

Study on Addressing the Infrastructure Needs of Northern Aboriginal Communities



**Developed for the National Aboriginal Economic Development
Board**

By Centre for the North at the Conference Board of Canada

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Table of Contents

Table of Contents.....	2
Executive Summary.....	3
Chapter 1: Introduction	4
Purpose and methods	5
Chapter 2: Linking infrastructure to economic development	8
Linking infrastructure to economic development in Canada's Northern Aboriginal communities	10
The pivotal economic role of natural resources in Canada's North	10
Ensuring long-term economic development, diversification, and sustainable gains	15
Chapter 3: What is the status of infrastructure in the North?	18
Focal community profiles for five regions of interest.....	18
Transportation infrastructure.....	18
Energy infrastructure	28
Telecommunications infrastructure	33
Infrastructure that supports education	38
Housing infrastructure and vital amenities (water, sewage, and solid waste management).....	42
Health care infrastructure	49
Chapter 4: Opportunities and challenges in addressing the infrastructure needs of Northern Aboriginal communities.....	51
Overview of the funding environment for infrastructure in Canada's Northern Aboriginal communities.....	65
Key federal funding sources under Building Canada	66
Historical trajectory of the Building Canada Plan – What Northern Aboriginal community needs and priorities did it address?.....	72
Funding mechanisms – The challenge to understand and address evolving needs	78
Conclusion	80
Bibliography.....	85



Executive Summary

Canada's North, and the Aboriginal communities within it, are facing a significant infrastructure deficit that acts as an impediment to economic growth in the region. Exacerbated by a number of environmental factors including remoteness of some communities, a short building season, and challenging terrain mean that the costs of building and maintaining infrastructure are higher than average. Climate changes such as rising sea level and reductions in permafrost extent are contributing to maintenance and upkeep costs for existing infrastructure. The purpose of this study was to examine the relationship between infrastructure and economic development in a northern context and to identify infrastructure deficits that act as barriers to economic development.

It is generally understood that adequate infrastructure is an important pre-requisite to economic development. In the context of Canada's North, this study found that investment in three types of infrastructure was most strongly connected to economic development: transportation, energy and telecommunications infrastructure. Specifically, transportation infrastructure that is multi-modal and creates connectivity; telecommunication infrastructure that is of adequate speed, not too costly, and is reliable; and energy infrastructure that is scalable and of adequate capacity – all act to support economic growth. These forms of infrastructure also support major resources development projects in which Aboriginal communities are poised to have a significant role. This lends further strength to the idea that these types of infrastructure should be given weighted consideration in terms of infrastructure investment.

Evidence suggests that long term and diversified economic growth is supported by other classes of infrastructure. These secondary types of infrastructure – education infrastructure; health care infrastructure; water, waste water and solid waste disposal; and housing infrastructure – act to enhance quality of life in communities which in turn increases the potential of a business to attract workers and acts as a disincentive to out-migration of community members. They also provide essential services for businesses and industries that would otherwise be a significant operating cost.

This study considered the infrastructure endowment across the study regions and found it to be highly variable based on the region's geography, history and location. Overall, infrastructure deficits in the study region were significant. Current infrastructure funding programs are insufficient to do more than address basic, systemic backlog in the various regions. As such, regions are in the position of having to address immediate basic infrastructure needs instead of being able to consider longer-term, strategic investments in infrastructure to support economic development.



Chapter 1: Introduction

Canada is facing an infrastructure deficit. Due to the inadequate maintenance of existing infrastructure and insufficient investment in new infrastructure, the country now finds itself in the position of having to play catch-up with regard to its capital assets. Depending on the methodology employed, the dollar figure associated with this deficit has been measured to be at minimum \$50 billion, and possibly as much as \$570 billion.¹ As a country, we are only beginning to address the problem, one that the Federation of Canadian Municipalities has characterized as “a backlog of delayed repairs and construction that hurts every Canadian family and business.”²

If the quantity and quality of infrastructure is a challenge for Canada as a whole, this is especially true for much of Canada’s Northern regions and the Aboriginal communities located within them. Limited transportation, communications, and energy infrastructure are features of many Aboriginal communities located in Canada’s North. Transportation infrastructure, for instance, is either “bare-bones” or absent altogether throughout large sections of the territories and the northern reaches of the provinces. In Nunavut, for example, there are no roads linking any of the territory’s communities to one another or to points south. Housing and the state of basic amenities such as water, sewage, and solid waste management systems are also sub-standard in many remote Northern communities.

The current infrastructure challenges faced by Canada’s Northern Aboriginal communities are exacerbated by a number of environmental factors. The remoteness and isolation of most Northern Aboriginal communities make the construction and maintenance of infrastructure more costly than in southern, more populous regions. Rugged terrain, a short building season, and harsh climate conditions constitute other hurdles. In addition, the lack of infrastructure can prove an impediment to the construction of new infrastructure, creating cycles of underdevelopment feeding underdevelopment.

Northern environments are also changing, and an increasingly substantial challenge is climate change. For Arctic and sub-Arctic regions a warming climate is leading to permafrost reduction which is in turn causing ground-instability and subsidence. Rising sea levels, in conjunction with severe weather and storm surges, are having a detrimental impact on Northern seaside communities through coastal erosion. Increasingly severe weather also poses a threat to the structural integrity of buildings and other physical assets, including wastewater treatment systems and landfills (which may leach out hazardous materials). These and other effects of climate change require innovative approaches to the construction and upkeep of infrastructure.

¹ Canadian Chamber of Commerce, *The Foundations of a Competitive Canada*, 8.

