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Critical Infrastructure in the Arctic Needs a New Security Approach

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JCSP 48

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WAITING FOR BLACK SWANS: WHY CRITICAL INFRASTRUCTURE IN THE ARCTIC NEEDS A NEW SECURITY APPROACH

INTRODUCTION

Critical infrastructure¹ ensures that many of Canada's most important public and private services, including the communications, financial, transportation and health sectors, run reliably and predictably behind the scenes. These processes, systems, technologies and networks have evolved in response to changes in human behaviour, socioeconomic trends and imperatives of a functioning state. For example, successful trade relies on interoperability in supply chains and financial markets. Modern health care has been transformed by electronic health records and diagnostic imaging. Food distribution with an optimized cold chain and predictive consumer demand reduces food waste and improves the affordability of household groceries. Each of these systems draws upon critical infrastructure that is both adaptive and protected. There are often very few options to fulfill these functions because systems are complex and challenging to secure, and there is limited supply and demand. For these reasons, critical infrastructure management often has a narrow field of solutions, and possibly a single point of failure, that must be protected from threats and vulnerabilities. Its importance to society is what makes this infrastructure critical by definition.

Determining what infrastructure deserves this special status remains under debate; this will be explored in a later chapter. As societies incrementally change as a result of urbanization, technology and basic human behaviour, so to does the infrastructure that

¹ According to Public Safety Canada, *Critical infrastructure* (CI) refers to processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government. See Canada and Public Safety Canada, *National Strategy for Critical Infrastructure*. (Ottawa: Public Safety Canada, 2009), 2.

underpins this social economy. Yet, human behaviour, social economy and even social identity are far from any single definition or overarching theme among Canadians. The demography of such a vast country has changed like any other nation-state yet it has also taken a trajectory different from the United States, its principal ally and most frequent compared. Canada balances a highly urbanized population with a vast and sparsely populated territory with harsh environmental conditions. Protecting critical infrastructure is about protecting people, livelihoods, welfare and prosperity. To do so effectively requires skill and experience, but perhaps more importantly, an agreed-upon set of rules. This paper demonstrates that while critical infrastructure has benefited from a taxonomy of sectors, discussions regarding the protection of those sectors, and the systems-level understanding of how they function, overwhelmingly favor Canada's southern and urban population. Canada's Arctic and Northern regions remain at a disadvantage in national discussions. Former Chair of the Inuit Circumpolar Council Sheila Watt-Cloutier presents this succinctly:

I firmly believe that if these systems—whether school systems, judicial systems or health systems—do not contextualize our community's problems, helping individuals, families and communities to understand the historical context from which the problems arise..." and that "part of the problem is a lack of culture match between the institutions now in places in the Inuit communities and core values and traditions. It seems we are always saying yes, accepting the learning arrangements and the living structures from the South and, in essence, replicating a system that is not ours.²

Canada needs to find a new model for understanding critical infrastructure to improve the equity of Northern residents. Without a change, modern-day and emerging threats like climate change, resource extraction, and increasing competition with China and Russia

² Sheila Watt-Cloutier, *The Right to Be Cold: One Woman's Story of Protecting Her Culture, the Arctic and the Whole Planet* (Toronto, Ontario, Canada: Allen Lane, 2015), 317-318.

will worsen existing vulnerabilities and grievances regarding policy decisions and structures that favour the south.

This paper looks at the question of how those with authority and responsibility for critical infrastructure in the North should consider and manage its security to produce better outcomes. Human security is a relatively new idea, yet it presents an opportunity to orient critical systems, structures and processes to users (i.e. human-centric) instead of the integrity of the system itself as the referent object (i.e. system-centric). Looking at critical infrastructure through a human security approach provides higher resolution across seven domains which will be explained in greater depth in the following chapter. Infrastructure sectors labelled *critical* have new meaning when viewed through the faceted approach that human security provides. These domains are broadly considered within two comprehensive security paradigms as ‘freedom from want’ and ‘freedom from fear.’ This paper also discusses the implications for sovereignty from the viewpoint of the person in Canada’s North. A human-centric approach ties each of these security domains to concepts of popular sovereignty and the state’s role in providing security and guaranteeing the welfare of its citizens. In doing so, a new idea that couples human security and the will of the person to participate in this arrangement emerges to address this vulnerability.³ In guaranteeing greater human security, the state fosters the fulfilment of human potential, thereby enhancing the collective strength of the state.

³ Watt-Cloutier, 303; sovereignty as a construct is well described in Eiki Berg and Ene Kuusk, ‘What Makes Sovereignty a Relative Concept? Empirical Approaches to International Society’, *Political Geography* 29, no. 1 (January 2010): 40–49; see themes of social interaction with concepts of state welfare discussed in: Frederick Edmund Emery and E. L. Trist, *Towards a Social Ecology: Contextual Appreciations of the Future in the Present* (New York: Plenum Pub. Corp, 1975), 149.

Consequently, viewing critical infrastructure through the lens of human security raises considerations about new vulnerabilities that can be exploited, such as simple threats to physical safety, or undetectable assaults that yield disproportionate effects⁴, yet remain below the threshold of physical conflict. The tangible aspects of critical infrastructure can therefore be considered at risk of being weaponized by Canada's adversaries. In returning to a period of great power competition with China and an emboldened Russia, these trends threaten Canada's aspirational future and detract from its role as a middle power in the rules-based international order.

This paper is also about the relationships and vulnerabilities of Canada's northern population. Before critical infrastructure can be securitized, decision-makers must consider and understand the effects on remote communities. Northern residents are increasingly susceptible to exploitation by actors who wish to destabilize the relationship between the Canadian federal government and northern communities whose security is integrally connected to that of North America overall. There is a tenuous relationship between northern populations and the services and sectors operating in the south. Remote northern communities rely on urban Canada for various otherwise unavailable items. For example, computer technology, consumer goods, advanced healthcare, education resources and non-traditional food are all tied to supply chains that link into urban centers in southern parts of Canada.

⁴ A shift in understanding threats to Canada has been evolving in response to the concept of hybrid warfare and grey zone operations. The Canadian Armed Forces have traditionally dealt with conventional military threats, yet this is changing as new capabilities are developed and implemented (e.g. active and defensive cyber operations, chemical, biological, radiological and nuclear response capabilities) and liaison with other government departments increases. An example of this shift internally is a new doctrinal manual that addresses threats across all domains. See Department of National Defence Canada, 'Draft Pan-Domain Force Employment Concept', 2021.

This raises important questions about the evolving nature of critical infrastructure in Canada. *How is it designated? How is it protected? Who provides the protection and what, if any, independent oversight goes into auditing the management of this protection?* These questions are tremendously important and the discussions are equally so. Critical infrastructure disruption or loss costs billions to remedy and erodes public faith in authorities. Whether the loss or disruption is due to human error, neglect or system failure the types of questions are comparable. *Who is to blame? Who is accountable? What needs to improve?* Less honest questions typically follow outside the scrutiny of public institutions. These questions serve corporate interests or political motives and typically invoke themes of risk reduction, media exposure, shareholder confidence and the optics of public response.

Canada's Arctic and Northern regions present a convergence zone for these themes. Climate change is opening previously closed waterways, including the Northwest Passage. At the same time, economic activity and natural resources development, coupled with a younger demographic, have led to population growth in all three of Canada's territories. There is added pressure on legacy food and healthcare distribution structures as the population grows. Residents also rely on high-speed internet connections for day-to-day activities and education. These and other factors have fundamentally changed the notion of what infrastructure is deemed to be 'critical.'

The title of this paper refers to the useful metaphor of a black swan. A black swan describes an unexpected event that catches many people by surprise, but which is then rationalized with the benefit of hindsight and the ability to research backwards, easily identifying the totality of contributing factors. The term was popularized by author Nassim Nicholas Taleb, who wrote a book of the same title in 2001, arguing that

catastrophic, rare, and hard-to-predict events throw off our understanding of risk, cause biases and affect our decision-making when, in reality, they are outliers. The current policy framework to secure Canada's critical infrastructure is based on this irrational premise – that federal and territorial governments have prioritized preparation for the *worst* at the expense of the most *likely*. In Canada's Arctic and Northern regions, the remoteness and interconnectedness of critical infrastructure, and the communities it supports, make this situation all the more precarious.

Canada must protect its critical infrastructure as an essential part of maintaining its national security and its claim to sovereignty. However, traditional approaches to these themes limit the scope of analysis in a globalized world with increasing access to the Arctic and Northern regions. This narrowed scope reduces the concept of defence and security of critical infrastructure to physical sites, defence technology, materiel, and communications systems. This rudimentary concept of security cannot guarantee Canadian sovereignty in the modern era. While this view of security may succeed in monitoring Canada's territorial frontiers, it does not address the increasing threats from non-state actors or activities below the threshold of conflict. Conventional security models will never create a national space that is impenetrable to Canada's adversaries, who aptly target our susceptibilities, with increasing effectiveness, through technological advancement. An evolved paradigm is necessary. Sovereignty, at its fundamental core, is an expression of the will of the people to be governed by the nation-state. Further, providing security to a sovereign group requires more than physical infrastructure and technology alone in order to be resilient and maintain the confidence of those under protection.

This paper argues that meeting the future sovereignty and security needs of Canada's Arctic and Northern Regions requires a new approach to understanding critical infrastructure. This research further contends that modernizing this approach is best achieved by considering critical infrastructure through a human security paradigm. Lastly, that this evolution must also consider critical infrastructure governance. This analysis is divided into four chapters, each describing an element of the research and overarching argument. It proceeds as follows: the first chapter provides a brief history to contextualize Canada's Arctic and northern regions in the contemporary period and explains the specialized language used in this document. This opening chapter discusses exploration, settlement, conflict, trade and globalization in the region to provide a better understanding of extant grievances and challenges in the region that affect national strategies including security policy.

The second chapter introduces the theory of human security as a multifaceted approach to understanding vulnerabilities as being deeply interrelated. Traditional concepts of physical security are contrasted with emergent problems that undermine Arctic security but fall outside the normal security dialogue. The chapter closes by exploring the links between human security, sovereignty and the legitimacy of state institutions as a social construct resulting from protecting citizens and improving their well-being.

Chapter Three explains what is meant by the term critical infrastructure and breaks the terms *critical* and *infrastructure* apart with particular consideration for Canada's North. It will address important questions: *What constitutes infrastructure, and what makes it critical? To whom is it critical?* The chapter lists Canada's ten critical infrastructure sectors and provides a brief overview of five sectors in a Northern context

that will be used to compare conventional and human security approaches to understanding critical infrastructure.

Chapter Four presents and compares the concepts of threats, vulnerabilities and risk management. It first describes the historical tendency to focus on physical security and a brief overview of the future security environment expected in the North. It then explores the idea of threats and vulnerabilities to critical infrastructure in the North using three scenarios to compare conventional and human security approaches. Five specific critical infrastructure sectors are used in the comparison. This chapter draws together the previous three and establishes the value of the human security model as a more evolved and forward-thinking means to classify critical infrastructure and its security. The consequence of avoiding employing a human security approach to improving critical infrastructure governance in the context of these scenarios is also discussed before transitioning to a conclusion.

CHAPTER 1: UNDERSTANDING CANADA'S ARCTIC

This chapter provides a brief history of what is referred to as the Canadian Arctic or simply the North in contemporary dialogue. Ancestral populations have lived in this area for centuries in both nomadic and permanent habitations. While the scope of this paper focuses attention on the Arctic and Northern regions in the present and future security environment, there are historical elements to provide necessary context. A brief description of a few essential terms and themes is required to allow the reader to appreciate the geography and remoteness of the Arctic region and the devastating effects of climate change on residents of Northern Canada. Defining these terms clarifies the disproportionate impacts caused by instability or disruption to northern communities, in the materiel and demographic sense, and in rural and urban situations in the North.

Canadian Arctic and Northern Regions

Canada's Arctic is a broad label that aims to define an immense and culturally and linguistically diverse region by its shared geography, common political concerns, and the remoteness of its communities. There is no single definition of the Arctic. The region is geographically immense—it represents over a third of the entire Canadian landmass and half of its coastline—but it is categorically different from southern Canada in almost every metric: social demographics, economic drivers and employment opportunities, education levels, languages and cultures, and health indicators. Of the three territories, only Yukon has political parties, whereas the Northwest Territories and Nunavut govern by consensus— an idea that would seem unworkable in the rest of the country, and

speaks to the appeal of community-centric governance.⁵ The majority of the population in Nunavut and the Northwest Territories is Indigenous, as is a quarter of the Yukon.⁶ These demographic differences are central to a relationship with the federal government that has never resembled that of the ten provinces. Census data indicate the Arctic is also growing in population and economic output, adding increased pressure on housing, healthcare and transportation, which are already severely limited. For the purposes of this paper, as it is focused on discussing critical infrastructure and the roles and responsibilities of the various levels of government, the term Arctic will be aligned with that of the Canadian federal government, most recently published in a Senate Report⁷, and taken to include Yukon, the Northwest Territories, Nunavut, along with the Nunavik and Nunatsiavut areas of Quebec and Labrador. These areas are identified in Figure 1.1 on the following page.

⁵ An interesting and descriptive overview of the consensus government format is provided in Tim Mercer, *Consensus Government in the Northwest Territories: Westminster with a Northern "Twist"*, Studies of Provincial and Territorial Legislatures (Ottawa: Canadian Study of Parliament Group, 2015).

⁶ Demographic statistics are as follows: 86 percent in Nunavut; 51 percent in the Northwest Territories; 23 percent in Yukon, according to Statistics Canada. 2022. *Census Program Data Viewer. Census of Population*. Statistics Canada Catalogue number 98-507-X2021001. Ottawa. Released February 9, 2022.

⁷ Canada, Special Senate Committee on the Arctic, *Northern Lights: A Wake-Up Call for the Future of Canada*, June 2019.



Figure 1.1 – Map of Canada's Arctic and Northern Regions

Source: Senate of Canada, *Northern Lights: A Wake-Up Call for the Future of Canada*⁸

Near-Arctic Littorals

In addition to the area in Figure 1.1 above, this research also includes remote regions and communities along Canada's coastlines. They share similar risks of isolation and impediments to access, coastal erosion, fragile ecosystems, and dilapidated infrastructure that jeopardizes the overall resilience in the area. In contrast to the Arctic and Northern Regions, most of these near-Arctic coastal regions are in demographic and economic decline, resulting in less political or societal prominence and undermining the likelihood of infrastructure improvements in the future. Figure 1.2 below illustrates the regions of Newfoundland and

⁸ This map appears on page 17 of the Senate report titled *Northern Lights: A Wake-Up Call for the Future of Canada*, and is therefore cited as such for brevity. In the actual report however, the map is cited as being created from a compilation of public and academic sources.

Labrador identified as the near-Arctic littorals. There are two ferries, one continuous and one seasonal, connecting Labrador to Newfoundland. Labrador also has a significant Indigenous population. Its main urban and industrial center is Happy Valley-Goose Bay.



Figure 1.2 – Labrador Region
Source: Elections Canada, (2022)

The Northwest Passage

The Northwest Passage (NWP) is a transit corridor through Canada's Arctic Archipelago identified in the late nineteenth century. It has been inaccessible for

much of the twentieth century due to thick layers of multi-year ice⁹ and few logistical support locations along the route. However, increasing ambient temperatures caused by climate change have reduced these ice volumes, increasing the overall accessibility in the area. In the polar region generally, the coverage of multi-year ice at least five years old declined 90 percent between 1979 and 20018.¹⁰ Further, changing economic conditions have increased interest in the region's natural resources, amplifying the attention in the area, most notably by the United States, which shares access and rights in the Alaskan region and China which recently declared itself a near-Arctic nation. Both China and Russia see the enormous potential for time and fuel savings by transiting through polar area routes. The western section of the NWP beyond Resolute Bay is divided into two routes. The deeper northern route is accessible for less of the year. In contrast, the shallow southern route is unsuitable for ships with deeper draughts but accessible for a more extended period and is likely to draw pleasure craft and eco-tourism in the future as accessibility increases. The safety, security and environmental implications of this additional maritime traffic will be discussed in Chapter Four.

Permanent Frost (Permafrost)

Permafrost (a contraction of permanent frost) refers to the phenomenon of soil or rock, typically containing moisture, remaining at sub-zero temperatures for

⁹ Multi-year ice is created through annual freeze-thaw cycles, has less saltwater and air pockets, making it more difficult for icebreakers to transit and clear. Remote sensing capabilities are able to differentiate between first-year ice and generations of multi-year ice. See National Snow and Ice Data Center, *Multiyear Ice*, <https://nsidc.org/cryosphere/seaice/characteristics/multiyear.html>.

