Public Geoscience and Byproduct Mapping

Provincial governments should strengthen public geoscience and byproduct mapping to help identify strategic minerals inside existing mineral systems.

Provinces are closest to the geology, mineral tenure systems, historical exploration data, and regional project pipelines. Their geological surveys are therefore essential to expanding discovery beyond primary commodities.

Lead: Provincial geological surveys
Support: Mines ministries and federal geoscience partners

Implementation mechanics:

- Map byproduct and co-product potential in existing mineral belts.
- Re-analyze historical drill core and archived samples for designated defence and dual-use minerals.
- Update provincial geoscience databases to include byproduct indicators.
- Prioritize mapping in mineral systems with strong defence relevance, including copper, zinc-lead-silver, nickel-copper, rare earth, lithium-cesium-tantalum, heavy mineral sand, and phosphate systems.
- Partner with NRCan, GSC, CanmetMINING, Indigenous governments, universities, and industry.
- Publish regional byproduct opportunity maps to guide exploration investment.

Recommendation 7:
Streamline Permitting and Organize Project Advancement

Provincial governments should streamline permitting and create clearer project-advancement pathways for designated defence and dual-use mineral projects.

Permitting reform should not weaken environmental standards or Indigenous consultation. It should make the process clearer, more predictable, and better coordinated. Strategic projects need service standards, early coordination, and practical guidance so they can move from exploration to development without unnecessary delay.

Lead: Provincial permitting and mines ministries
Support: Critical minerals offices and land-use planners

Implementation mechanics:

- Establish service standards for exploration permits, bulk sampling, and early development permits.
- Create a designated project pathway for defence and dual-use mineral projects.
- Use critical minerals offices or project coordination teams to help proponents navigate permitting.
- Ensure land-use planning recognizes the strategic importance of minerals needed for clean energy, defence, and allied supply chains.
- Coordinate early with Indigenous governments, local communities, and environmental regulators.
- Create clearer guidance for bulk sampling, metallurgical testing, and project-advancement work.
- Track and publicly report permitting timelines for strategic mineral projects.

Recommendation 8:
Connect Exploration to Provincial Industrial Ecosystems

Provincial governments should connect mineral exploration to regional industrial ecosystems, infrastructure planning, and downstream customers.

Exploration is more valuable when companies can see where future customers, processing capacity, transportation corridors, power infrastructure, and partnership opportunities may exist. Provinces are well placed to map these regional opportunities.

Lead: Provincial industry and economic development ministries
Support: Regional partners, infrastructure agencies, cluster organizations, and local governments

Implementation mechanics:

- Map regional supply chains for defence and dual-use minerals.
- Identify potential downstream customers in manufacturing, aerospace, energy, shipbuilding, defence, battery, semiconductor, and advanced materials sectors.
- Identify infrastructure gaps that affect strategic mineral development, including roads, ports, rail, transmission, clean power, and processing capacity.
- Create regional partnership tables linking explorers, Indigenous governments, processors, manufacturers, utilities, ports, and economic development agencies.
- Support industrial clusters around priority mineral systems and regional strengths.
- Help projects connect earlier with potential customers, investors, and processing partners.



AME Association for Mineral Exploration