² Federation of Canadian Municipalities, “About the Issue,” <http://www.fcm.ca/home/issues/infrastructure/about-the-issue.htm>



Indeed, some studies have estimated that rising temperatures could more than double the costs associated with the North's infrastructure deficit.³

Challenges in the physical environment in Canada's North are compounded by a complex, multi-stakeholder policy environment that involves a variety of public and private groups. It can be challenging to find suitable financing tools and program funding to adequately resource infrastructure development.⁴ Some stakeholders, including the National Aboriginal Economic Development Board (NAEDB), for example, have observed that federal funding practices could be more flexible in addressing the varied infrastructure needs of individual Aboriginal communities.⁵ Many of the existing program funding mechanisms available to communities and regional governments in Canada's North appear to be overwhelmed by the magnitude of their infrastructure deficits in core areas – such as housing, ground and air transport, water, sewage, and solid waste management – leaving little room for consideration of strategic investments in infrastructure to support economic development.

The lack of infrastructure is a pivotal issue for Northern Aboriginal communities. Sufficient and appropriate infrastructure is a prerequisite to economic development. Indeed, the strong correlation between the availability and quality of infrastructure and economic development has led some to identify adequate infrastructure “as the single most important criteria for the attraction and growth of business in remote communities.”⁶

Purpose and methods

The purpose of this paper is to contribute to developing a detailed understanding of the state of infrastructure in and around Northern Aboriginal communities, and of the role of infrastructure in economic development; and to identify infrastructure deficits that act as key barriers to economic development in and around Northern Aboriginal communities, and recommend strategies for addressing them.

The study identifies the relationship between economic development and infrastructure. In doing so, it identifies the types of infrastructure that are most important to economic development, particularly from the perspective of enabling Canada's Northern Aboriginal communities. With this as a backdrop, the study assesses the state of infrastructure in and around Canada's Northern Aboriginal communities and provides a snapshot of the current state of infrastructure in five Northern regions, and identifies the prevailing characteristics, challenges, and opportunities associated with each of them.

³ Buda, *The State of Municipal Infrastructure*, Federation of Canadian Municipalities, 2.

⁴ NAEDB, *Recommendations on Financing First Nations Infrastructure*, 4.

⁵ NAEDB, *Recommendations on Financing First Nations Infrastructure*, 4.

⁶ GE Canada, *Towards a Remote Communities Investment Strategy*, 7.



The study regions are Yukon, the Northwest Territories, and Nunavut, as well as Nunavik and Eeyou Istchee in Northern Québec (taken as a whole), and the coastal region of Nunatsiavut, in Newfoundland and Labrador. (See Table 1 below, for geodemographic details from the 2011 National Household Survey.) Note: where Aboriginal communities in the five regions shared significant portions of critical infrastructure with neighbouring non-Aboriginal communities these were considered together for the purpose of this study.

Table 1: Distribution of Aboriginal populations and households for five Northern regions of interest

Geodemographic information on the five regions of interest				
		Regional profiles		
		Regional Aboriginal population (NHS 2011)	Number of Aboriginal households (NHS 2011)	Square area of region (km ²)
Region				
	Nunatsiavut	2,360	730	72,520
	Nunavik	10,880	2,535	443,685
	Eeyou Istchee	15,725	3,485	450,000
	Nunavut	27,365	6,820	1,877,787
	Northwest Territories	21,155	7,525	1,143,793
	Yukon	7,705	3,575	483,450
Total		56,225	24,670	4,474,235

Source: GeoSuite, 2011 Census, Statistics Canada Catalogue no. 92-150-XBB



The NAEDB and infrastructure development in Northern Aboriginal communities

Established in 1990, the National Aboriginal Economic Development Board is an Order-in-Council board mandated to provide policy and program advice to the federal government on Aboriginal economic development. Comprised of First Nations, Inuit and Métis business and community leaders from across Canada, the Board plays an important role in helping the federal government develop and implement policies and programs that respond to the unique needs and circumstances of Aboriginal Canadians. The Board also provides a vital link between policy-makers, federal departments, and Aboriginal and non-Aboriginal business and community leaders.

As a champion of economic development opportunities for Aboriginal communities, the NAEDB understands the inherent connection between economic development and infrastructure. This research paper reflects the NAEDB's commitment to improving the infrastructure of Canada's Northern Aboriginal communities, and its mandate to provide strategic policy and program advice to the federal government on issues pertaining to Aboriginal economic development.

Special note: Subject to the methodological conditions discussed above, this study is not intended to be an exhaustive account of the state of infrastructure in Canada's North. Moreover, the research team did not have sufficient resources to undertake site visits to assess local infrastructure conditions. Our task was to provide a comparative analysis of summary information on the state of critical infrastructure in the five Northern regions and 100 focal communities. Staff under the NAEDB secretariat at Aboriginal Affairs and Northern Development Canada (AANDC) produced an initial database of available departmental information and data from secondary research. The database was then updated and revised and fact checked with regional stakeholders operating in the five regions. Among several challenges we encountered during this research process, most troubling was a lack of consistent definitions and standards in use for some basic forms of Northern infrastructure including water and wastewater treatment facilities, solid waste facilities, and even airports, roads, and harbours.