¹⁰ H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer, 'Summary for Policymakers — Special Report on the Ocean and Cryosphere in a Changing Climate', 2019, sec. A.1.4, <https://www.ipcc.ch/srocc/chapter/summary-for-policymakers/>.

two or more years. Where permafrost exists, it is classified by the amount of time the ambient temperature remains below freezing. Monitoring and studying permafrost in Canada's Arctic is of vital importance to both existing structures and future civil engineering projects as it affects public safety in the near term and the long term life-cycle planning for infrastructure. Satellite-based remote sensing cannot accurately detect permafrost, only the ambient air, complicating monitoring and forecasting, but compelling data indicates a trending loss of permafrost area as a result of warming atmospheric temperatures.¹¹

Remote Sensing

Remote sensing is a technical process of 'detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance (typically from [a] satellite or aircraft).'¹² Multi-spectral and hyper-spectral imagery¹³ includes that which extends outside the visible range for human sight. Remote sensing may also refer to a community of practice where the data collected is analyzed to provide material to support decision-making. Examples include: tracking the size and burn rates of forest fires, determining the extent of sea ice area coverage, measuring ocean temperature, and collecting digital

¹¹ Andrew G. Slater and David M. Lawrence, 'Diagnosing Present and Future Permafrost from Climate Models', *Journal of Climate* 26, no. 15 (1 August 2013): 5608–23, <https://doi.org/10.1175/JCLI-D-12-00341.1>; W E Sladen, Geological Survey of Canada, 'Permafrost', 2011, <https://doi.org/10.4095/288000>; National Snow and Ice Data Center, *Permafrost and Frozen Ground*, <https://nsidc.org/cryosphere/sotc/permafrost.html>.

¹² 'What Is Remote Sensing and What Is It Used for? | U.S. Geological Survey', accessed 14 April 2022, <https://www.usgs.gov/faqs/what-remote-sensing-and-what-it-used>.

¹³ A *multi-spectral* image is a collection of several images of an object taken by a sensor that captures different and specific wavelength bands. These separate images are then combined to form a multi-spectral image. *Hyper-spectral* imaging is similar to *multi-spectral* imaging but collects narrow and significantly more wavelength bands with much finer spectral resolution. The goal of both sensors is to discriminate, classify, identify and quantify materials present in the image. See Canada, Royal Canadian Air Force, *Royal Canadian Air Force Doctrine: Intelligence, Surveillance and Reconnaissance*, 2017, A-1.

photographic imagery. In the context of this research, it is important to note the reliance on satellite networks to both sense and transmit the collected data.

Remote Monitoring and Management (RMM)

Remote monitoring and management are conceptually similar to remote sensing, whereas the information is obtained at a distance and either returned or transmitted to the end-user. However, two key differences exist: first, in most situations, the data are sent continuously rather than being a singular snapshot; and second, this typically involves the ability to influence or ‘manage’ the system(s) under observation. RMM has grown aggressively over the past decade, primarily enabled by faster, more reliable, and accessible Internet connectivity. In popular parlance, this includes the Internet of Things, where any device with an Internet Protocol (IP) address can be figuratively connected to any other. It must be pointed out that RMM has shortfalls in selecting the frequency and source(s) of data being monitored and what two-way connections are desired since each need consumes additional precious bandwidth and may provide no discrete advantage. In northern Canada, the lack of reliable Internet connectivity has meant the panacea of remote monitoring is a series of disconnected and expensive technology requiring dedicated connections and frequent troubleshooting to provide value for the cost.¹⁴

Information and Communications Technology (ICT)

This is the term used by an Arctic Council Task Force report to capture the broad range of systems necessary to meet the needs in the region and provide redundancy, as “independent of bandwidth or technology, dependence upon a

¹⁴ Arctic Council Task Force on Telecommunications Infrastructure in the Arctic, ‘*Telecommunications Infrastructure in the Arctic: A Circumpolar Assessment*’ (Tromsø, 2017) 23-24.

single system or provider creates vulnerability for users.”¹⁵ High-bandwidth digital communication links are sparse in Canada’s northern territories. At certain higher latitudes this term may indicate line-of-sight radio or satellite mobile phones instead of fixed infrastructure. Smaller communities in the Arctic frequently have unreliable or prohibitively expensive broadband internet which is often the backbone for other ICT services. This underlying causes for this are “vast geographical distances between communities, a lack of infrastructure, and few service providers.”¹⁶ Consequently, these communities are at a disadvantage considering the seemingly limitless services being delivered virtually or digitally. Telephones and email have helped isolated families and communities connect. These links also improve the safety and security of the individual (i.e., emergency response, search and rescue localization) and have greatly enhanced the ability of citizens to access government services.

¹⁵ See Arctic Council Task Force on Telecommunications Infrastructure in the Arctic.

¹⁶ Arctic Council Task Force on Telecommunications Infrastructure in the Arctic, 10.

Contemporary Western Development in the Arctic

Before discussing human security and critical infrastructure in greater depth, it is worth presenting some background on exploration and development in Canada's North. While the modern history of Canada's Arctic predates Canada as a nation-state, in keeping with the scope of this paper, the focus is predominantly in the contemporary period from the early twentieth century to the present. Our understanding of history in Canada's Arctic and Northern Regions is still evolving. Indigenous histories, much of it passed orally, date back centuries while the historical accounts of European settlers and explorers have indisputably benefited from recorded accounts, texts and reprinting which unfairly biases these interpretations as being more accurate. This contrast in what accounts are respected and trusted is a recurring theme in this research.

The Dorset were the first significant population in the region predating the Canadian Arctic.¹⁷ Their migration and expansion through the Arctic, including Greenland, occurred in waves connected to population growth and decline. During this period there is evidence of long-distance trade between Dorset communities across the Arctic and likely interactions with European Norse populations and eventual expansion into present-day Labrador.¹⁸ The Dorset existed in isolated communities of only a handful of houses. This history clearly indicates the presence of long-established settlements, codependent communities, hunting practices, subsistence fishing, and trading routes. Such interdependencies were critical to the successful functioning and survival of the Dorset communities and their successor

¹⁷ Jared M. Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Viking, 2005), 256.

¹⁸ Diamond, *Collapse*.

Inuit populations. Although the term *infrastructure* may seem grossly exaggerated in this context, it is temporally appropriate to consider its use in conceptual sense of the word as an arrangement that supports from within.¹⁹

The growth of the Inuit population led to it succeeding the Dorset approximately one thousand years ago after migrating east from the Bering Strait region between Alaska and Russia.²⁰ Dog sled transportation and improved whale hunting techniques improved survival and much larger settlements. Atmospheric warming during this period also opened new waterway transit routes enabling Inuit settlement in Greenland. The Inuit were distinctively successful in community survival following migration to a new area: “Unlike the Norse, the Inuit represented the climax of thousands of years of cultural developments by Arctic people learning to master Arctic conditions.”²¹ The Inuit used whale and seal fats to provide heat and light, and stretched seal skins over frames to build kayaks and boats used for hunting. Conversely, the Norse had difficulty adapting technology that relied on an abundance of wood for construction and fuel. The sophistication of Inuit hunting, at sea and on land, remains a core part of their identity and this knowledge is passed between generations. Food security in the North is discussed in later chapters, but it is important to note that modern Inuit access to country food (e.g. walrus, seal, caribou, bear, fox, duck, goose, and fish) relies not only on the stability of the

¹⁹ Kevin Quigley, Ben Bisset, and Bryan Mills, *Too Critical to Fail: How Canada Manages Threats to Critical Infrastructure* (Montreal ; Kingston ; London ; Chicago: McGill-Queen’s University Press, 2017), 8.

²⁰ Diamond, *Collapse*, 257.

²¹ Diamond, 258.

natural environment but the relationships and practices that allow traditional knowledge to be passed down between generations.

Recorded history of European exploration is limited between the tenth and late-nineteenth centuries beginning with a small demographic of permanent Viking settlers migrating from present day Iceland and Norway in the tenth century. These settlements survived until the early 1400s when contact with European empires was lost and subsequent exploration found no survivors.²² That the Viking communities ultimately perished in what is now Greenland, a consequence of the harsh climate on subsistence farming and impenetrable ice denying resupply, is indicative of the enduring complications and unforgiving nature of the Arctic. The extremely short seasons when sea ice was passable prevented any major exploratory activity or the establishment of settlements to gain a foothold on the continent. Still, during the following three centuries European monarchies remained aggressive in backing exploration because the notion of a Northwest Passage that would reduce the distance between Europe and Asia was too valuable to ignore.²³

Another wave of European exploration began in the mid-nineteenth century with improved ship design and navigation methods. This wave ultimately fared more successfully than past attempts at mitigating the risks of seasonal ice but still encountered problems. Among these was the British-led and ill-fated 1845 Franklin Expedition which had to abandon its two ships, HMS *Terror* and HMS *Erebus*, after they became stuck in the ice and unable to survive. History indicates this was

²² Diamond, 270.

²³ Charles Emmerson, *The Future History of the Arctic* (New York: Public Affairs, 2010), 6–8.

due in part to Imperial European arrogance and reluctance to learn from Inuit practices on land and during navigation at sea. All 138 members died.²⁴

In 1906, nearly forty years into the idea of a Canadian Dominion, the Norwegian expedition of Roald Amundsen finally succeeded in navigating the Northwest Passage. The expedition took three years, remaining for two years on the eastern shore of King William Island learning arctic survival skills from the Netsilingmuit Inuit²⁵ inhabitants and collecting survey data. This marked a turn in European interaction with the Inuit to a more peaceful and cooperative relationship.²⁶ The importance of Indigenous support to the majority of these expeditions underscores a history of unconscious misrepresentation of how independent European-led Arctic exploration truly was. “The European explorers and settlers who succeeded best in the Arctic were those most extensively adopting Inuit ways, like Robert Peary and Roald Amundsen.”²⁷ Of the themes in this essay, it is worth highlighting the sovereignty of what is present-day Canada has *always* relied heavily upon the willingness of the Indigenous population.

Unlike the transit of the Northwest Passage, and perhaps only for legend and distinction, a US expedition led by Robert Peary and Matthew Henson reached the North Pole in April 1909.²⁸ Noteworthy in this effort is the seldom mentioned support of the scores of Inuit that crewed and guided their ship *Roosevelt* and the

²⁴ Adriana Craciun, ‘Of Shipwrecks & Sovereignty; Inuit Claims to Franklin Shipwrecks and Surrounding Waters Challenge Long-Held Narratives about the Arctic’, *The Ottawa Citizen*, 15 July 2017.; Diamond, *Collapse*, 275.

²⁵ Inuit group predominantly located west of the Hudson Bay.

²⁶ Richard R. Vondrak, ‘Amundsen’s Difficult Search for the Elusive North Magnetic Pole during His Voyage to the North West Passage’, *Terrae Incognitae* 50, no. 2 (3 July 2018): 147.

²⁷ Diamond, *Collapse*, 275.

²⁸ Emmerson, *The Future History of the Arctic*, 81, 82.

small team of four that transported Peary and Henson from their ship to the North Pole by dogsled.²⁹ For centuries the prospect of more efficient, and therefore profitable, trade routes has driven exploration. Indigenous people were sought as guides to facilitate these expeditions and in some cases reciprocal trade was mutually beneficial. This relationship, however, is one steered for the benefit of European expansion. Indigenous Peoples have had little say in how their land has been explored, surveyed, and settled by settlers over the centuries. From the origins of Western-led exploration, the Indigenous population has been vital to appreciating the risks of working in the Arctic and ensuring the survival of those who listen.

It is perhaps then fitting to end this section with a recent—but historically related—case of distinctly *Canadian* hubris. In 2014, a Parks Canada remotely operated vehicle located the wreck of one of the Franklin Expedition’s two ships, *HMS Erebus*, abandoned during the voyage after becoming locked in ice. Reflections on explorer history play well to the public and the federal government at the time had no objections to drawing on the find as a point of national pride, despite the fact that a nascent Canadian dominion was generally uninvolved. Then-Prime Minister Stephen Harper’s claim the expedition “laid the foundations of Canada’s Arctic sovereignty”³⁰ was political hyperbole when considering the

²⁹ Donald Baxter MacMillan, *How Peary Reached the Pole: The Personal Story of His Assistant* (Montréal: McGill-Queen’s University Press, 2008), 174–78.

³⁰ See “*PM announces HMS Erebus as the discovered Franklin Expedition ship*” <https://www.canada.ca/en/news/archive/2014/10/pm-announces-hms-erebus-as-discovered-franklin-expedition-ship.html>

century-and-a-half that had passed since Franklin's death and completely ignored the history and consequence of Indigenous history in the region.

This next section describes relevant history in the Canadian Arctic from the early twentieth century to the present. At the turn of the century, Canadian interests and activities in the region were survey and mapping-related.³¹ The conditions were too austere for a permanent Western presence. Icelandic-Canadian-American Explorer Vilhjalmur Stefansson increased the prominence of the region as the new frontier, challenging the "traditional view of Arctic marginality" and "the notion of an unbreakable link between latitude and civilization as unsubstantiated, unscientific, and unimaginative."³² In fact, Stefansson is regarded as one of the first settler Canadians to abandon the romanticized explorer image in favour of a strategically important Arctic that would someday be "humming with human activity and economic development."³³ Stefansson pressured both the Canadian and American governments to establish national interests further north. His work led him to provide regular advice to the United States in the late-1940s as it pivoted to the Cold War threat of potential Russian activity in the polar region. Canada was of course involved, but many of the defence priorities in the region overall were guided by the United States government with Canada deferentially supporting them.³⁴ By this point, Ottawa has also distanced itself from Stefansson after a

³¹ Emmerson, *The Future History of the Arctic*, 7.

³² Emmerson, 8.

³³ Emmerson, 14.

³⁴ Charles F. Doran et al., eds., *Canada and the United States: Enduring Friendship, Persistent Stress* (Englewood Cliffs, N.J: Prentice-Hall, 1985), 182, 197, 201-202.

misguided attempt to colonize a remote island resulted in a relief mission necessary to guarantee the survival of the group.³⁵

At the outset of the Cold War, Canada's national commitment to supporting the Western structure led by the United States could not be overstated.

Policymaking, research and development within the military branches firmly supported the North American Aerospace Defence Command (NORAD) mandate. Canada developed its own long-range interceptor in the CF-105 Avro Arrow with specifications designed for operations over the Arctic. It also built scores of radar sites and a northern base to safeguard the continent: the Distant Early Warning (DEW) Line, the Pine-Tree Line, the Mid-Canada Line, and Canadian Forces Station Alert. Forward Operating Locations (FOLs) were built to enable the forward deployment of interceptors, thus reducing the time between initial detection to a physical interception and keeping the conduct of that activity in international airspace. The second-strike capability of nuclear powers drastically changed the calculus of deterrence and consequently reduced the importance of building new physical infrastructure in the Arctic region. Aircraft could travel further without refueling on the ground. Nuclear submarines could remain submerged indefinitely. Strategic assets (read nuclear-capable or equipped) were less reliant on Arctic infrastructure. In many cases this freed up infrastructure in smaller Northern communities to become dual-use in purpose.

These massive projects to protect North American infrastructure became critical infrastructure in their own right. In doing so it normalized the expansion of

³⁵ Emmerson, *The Future History of the Arctic*, 21.

large-scale infrastructure northwards in ways prophesized by Stefansson. Some elements remain part of Canada's contemporary defence infrastructure. The North Warning System (NWS) was developed from the existing DEW Line infrastructure.³⁶ Canada's Arctic gives it strategic relevance and geographic importance, particularly with infrequent yet sustained advances by Russia near the Air Defence Identification Zone (ADIZ). What the preceding paragraphs illustrate is that development in the Arctic for security purposes can be characterized as sporadic, rushed when necessary and frequently without consultation of local populations. Hubert writes that "it becomes apparent that the Canadian Government has historically preferred to minimize its presence [in the Arctic]."³⁷ This lack of consultation is not only in regard to Indigenous populations but also settlers who have lived there for generations. An exception to this is the Canadian Rangers, a volunteer force of mostly Indigenous peoples from northern communities who contribute to Arctic security and sovereignty through their overall presence, and by passing information gathered through surveillance patrols throughout the area to regional and national headquarters of the Department of National Defence (DND).³⁸

The Arctic is shifting into the tighter focus of the Canadian government after consistently being ignored outside academic, natural resources and Indigenous rights circles. Contemporary work has drawn climate scientists continuously attempting to characterize the anthropological (i.e. human-made) impact on the

³⁶ Brian MacDonald, *Vimy Paper No. 2: Defence Requirements for Canada's Arctic* (Ottawa: Conference of Defence Associations Institute, 2007), 10.

³⁷ Rob Huebert, 'Renaissance in Canadian Arctic Security?', *Canadian Military Journal* 6, no. 4 (2005): 17.

³⁸ Huebert.

region and the consequences of melting glaciers. Adventure and ecological tourism marketing travel in remote austere locations have thrust arctic landscapes and lifestyles into day-to-day discussions through social media. Political scientists across a variety of fields share a common interest in the fact that Canada's Arctic and Northern regions are changing aggressively and impacting the socioeconomic makeup in a region that has remained largely unknown and ignored by the majority of Canadians over the past century.

More recently, exploitation in the Arctic has brought together a concerted effect among nations with economic interests, in some cases sharing legal and regulatory resources across borders to optimize the access to natural resources.³⁹ What will be described further in this paper is the degree to which this challenges human security at the community level. Decisions made in southern Canada continue to move wealth and self-government away from the local populations which have already had their autonomy eroded over decades of ceding power to government authority. When decisions about critical infrastructure are made in a parallel fashion it has the same effect: *about* the North, but *without* the North.

Hough writes:

In as clear an illustration as you could have of the misprioritization of political concerns that can occur with a traditional security perspective, whilst the national security dimensions of Arctic environmental change appear to have been greatly exaggerated, the human security impact of this on the region's indigenous people is only just coming to the attention of the world.⁴⁰

³⁹ Peter Hough et al., *International Security Studies: Theory and Practice* (Milton, UK, 2020), 408.

⁴⁰ *Ibid.*

The opening of multiyear Arctic sea ice, previously closed without the additional work of an ice breaker to clear pathways, is facilitating a globalizing effect in the North on both domestic and international axes. Previously inaccessible resources once locked under sea ice are “awakening the interests of governments and Multi-National Corporations (MNCs) from within the Arctic and beyond.”⁴¹ Greater connection between northern communities and southern, urbanized Canadians will increase the awareness of life in the north, presenting opportunities and consequences for the stability and traditional ways of life. A generally accepted understanding of Canada's north includes the landmass and waterways north of the 60 degrees latitude. However, many communities in Labrador, Northern Quebec, Northern Ontario, and the northern areas of the Prairie Provinces can undoubtedly share the characteristics identified in the concept of the north. In a similar vein, urban areas such as Whitehorse, Yellowknife, and to a lesser extent Iqaluit, have inherent resiliency, amenities and protections exceeding many smaller rural communities in southern Canada.

⁴¹ *Ibid.*

CHAPTER 2: HUMAN SECURITY THEORY

This section of the paper will present the concept of human security to provide the background necessary for further discussion. Later chapters will refer back to this concept while linking to the other themes in this research. As a foundation, the Copenhagen School of international relations theory evolved this concept and presented new ways of considering security beyond its traditional markers. This was articulated by Barry Buzan, Ole Wæver, and Jaap de Wilde who, in addition to the conventional political and military concepts, presented three new categories in which to consider security: economic, societal and environmental.⁴² Their arguments changed the dynamic of security discussions. However, shifting away from traditional military security fundamentals required an extension of the logic of how the latter three could be tangible threats to the state.

Lipschutz adds:

Military threats have been primary in the past because they emerged very swiftly and with a sense of outrage at unfair play; if defeated, a state would find itself laid bare to imposition of the conqueror's will. Such outcomes used to characterize the military sector. But, if the same overturning of the political order can be accomplished by economic or political methods, these, too, will constitute security problems.⁴³

As a modern term, human security is often traced back to the 1994 United Nations (UN) Human Development Report (HDR), which argued a fundamental change was necessary for the evolving post-Cold War era. The HDR proposed that:

The concept of security has for too long been interpreted narrowly: as security of territory from external aggression, or as protection of national interests in foreign policy or as global security from the threat of nuclear

⁴² Barry Buzan, Ole Wæver, and Jaap de Wilde, *Security: A New Framework for Analysis* (Boulder, Colo: Lynne Rienner Pub, 1998), 7–8.

⁴³ Ronnie D. Lipschutz, ed., *On Security*, New Directions in World Politics (New York: Columbia University Press, 1995), Chap. 3 who also quotes Barry Buzan, *People, States and Fear: An Agenda for Security Studies in the Post-Cold War Era* (Boulder: Lynne Rienner, 1991, 2nd ed.), p 117; and Egbert Jahn, Pierre Lemaitre and Ole Wæver, *European Security: Problems of Research on Non-Military Aspects* (Copenhagen: Copenhagen Papers of the Centre for Peace and Conflict Research, 1987), 9.

holocaust. Forgotten were the legitimate concerns of ordinary people who sought security in their daily lives.⁴⁴

The argument made by the human security school of thought is that security practitioners (government policy-makers; defence, security and civic organizations) must consider security as a concept more broadly than territorial defence or military deterrence.⁴⁵ The idea has gained endorsement from professional and academic communities who favour the analysis of conflict from human-centred causal factors rather than those centred on national interests. Human security has also faced criticism for lacking an accepted definition and being so broad that every problem can be analyzed as a human security problem without offering particularly evident solutions or identifying principal actors and relationships.⁴⁶

Canadian scholar Roland Paris articulated some of the frustrations encountered when the concept was first introduced. As an academic framework to examine conflict and security dilemmas, he wrote:

Existing definitions of human security tend to be extraordinarily expansive and vague, encompassing everything from physical security to psychological well-being, which provides policymakers with little guidance in prioritizing competing policy goals and academics little sense of what, exactly, is to be studied.⁴⁷

Principal among these critiques is that human security, by being too broad, may not be effective as a model for analysis in international relations and interstate security dialogue. However, the human security model could serve as a practical tool for comprehensively analyzing security vulnerabilities internal to a state. Hence, this paper seeks to describe

⁴⁴ United Nations Development Programme, Human Development Report, 1994 (New York: Oxford University Press, 1994), 22.

⁴⁵ Roland Paris, 'Human Security: Paradigm Shift or Hot Air?', *International Security* 26, no. 2 (October 2001): 87.

⁴⁶ Roland Paris, 88.

⁴⁷ Paris, 88.

the application of such a framework to safeguarding critical infrastructure from a multitude of threats and vulnerabilities.

The characteristics of human security also provide a suitable framework to analyze the social, economic, political, and security differences in Canada's Arctic and Northern regions. The unique conditions in the Arctic necessitate a narrowing of geographical scope to capture the significant impacts on the population accurately. This explains the area defined in the previous chapter and why the research has not looked at Canada as a whole. The next chapter explains critical infrastructure in greater depth and introduces characteristics this paper will link to human security.

The academic criticism highlighted in the previous section remains an obstacle to its adoption. Earlier versions of human security and related security concepts required a more structured arrangement to actually apply it in the practical sense. The UN Development Programme (UNDP) authors who developed the concept further categorized human security across seven domains: (1) economic security (e.g., freedom from poverty, fair wages); (2) food security (e.g., access to clean water, food, subsistence farming); (3) health security (e.g., access to treatment, medication, sanitation, protection from diseases); (4) environmental security (e.g., protection from pollutants, resource depletion, natural disasters, climate change impacts); (5) personal security (e.g., physical safety from such things as torture, war, crime, violence, robbery); (6) community security (e.g., security to maintain traditional cultures, ethnic group identity, protection from hate and prejudice); and lastly (7) political security (e.g., affording civil, political, associative

rights, and freedom from political oppression).⁴⁸ This list is comprehensive and seemingly captures every aspect of human interaction with other humans and with the nation-state, resulting in questions of its overall utility. If everything is a human security problem then what distinction does it provide? Arguably, applying this analytical concept specifically to critical infrastructure is possible because the importance and centrality to our quality of life and sustainable human development is responsible for establishing its *criticality*.

Human security is also conceptually linked to sovereignty, particularly outside the strict interpretation of the term that implies territorial or frontier defence and security. A later section of this paper will discuss the concept of sovereignty in greater depth. However, it is worth highlighting that these links have been fundamental to the evolution of human security as an idea. On this point, former Canadian Foreign Affairs Minister Lloyd Axworthy, a long-standing proponent of including human security in official government policy, offered that in addition to physical security, an evolved model should consist of qualitative concepts such as human rights protection, individual and collective quality of life, the rule of law, legitimate governance, social equity, and sustainable development.⁴⁹ Indeed, these concepts are at the core of sovereignty as a government's responsibility to its citizens and they are fundamental to maintaining its legitimacy. States aspiring to improve human rights and the other indicators listed above may do so through

⁴⁸ List adapted from the following sources: UNDP, ed., *Human Development Report 1994* (New York: Oxford Univ. Press, 1994), 24–25; Lloyd Axworthy, 'Human Security and Global Governance: Putting People First', *Global Governance* 7, no. 1 (2001): 20–21; George MacLean, 'Instituting and Projecting Human Security: A Canadian Perspective', *Australian Journal of International Affairs* 54, no. 3 (November 2000): 271–74; Paris, 'Human Security', 90–91; Joseph S. Nye and David A. Welch, *Understanding Global Conflict and Cooperation: An Introduction to Theory and History*, 9th ed (Upper Saddle River, N.J.: Pearson, 2013), 256–59.

⁴⁹ Lloyd Axworthy, 'Canada and Human Security: The Need for Leadership', *International Journal* 52, no. 2 (1997): 184.

a number of methods that extend beyond a traditional understanding of security—for example, changes in health policies, targeted energy investments, and renewed governance. The resultant outcomes are also linked to the particular domain(s) of a wider human security concept. If citizens feel these outcomes improve their well-being and increase their faith in public institutions, or as the Canadian Charter of Rights and Freedoms states, “life, liberty, and security of the person,”⁵⁰ then broadening the scope of security reinforces national sovereignty as the will of the people to be governed. In other words, there is a convergence between the theories of human security, how citizens interpret the legitimacy of government activities, and fundamental concepts of sovereignty.

As mentioned above, the primary criticism of human security is that, as a concept to analyze security problems, it is too broad. This criticism has arguably been resolved in the past three decades since its exposure. The concept has gained merit as unsuccessful interventions in Libya, Iraq, and Afghanistan have all been criticized for failing to fully understand the comprehensive nature of building durable peace.⁵¹ In its infancy as a concept, human security attracted multiple attempts to further subdivide categorize actors, roles and relationships within security’s broader understanding. These efforts ultimately led to the seven domains listed above from the UN’s benchmark report. However, it is not always clear in which domain a specific security gap belongs. For example, if a farmer who produces crops for both family subsistence and income generation loses a planting

⁵⁰ Constitution Act, Part I, Section 7, Canadian Charter of Rights and Freedoms, (1982).

⁵¹ The term *comprehensive* is similarly used to describe the broad consideration for the interdependencies that must be considered in peace and stability operations, and occasionally within civil-military cooperation (CIMIC). This term ‘JIMP’ (joint, inter-agency, multinational, public) was previously used in some Canadian organizations. A good resource on this concept from Canadian and international perspectives is Dave Woycheshin, et al. (eds.), *The Comprehensive Approach to Operations: International Perspectives*, (Kingston: Canadian Defence Academy), 2013.

season due to flooding, which is widely considered an effect of climate change, is this to be considered an impact on food security, economic security, or economic security or environmental security? One could ask whether specifically categorizing the security erosion matters so long as the nature and root of the *insecurity* has been identified and considered, irrespective of an imprecise quantification. The fact that all domains of human security appear to overlap has also been accepted as an advantage which reinforces its credibility as an effective model.

Changing the approach to understanding security presents its own difficulties when trying to specifically categorize elements (e.g. actors, functions, relationships) according to one of the specific seven domains. Their role as categories should rather serve to identify trends in the relationships between domains or causal factors that improve or diminish security relative to other variables. Other variables could include power structures, decision making and the state (e.g. government priorities, urban planning, and policing activities). For the same reason, it would be irrational, or simply inefficient, to assess security variables when not also considering human inputs and the resulting outcomes. As a practical illustration, examining the human security impacts of receding ice in Northern Canada on Indigenous ice fishing practices would serve little benefit if the consequences of human activity, possible safety mitigations or alternative food sources were not concurrently discussed.

Inflexibility and friction in the applications of human security may arise from the entrenched bureaucracy that occasionally accompanies government policy-making, despite security policy often demanding a more agile decision-making process within smaller or less vertically collaborative groups. As an example of technocratic impositions, government policy-making might impose a requirement to identify and classify

insecurities so as to provide funding, expertise or effort from federal agencies or third-party organizations acting on their behalf (i.e., NGOs). This imposition serves to focus on a government process rather than governed populations as the referent object. The broad labels human security has applied contribute to these problems, and there seems to be little desire among academics to rein in the all-encompassing definition.⁵² Yet, beyond these relatively minor differences in labelling, for those who subscribe to the concept as a valid viewpoint for understanding security, there is vastly more agreement than disagreement that the seven domains listed above are suitable and appropriate. Successive Canadian governments have been proponents of furthering the human security approach within international bodies and with the assistance of some of our security allies, including Norway and the Netherlands. Canada has also delimited the definition of human security to align more with physical security threats to rights, safety and lives. Still, it has undoubtedly not rejected the holistic approach to the concept.⁵³ Marketing the legitimacy of human security has been a popular refrain for middle power states that lack strategic military capabilities but are also ideologically aligned in demilitarization, the threat or use of armed forces as a last resort and the primacy of diplomacy and multilateralism. The effect of this human security paradigm on the Canadian government's approach to securing critical infrastructure is discussed in later Chapters of this paper.

⁵² Paris, 'Human Security', 92.

⁵³ Michael Small, *Should Canada Revisit the Human Security Agenda?*, Occasional Paper, Canadian Global Affairs Institute, September 2016.

CHAPTER 3: WHAT IS CRITICAL INFRASTRUCTURE?

There are wide-ranging opinions on what physical sites and systems constitute critical infrastructure, and there is no globally agreed-upon definition. The term has different connotations for private enterprise, public institutions, and various levels of government. Academic research also further attempts to understand critical infrastructure in other contexts, such as the socioeconomic impacts of accessibility. Technical research may look at systems, interfaces, control and data within critical infrastructure. There is also a sense of an unseen or special meaning to the term as if the discussions of its criticality ought to be hidden from public discourse because of its special status. The language used in discussions is specialized and often forbidding due to sensitivities around intellectual property, controlled technology, and system vulnerabilities. Discussions regarding critical infrastructure frequently occur in public settings, but important decisions are made in closed settings for the reasons listed above.⁵⁴ This raises important questions regarding transparency and participation in determining what falls under the label of critical infrastructure and the protection it affords.

Quigley et al.⁵⁵ provide common-sense descriptions of the term as the “physical assets upon which we rely every day, but which we don’t always see” and illustrative examples that are universally familiar, including “transportation networks, water and food distribution systems, energy and utilities, and telecommunications and banking systems.”⁵⁶ Table 3.1 below lists the ten sectors considered critical infrastructure in

⁵⁴ Wendy Steele, Karen Hussey, and Stephen Dovers, ‘What’s Critical about Critical Infrastructure?’, *Urban Policy and Research* 35, no. 1 (2 January 2017): 74–86.

⁵⁵ Kevin Quigley is the scholarly director; Ben Bisset and Bryan Mills are research analysts, at the MacEachen Institute for Public Policy and Governance at Dalhousie University.

⁵⁶ Quigley, Bisset, and Mills, *Too Critical to Fail*.

Canada and compares these categories with four other comparable nations. There is a great degree of commonality across the four with the United States and the United Kingdom having additional sectors related to their defence industry and strategic nuclear deterrence.

Table 3.1 – Critical Infrastructure Sectors in Four Countries

<i>Canada</i>	<i>United States</i>	<i>United Kingdom</i>	<i>Australia</i>
Energy and utilities	Energy	Energy	Energy
Information and communication technology	Information technology	Communications	Communications
Finance	Financial services	Finance	Banking and finance
Health	Health care and public health	Health	Health
Food	Food and agriculture	Food	Food chain
Water	Water and waste water systems	Water	Water services
Transportation	Transportation systems	Transport	Transport
Safety	Defense industrial base	Defence	
Government	Government facilities	Government	
Manufacturing	Critical manufacturing	Space	
	Chemical	Chemicals	
	Nuclear reactors, materials and waste	Civil nuclear	
	Emergency services	Emergency Services	
	Commercial facilities		
	Communications		
	Dams		

Source: Quigley, Bisset and Mills, *Too Critical to Fail: How Canada Manages Threats to Critical Infrastructure*, 10.

Canada's federal government has two framework documents outlining its national critical infrastructure strategy: *The National Strategy for Critical Infrastructure* (2009, herein referred to as the *National Strategy*) and *The National Cross-Sector Forum 2021-2023 Action Plan for Critical Infrastructure* (2021, herein as the *Action Plan*). These two documents characterize critical infrastructure in similar terms. In the *National Strategy*, which is the first of its kind to be coordinated federally by Public Safety Canada, critical infrastructure is defined as referring to

processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government. Critical infrastructure can be stand-alone or interconnected and interdependent within and across provinces, territories and national borders. Disruptions of critical infrastructure could result in catastrophic loss of life and adverse economic effects.⁵⁷

A detailed review of these documents provides definitions and language still rooted in physical systems. This narrow scope makes it difficult to fully capture the second and third-order effects on these various critical systems caused by external impacts. You can only protect something if you understand from what it is being protected. Conversely, understanding the consequent effects on individuals and collectivities requires broadening the definition.

Descriptions from De Bruijne and Van Eeten, and Laporte, are even narrower in scope. They describe critical infrastructure as “large technical systems” existing as connected grids with an emphasis on their importance in “Western, urbanized societies” and likely to contain services that cannot be replaced or substituted, which also leads to

⁵⁷ Public Safety Canada, *National Strategy for Critical Infrastructure*, 2.

the trait of being a source of public anxiety should these services be interrupted or reduced in capacity.⁵⁸ Others have attempted to focus on the essence of its criticality as a defining characteristic discussed in the following section.

Theorizing the Criticality of Infrastructure: *Why is it Critical and to Whom?*

Thriving communities rely on various systems that would significantly reduce their ability to function if taken away. As a term, *critical infrastructure* carries a meaning that sounds as if it should be a field of engineering or a municipal agency. More commonplace have been terms used to convey the area impacted by its loss, for example, quality of life; health and well-being; banking and trade systems; safety or security systems; energy systems, etc. However, using such terms may have the opposite effect of that which is intended by blurring the lines of what infrastructure is truly critical over simply important or highly desired. Moreover, the federal government definition presented earlier is not as helpful as it could be in understanding differences in criticality between urban and rural environments.