Chapter 2: Linking infrastructure to economic development

The assumption that adequate and properly functioning infrastructure enhances economic development has long held intuitive validity. However, effectively measuring the impact of infrastructure on economic growth and activity has proven challenging. Simply defining what we mean by economic development and growth can be difficult. Delineating the scope and content of what is encompassed under the heading of “infrastructure” is equally problematic.⁷

Infrastructure can refer to a broad range of entities, including everything from roads, ports, and electrical grids to housing as well as educational, cultural, and sports facilities. And though there is now a solid consensus that infrastructure effectively bolsters economic development, there remains some debate about the actual details of this causal relationship.⁸ As a 2013 Canada West Foundation report remarks, “we know that the effect of infrastructure on productivity is positive, we just don’t know how great that effect is. There are many reasons for this, including differences in the types of infrastructure examined, the scope of the studies and the economic models that were used.”⁹

That said, it is generally agreed that research undertaken over the past decade or so has successfully managed earlier criticism and challenges. This work indicates a robust causal relationship between public infrastructure investment and output on the part of the private sector.¹⁰ Studies carried out by Statistics Canada, the Canada West Foundation, the Institute for Research on Public Policy (IRPP), the Conference Board of Canada, and others have arrived at similar conclusions.¹¹ Statistics Canada’s research, for example, determined that investment in public infrastructure in Canada contributed to an average of 9% growth in labour productivity from 1962 to 2006.¹² The IRPP concluded that investment in public infrastructure could generate productivity returns ranging from 17% to 25%.¹³ Recent work has identified a “strong correlation between the physical stock of public capital and an economy’s overall productivity.”¹⁴ Conversely, a lack of adequate infrastructure undermines economic activity and growth (see text box: *The Consequences of Inadequate Infrastructure*).

Through its economic research, the Canadian Chamber of Commerce concludes that some types of infrastructure are more strongly related to economic development than others.¹⁵

⁷ Rives and Heaney, *Infrastructure and Local Economic Development*, 59-60.

⁸ Canada West Foundation, *At the Intersection*, 6.

⁹ Canada West Foundation, *At the Intersection*, 6.

¹⁰ Antunes and others, *The Economic Impact of Public Infrastructure in Ontario*, 3.

¹¹ The Canadian Chamber of Commerce, *The Foundations of a Competitive Canada*, 4.

¹² Gu and MacDonald, *The Impact of Public Infrastructure on Canadian Multifactor Productivity Estimates*.

¹³ The Canadian Chamber of Commerce, *The Foundations of a Competitive Canada*, 4.

¹⁴ Antunes and others, *The Economic Impact of Public Infrastructure in Ontario*, 3.

¹⁵ The Canadian Chamber of Commerce, *The Foundations of a Competitive Canada*, 4. See also, Canada West Foundation, *At the Intersection*, 8.



Accordingly, it is important to make targeted strategic investments if the goal is to drive economic activity and growth. In other words, “it is not [necessarily] more infrastructure that contributes to growth and productivity but the right infrastructure in the right places.”¹⁶ The forms of infrastructure that the literature tends to identify as being more closely correlated with increased productivity and growth are transportation, energy, and telecommunications. Other types of infrastructure mentioned in the literature, though with less prominence, are vital community amenities such as suitable housing and water, sewage, and solid waste management facilities. Transportation infrastructure, such as roads, harbours, ports, rail lines, and airports, may be especially important for economic activity in general and for certain industrial sectors in particular, such as mining and oil and gas. A detailed and comprehensive study undertaken by the *Institut national de la recherche scientifique* concluded that investments in rail, roads, ports, and airports that improve the continental accessibility of communities could facilitate growth in local employment, particularly when these improvements are *significant* and target synergies between complementary forms of transportation infrastructure (such as roads, rail and ports).¹⁷

The consequences of inadequate infrastructure

The literature shows that inadequate public infrastructure is a threat to long-term economic growth. Inadequate infrastructure lowers economic potential in a direct and obvious way according to this simple progression:

- Inadequate public infrastructure results in increased costs for business.
- Increased costs result in a lower return on private investment.
- Lower returns—profits—mean less money for business to re-invest.
- Less investment means fewer jobs and less productive labour.
- Lower productivity means less economic output and lower personal incomes.

Source: Canada West Foundation, *At the Intersection*, 4.

¹⁶ The Canadian Chamber of Commerce, *The Foundations of a Competitive Canada*, 4.

¹⁷ Aparicio and others, *Transport Infrastructure and Local Economic Development*, 66.



Notably, the key types of infrastructure discussed above are also paramount to the development of Canada's natural resource sectors. A number of organizations and think tanks suggest that infrastructure which supports resource development should be a top priority and focus within Canada, given that our natural resource sectors are poised to play significant roles in the mid- to long-term growth of the Canadian economy.¹⁸ As the Canadian Chamber of Commerce and GE Canada have observed, commodities represent roughly a third of the country's exports and, due to our extractive potential, "the world is beating a path to Canada's natural resources' door."¹⁹

And as we will see below, the link between natural resource development and the presence of adequate transportation, energy, and telecommunications infrastructure could be particularly important for regional governments, Northern Aboriginal businesses, and strategically located communities.

Linking infrastructure to economic development in Canada's Northern Aboriginal communities

A discussion of the link between infrastructure and economic development in Canada's Northern Aboriginal communities will necessarily revolve around the issue of natural resource development. Indeed, if the link between infrastructure that supports resource development and economic growth is significant for Canada as a whole, it is particularly relevant for Northern Aboriginal communities. Investments in infrastructure will have meaningful local impacts if they enhance both the amount of natural resource development in and around Northern Aboriginal communities and enable the participation of Aboriginal peoples in co-managing this development. Also important are the types of infrastructure that support economic diversification and long-term gains, and which prevent the "boom and bust cycles" that are often associated with the participation of communities in major resource development projects. These types of infrastructure include health facilities, housing, education facilities, and water, sewage, and solid waste management systems.