Steele et al. describe an early nineteenth-century reductionist view of urban infrastructure that distinctly divided the planning and administrative management functions.⁵⁹ This had the consequence of well-intentioned long-term planning strategies that were incompatible with present-day regulatory models, resulting in excessive administering, change fatigue, and municipalities inhibited from optimal development.

⁵⁸ Mark de Bruijne and Michel van Eeten, 'Systems That Should Have Failed: Critical Infrastructure Protection in an Institutionally Fragmented Environment', *Journal of Contingencies and Crisis Management* 15, no. 1 (March 2007): 18–29; Todd R. La Porte, 'High Reliability Organizations: Unlikely, Demanding and At Risk', *Journal of Contingencies and Crisis Management* 4, no. 2 (June 1996): 60–71.

⁵⁹ Steele, Hussey, and Dovers, 'What's Critical about Critical Infrastructure?', 75.

The interpretation of the term critical infrastructure will depend on the lens through which one views which elements are essential for their day-to-day functioning. Entrepreneurs will bias toward supply chains and enablers of financial transactions. Police and security will prioritize the safe control of traffic routes and means to detect criminal activity. The medical community will, of course, look at hospital infrastructure, medical supplies and health care human resources as necessary parts of a functioning healthcare system. What makes it critical is not solely the impact of the loss but perhaps the means to return to reliable availability and the absence of a persistent threat or worry of loss—in other words, the concepts of fragility and insecurity. Terms like ‘single point of failure’ and ‘weak link in the chain’ have been used colloquially to impart the idea of critical infrastructure.

Northern urban environments are not immune to these problems either and have their own unique characteristics; the Northern environment is different. Impacts on critical infrastructure in the Arctic and Northern Regions are overwhelmingly outside the control of local populations and governance. Environmental threats in the form of climate change, black carbon deposits and other transboundary pollutants are the result of actions by those in southern parts of the country. Increased air and maritime traffic over and through Arctic airspace and waters contribute to the environmental impacts above but is also an effort to travel more efficiently and indicative of increasing shipping volumes as a consequence of globalization connecting centres of production and centres of wealth. Ecotourism continues to rise and is also gaining from the false narrative that to see the beauty and vastness of untouched land is to better appreciate it and protect it.

All of these threats are the result of activities in southern areas with little appreciation for the impact it has on northern communities. While they have the amenities

of city life—an inference that population size offers greater redundancy over a greater risk—their function is a balancing act between increased density, long supply chains and transportation links vulnerable to interruption. “The interdependent nature of critical urban infrastructure makes it more vulnerable to external impacts, leading to a domino effect amongst different assets and sectors, impacting people and places.”⁶⁰

Recalling the research questions in the introduction, the query of criticality to whom is recognized in the *National Strategy* as a “matter of relativity” and instead should be answered by the collectivity whose job it is to collaborate, identify the interdependencies and strengthen the resiliency of critical infrastructure.⁶¹ Scant on details, it holds enough ambiguity to be technically accurate but is nearly irrelevant.

Although there is a wider diversity of research available regarding urban infrastructure, certain attitudes towards the control of infrastructure remain equally applicable in a rural environment. The distribution of capital, networks, and access is increasingly affected in two ways: first, “through privatisation as a neoliberal response to [the] public interest; and [second] through securitisation in the name of the national interest.”⁶²

The progressive replacement of the “redistributive social role implied by public monopolies”⁶³ and the underlying commitment to universal provision with a liberal market model has (sic) left the more vulnerable members of Westernised society highly susceptible to any shifts in the provision of basic services such as water, energy, shelter and transport.⁶⁴

When critical infrastructure fails, much of the public denunciation and demand for increased accountability is directed at public institutions, including the government. It is

⁶⁰ Steele, Hussey, and Dovers, 75.

⁶¹ Public Safety Canada, *National Strategy for Critical Infrastructure*, 4.

⁶² Steele, Hussey, and Dovers, ‘What’s Critical about Critical Infrastructure?’, 76.

⁶³ P. Little, Changing utilities. *Utilities weekly*, 16 October 1995, p. 9. (as cited in Steel et al.)

⁶⁴ Steele, Hussey, and Dovers, ‘What’s Critical about Critical Infrastructure?’, 77.

true the regulatory and watchdog functions of critical infrastructure lay predominantly with public agencies, and the first round of questions in a public inquiry ought to include government respondents. However, the National Strategy is explicit in naming critical infrastructure owners and operators not only as a core stakeholders but as "bear[ing] the primary responsibility for protecting *their* assets and services (author's emphasis)."⁶⁵

Critical Infrastructure in Canada's Arctic and Northern Regions

The first chapter of this research established the history and unique conditions in Canada's Northern regions. Having provided an introductory overview on the principle of critical infrastructure earlier in this chapter, this section will briefly discuss five critical infrastructure areas in Canada's Arctic and pertinent to the region's future security. These are: energy and utilities; information technology and communication; health; food; and public safety. These five critical infrastructure areas will be used to compare traditional and human security approaches in the latter part of Chapter Four. Each sub-section will describe the scope of the critical infrastructure area, and why the critical infrastructure sector is more tenuous in Northern Canada and offer ideas on where the scope might need to be widened to improve its protection.

Energy and Utilities Infrastructure

Energy infrastructure includes the systems, technology, and management to generate, distribute, and safeguard sources of electricity, steam heating, heating oil and natural gas. Utilities infrastructure is not well defined and could include subsidized housing, sewage treatment, storm water, electricity and energy distribution in Northern Canada is faced with long distances to cover with systems ideally suited to warmer

⁶⁵ Public Safety Canada, *National Strategy for Critical Infrastructure*.

climates. Extreme weather poses risks of mechanical breakdown and interrupted resupply. Many communities obtain their heating oil, diesel and gasoline for vehicles once or twice annually by barge during the summer months, which can cause price shocks based on the geopolitical climate⁶⁶. Many communities produce electricity locally by diesel generators which are costly to maintain and require specialist skills in both engine mechanics and industrial-scale electricity distribution. For example, the Qulliq Energy Corporation in Nunavut, a single entity, provides all the electricity in the territory.⁶⁷ Consider the impacts of a computer virus or remote monitoring and management system on the inability to control these systems or prevent their damage.

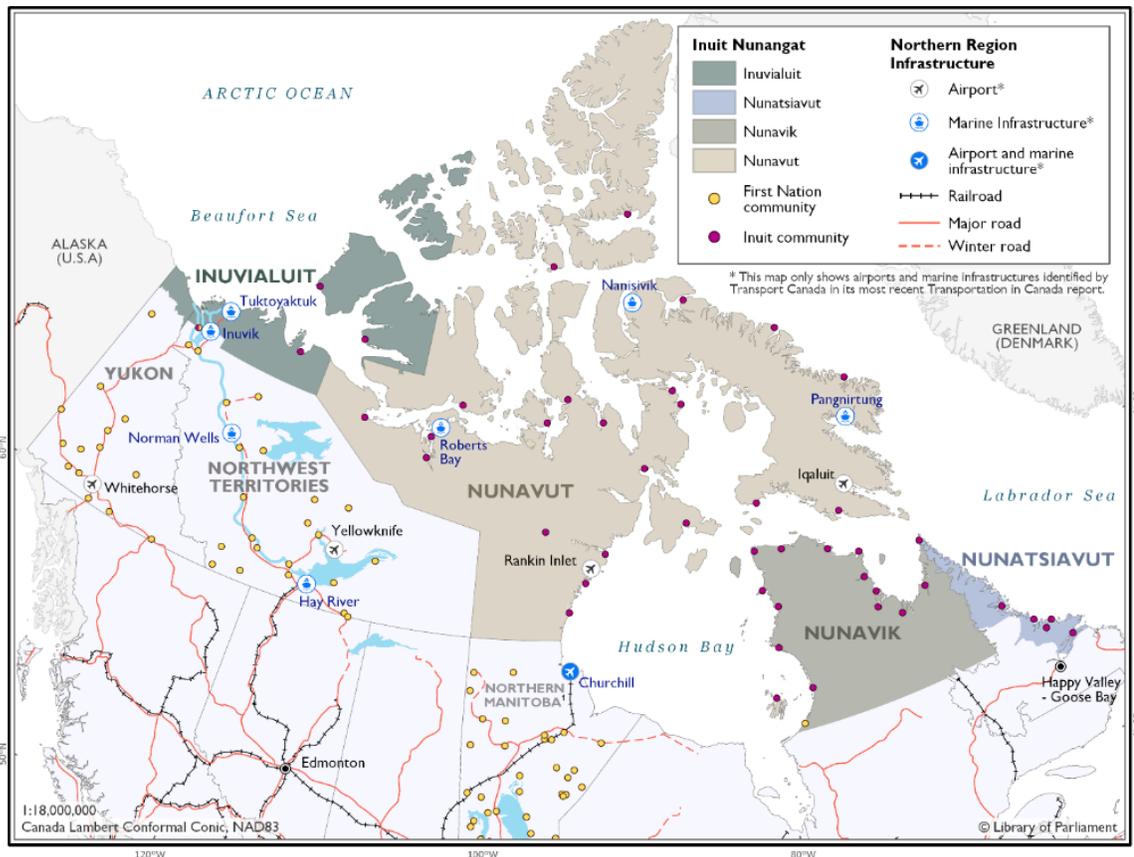
The harsh environment and isolation from alternate energy sources also compound these risks of interruption. Diesel fuel contamination or fuel shortages due to delays in shipping would result in electricity rationing and, in the worst cases, the interruption of critical services such as healthcare, policing and government functions. These methods also produce excess pollution compared to the variety of energy sources in southern Canada. Particulate soot landing on snow, even in trace amounts, accumulates over time and reduces the reflectivity of the snow, increasing the ambient temperature, which melts more snow and ice.

Fuel distribution for aviation purposes is also an important necessity. Many towns are only accessible by air, and the interruption to aviation fuel supplies would impact supply chains, medical evacuation, government services and ultimately community well-being. The great distances between communities and the rationalization of transportation

⁶⁶ Fuel is federally subsidized in some circumstances. However, in many cases there is a requirement to absorb the increased cost at the end-user level.

⁶⁷ Canada, Special Senate Committee on the Arctic, 'Northern Lights: A Wake-Up Call for the Future of Canada', 47.

routes could not be clearer than as shown in Figure 3.1 below. The North must broaden its energy sources in order to mitigate risk through redundancies.



¹Crown-Indigenous Relations and Northern Affairs Canada does not use a standardized definition to determine the boundaries of "Northern Manitoba". As such, on this map, there are no clear boundaries for this region, but the location of First Nations communities was nonetheless included.

Figure 3.1 – Arctic and Northern Region Infrastructure

Source: Senate of Canada, *Northern Lights: A Wake-Up Call for the Future of Canada*

As a result of the environment, adequate housing could be considered within the scope of critical utility infrastructure. Northern Canada faces a deficit in available housing.⁶⁸ This has innumerable second-order effects in remote communities where multiple families live in a single-family dwelling, increasing the risk of respiratory

⁶⁸ National Round Table on the Environment and the Economy (Canada), ed., *True North: Adapting Infrastructure to Climate Change in Canada's North* (Ottawa: National Round Table on the Environment and the Economy, 2009), 51.

illnesses such as tuberculosis⁶⁹ and communicable skin conditions.⁷⁰ Various stakeholders offered to a special Senate committee that “a continuum of housing types is required in the Arctic and northern regions, including: new homes including home ownership and rentals, long-term care facilities for the elderly, transitional homes, shelters for victims of violence, and residential addictions treatment centres.”⁷¹ Housing needs are also impacted by heightened material and labour costs, seasonal constraints on construction, gaps in other complementary infrastructure, and climate change's impact on existing housing, which must be retroactively adapted to prevent damage due to permafrost.⁷²

Other important utilities such as wastewater collection and treatment and garbage collection can be interpreted as critical infrastructure in remote areas. While the volume to manage is small compared to a large urban city, the technology available to triage and render waste streams inert is not always accessible. Sewer pipes risk being damaged by shifting terrain as a result of permafrost.⁷³ Untreated sewage may result in illness or cross-contamination with traditional food sources. In some communities, garbage is still burned in situ, releasing toxins into the immediate area. There is a lack of waste disposal infrastructure or more importantly, foresight into the types of products and materials

⁶⁹ Nunatsiaq News, ‘Addressing Inuit Housing Shortage Will Be Key to Eliminating TB, Says Study’, *Nunatsiaq News* (blog), 18 April 2019, <https://nunatsiaq.com/stories/article/addressing-inuit-housing-shortage-will-be-key-to-eliminating-tb-says-study/>; C. B. C. News, ‘Stephen Lewis Calls on Ottawa to Step up as Nunavut Grapples with TB “crisis” | CBC News’, CBC, 11 September 2017, <https://www.cbc.ca/news/canada/north/stephen-lewis-nunavut-tb-crisis-1.4282651>.

⁷⁰ Watt-Cloutier, *The Right to Be Cold*, 56–57.

⁷¹ Canada, Special Senate Committee on the Arctic, 42, specifically noting submissions and interviews provide at note 86.

⁷² For example, in 2009 the cost of housing construction in Nunavut was five times higher than the national average; National Round Table on the Environment and the Economy (Canada), *True North: Adapting Infrastructure to Climate Change in Canada's North*, 33; see also Emmerson, *The Future History of the Arctic*, 151–52.

⁷³ Canada, Special Senate Committee on the Arctic, ‘Northern Lights: A Wake-Up Call for the Future of Canada’, 27.

brought to the North that could be more effectively disposed of with marginal impact on the environment.

Information and Telecommunications Infrastructure

A concise description of information and telecommunications infrastructure was provided in the first chapter. Canada, along with Arctic and circumpolar nations, has made strides to improve its information and telecommunications infrastructure despite the complex environment, large distances and lack of investment capital outside areas of population density. These changes are a result of two principal factors: the digital transformation of global economic activity and the demand for better connectivity to support individual and collective welfare (e.g. education, employment, research, safety). Regarding the second factor, governments of the Arctic Council came together in Iqaluit in 2015 to create a task force to examine telecommunications and its importance to northern communities.⁷⁴ The task force report highlighted the need for communities to build more resilient systems that do not rely on a single system, technology or service provider as it creates vulnerabilities which can be harmfully isolating.⁷⁵

Resource exploration and extraction have contributed to population growth in Northern Canada because its rise has brought employment, services and revenue remaining in the three territories. Improved socioeconomic outcomes result in a greater propensity for populations to remain in the region, especially for Indigenous populations

⁷⁴ See Arctic Council, *Iqaluit Declaration*, Article 13, 24 April 2015 which created the Task Force on Telecommunications Infrastructure in the Arctic (TFTIA).

⁷⁵ Arctic Council Task Force on Telecommunications Infrastructure in the Arctic (TFTIA), *Telecommunications infrastructure in the Arctic: a circumpolar assessment* (Tromsø: Arctic Council Secretariat, 2017), 10.

who prioritize proximity to family connections.⁷⁶ These factors have led to increased demand for information technology and connectivity in Northern communities which can “improve the delivery of public services, help preserve culture and language and enable economic diversification by connecting remote communities and the rest of the world.”⁷⁷ Figure 3.2 below illustrates the sparsity of wireless (mobile phone) and broadband connectivity in Northern Canada. In the most remote communities, the lack of service is largely a function of large distances and shortcomings in transmission technology.

⁷⁶ Kevin McMahon, ‘Arctic Blue with Peter Mansbridge’, Video (Toronto: Canadian Broadcasting Corporation, 2022); Caitlin Amborski and Erin Miller, ‘Social Hierarchy and Societal Roles among the Inuit People’ (University of Alaska Anchorage Alaska Medical Library, n.d.), 4.

⁷⁷ Canada, Special Senate Committee on the Arctic, ‘Northern Lights: A Wake-Up Call for the Future of Canada’, 45.

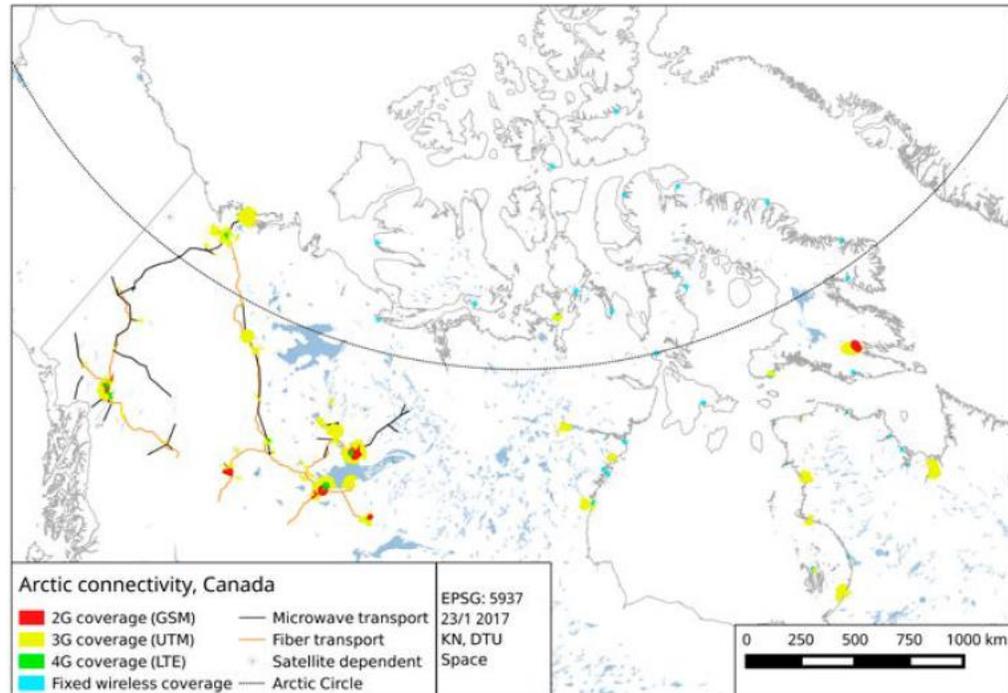


Figure 3.2 - Mobile, fibre and microwave transport coverage and satellite dependent areas in Canada

Source: Arctic Council, *Telecommunications infrastructure in the Arctic: a circumpolar assessment*.