The pivotal economic role of natural resources in Canada's North

The past few decades have witnessed natural resource development and exploration spread into just about every region of the country. While the environmental and socio-economic concerns associated with natural resources extraction must be addressed and the impacts mitigated, resource projects can also entail a host of benefits for Aboriginal communities that find themselves located in their vicinity. Benefits include remunerations and revenue streams as

¹⁸ See for instance, Canada West Foundation, *At the Intersection*. See also The Canadian Chamber of Commerce and GE Canada, *The Business Case for Investing in Canada's Remote Communities*. See also Department of Finance Canada, *The Road to Balance: Creating Jobs and Opportunities*.

¹⁹ The Canadian Chamber of Commerce and GE Canada, *The Business Case for Investing in Canada's Remote Communities*, 10.



well as job and business opportunities.²⁰ According to Canada's Public Policy Forum, the years ahead will position more than 500 Aboriginal communities at the doorstep of some of the most significant mining, forestry, and oil and gas projects the country has seen in decades.²¹ Many of these projects will take place in Canada's North. Examples include the Ring of Fire in Northern Ontario, worth an estimated \$60 billion in mineral value; mining developments in Northern Québec, with \$8.2 billion projected in proposed new investments; the Enbridge Northern Gateway Pipeline in British Columbia and Alberta, projected to generate roughly \$5.5 billion in proposed new investments; and, if revived, the currently suspended Mackenzie Gas Project in the Northwest Territories which could potentially contribute \$16.2 billion in estimated direct and indirect investments.²² See also our discussion of related investment patterns in Chapter 4. Offshore projects may also present substantial opportunities for Northern Aboriginal communities. Oil and gas development in the Beaufort Sea, for instance, could mean significant advantages and opportunities for the Inuvialuit region – keeping in mind that the substantial risks associated with offshore oil and gas activity have to be properly assessed and mitigated. (See Exhibit 1, below, for a map of major industrial activities occurring in or near Northern Aboriginal land claim settlement areas.) The same might be said for the continued development of Northern fisheries – such as in Nunavut or Nunatsiavut – and for the related gains that may accrue to Aboriginal communities and businesses, provided that local Northern fisheries can successfully compete with global fisheries and/or protect their regional markets.

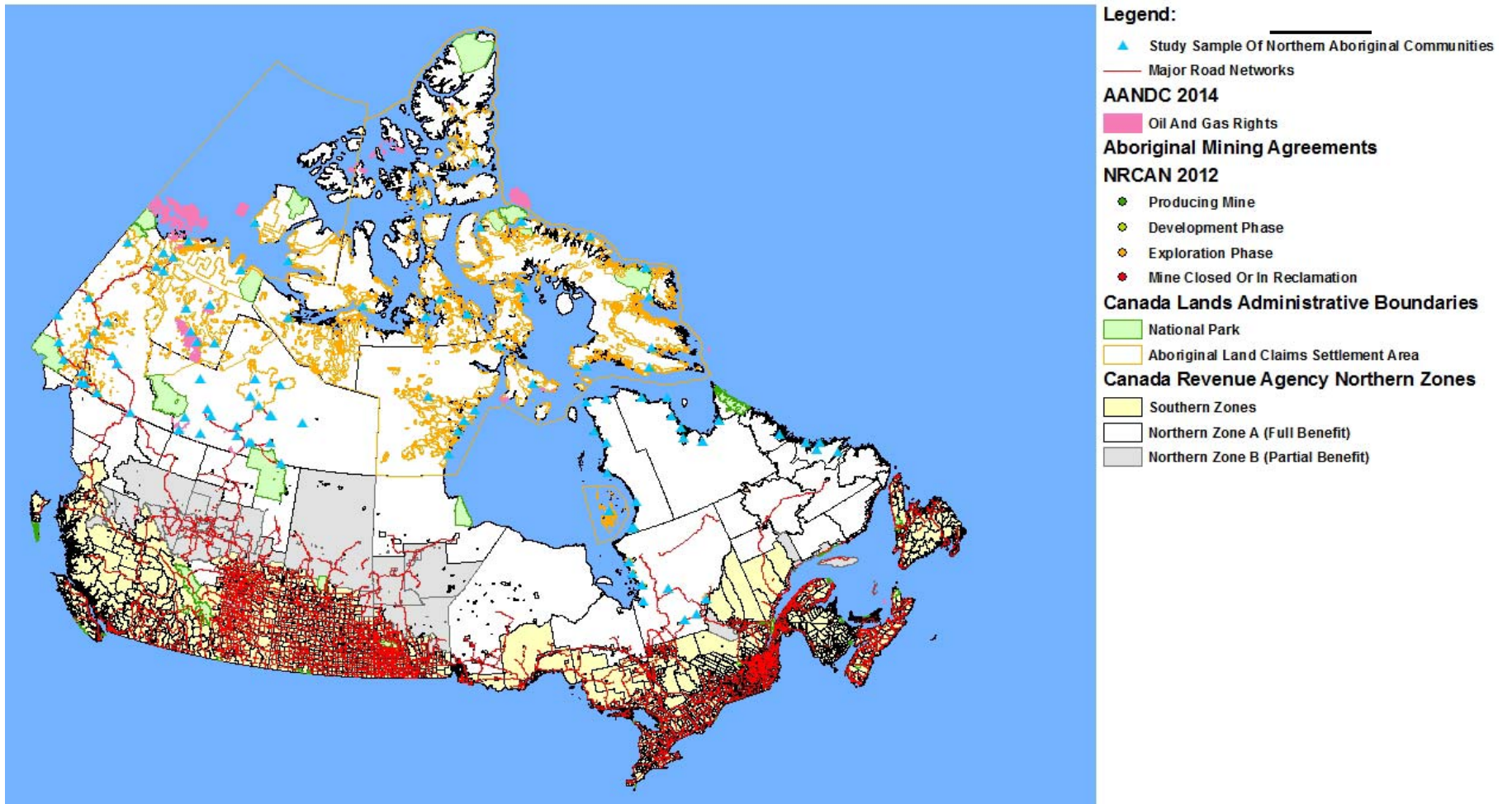
²⁰ NAEDB, *Increasing Aboriginal Participation in Major Resource Projects*, 3.

²¹ Public Policy Forum, *Building Authentic Partnerships*, 6.

²² NAEDB, *Increasing Aboriginal Participation in Major Resource Projects*, 3.



Exhibit 1: Map of major mining and oil and gas activities in or near Northern Aboriginal land claims settlement areas



Sources: Canada Revenue Agency, "Northern Residents Deductions," 2014; Natural Resources Canada, Earth Sciences Road Network 2.0," 2007; Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Surveyor General Branch, "Aboriginal Lands," 2009; Natural Resources Canada, "Interactive Map of Aboriginal Mining Agreements," 2014; Statistics Canada, 2011 Census Subdivisions Digital Boundary Files.Sector; Geomatics Canada, Centre for Topographic Information.



The state of Northern infrastructure will play a vital role in determining the varying strengths of different natural resource sectors, and in defining the extent to which these sectors will contribute to the economic development of Canada's Northern Aboriginal communities. The importance of infrastructure and of the participation of Northern Aboriginal communities in the natural resources economies is recognized by Aboriginal communities, private sector organizations and governments alike. In the 2014 budget, for example, the federal government stated that "the significant employment and profit opportunities for Aboriginal peoples associated with natural resource development cannot be overstated."²³ This signals a federal interest in providing much needed public support to help realize these opportunities. The budget further acknowledges the fundamental role of infrastructure in ensuring that Northerners and their communities effectively benefit from resource extraction activities.²⁴ A forum convened in 2011 to discuss potential economic, social, and environmental changes in the circumpolar world concluded that infrastructure will be vital to capturing future economic opportunities in the Canada's North, and that the current "lack of infrastructure is a major impediment to progress."²⁵ Echoing this perspective is the Federal Framework for Aboriginal Economic Development, which identifies the deficit in infrastructure as one of the main obstacles to economic activity and investment within Northern communities.²⁶ Not surprisingly, in a survey conducted by GE Canada which involved more than 350 respondents including Northern business and community leaders, infrastructure was ranked by 70% of those surveyed as "the single most important criteria" for attracting investment and facilitating business development in remote communities.²⁷

It was mentioned above that not all types of infrastructure are created equal in terms of their ability to boost Northern economic development; energy, transportation, and telecommunications infrastructure were identified as having a comparative advantage. The literature indicates that these types of infrastructure are also vital to the natural resource sector and to the economic development of Northern Aboriginal communities more generally.²⁸ Given their importance to growth and economic activity, the lack of these types of infrastructure in many Northern Aboriginal communities constitutes a significant hurdle. Indeed, the NAEDB notes that "the lack of adequate transportation, telecommunication and energy infrastructure in and around Aboriginal communities is an obstacle to economic development and limits the full participation of Aboriginal communities in major projects opportunities."²⁹ An adequate stock of

²³ Department of Finance Canada, *The Road to Balance*, 141.

²⁴ Department of Finance Canada, *The Road to Balance*, 152–153.

²⁵ Macklin and Meisen, *The Global North 2050*, 56.

²⁶ Government of Canada, *Federal Framework for Aboriginal Economic Development*, 9.

²⁷ GE Canada, *Towards a Remote Communities Investment Strategy*, 8.

²⁸ See for instance, Macklin and Meisen, *The Global North 2050*. See also GE Canada, *Towards a Remote Communities Investment Strategy*; The Canadian Chamber of Commerce and GE Canada, *The Business Case for Investing in Canada's Remote Communities*; Canada West Foundation, *At the Intersection*.

²⁹ NAEDB, *Increasing Aboriginal Participation in Major Resource Projects*, 5.



these types of infrastructure, on the other hand, could support economic activity in and around Aboriginal communities in a variety of ways.

Why energy, transportation, and communications infrastructure are important to the economic development of remote communities

Energy

Energy is fundamental to the daily operations of large industry and small businesses alike. It is required for the operation of machinery and equipment, lighting, telecommunications, and heat. For private sector organizations weighing the costs and benefits of investing in remote communities, the availability and cost of energy is critically important. The shortage of low-cost and environmentally sound energy options can prove a significant obstacle and challenge for businesses.”

Transportation

Access is a key determinant of cost for both small businesses and large industrial projects. For companies wanting to move goods, or commodities such as ore, minerals, or timber from their points of origin to southern or foreign markets, the existence of adequate roads, ports, and rail lines are an incentive to investment. Similarly, small business ventures, from craft economies to adventure tourism, require logistical supports appropriate to their scale. Transportation infrastructure is vital for inputs and supplies, and for enabling the movement of people. The availability or absence of transportation infrastructure plays a major role in terms of attracting or deterring investment.

Telecommunications

Telecommunications facilities are vital to economic activity, business development, and corporate relations. They are necessary for moving business data, completing secure retail transactions, communicating with staff and clients, as well as accessing online information. The availability and reliability of high-speed Internet also helps to ensure such affordances as distance-learning programs and effective telehealth services. In remote regions, telecommunications systems provide vital lifelines between communities.

Source: GE Canada, Towards a Remote Communities Investment Strategy, and the Canadian Chamber of Commerce, The Business Case for investing in Canada’s Remote Communities.