Expanded connectivity in the most northern areas (i.e. above 80 degrees latitude) is also problematic due to the horizon of geostationary satellites optimized for users in southern Canada. Copper or fibre-optic connections in these regions are rare because of the significant distances and initial capital cost. In these regions, the primary communications method remains High Frequency (HF) or Very High Frequency (VHF) systems. These systems have very low bandwidth for digital data connectivity and are suited to voice communications or very limited data links (i.e. rudimentary text messaging would be possible). These systems are unsuitable for education, commerce or other needs expressed by the community and place them at a significant disadvantage

compared to Canadians in the southern part of the country who benefit from digitally provided services and e-commerce.⁷⁸

Future investment in telecommunications systems for the region is expected in the coming years. Increasing volumes of tourism and shipping traffic are expected as the Northwest Passage becomes free of ice in the summer months. Maritime traffic has become dependent on real-time communications data for a number of uses: charting and navigation information; crewmember amenities; and commercial operations updates.⁷⁹ The same can be said about local maritime traffic involved in the fishing industry in Canada's territories. In some cases, the availability of communications information is life and death. Where no cellular service exists, which is the case for many of the most northern communities, an assembled patchwork of radios and satellite links provide fragile connectivity to emergency responders.⁸⁰

It is also worth considering the role of communications technology in the search and rescue (SAR) mandate of the Canadian Armed Forces. Commercial air traffic transiting the circumpolar region is expected to grow 3.5 percent annually which equates to 400-500 additional flights.⁸¹ This will proportionally increase the chances, however remote, of an emergency in the airspace over the Canadian Arctic. In fact, multiple

⁷⁸ P. Whitney Lackenbauer, 'Canada's Northern Strategies: From Trudeau to Trudeau, 1970-2020', Documents on Canadian Arctic Sovereignty and Security (DCASS) (17: Calgary: Centre for Military, Security and Strategic Studies, 2020), 102-4.

⁷⁹ Arctic Council Task Force on Telecommunications Infrastructure in the Arctic, 'Telecommunications Infrastructure in the Arctic: A Circumpolar Assessment', 25-26.

⁸⁰ Lackenbauer, 'Canada's Northern Strategies: From Trudeau to Trudeau, 1970-2020', 63-65; Canada, Special Senate Committee on the Arctic, 'Northern Lights: A Wake-Up Call for the Future of Canada', 45; National Round Table on the Environment and the Economy (Canada), *True North: Adapting Infrastructure to Climate Change in Canada's North*, 103.

⁸¹ More recent papers and presentations from the Cross Polar Trans-East Air Traffic Management Providers' Working Group presentations can be obtained here: https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/mission_support/ato_intl/cross_polar.

iterations of Operation *NANOOK* have practiced responses to these types of scenarios, including an actual response following a fatal crash in Resolute, Nunavut during the summer of 2011.⁸² In an emergency requiring SAR asset coordination, broadband availability enables mission planning (e.g. weather, ice coverage, and maintenance) and operational coordination with command and control authorities, without having to adapt procedures.

Furthermore, SAR aircraft needing an internet connection to complete maintenance record-keeping prior to take-off authorization will encounter delays or require waivers from higher authorities.⁸³ This is illustrative of how systems and processes that rely on readily available broadband in southern Canada may be seriously impeded when operating in the North without having the necessary mitigations. The slow improvement to mobile phone coverage is promising for remote communities. Broadcast alerts over the network are another means of communicating urgent messages. Wireless towers can be used to triangulate the location of not only phones but increasingly other enabled devices such as vehicles or GPS tracking devices. In cases such as missing persons or overdue aircraft, this type of triangulation could save time in life and death situations.

Health Infrastructure

Health infrastructure is wide-ranging and can include hospitals, clinics, specialist care, ambulances, and aircraft-enabled medical evacuation (medevac) capability. It is also

⁸² See CBC News, 'Plane Crash near Resolute Bay Kills 12, 20 August 2011, <https://www.cbc.ca/news/canada/north/plane-crash-near-resolute-bay-kills-12-1.1021035>.

⁸³ See *CH147 Chinook* in K.E. Dubreuil, "Agile and Responsive? Is the Royal Canadian Air Force Contracting Out its Agility and Responsiveness through Outsourcing Supply Chain Management?", Joint Command and Staff Program Directed Research Project, Canadian Forces College, 2018), 69.

closely linked to other critical infrastructure areas such as utilities, telecommunications and manufacturing (i.e. supply chains). Food, water and public safety infrastructure can disproportionately impact the health sector in Northern Canada because of its isolation and lack of adaptive capacity; it is a whole-of-community concern. Health infrastructure in the Arctic, like other infrastructure sectors, is challenging to maintain and deliver. Remote communities, many of which are primarily Indigenous peoples, have challenges characterized in three ways.

First, there is a persistent deficit of human capital in trained medical personnel.⁸⁴ Consequently, high turnover results in reduced experience in training and familiarity with local populations.⁸⁵ Even student loan repayment is a contributing factor as the cost of living in Arctic communities is outside the affordability range of new nurses and physicians. Many patients must travel south to Ottawa to receive specialist care which normalizes the lower level of care in Northern communities.⁸⁶ The high turnover of personnel generates language barriers to the delivery of healthcare in the mother tongue of patients.⁸⁷

Secondly, the costs of delivering healthcare in the Arctic are exceptional compared to the rest of Canada. Like most services in the North, these costs are not unexpected but they do occasionally come at the expense of other services when budget

⁸⁴ Office of the Auditor General, 'Health Care Services - Nunavut (March 2017)', Reports to Northern Legislative Assemblies (Ottawa: Office of the Auditor General of Canada, 7 March 2017); Office of the Auditor General, 'Health Resources for Indigenous Communities (April 2021)', 2021 Reports of the Auditor General of Canada to the Parliament of Canada (Ottawa: Office of the Auditor General of Canada, 23 April 2021).

⁸⁵ Sara Frizzell, 'Auditor General Finds Gaps in Nunavut's Health-Care Training and Recruitment', CBC, 8 March 2017, <https://www.cbc.ca/news/canada/north/auditor-general-nunavut-health-1.4014529>.

⁸⁶ Office of the Auditor General, 'Health Care Services - Nunavut (March 2017)'.

⁸⁷ Paul Webster, 'Language Barriers Restricting Access to Health Care for Indigenous Populations', *Canadian Medical Association Journal* 190, no. 24 (18 June 2018): E754–55, <https://doi.org/10.1503/cmaj.109-5613>; News ·, 'Stephen Lewis Calls on Ottawa to Step up as Nunavut Grapples with TB "crisis" | CBC News'.

decisions are being made and are often examined with greater scrutiny.⁸⁸ Smaller communities may have a clinic, yet require expensive air travel to seek care at a hospital in an urban setting, thus access issues are often debated. Linked to this is the debate over the prioritization of resources between care of acute health conditions or public health education to support better health outcomes. Public health programs require long-term investment, often take years to show tangible results, and progress is largely demonstrated through stability (i.e. the absence of a problem), thus there is little public recognition when success is achieved.⁸⁹

Lastly, the North has a number of unique health concerns requiring specialized knowledge that must be considered part of the overall health infrastructure.

Environmental pollutants are a serious threat to Northern health. One of the unique threats to human health, predominantly Indigenous health, is the elevated presence of heavy metals (e.g. mercury), bromine and chlorine-based flame retardants and persistent organic pollutants (POPs) in the environment which bio-accumulates into the traditional food chain and is atmospherically drawn north due to the physics of colder temperatures: “it is estimated that fully 80 percent of the pollutants found in the Canadian Arctic come from outside Canada.”⁹⁰ Finally, familiar health concerns are exacerbated by the remoteness of the North and the compressed nature of small isolated communities. Mental health treatment, suicide intervention, substance abuse, domestic violence, maternal health,

⁸⁸ Beth Brown, ‘Politician Sounds Alarm on Missed Medical Flight Costs in Canada’s Eastern Arctic’, *Eye on the Arctic*, 19 February 2020, <https://www.rcinet.ca/eye-on-the-arctic/2020/02/19/politician-sounds-alarm-on-missed-medical-flight-costs-in-canadas-eastern-arctic/>.

⁸⁹ Quigley, Bisset, and Mills, *Too Critical to Fail*, 212.

⁹⁰ Canada, Special Senate Committee on the Arctic, ‘Northern Lights: A Wake-Up Call for the Future of Canada’, 82; pollutants quote is from Watt-Cloutier, *The Right to Be Cold*, 134, see also page 143.

patient monitoring and preventative medicine are all areas where southern standards of practice are less effective.⁹¹

These must be considered part of health infrastructure because of their impacts on the social stability of families in Arctic communities. The increased delivery of healthcare over electronic means (telemedicine) is a promising trend and represents a supportive connection between information and communications infrastructure and health infrastructure.⁹² Telemedicine delivers healthcare in the patient’s language of choice and “in many cases, a community will have a clinic with one medical staff and a broadband connection to a hospital. This arrangement is often sufficient to serve many basic healthcare needs.”⁹³

Food Infrastructure

Food infrastructure can be described as the “production, processing, storage, distribution, retailing, consumption and waste management”⁹⁴ within food systems which are “interconnected and are integral to the wellbeing of communities, including northern and Indigenous communities, public health, environmental sustainability, and the strength of the economy.”⁹⁵ Food infrastructure is also connected to health and water infrastructure. Food infrastructure in the Arctic can be considered in two domains, southern food and northern traditional country food.

Southern food includes heavily processed, preserved and packaged food but also includes fresh fruits, vegetables, grain, dairy and meat products that would not be

⁹¹ Office of the Auditor General, ‘Health Care Services - Nunavut (March 2017)’.

⁹² Arctic Council Task Force on Telecommunications Infrastructure in the Arctic, ‘Telecommunications Infrastructure in the Arctic: A Circumpolar Assessment’, 18.

⁹³ Arctic Council Task Force on Telecommunications Infrastructure in the Arctic, 19.

⁹⁴ City of Thunder Bay, Ontario, ‘Food Strategy & Food Infrastructure’, March 2020, <http://tbfoodstrategy.com/pillars/food-infrastructure/>.

⁹⁵ Agriculture and Agri-Food Canada, *Food Policy for Canada: Everyone at the Table.*, 2019, 3.

normally cultivated in Northern communities. These categories of food are accessible in the North and gaining popularity due to population increases of those arriving from outside the region and the desire for greater food diversity among Indigenous communities.⁹⁶ The delivery of southern food is at the end of long supply chains mostly originating in southern Canada and the United States. In the event these food sources are interrupted, the decreasing lack of familiarity with hunting and fishing skills leaves communities in a malnourishment situation that must be responded to by the government or other communities. This could have a ‘domino effect’ of reducing available food sources throughout remote communities. The cost of southern food is another cause for concern as it is closely affected by the price of transportation fuels and can rapidly increase unexpectedly without subsidy support from territorial and federal governments.⁹⁷ In the scope of southern food, maintaining the critical infrastructure is best described as the maintenance of affordability, distribution and nutritional content awareness—the last element being closely tied to digestive health, chronic illnesses and diabetes.⁹⁸ Northern food, or country food described in Chapter One, is extremely important to Indigenous culture and community. Hunting whale and seal is considered a core part of Inuit identity as hunters in the vastness of the Arctic landscape.⁹⁹

Climate change has impacted the migratory patterns of wildlife that local populations rely upon for subsistence and moderate levels of income from hides and

⁹⁶ Tim M. Loughheed, ‘The Changing Landscape of Arctic Traditional Food’, *Environmental Health Perspectives* 118, no. 9 (2010): A389-90.

⁹⁷ Canada, Special Senate Committee on the Arctic, ‘Northern Lights: A Wake-Up Call for the Future of Canada’.

⁹⁸ Peter Bjerregaard et al., ‘Review Article: Indigenous Health in the Arctic: An Overview of the Circumpolar Inuit Population’, *Scandinavian Journal of Public Health* 32, no. 5 (October 2004): 393–94.

⁹⁹ Emerson, *The Future History of the Arctic*, 236.

furs.¹⁰⁰ In recent decades, urbanization and other socioeconomic trends in Northern communities have reduced the enthusiasm of younger generations to participate in traditional hunting and fishing activities.¹⁰¹ “Increased costs to hunt, changing food-sharing relationships, and adherence to a money-based economy (which means employed Inuit have less time to hunt) are some of the barriers communities see to consuming traditional food.”¹⁰²

As mentioned above in the section on health infrastructure, the bioaccumulation of POPs in traditional food has resulted in exposure to toxic substances from what was traditionally a reliable and safe food source. Some experts have pointed out this also affects the food security of infant children the high-fat content of breast milk may carry proportionately high levels of these substances, whereas formula is difficult to obtain in remote communities.¹⁰³ In a traditional food sense, the idea of critical infrastructure is abstract since hunting and fishing do not rely on supply chains and transportation. However, the impact of climate change and pollution are changing the resilience and success of traditional knowledge passed between generations. Consequently, future ideas regarding food infrastructure might include higher resolution wildlife monitoring systems, increased marine mammal protection zone monitoring and diagnostic testing for trace elements and pollutants in hunted animal tissues and local environments.¹⁰⁴

¹⁰⁰ Watt-Cloutier, *The Right to Be Cold*, 64–66; Emmerson, *The Future History of the Arctic*, 151–52.

¹⁰¹ Watt-Cloutier, *The Right to Be Cold*, 62, 321.

¹⁰² Loughheed, ‘The Changing Landscape of Arctic Traditional Food’, A388; Hing Man Chan et al., ‘Food Security in Nunavut, Canada: Barriers and Recommendations.’, *International Journal of Circumpolar Health* 65, no. 5 (2006): 416–31.

¹⁰³ Watt-Cloutier, *The Right to Be Cold*, 135.

¹⁰⁴ For example see the *Nunavik Research Centre* operated by *Makivik Corporation*. Scientists at the Centre test country foods, such as marine mammals, for diseases and heavy metals following guidelines established by the Canadian Food Inspection Agency; Canada, Special Senate Committee on the Arctic, ‘Northern Lights: A Wake-Up Call for the Future of Canada’, 75.

Public Safety Infrastructure

Public safety infrastructure, as a label, is perhaps the least coherent of the ten sectors of critical infrastructure. It sounds all-encompassing and yet if all aspects of public safety are critical then consequently none are critical. For the purpose of this discussion public safety infrastructure is considered to include capabilities, systems, and processes to protect against or respond to fires, floods, natural disasters, accidents, and acts of a criminal or negligent nature. These could include surveillance, investigation, access control, evacuation, public alerts, and crisis communications.¹⁰⁵

Attempts to maintain public safety infrastructure with a suitable response capacity in Northern Canada face challenges similar to those of the energy, mining, healthcare and telecommunications sectors. Retaining skilled experience is difficult because the lifestyle is hard on families. Maintaining a consistent level of service capacity is contingent on a range of demand volume—multiple concurrent emergencies can quickly overwhelm a system with little elasticity to surge. Finally, the lack of integrated communications technology; remote sensing systems for forest fire, flood, and landslide risks; and remote monitoring and management systems for energy utilities are necessary to mitigate the lack of human staff for work that is ‘dull, dirty, or dangerous.’

Retaining experienced, skilled first responders in the various communities of Canada’s Arctic is difficult. Federal and provincial accreditation, training, and employment models provide a limited number of pathways to becoming a police officer, professional firefighter, paramedic, coroner, accident investigator, and other specialized

¹⁰⁵ This definition was created following the review of websites, policies, directives, news releases and documents from the Canadian federal government and provincial and territorial governments, and Kevin Quigley, "Man Plans, God Laughs," Canada’s National Strategy for Protecting Critical Infrastructure", *Canadian Public Administration* 56, no. 1 (March 2013): 142–64.

skill sets. Training almost always occurs at institutions in southern Canada, a consequence of the efficiency in locating education and training opportunities in large cities, which is an obstacle to Indigenous representation in policing along with attitudes towards Northern community policing relationships.

High costs of living, poor work-life balance, living conditions and impacts on family well-being (education, health, spousal employment) impact the willingness of experienced police officers to remain.¹⁰⁶ Employment in the North is often temporary as a result and assigned at an early point in these career pathways. For example, Northern postings are quite common for Royal Canadian Mounted Police (RCMP) officers following graduation, however, follow-on postings are seen as a chance to return to southern Canada.