Ideally, the development of the main types of infrastructure associated with natural resource development should lead to economic gains in addition to increased participation in the resource extraction industries and in associated business opportunities. There are numerous spinoff benefits to these forms of infrastructure. For example, the government of Nunavut notes that if strategically situated, the construction of an access road for a mining operation could also improve local access to hunting and fishing areas. Similarly, better port facilities can benefit



strategically located communities by increasing tourism and facilitating local fisheries.³⁰ Of course geographic and geological factors play a major role in determining feasibility, but such synergies should be given due consideration by default. Telecommunications infrastructure can increase social cohesion and connectedness between community residents across Northern regions, and support their participation in global commerce and social networking opportunities.³¹

Anecdotal evidence suggests that appropriate connectivity-enhancing infrastructure can have a positive impact on educational outcomes, employee and business performance, and overall socio-economic productivity. These types of ripple effects are not unique to Northern communities. In a 2013 report, the Canadian Chamber of Commerce concluded that “there is an indisputable strong link between investment in the core public infrastructure of roads, transit and utilities and productivity performance in all sectors of the Canadian economy.”³²

Finally, maximizing the impact of infrastructure on economic development means determining what types of infrastructure are best suited to each Northern region and participating community. Understanding the economic potential in and around Northern communities, in addition to the specific objectives and local policies of each community, is paramount. The impact of a small craft harbour on a coastal community in Nunavut or Inuvialuit in the Northwest Territories, for instance, might be more significant than roads linking it to other communities in its vicinity. Research has also found that combining different types of infrastructure can enhance their respective impacts. As an example, the findings of the *Institut national de la recherche scientifique* indicate that the construction of an airport is not, on its own, sufficient for generating long-term economic activity, particularly for rural communities; however, when combined with a well-developed system of regional roads, the economic benefit of an airport improves.³³ These findings may play out differently in Northern regions such as Nunavut, where small, isolated communities depend on air transport for access to basic goods and services but which are geographically disconnected from transport networks, on the margins of global and national markets, and not within the vicinity of major economic activities.

Ensuring long-term economic development, diversification, and sustainable gains

There is a clear and robust relationship between telecommunications, energy, and transportation infrastructure and economic development. However, within the context of Northern Aboriginal communities, if this type of infrastructure is put in place primarily to support natural resource development projects, it may not, on its own, be enough to drive long-term and sustainable economic growth. Certain common characteristics make Northern

³⁰ Government of Nunavut, Parnautit: A foundation for the future, 34-35.

³¹ GE Canada, Towards a Remote Communities Investment Strategy, 10, 12.

³² The Canadian Chamber of Commerce, *The Foundations of a Competitive Canada*, 26.

³³ Aparicio and others, Transport Infrastructure and Local Economic Development, 4, 69.



Aboriginal communities vulnerable to “boom and bust” cycles: their remoteness; their limited access to a central service hub; their limited access to health, sports, entertainment, and educational facilities; and their reliance on one or two major employers.³⁴ In terms of the last point, communities situated near a major natural resource project are particularly vulnerable. It is paramount, then, to manage natural resource projects and the development of necessary infrastructure in such a way as to ensure economic diversification, sustainable growth, and the overall attractiveness of Northern Aboriginal communities to investors, businesses, and their employees.

The literature identifies a number of other types of infrastructure that increase a community's longer-term viability and its attractiveness to investors. Chief among these are water, wastewater, health, housing, and educational facilities. These additional types of infrastructure are identified by academic and policy research, as well as by community residents, as being important to developing the economy and meeting societal needs.³⁵

For example, a 2012 Centre for the North report on housing in Canada's North determined that the availability of affordable, quality housing plays a significant role in supporting economic development and employment in the North. Conversely, businesses across the North struggle to attract and retain employees when there is a shortage of suitable housing.³⁶ These findings dovetail with the GE Canada survey which found that housing quality, adequacy, and affordability all contribute to the attractiveness of remote communities for private investment, and that “the lack of affordable housing stock, where it exists, inhibits business investment.”³⁷ In addition to attracting investment, adequate and well-made housing may also enhance positive educational outcomes³⁸ – an important contributor to community and economic development. Given the importance of education for skills development and job growth, infrastructure and technologies that enhance educational outcomes also help to increase the attractiveness of Northern Aboriginal communities to investors, businesses, and residents alike.³⁹

The attractiveness and liveableness of Northern communities depend on the availability of certain basic amenities. The Canadian Chamber of Commerce points out that infrastructure investment is “unthinkable” without an adequate supply of safe, clean drinking water. An abundant supply of water is also necessary to fulfill a variety of industrial and extractive sector

³⁴ GE Canada, *Towards a Remote Communities Investment Strategy*, 3.

³⁵ See Grigg, *Infrastructure Finance*, 2–4. See also SakKijānginnatuk Nunalik: Understanding opportunities and challenges for sustainable communities in Nunatsiavut, *Learning from the Coast*, 10–32.

³⁶ Pulla, *Framing Sustainable Options for Housing in Canada's North*, 39.

³⁷ GE Canada, *Towards a Remote Communities Investment Strategy*, 14.

³⁸ Sisco and others, *Lessons Learned: Achieving Positive Educational Outcomes in Northern Communities*, 15.