There is a distinct role for the CAF in supporting public safety infrastructure. In times of crisis, military aircraft and ships are on short-notice standby postures and able to mitigate the lack of roads and the significant distances between communities. Joint Task Force North, the regional headquarters of Canadian Joint Operations Command which is responsible for domestic and expeditionary operations of the CAF, has extensive experience with contingency planning in the Arctic.

Arguably the most agile CAF capability in the North are the four Canadian Ranger Patrol Groups, often simply called the Rangers. Arctic defence and security expert P. Whitney Lackenbauer notes the unique capability the Rangers provide in

strengthening the disaster resiliency of their communities through their presence, organization, leadership, and training; the mobilization of their knowledge; their ongoing involvement in community preparedness and

¹⁰⁶ Rick Ruddell, Savvas Lithopoulos, and Nicholas A. Jones, 'Crime, Costs, and Well Being: Policing Canadian Aboriginal Communities', *Policing: An International Journal of Police Strategies & Management* 37, no. 4 (11 November 2014): 782-784.

hazard risk analysis; their social relationships and networks; and the trust they have earned from fellow community members.¹⁰⁷

A recent example of this agility is the Rangers' support during Operation *LASER*, the CAF support to the healthcare sector and the distribution of vaccines during the coronavirus pandemic, where they regularly assisted other government agencies in remote Arctic hamlets.¹⁰⁸

Following a natural disaster, major fire or flood, the urgency of the response or the technical capabilities required often necessitates support from Canada's military through the Request for Assistance process managed by the Emergency Management Office of the respective territorial government. There has been a steady increase in these types of operations over the past two decades, most recently titled Operation *LENTUS* as a standing contingency plan.¹⁰⁹

The opening of sea routes as a result of climate change will also require additional spill response infrastructure to support a greater volume of shipping traffic expected in this vulnerable area. An increase in fueling locations will require revising national and regional disaster response postures. Cleaning up a spill in a remote location **earies carries** uncertainties from weather conditions, hazardous materials disposal, and environmental remediation plans once the crisis has subsided.

Public safety infrastructure is necessarily broad to cover gaps (i.e. it captures everything left out of the other nine critical infrastructure sectors and with a bit of overlap) but a revealing take-away is that in many serious cases, Canada's Arctic and

¹⁰⁷ Peter Kikkert and P. Whitney Lackenbauer, 'Enhancing the Canadian Ranger Role in Disaster/Emergency Management', Policy Brief (North American and Arctic Defence and Security Network, 24 February 2021), 1.

¹⁰⁸ Kikkert and Lackenbauer, 'Enhancing the Canadian Ranger Role in Disaster/Emergency Management'.

¹⁰⁹ Briefing from Director of Operations (J3) from the Canadian Joint Operations Command Headquarters (CJOC HQ) to the Canadian Forces College, January 2022.

Northern regions are likely to require the response of a national-level capability provided by Public Safety, National Defence or Fisheries and Oceans (including the Canadian Coast Guard).

Critical infrastructure in Northern Canada must therefore be looked at with a local lens to ultimately appreciate its place and role in serving communities. Mass transit may be considered critical infrastructure in Toronto or Vancouver, but in many Northern communities where the majority of dwellings are within a small radius, the principal method of transportation is walking or hitchhiking. Not owning a vehicle is of far less consequence to a family. The many towns and villages in the eastern sections of the Northwest Territories and all but a handful in Nunavut are accessible only by air or by sea. Thus, even suggesting the construction of roads is neither economically nor structurally feasible. On the other hand, fuel oil for boilers, furnaces and generators is of vital importance to heating and electricity, the loss of which in the middle of winter could wreak havoc on other critical systems like healthcare, water and sewer. In southern environments, the loss of heating may only be an acute threat during a short span of the year and multiple redundant systems lessen the impact.

The idea of using *human security* as a means to think about critical infrastructure in the North offers a unique perspective that addresses the concerns raised earlier in this chapter. Using this approach is possible because critical infrastructure has been studied extensively, and attempts to define it have been relatively consistent in Western societies. There is also considerable literature on critical infrastructure and traditional security concepts (i.e. protection, hardening, and securitization). It is also possible, despite the above-mentioned difficulty with overly broad definitions, to understand critical infrastructure in everyday terms and applications regarding its uses and impact on

socioeconomic behaviour, similar to human security. The next chapter will discuss the threats, vulnerabilities, and the future security environment in Canada's Arctic and Northern Regions and present three scenarios to compare conventional security and human security approaches.

CHAPTER 4: ENVIRONMENT, THREATS, AND VULNERABILITIES

The previous two chapters explored the concepts of human security and critical infrastructure. This chapter brings these concepts together in the future security environment to compare approaches to assessing critical infrastructure vulnerabilities. Initially, this chapter will describe the concepts of threats and vulnerabilities with a brief discussion of how they might apply in critical infrastructure protection planning. This will be followed by a section describing the prevailing trend in Canada to focus on traditional concepts of security, often with symbolic commitments that do little to achieve the stated aims. It then presents three threat scenarios based on credible possibilities extrapolated from future security environment literature. Vulnerabilities in the critical infrastructure areas of energy and utilities, information technology, food, health and public safety are then explored from the viewpoints of both conventional security and human security theories. The chapter closes by reaffirming the validity of including human security in Canada's critical infrastructure protection policies and processes.

Threats and Vulnerabilities

Both threats and vulnerabilities have the potential to erode security, but they are distinctly separate. Conceptually, the label *threat* does not neatly align with the human security title of freedom from fear, despite their overlap in the physical security sense. On the other hand, nor does freedom from want—in theory more oriented towards the idea of vulnerabilities—perfectly align with the term, though this does seem instinctively appropriate. Liotta has identified threats as "identifiable, often immediate, and requires an understandable response" which are likely to include military or security responses to

deter, protect and defend against adversarial aggression.¹¹⁰ To security and defence scholars and policymakers threats are either "clearly visible or commonly acknowledged".¹¹¹

Threat forecasting well into the future is inherently difficult. While future security environment analyses are able to theorize and identify potential aggressors, vulnerabilities, targets and outcomes, if a new capability (to which a vulnerability may exist) has not yet been developed, the degree to which threats can be accurately conceived is dubious, which is not the same as discounting the existence of future threats, but rather limiting the ability to prioritize and plan possible outcomes. An example may help illustrate this paradox. Future security environment forecasting often looks at the twenty to twenty-five-year horizon. In using the Internet as an example, it would have been exceptionally difficult in 1995 to forecast the pervasiveness of vulnerabilities brought with the 'Internet of Things' by 2015 and the explosive need for cybersecurity.

On the other hand, a vulnerability, as described by Liotta, consists of "an indicator, often not clearly identifiable, often linked to a complex interdependence among related issues, and does not always suggest a correct or even adequate response."¹¹² Identifying vulnerabilities are more likely to lack consensus as these interdependencies are interpreted differently by those analyzing the problem and through what frame it is evaluated; a vulnerability to whom and by what exactly is it being caused? For example, the impact of climate change to Canada's northern populations has often been referred to as a threat, but what the climate change discussion is actually exposing are a set of

¹¹⁰ P. H. Liotta, 'Boomerang Effect: The Convergence of National and Human Security', *Security Dialogue* 33, no. 4 (December 2002): 478–79.

¹¹¹ Liotta, 'Boomerang Effect'.

¹¹² Liotta.

systemic and connected vulnerabilities to communities and traditional patterns of life.

Labelling climate change a threat may serve to highlight the severity in political discourse, but it cannot be deterred and adequate responses—including denying its existence—are continuously debated by Western governments despite the overwhelming evidence of its severity. Considering the effects of climate change as a vulnerability is more appropriate in this case.

Another example that captures the distinction between threats and vulnerabilities exists in the information domain in Canada's remote northern communities. As described earlier, small Arctic hamlets often lack access to reliable broadband services and wireless telephone coverage due to inadequate infrastructure. The revenue from the subscriber base simply does not support the initial cost of capital infrastructure.¹¹³ This contributes to a sense of isolation in smaller Arctic communities where information and communications technology is chronically lacking.¹¹⁴ The consequence of these gaps are themselves compounded vulnerabilities: diminished education opportunities (e.g. modern immersive classroom multimedia is inaccessible); outdated healthcare practices (e.g. access to medical libraries, electronic health records, or simply a deterrent to hiring professionals); small and entrepreneurial businesses (e.g. barriers to joining e-commerce;

¹¹³ CBC News (Eye on the Arctic), 'New Fibre Optic Line to Ensure Reliable Internet Access in Northern Canada', 22 June 2018, <https://www.rcinet.ca/eye-on-the-arctic/2018/06/22/internet-yukon-nwt-north-cable-ottawa/>; CBC News (Eye on the Arctic), 'Canada Announces \$72M in Broadband Internet Improvements for Northern Communities', 12 August 2020, <https://www.rcinet.ca/eye-on-the-arctic/2020/08/12/canada-announces-72m-in-broadband-internet-improvements-for-northern-communities/>; CBC News (Eye on the Arctic) and Anna Desmarais, 'Canadian Telecom Businesses Say Recent Federal Funding Solidifies Northwestel Monopoly', 14 August 2020, <https://www.rcinet.ca/eye-on-the-arctic/2020/08/14/canadian-telecom-businesses-say-recent-federal-funding-solidifies-northwestel-monopoly/>.

¹¹⁴ CBC News (Eye on the Arctic) and Mackenzie Scott, 'Western Arctic Hamlet Left without Reliable Internet for 8 Days, Worst Residents Have Seen – Eye on the Arctic', 5 March 2021, <https://www.rcinet.ca/eye-on-the-arctic/2021/03/05/western-arctic-hamlet-left-without-reliable-internet-for-8-days-worst-residents-have-seen/>.

stunted advertising exposure); energy security (e.g. supply chain information management). However, there are in fact distinct threats poised to exploit these vulnerabilities to serve the interests of competitors. For example, this could include spreading disinformation by impersonating the social media account of a community member or physically disrupting access to reduce confidence in communications services providers and municipal, or territorial governments. These security concerns are palpable; in the words of former Canadian Ambassador to NATO, Kerry Buck,

we have a lot of work to do, not just in improving [Canada's] military cyber capabilities, but much broader... Cyber resilience of our major civilian infrastructure and into the information space. Our civilian security literacy at all levels of government needs to be increased. Do we have the information, tools and skills in the government, in the private sector, in our communities, to withstand disinformation?¹¹⁵

Of course, there is also an element of vulnerability in lax regulation and trusting private companies' interests in policing themselves in risk management, prevention and response, which the *National Strategy* identifies as *their* role in critical infrastructure. But is that an appropriate safeguard mechanism to deter risk ignorance and careless management? Multiple vulnerabilities in essential services sectors supplied by private companies, seemingly insignificant, may well coalesce into a catastrophic breakdown because they were invisible or minimized through communications strategies.

More often, instead of being forthcoming with regulators, time and effort are spent marketing the business appearance and moral conviction to protect critical infrastructure as another important part of corporate social responsibility. Writing about this corporate

¹¹⁵ Kerry Buck et al., *Rethinking NATO in the 21st Century*, interview by Colin Robertson, Recorded Audio, 14 February 2022, https://www.cgai.ca/rethinking_nato_in_the_21st_century.

trend, Bakan offers “pious social responsibility themes now vie with sex for top billing in corporate advertising” and that presumably

[the] message is clear, as is that of legions of similar advertisements: corporations care about the environment and communities, not just the soulless pursuit of profit; they are part of the solution to world ills, not the cause; they allies of governments and non-governmental organizations, not enemies.¹¹⁶

The Gravity of Physical Security

This double-meaning in this title is deliberate. Physical security attracts attention and appeases scrutiny and yet the seriousness of an increasingly armed Arctic cannot be understated. There has been a historical tendency to posture physical security and defence elements in the North if only to bolster claims to Arctic security and sovereignty. At the height of the Cold War, major infrastructure projects discussed in Chapter One were rapidly built to safeguard North American continental security, but the forbidding environment rendered most operations all but impossible, for both sides. In this regard, and militarily speaking, the Arctic was merely a transitory space that ballistic weapons, launch platforms (i.e. aircraft and submarines) could exploit by evading detection while closing distances to major cities. Since the collapse of the Soviet Union, successive Canadian governments have made animated claims and symbolic gestures toward physical security in Northern Canada, though any tangible presence has been inconsistent. If one were to characterize the Canadian government’s approach it is to make symbolic overtures about Arctic security while following up with token gestures.

¹¹⁶ Joel Bakan, *The Corporation: The Pathological Pursuit of Profit and Power* (Toronto: Viking Canada, 2004), 32.

In other words, with respect to the Arctic, Canada is lacking in security literacy. There are many contemporary examples of this. Canada has “seriously underinvested in [the] Arctic and North American security” and “needs to rethink the Canadian Arctic strategy and reinvest in Arctic capabilities, not just maritime but in the civilian space on connectivity, etc.”¹¹⁷

Canada’s Arctic icebreaking capacity has become dilapidated while waiting for replacement vessels. These vessels are required to clear routes in the North for commercial shipping, naval sovereignty patrols, and to respond to incidents that might result in grounding or environmental damage.

Search and rescue capabilities in Northern Canada are steadily disintegrating. The replacement fixed-wing aircraft faces a litany of delays while DND waited until the last possible moment to replace them, ultimately retiring the predecessor aircraft on the west coast.¹¹⁸ Backfill aircraft have been repositioned around the country impacting other airlift operations. The only aircraft stationed in northern regions (the CC138 Twin Otter in Yellowknife and CH146 Griffon in Goose Bay) are considered utility aircraft and not primarily for search and rescue.¹¹⁹

Canada has been repeatedly pressured by the United States to make NORAD modernization a priority, which arguably took Russia’s invasion of Ukraine to gain traction in Ottawa. Since the end of the Second World War, the United States has largely

¹¹⁷ Buck et al., *Rethinking NATO in the 21st Century*.

¹¹⁸ National Defence, ‘Backgrounder – Delay in Initial Operational Capability (IOC) of the CC-295 Kingfisher’, 4 May 2022, <https://www.canada.ca/en/department-national-defence/news/2022/05/backgrounder--delay-in-initial-operational-capability-ioc-of-the-cc-295-kingfisher.html>.

¹¹⁹ Sarah Lemay, ‘Dividing The CH146 Into Sub-Fleets’, CFC Service Paper, 2019, 8, <https://www.cfc.forces.gc.ca/259/290/308/192/lemay.pdf>; The Canadian Press, ‘Innu Nation Chief’s Death Prompts Criticism of SAR Efforts’, 12 May 2013, <https://www.cbc.ca/news/canada/newfoundland-labrador/innu-nation-chief-s-death-prompts-criticism-of-sar-efforts-1.1406649>.

been the guarantor of North American continental defence while Canada minimized its role in less public settings.¹²⁰ The North Warning System requires a significant reinvestment to upgrade technology, improve the physical condition of the sites themselves and steps to reduce the reliance on diesel-fuel generators for electrical power.

Canada's annual northern exercise, Operation NANOOK, is laudable for bringing together various agencies to work together on potential emergencies, however, it takes place in Iqaluit and occasionally Yellowknife. It would improve preparedness by rotating through other communities, similar to HMCS *Harry Dewolf's* visit to Pond Inlet, Nunavut in the summer of 2021. In statements by political leaders, it is clear that Canada has great ambitions to protect its third coastline but often fails to translate this into real outcomes. In other words, Canada prefers to 'talk the talk' without 'walking the walk'.

A further indication of deficient security literacy in Canada is the notion we are to restart the process of a defence policy review, as announced in the 2022 federal budget, without having completed the requisite and antecedent review of a national security strategy or foreign policy for the future. This same error was made in the development of Canada's most recent defence policy, *Strong, Secure, Engaged*, and raised questions about its underpinnings as an extension of Canada's notably dated foreign and security policy.¹²¹ The lack of these strategies, in their modern iterations, effectively amounts to carrying out a policy review for review's sake and does not link future spending or

¹²⁰ Matt Gurney, 'With Russia's Invasion of Ukraine, Reality Has Caught up with Canada', *National Post*, 25 February 2022, <https://nationalpost.com/opinion/matt-gurney-with-russias-invasion-of-ukraine-reality-has-caught-up-with-canada>.

¹²¹ Richard Cohen, 'Strong, Secure and Engaged – More of the Same?', *Macdonald-Laurier Institute Inside Policy* (blog), 12 June 2017, <https://macdonaldlaurier.ca/strong-secure-and-engaged-more-of-the-same-richard-cohen-for-inside-policy/>; Randolph Mank and Canadian Global Affairs Institute, 'Does Canada Need a Foreign Policy Review', Canadian Global Affairs Institute, January 2019, https://www.cgai.ca/does_canada_need_a_foreign_policy_review.

capability priorities to the necessary overarching outcomes. In the worst scenario, it simply reaffirms or refreshes the justification for certain already-approved programs and funding. There has been so much change in the Canadian arctic that a national security review is beyond necessary to forecast the expectations for the CAF in the region. The briefly stated pledge to leaves a lot to the imagination. It is difficult to carve out the future role of the Canadian military in the arctic and what materiel it is expected to procure and maintain to serve this purpose. *Strong, Secure, Engaged* outlines opportunities to procure systems to improve surveillance in the North, which will undoubtedly benefit longer-term goals to improve awareness overall, but offers only a brief statement or policy objective regarding engagement with local populations and organizations: “increase presence in the Arctic over the long-term and work cooperatively with Arctic partners.”¹²² Goal 7 of the *Arctic and Northern Policy Framework* also comments on the changing security considerations but then reverts back to highlighting policing, NORAD and Maritime Security Operations Centers (MSOCs), providing little evidence of new thinking that could be interpreted as corroborating a human security viewpoint. Thus, this reinforces the need to include a broader understanding of security beyond the physical and military dimensions. This is not to say they do not remain vitally important elements of the security landscape overall. Indeed, increased access and contested geography will only increase the requirement for security and defence capabilities in the region. It must, however, be balanced with other infrastructure areas and social development.

Physical security needs will increase in four distinct ways. First, Canada’s Arctic is believed to hold immense amounts of untouched energy resources and rare-earth

¹²² Department of National Defence Canada, ‘Strong, Secure, Engaged’, 7 June 2017, 14.

minerals. It is therefore important in both the present and future visions of energy sustainability, not only in Canada but globally. It is also drawing significant economic interest from other economies, principally China, looking for opportunities to access to these resources and bring them to market as value-added commodities.

Secondly, climate change is opening waterways for longer periods during the year. Use of these routes will reduce transit distances between major ports and speed up the pace of international trade. Figure 4.1 below illustrates the reduced distances in shipping available to commercial carriers with reduced ice cover in the Arctic. Russia has invested in its Arctic regions at a much greater pace than Canada and actively promotes the use of the Northeast Passage to generate revenue from transient shipping.

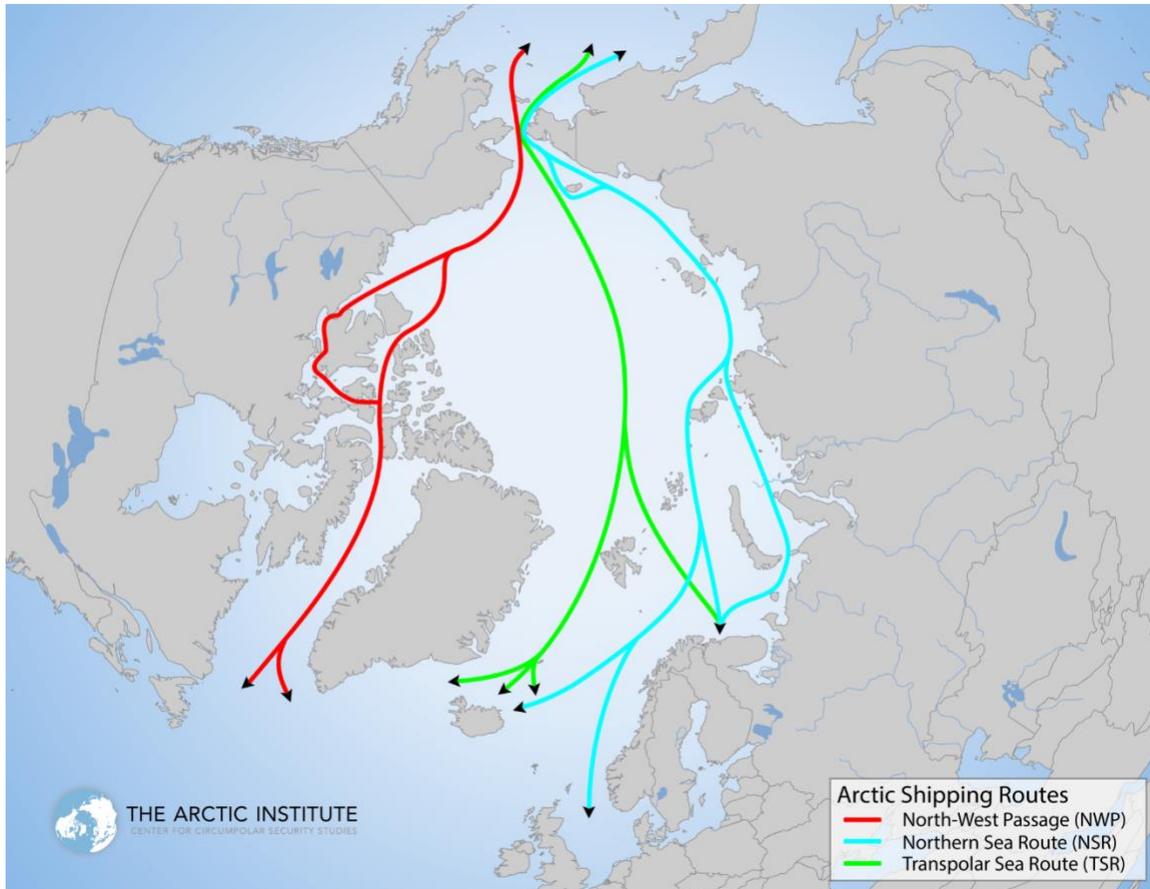


Figure 4.1 – Arctic Shipping Routes

Source: The Arctic Institute (2021)

Added to this, the United States along with other nations considers the Northwest Passage as an international strait with the rights of innocent passage and legally contests Canada's claim of it being internal waters. There will be pressure for Canada to adopt an open corridor approach while ostensibly taking steps to minimize the environmental impacts on wildlife, water and communities. This will require not only increased icebreaking and constabulary presence but also greater resources for Arctic communities along the northern and southern routes of the Northwest Passage. Third, contested geography will require increased physical presence by military and oceanographic research vessels collecting additional data to support extended continental shelf claims, a process expected to take many years.

Lastly, the world is returning to a period of great power competition with a rising China and Western disengagement from Russia following its invasion of Ukraine. China has declared itself a near-Arctic nation with explicit interests in the region. The physical security posture in Northern Canada must increase in order to meet Canadian foreign policy declarations and expectations within NORAD and NATO alliances. To meet the needs of security and sovereignty aspirations, Canada needs to be present in the Arctic with responses balanced between physical and other components of human security. The approach to security must address the intersection of adversaries' physical threats, non-state actors and transnational corporations, and the local communities they impact across a wide array of vulnerabilities.

Future Security Environment Scenarios

The following section of this paper will present three threat scenarios assembled from a review of security forecasting documents from Canada and the United States. Also consulted was a Five-Eyes discussion paper covering critical infrastructure themes, the Canadian federal government's *2019 Arctic and Northern Policy Framework* (specifically the international chapter) and World Economic Forum Global Redesign Initiative thought piece *Everybody's Business: Strengthening International Cooperation in a More Interdependent World*. These three vignettes are fictional yet representative of potential outcomes at the time of writing. The use of an example scenario supports the comparison of various factors from conventional security and human security approaches. In the human security approach, potential effects between the five specific critical infrastructure areas are highlighted to illustrate the broader interdependencies made more apparent by comparing these scenarios. Within these scenarios, indicative questions are posed to

highlight the potential issues, risks, and oversight discovered when considering human security factors.

Scenario 1: Aggressive Foreign Commercial Interests (2025)

China is aggressively pursuing the development of rare-earth materials and iron ore in northern Canada. It aspires to establish mines in areas where sample drilling has indicated deposits of cobalt and lithium, important minerals for increasingly competitive battery technology development. As a declared near-Arctic power, it has remained consistent in its messaging to the Canadian government regarding access through the Northwest Passage, which it considers an international strait. It has the expressed support of three regional resource extraction firms in Nunavut along with a tacit endorsement from Inuit Tapiriit Kanatami (ITK)¹²³ support. Would-be Chinese firms have promised to develop deep-water port infrastructure, road grading between the port, mining facilities, and the nearest two hamlets of Hall Beach and a submarine cable to Igloolik, where it has offered employment, training, increased healthcare services, and high-speed broadband internet. The firm has also committed to using heavy equipment to build a berm to prevent localized flooding that occurs each May during the snowmelt in Hall Beach. Youth unemployment is high in both towns and other opportunities require travel two hours by air to Iqaluit or seven hours to Rankin Inlet. The firm has hired lobbyists in both Iqaluit and Ottawa to pressure the government on regulatory approvals for foreign investment and environmental assessment.

Conventional Security Observations	Human Security Considerations
<p><u>Energy and Utilities Infrastructure</u></p> <ul style="list-style-type: none"> • China's state-owned or private business interests seeking additional revenue from the project offer to build electricity and housing utilities on-site and in nearby towns. • A diesel-powered generator is shipped from China and installed at the mining site with surplus electrical power distributed to the towns. • The federal government involvement is limited to foreign investment rules, environmental assessment and building/electrical code adherence. 	<ul style="list-style-type: none"> • What is the impact and risk of bringing in additional fuel (shipping, storage) into the area on the environment? • Who is conducting the inspections of the sites and what possible economic coercion is placed on the local community to accept greater risk? • What mitigations exist for providing additional stable electricity to the town should the company cease operations? • What impact does the additional pollution (diesel soot) have on the local environment and food?

¹²³ The National Representational Organization Protecting and Advancing the Rights and Interests of Inuit in Canada (see <https://www.itk.ca/>)

Conventional Security Observations	Human Security Considerations
<p><u>Information Technology Infrastructure</u></p> <ul style="list-style-type: none"> • Satellite downlink stations provide a broadband Internet connection for the site which is partially shared with the local town through a Wi-Fi mesh network.¹²⁴ • There is little to no regulatory oversight at the federal or territorial level because this broadband link is stand-alone and not connected to government-funded, commercially provided Internet services (which are much slower). 	<ul style="list-style-type: none"> • What risks exist by introducing potential foreign national IT infrastructure in towns where inequality could be used for targeted coercion or enticement of local leaders? • What cyber vulnerabilities exist as a result of local business and critical infrastructure using the commercially supplied Wi-Fi (e.g. local airport, vendors, grocery supply chains)? • If far fewer people are using government-provided broadband, does its poor condition go unnoticed? • Have foreign signals intelligence agencies used the establishment of local commercial infrastructure to include other systems capable of signals intelligence collection or interference or disruption with Canadian government systems?
<p><u>Health Infrastructure</u></p> <ul style="list-style-type: none"> • Because the approximately 20 Chinese nationals employed at the mine are not eligible for Canadian healthcare, and do not want to place a burden on the limited local health care delivery, contracted physicians and nurses from Vancouver are rotated out every thirty days by the mine management company. 	<ul style="list-style-type: none"> • In circumventing federal programs do the contracted medical staff have a significant language barrier in serving local residents? • Do local residents feel compelled to wait longer for national medical supply chains or are likely to take more affordable, yet unregulated medicine? Are local nursing staff in the hamlets willing to identify the issue? Are they aware of the issue or is the trust of government-provided medical services lacking and a barrier to a sense of community? • Is medical care potentially used as leverage with labour leaders to reduce accident reporting or complaints about work conditions? To what degree does the remoteness of the location impact appropriate federal and territorial oversight?

¹²⁴ A mesh network allows continuous coverage despite moving across a large area served by multiple connectivity devices.

Conventional Security Observations	Human Security Considerations
<p><u>Food Infrastructure</u></p> <ul style="list-style-type: none"> The mining company ships in food for the Chinese workers in quantities with some excess available for the local population. Community leaders enter into agreements for the mine’s shipping contractor to transport food and supplies from other locations because it is available at a more competitive price. 	<ul style="list-style-type: none"> How has the increased vessel traffic (fuel delivery, iron ore export) and air traffic (inspections, urgent resupply) affected local wildlife and hunting patterns? What is the impact of foreign nationals providing contract-supplied southern food to local workers on a regular basis? Are dry foodstuffs arriving unregulated from China through commercial partnerships and interests of the mining company?
<p><u>Public Safety Infrastructure</u></p> <ul style="list-style-type: none"> The mining company indicates that it will meet the requirements for fuel spill response with its own in-house capability. Community leaders are not entirely convinced they have the capacity or understanding of the risks however they are unwilling to risk delaying the hiring of local workers while a secondary environmental assessment takes place. 	<ul style="list-style-type: none"> Noticeable shifting of a concrete foundation is occurring. This foundation predated the arrival of the mining company that deemed it suitable to support a fuel storage tank. In the event of a major fuel spill as a result of additional shifting what liability does the company have? What liability does the company have? These industrial activities occurred without federal inspections and therefore federal responses have not accounted for the site in its overall response planning framework.

Scenario 2: Increased Foreign Military Presence in EEZs (2028)

Cooperation and integration between Russian and China have increased steadily since the imposition of Western sanctions throughout 2022 which resulted in their pivot away from European economies. The Sino-Russian alliance has held semi-annual exercises in locations favourable to Chinese interests. However, this year a compromise has led to the exercise being held north of Svalbard and Franz Josef Land with Russia practicing surface fleet staging for amphibious operations in Arctic waters. China’s participation is seen as a means to gain familiarity with naval operations in the Arctic, indicating further alignment with its declaration as a near-Arctic power a decade earlier. Some observers have even gone so far as to consider the littoral and island exercises as a representative opportunity to rehearse military surveillance and targeting of Taiwan which is almost identical in size to Spitsbergen, the main island in the Svalbard archipelago. For three months leading up to these exercises, both Russian and Chinese naval vessels conducted surface and subsurface screening activities north of the exercise area. This activity occurred within Canada’s Exclusive Economic Zone (EEZ) and at times was less than 150 nautical miles from Alert. Government officials have assessed that Russian vessels are concurrently using imaging sonar to map the

seabed along the Lomonosov Ridge at a higher resolution in order to contest the 2025 UNCLOS decision on an extended continental shelf claim Russia felt was prejudiced by the conflict in Ukraine. Russian and Chinese long-range surveillance aircraft have also been operating throughout this area, occasionally testing the responsiveness of Canada's expanded Air Defence Identification Zone (ADIZ) which now benefits from full radar coverage following the upgrade to NORAD infrastructure three years prior. The frigid seawater temperature and water column depth of the area has resulted in Russia using hull-mounted and variable-depth sonar transducers at maximum output. As the survey has been occurring for three weeks in this specific area, marine mammals have been markedly and negatively affected. Royal Canadian Navy Arctic Offshore Patrol Ships (AOPS), with embarked CH148 Cyclone helicopters, along with CP140M Aurora long-range patrol aircraft, have reported at least three sightings of lifeless bowhead and beluga whales in areas where Russian ships were operating the day prior. It is widely known by NATO members that Russian naval vessels do not employ marine mammal mitigation strategies and expert assessment indicates a similar operational posture from the Chinese People's Liberation Army (Navy). Inuit leaders are increasingly vocal about the impact on the environment and the apparent lack of action by the Canadian government to exert diplomatic pressure and protect what they consider a challenge to Canada's environmental sovereignty.

Conventional Security Considerations	Additional Human Security Considerations
<p><u>Energy and Utilities Infrastructure</u></p> <ul style="list-style-type: none"> • Russia is attempting to expand its extended shelf claim to access greater energy deposits with improved extraction-to-production ratios. • Increased financial motivation due to the impact of sanctions has resulted in a diplomatic push among Russia-friendly and otherwise neutral nations, resulting in the politicization of Arctic resource exploration and Canadian sovereignty. • Russian maritime operations are purposely disruptive and involve hyperbole from Moscow and exercise leadership. This is seen as just another act of retaliatory measures towards Canada and NATO for its sanctions and expansion. Grey-zone operations are distinctly attempting to foment distrust between Indigenous peoples in Canada's Arctic with the federal government. In fact, Moscow is seeking advice from Russian Inuit on areas to target to sow discord in Canada. 	<ul style="list-style-type: none"> • Responding militarily to perceived challenges to Canadian Arctic sovereignty, the CAF and DFO send ships and aircraft to patrol the area. • A Canadian Ranger Patrol Group conducts a sovereignty patrol from Grise Fjord to Eureka on Ellesmere Island which is amplified on national social media channels. • With the increased military presence, what is the impact on energy stores in nearby towns? The federal government wishes to maintain a lasting presence in the region for weeks but is consuming significant amounts of fuel for the dozens of air and maritime assets patrolling the area. • The lack of a replenishment ship has caused communities to have to ration available fuel. This has reinforced distrust between Indigenous communities and the federal government which has prioritized an Armed Forces and Coast Guard response to Russian and Chinese presence in the Arctic Ocean.

Conventional Security Considerations	Additional Human Security Considerations
<p><u>Information and Telecommunications Infrastructure</u></p> <ul style="list-style-type: none"> • All vessels in the area are collecting signals intelligence and acoustic intelligence. Foreign vessels are attempting to jam radio and GPS signals to characterize the attenuation patterns in fjords, thermal inversions, and shallower ionosphere. • Canadian naval and air assets focus efforts on collecting data and developing an updated electronic order of battle by sending received intelligence to Ottawa and Halifax for more detailed analysis by experts. • The high density of military assets¹²⁵ requiring satellite bandwidth exceeds that available through the available satellite systems. 	<ul style="list-style-type: none"> • If the various ships participating in the exercise change location, what effect does the GPS jamming have on hunting parties in remote communities? Is the Coast Guard providing alternate navigation methods to mitigate the impact of the GPS jamming or backup positional guidance systems? • The use of commercial satellite bandwidth to meet the additional communications needs of the military has a moderate impact on the quality of life of other users in the area. Phone calls repeatedly drop and users experience difficulty loading news websites, conducting online banking, and telemedicine. The military attempts to maintain a positive messaging strategy over shortwave (HF) radio and visits to communities to engage with local leadership.
<p><u>Food Infrastructure</u></p> <ul style="list-style-type: none"> • A traditional security viewpoint on food infrastructure focusses predominantly on securing the supply chains. Potential impacts to marine mammals and wildlife from greater military presence is not considered by military or coast guard authorities. • Only if concerns were raised at the community level, in significant numbers, would the federal response likely shift over time, and not within the timeline of the military exercise. 	<ul style="list-style-type: none"> • The operations are noticeably increasing pollution in the area and negatively impacting wildlife, possibly to a greater extent than the Russian operations initially, which were further north of Ellesmere Island. Canadian assets are operating closer to Nunavut hamlets and the adjacent waters, and is therefore causing the greatest impact closest to those areas it is seemingly attempting to safeguard.