³⁹ The Canadian Chamber of Commerce and GE Canada, *The Business Case for Investing in Canada's Remote Communities*.



needs.⁴⁰ Most importantly, potable water is essential for the health and well-being of community residents. The availability of infrastructure that ensures an adequate quantity and quality of water is an issue in a number of regions throughout the North. Many Northern Aboriginal communities, for example, distribute their water by truck.⁴¹ The presence or absence of adequate health care services is also a key factor for community residents and outside investors. A lack of locally available health care infrastructure – including technology to support telehealth and e-health services – can be a disincentive to individuals who might otherwise consider relocating to the community; existing residents may consider moving to urban centres, particularly in instances where advanced age or chronic illness is involved.⁴² The quality of community infrastructure, including water and sewage treatment systems, housing, solid waste management, and health care infrastructure has a direct influence on community well-being, as well as on its attractiveness to business investment.⁴³

It should be noted that other types of infrastructure may also enable and facilitate local economic development. Though their influence may not be as direct as the three types of core infrastructure identified earlier – transport, energy, and telecommunications – or as those which contribute to long-term growth noted immediately above, additional types of infrastructure may nevertheless have a positive effect on economic activity and growth. Sports facilities, for instance, can improve the overall quality of life and health of community residents, thereby stimulating productivity and increasing the appeal of the community to business investment. The same can be said of cultural facilities. Infrastructure that encourages community members to come together and which enhances the social cohesion of the community may also indirectly contribute to economic development. An adequate public safety infrastructure, such as a proper fire hall and constabulary facilities, also improves the overall attractiveness of a community to its residents and potential investors.

⁴⁰ Canadian Chamber of Commerce, *The Business Case for Investing in Canada's Remote Communities*, 15.

⁴¹ Pulla, *Building on Our Strengths*, Aboriginal Youth Wellness in Canada's North, 12, 20, 120, see also: Frideres, *First Nations in the Twenty-First Century*, 122.

⁴² The Canadian Chamber of Commerce, *The Business Case for investing in Canada's Remote Communities*, 15. GE Canada, *Towards a Remote Communities Investment Strategy*, 13.

⁴³ Frideres, *First Nations in the Twenty-First Century*, 122.



Chapter 3: What is the status of infrastructure in the North?

While each region and community is unique, many of Canada's Northern Aboriginal communities face a set of relatively common infrastructure challenges. In small Northern communities, especially in remote areas with small populations, the types of critical regional infrastructure identified in Chapter 2 – telecommunications, transportation, and energy – are often deficient or absent. Also deficient or absent are the other types of critical infrastructure that contribute to long-term socio-economic development, economic diversification, and community well-being, including education and health care facilities, high-speed Internet, and other basic amenities such as suitable housing with reliable water, sewage, and solid waste management facilities.

Focal community profiles for five regions of interest

The following section provides an overview of the state of infrastructure in communities across five regions in Canada's North.

Transportation infrastructure

Transportation infrastructure across the study region, particularly when compared to the rest of the country, is often poor or altogether absent. There are no railroads connected to any of the regions other than a short railroad linking southwestern Yukon to the nearby coast in northern British Columbia. Rail networks can be important transportation assets, but the development of rail lines requires a substantial investment. In 2011, a feasibility study by Genivar estimated the cost of developing a rail line between Kuujjuac, the regional hub of Nunavik, and Schefferville Québec to be \$2.5 billion. Developing the line would involve contending with numerous environmental obstacles including 400 streams, several small to large rivers, and at least 79 kilometres of permafrost.⁴⁴

Road infrastructure is more prevalent in Northern regions, particularly within communities; but road construction is also costly and challenging.

Table 2, below, provides an overview of road infrastructure within the five regions of interest. The table identifies the proportion of study communities that have only local roads; seasonal roads that provide access to points beyond a community (sometimes referred to as "continental access"); and all-season roads that provide access to points beyond a community. A look at

Table 2 reveals that all-season road access is limited across the study area, with the exception of Yukon, where only one community – Old Crow – is not connected to the territory's network

⁴⁴ Rogers. "Nunavik may be on track for railway." *Nunatsiaq Online*.
http://www.nunatsiaqonline.ca/stories/article/65674nunavik_may_be_on_track_for_a_railway/



of all-season roads. Moreover, due to Yukon's relatively small population base, the territory "has the highest per capita road network in the country with more than 155 kilometres of road for every 1,000 residents."⁴⁵ This is not the case in the other geographic regions in the study. In the Northwest Territories, the percentage of communities that have access to all-season roads is only 50%. In the regions of Northern Québec, eight of the nine Cree communities in Eeyou Istchee have access to all-season roads (developed to serve the James Bay hydroelectric network), whereas, none of the 14 Inuit communities in Nunavik has access to more than local roads.

Due to the comparatively more challenging geography, none of the communities in Nunatsiavut (Labrador) and Nunavut is connected to an all-season or winter road; however, when coastal waters off Labrador freeze, Nunatsiavut communities may take advantage of sea-ice routes for snowmobile travel. Nunavut's greater extent and relative isolation between communities largely precludes all-season road connectedness. In some cases, other modes of transportation can extend the potential for ground transport. Nunatsiavut Marine for example, provides a ferry and cargo service that connects vehicular traffic to Labrador's growing highway system, including during the winter if weather and ice conditions are suitable.

As discussed in Chapter 2, there is a positive relationship between continental access and employment/productivity and a lack of all-season and seasonal roads is an impediment to economic development in Northern communities. The impact of the lack of road infrastructure is not lost on the communities and governments of these regions; a number of potential projects are being discussed and others are under way. (See also our analysis of regional project funding patterns in Chapter 4.) In Nunavut, for instance, a road linking the Kivalliq region of Nunavut to Manitoba has been the subject of talks and feasibility studies for the better part of a decade.⁴⁶ Yet, to date, given the expected high costs, no construction has taken place. In Nunatsiavut, a series of workshops took place in early 2012 to discuss the feasibility and potential impacts of an all-season road. Residents of Makkovik, Rigolet, and Postville were generally interested in the possibility of an all-season road which would link their communities to the regional hub of Happy Valley-Goose Bay – though the prospect of a road was also seen by some community members as a source of potential risks and unintended consequences, such as increased crime, and vehicular accidents.⁴⁷

In 2013, workshops in Nunavik under the Parnasimautik initiative explored some of the issues associated with the absence of road linkages between the region's 14 Inuit communities and to destinations in southern Québec. Research supporting the initiative noted that "the cost of living and of doing business in [Nunavik] is very high due mainly to the prohibitive cost of

⁴⁵ Precision Research Services, *Yukon Roads Inventory*, 6.