¹²⁵ The Canadian Surface Combatant, Arctic Offshore Patrol Ships, CP140M Aurora (or its replacement, the Canadian Multi-Mission Aircraft) will all consume significant amounts of satellite communications bandwidth. At these very high latitudes, the signal-to-noise ratio, atmospheric attenuation and 'look angle' (the elevation of the satellite in orbit relative to the ground user) will reduce throughput and necessitate the use of other communications systems.

Conventional Security Considerations	Additional Human Security Considerations
<p><u>Health Infrastructure</u></p> <ul style="list-style-type: none"> • Similarly to food infrastructure, additional demands placed on health infrastructure would very likely be imperceptible to those in southern government institutions unless a health emergency raised attention. Little external capacity exists that can be rapidly sent to remote communities. Medevac options are available by air. 	<ul style="list-style-type: none"> • As the operations have temporarily impacted the delivery of telemedicine in the area and potentially reduced the volume of fuel for air medevac, is the CAF or CCG able to provide medical services in-lieu from their on-board capability?
<p><u>Public Safety Infrastructure</u></p> <ul style="list-style-type: none"> • In the event of collision at sea, by adversary vessels or by Canadian vessels, the government response would focus on containment, clean-up and messaging to alleviate public concern. It is consistently a ‘top-down’ federal approach with little involvement from the local communities due to federal regulations surround environmental response protocols. 	<ul style="list-style-type: none"> • A community-led or collaborative clean up effort would leverage the role of the Canadian Rangers and local communities to survey the area and assist in providing a prioritization of effort that works the best for their own livelihoods, food security, health security (water), and a remediation and monitoring plan.

Scenario 3: Climate Change and Extreme Weather Events (2035)

Consistent with the anticipated trajectory identified in the IPCC report, warming in the Canadian Arctic has remained above the international average. The quantity of multi-year ice north of the Arctic Circle, measured by the RADARSAT Constellation Mission, is at record lows. Commercial shipping firms aided by the Russian Federation Navy are attempting a great circle icebreaking route from Severodvinsk to the Bering Strait and onward to Shanghai. Approximately 15 percent of residential dwelling structures in all three territories are facing foundation issues resulting from permafrost loss. Federal and territorial levels of government have responded by providing emergency housing locations in schools, hotels, community centers and military facilities to shelter residents where their dwelling was unsafe for habitation. In northern parts of Yukon and the Northwest Territories, changing weather patterns have caused unprecedented levels of precipitation over a span of two weeks. This has led to multiple municipalities evacuating homes on sloped terrain where landslides are likely to occur after successive periods of increased precipitation, warming and cooling cycles. This has led to multiple municipalities evacuating homes on sloped terrain where landslides are likely to occur. In one town the small medical clinic, situated at the bottom of a hill, was destroyed as a result of the earth colliding into the west elevation. A washout of a section of the airport runway in Inuvik has made resupply by air impossible other than by helicopter. NORAD contingency operations have shifted to an airfield within the Alaska NORAD Region (ANR).

Conventional Security Considerations	Additional Human Security Considerations
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<p><u>Energy and Utilities Infrastructure</u></p> <ul style="list-style-type: none"> • Permafrost loss is expected to cause billions in damage to a variety of infrastructure, overwhelming the capacity of engineering, construction, and remediation mechanisms. • Because of costs, institutional infrastructure will likely be afforded greater attention from governments at the consequential neglect of infrastructure that serves local populations foremost. 	<ul style="list-style-type: none"> • The potential for interruptions to electricity, sewer, water, and communication systems is the greatest in remote communities where assistance is difficult to provide because of distances. • The already dire housing situation in many communities will worsen as a result of the priority expected to be placed on large infrastructure that has been damaged.
<p><u>Information and Telecommunications Infrastructure</u></p> <ul style="list-style-type: none"> • Large-scale ICT infrastructure across the North requires more frequent inspections, more complex construction techniques. • In order to mitigate future problems the government announces a comprehensive strategy to inspect all sites and prioritize the reconstruction of vulnerable sites. 	<ul style="list-style-type: none"> • ICT infrastructure will be prioritized to serve the delivery of government services at the federal and national level. As a result there are significant interruptions in certain services (radio, public alerts, wireless services, broadband internet) in the region causing wide-ranging impacts to quality of life in the North. • Because of impacts to connectivity and the specialized nature of the work, local businesses are largely removed from discussions on the remediation work, despite having the greatest interest in success. • Major southern construction firms are contracted for the projects because of the volume of work, bringing labour and employees from outside the region, increasing the cost of housing

<p><u>Food Infrastructure</u></p> <ul style="list-style-type: none"> • A traditional security viewpoint on food infrastructure would focus predominantly on securing the supply chains foremost and critical stocks secondarily. There would not be much beyond this basic level of protection. 	<ul style="list-style-type: none"> • Changes to the migratory patterns of fish, marine mammals and wildlife will impact the subsistence hunting of remote communities, resulting in increased requirements for southern food to augment nutrition. This may result in the further displacement of country food in Northern diets and due to supply and demand issues will increase the overall costs food. In a compounded risk scenario, federal or territorial levels of government may be required to provide additional food assistance to prevent the complete depletion of foodstuffs.
<p><u>Health Infrastructure</u></p> <ul style="list-style-type: none"> • In response to the damage to the local medical clinic the Territorial government responds by progressively evacuating residents requiring healthcare by contracted airlift; • Existing shortages in medical supplies cause excessive delays in delivering necessary stocks to other northern communities. 	<ul style="list-style-type: none"> • The evacuation of approximately 80 residents to seek medical attention in Whitehorse, YT places additional stress on the local emergency management framework and healthcare system. This has increased the workload of shift workers at local hospitals resulting in some taking stress leave, reducing the overall capacity of the hospital. • The loss of a local medical clinic given as an example in the scenario above requires an alternate delivery mechanism for healthcare. It is possible to do this through the use of local community centres or schools as a makeshift clinic, however these locations are not ideally situated and requires a complete replenishment of medical supplies.

<p><u>Public Safety Infrastructure</u></p> <ul style="list-style-type: none"> • The federal and territorial governments will focus on securing government infrastructure foremost, from the effects of climate change. This is not entirely problematic since many of these services are important for communities, however, they may not entirely reflect the priority of the communities and certain government services classified as public safety may not serve the interests of the population at all. 	<ul style="list-style-type: none"> • Local community leaders are engaged by various levels of government to provide data and findings from research organizations in southern Canada. At the same time, local communities are given the opportunity to present their priorities and interests and provide their impressions on how federal infrastructure, services, processes, etc. will be used to improve community resiliency and physical elements impacted by climate change.
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Summary

The four previous chapters have given the reader a brief historical background of Canada's Arctic and Northern regions and described the concepts of human security, critical infrastructure, threats and vulnerabilities. In each discussion, an emphasis on circumstances and considerations unique to Northern Canada provided the reader with the additional context to understand how a human security lens exposes an entirely new set of vulnerabilities from the viewpoint of the isolated communities, local leaders, and Indigenous populations.

While a recurring theme in this paper submits that the Arctic and Northern Canada must be considered differently than Canada's urban and densely-populated south when formulating critical infrastructure policy, this is not suggestive of two versions of Canada based on its geography or the errors of colonial history in the North. It is more the opposite case; the Arctic is almost quintessentially 'Canadian' in its existence. It has been described as a "zone of peace; territory of dialogue; unique; fostering multilateralism,

rules-based order; regional cooperation and peaceful co-existence”.¹²⁶ Dialogue within any of the numerous Arctic or circumpolar international organizations has often been complementary to Canadian foreign policy goals and dispute resolution approaches. Incorporating human security in the approach to international dialogue also provides a consistent baseline for setting priorities, goals and aligning domestic and foreign policies. Moreover, as all Arctic nations have adopted reporting metrics to align with the UN Millennium Development Goals (closely aligned with the seven domains of human security), international dialogue and cooperation are predictably able to benefit from these common approaches, which are likely to be expressed in domestic policy as well. This degree of consistency is not as obvious amongst national definitions of critical infrastructure.

The federal government has taken the leadership role in coordinating between the various levels of government in Canada. The 2009 *National Strategy* recognizes the "interconnected nature of critical infrastructure" which requires partnerships among levels of government and the private sector to advance "an all-hazards risk management approach, [and] measures to improve information sharing and protection."¹²⁷ There is a need to move ahead on making economic governance more equitable in Northern Canada and this includes critical infrastructure as both an enabler (i.e. transportation, financial, information technology) and an important safeguard (i.e. government and public safety infrastructure). For decades, dialogue between Arctic and Northern stakeholder organizations and Canada's federal government has maintained a consistent narrative:

¹²⁶ Canada, Special Senate Committee on the Arctic, 'Northern Lights: A Wake-Up Call for the Future of Canada', 90.

¹²⁷ Public Safety Canada, *National Strategy for Critical Infrastructure.*, 2.

climate change will mean the twenty-first century will be a Northern century and that increased economic opportunities will reinforce greater autonomy and prosperity as goals of the former. Heather Exner-Pirot, a senior policy analyst and research coordinator at the MacDonald Laurier Institute's Indigenous Policy Program, argues this likely won't be the case, and that positive change may have much more to do with governance and relationships.

In reality, many of the impacts of climate change make shipping, transportation and infrastructure development more difficult and expensive. *Accessible* (emphasis in original) is not a word to be applied to the Canadian Arctic, and that won't change for the foreseeable future... Looking at a map, it's obvious that some of that supply [of critical minerals] will have to come from the region, especially as securing supply chains becomes of greater importance for Canada and its allies. In that sense, it's not climate change itself that will drive Arctic development, but the policy response to it.¹²⁸

That the Canadian government has not released an updated Arctic Policy, domestic or foreign, or update to its northern strategy, is noteworthy. The last release of these documents was in the 2010 timeframe and both the environmental and security situations in the Arctic have changed markedly since then. Federal governments from both governing political parties have also repeatedly made Arctic sovereignty and presence in the region a major issue, along with the most recent government's pledge to improve relationships with the Indigenous populations in the North.

If Canada wishes to sincerely express its desire to maintain interests and overt sovereignty in the Arctic it needs to drastically increase its presence and investment in the region because the population, however small, is astutely aware of its own level of

¹²⁸ Heather Exner-Pirot, 'Climate Change Will Drive Arctic Development, but Not in the Way You Thought', *Macdonald-Laurier Institute Inside Policy*, 23 December 2021, <https://macdonaldlaurier.ca/climate-change-will-drive-arctic-development-not-way-thought-heather-exner-pirot-inside-policy/>.

prioritization within federal government activities. Disenfranchised communities can quickly become a fertile ground for foreign investment to enter and portray themselves as community saviours while carrying out activities to ensure local elite capture, and regulatory capture (at the local level) while embedding their own technology and gathering detailed information about the status and operations of local activities as a means to improve their future standing and relatability to the target population. This reinforces the narrative the federal government considers security threats as a low priority and unlikely to affect the status quo of lives in the North, which ignores many of the threats in the area posed by actors with strategic interests in the region and potential desires to destabilize the region for political gain and to reduce the obstacles to advance their own interests.

CONCLUSION

This directed research aimed to capture the difficulty in planning, managing, and providing security to critical infrastructure in Canada's most remote regions. It provided the reader with an overview of Canada's Arctic and Northern regions with a very brief history. It paid particular attention to the relationship European settlers have had with Indigenous peoples in Canada's North, particularly the Inuit, and the impact critical infrastructure sectors have on their way of life, subsistence, healthcare, education and employment. A more detailed description of five specific critical infrastructure sectors was given to prepare the reader for three future security scenarios. These vignettes compared traditional or conventional security approaches with a human security take on some of the same threats and vulnerabilities. Real-world examples illustrate the increased risks to infrastructure in Canada's North and the concepts of compound, cascading, interacting and interconnected risks and regional vulnerabilities.¹²⁹

These three scenarios: resource exploitation, increased foreign military presence, and the impacts of climate change were based on very recent profiles of what Canadians can anticipate experiencing in a future security environment, with its consequent threats to North American security, the near-pristine Arctic environment and the interaction with Canada's northern populations. These changes represent serious challenges to all levels of government in Canada and in many cases private enterprises operating on a regional scale in the North with a delicate balance of resiliency, entrepreneurialism, and cooperation with local populations.

¹²⁹ See Nicholas P. Simpson et al., 'A Framework for Complex Climate Change Risk Assessment', *One Earth* 4, no. 4 (2021): 491–92.; Gianluca Pescaroli and David Alexander, 'Understanding Compound, Interconnected, Interacting, and Cascading Risks: A Holistic Framework.', *Risk Analysis: An International Journal* 38, no. 11 (November 2018): 2247–51.

Canada faces a litany of environmental and operational threats and vulnerabilities to the North that require significantly developing our capacity to respond in a timely manner. Furthermore, these threats and vulnerabilities are deeply connected in many ways. This paper has presented information from audits, investigative journalism and expert testimony demonstrating that in maintaining these capacities, Canada is lagging in many ways. Airborne search and rescue response capacity is diminished, risking the ability to respond when increased activity in the North brings greater risks; access to country food and clean water are recurring problems which then impact healthcare; health care delivery is impacted due to staffing shortages and a lack of cultural appreciation for indigenous medicine and practices; staffing shortages and appreciation for local culture can only occur where communities are able to provide services that encourage outsiders to remain and feel welcome and move beyond language barriers.

The concept of interconnected vulnerabilities has been a recurring theme in this research because small impacts have disproportionate effects when communities grapple with remoteness, seasonal isolation and a climate threat they are powerless to influence. This criss-crossing of second-order effects is illustrative of the interdependencies with the human security paradigm. Focusing on human security reduces these encumbrances from the overall federal apparatus and builds lasting resilience in the north, but more importantly, it does so in a balanced and multifaceted way that is best executed by looking at problems and solutions through a human security approach.

This paper has also presented the security threats exposed and made more vulnerable by climate change, increased competition for resources and the surrounding vulnerable communities. The peace dividend that Canada has enjoyed since the end of the

Cold War has now lapsed. The actions of foreign powers, namely China and Russia, are contesting the existing rules-based order in the Arctic Circumpolar region. In the case of Russia, its government's actions in Georgia and Ukraine have relegated the Kremlin to international pariah status, consequently disintegrating its role as rotating Arctic Council Chair until 2024 and undermining the concert role of the body in so doing. Thus the previous two decade's conflicts in Central Asia and Eastern Europe have impacted multilateralism and Canadian Arctic security, further reinforcing the importance of a circumpolar worldview as complementary to the traditional ideas of the Global North and South. This then begs the question as to whether the Arctic will be a focal point of cooperation or conflict. Even at the current time, with much having been discussed regarding the need to understand human security more broadly, there remains a desire to respond with forms of tangible military hardware in the form of physical items rather than attempting to tackle a nebulous policy that seeks to enhance the resilience of the northern population as custodians of the existing critical infrastructure and improving these relationships as part of a wider economic and community development plan.

Conversely, there are incredible opportunities for Canada to further engage with like-minded nations in the international system. Japan and South Korea, see the expanding Arctic as part of the solution to their energy dependency and an opportunity to reduce shipping costs to their export-based economies. Canadian Arctic scholar Rob Huebert suggests these changes will put Canada in a dilemma between arming Northern Canada against emergent threats, regulating economic expansion and the long-term well-being of Arctic communities. While it has "historically posited itself as an Arctic state, the entry of new states and other bodies in the Arctic region with interests that do not

align with Canadian interests will be unsettling.”¹³⁰ That multiple states are increasing exercises and activities in their Arctic regions does not necessarily indicate an immediate risk of conflict in the region. It does, however, speak volumes regarding the emphasis on the Arctic in foreign policy priorities and a willingness to demonstrate as much given the difficulty in mobilizing forces in such an austere environment.

If the nature of future threats, in the holistic sense, is far beyond that of physical security concerns previously mentioned then improving our critical infrastructure remains the single best defence mechanism to protect Canada, territorially, and improve the conditions that foster long-term peace and security. Leaving critical infrastructure vulnerable to disruption by either malign actors or natural effects still encumbers major elements of Canada’s national response capacity (i.e. CAF, CCG, RCMP, etc.) that are currently entering a period of reconstitution and poorly equipped to focus on closing these gaps in response options over the near-term. Hence, an increased overall understanding and awareness of Arctic sovereignty through the eyes of those who live there, and best provided through a human security viewpoint, is of utmost importance to the future and overall security of Canada’s Arctic and Northern regions.

¹³⁰ Rob Huebert, ‘Canada and the Newly Emerging International Arctic Security Regime’, in *Arctic Security in an Age of Climate Change*, ed. James Kraska (Cambridge: Cambridge University Press, 2011), 193–94.

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