⁴⁶ Review, "Nunavut-Manitoba Route Selection." <http://www.gov.mb.ca/mit/tspd/pdf/newsletters/2007english.pdf>

⁴⁷ Goldhar and others, *SakKijānginnatuk Nunalik: Understanding opportunities and challenges for sustainable communities in Nunatsiavut. Learning from the Coast.*



transportation by air and the short marine shipping season which imposes excessive additional warehousing and financing costs.” Moreover, it was noted that this lack of transportation options can delay other infrastructure development projects; specifically that the “development of energy, mining and tourism potentials will proceed at the same pace as development of the region’s transportation system.”⁴⁸

Similar planning initiatives have occurred in other Northern regions. In the Northwest Territories for example, the Inuvialuit Regional Corporation is hopeful that sustainable employment and development opportunities will follow the completion of an all-weather road connecting Tuktoyaktuk to Inuvik and, from there, to the rest of the continent via the Dempster Highway. According to a report prepared for the Government of the Northwest Territories, the highway – slated to be completed between fall 2017 and winter 2018 – should increase gross domestic product (GDP) in the region by roughly \$330,000, and reduce the overall annual cost of living in Tuktoyaktuk by \$1.5 million.⁴⁹ In addition, the Government of the Northwest Territories is undertaking to develop a broader Mackenzie Valley Highway corridor that could support complementary infrastructure projects such as, for example, the laying of a fibre-optic backbone network to improve telecommunications in the region. In this case, planners for the Government of Northwest Territories recognized the benefit of bundling complementary infrastructure projects and systems.

Table 2: Road infrastructure

Community access to road systems (local and regional)					
		Number of communities per category			Total
		Local roads only	Seasonal regional road access	All-season regional road access	
Region	Nunatsiavut	5	0	0	5
	Nunavik and Eeyou Istchee	15	0	8	23
	Nunavut	25	0	0	25
	Northwest Territories	4	12	16	32
	Yukon	1	0	14	15
	Total	50	12	38	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014; Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Centre for Topographic Information, “National Road Network 2.0,” 2007

⁴⁸ Parnasimautik, “Our Region – Transportation.” <http://www.parnasimautik.com/our-region-transportation/>

⁴⁹ Jones, “Building a road to Open the Riches.” <http://www.theglobeandmail.com/news/national/the-north/building-a-road-to-arctic-prosperity/article16396177/?page=all>



Despite the presence of road systems, as Table 3, below, indicates, geography is a persistent challenge for many of the Northern regions remote communities. Average travel distances between peripheral communities and regional hubs (including ferry service, seasonal, and all-season road networks) are between 313 and 764 kilometres for the four relevant regions. As expected, Yukon's average travel distance is less than half the Northwest Territories', and over 100 kilometres shorter than Eeyou Istchee's (the next shortest). However, these travel distances are not insignificant hurdles for Northern travellers to negotiate.

Table 3: Road infrastructure - Average travel distances

Road travel distances between peripheral communities and regional hubs (including travel by ferry service, and seasonal and all-season roads)				
		Geographic information		
		# of peripheral communities with road network access to regional hub	Closest regional hub	Average distance in km
Region	Nunatsiavut	5	Happy Valley-Goose Bay	540 (includes ferry travel)
	Eeyou Istchee	8	Chibougamau	420
	Northwest Territories	27	Yellowknife or Whitehorse (whichever is closest)	764
	Yukon	13	Whitehorse	313

Source: Government of the Northwest Territories, "Distance in Kilometres Between Northwest Territories Communities"; Yukon Government, "Yukon Distance Chart"; Transport Québec, "Travelling Distance Estimation Tool"; Government of Newfoundland and Labrador, "Road Distance Data Base."

Given the lack of road infrastructure in substantial portions of the five regions, other modes of transport are critical. Airstrips and airports of varying sizes are common features of the study communities, particularly in Northern villages and hamlets that are both landlocked and without all-season roads.

Table 4 and Exhibit 2, below, indicate that out of the 100 communities included in the study located across the study area, only six have no recognizable airport infrastructure. At the other end of the spectrum are communities connected to regional air transit hubs. The table shows that eight out of 100 communities match this category. Hubs offering inter-provincial/territorial connections include the territorial capitals – Whitehorse, Yellowknife, and Iqaluit; Hay River (NT) which connects flights to Edmonton (AB); and Rankin Inlet (NU) which connects flights between Nunavut and Manitoba. Lesser regional hubs include Inuvik which provides connections to Whitehorse (YT); and Kuujjuac and Kuujjuarapik-Whapmagoostui (Nunavik-Eeyou Istchee) which provide direct flights to Montreal. As featured in Table 4, the categories



containing the highest percentage of communities are “direct flights” and “indirect flights” to a “regional air transit hub.” These two categories comprise 65% of all study communities.

Table 4: Air transportation infrastructure

Community access to air transport systems							
		Number of communities per category					Total
		No airport	Local airport ⁵⁰	Indirect flights to regional air transit hub ⁵¹	Direct flights to regional air transit hub ⁵²	Regional air transit hub ⁵³	
Region	Nunatsiavut	0	0	4	1	0	5
	Nunavik and Eeyou Istchee	2	1	13	5	2	23
	Nunavut	0	0	10	13	2	25
	Northwest Territories	2	9	5	12	3	32
	Yukon	2	11	0	2	1	15
Total		6	21	32	33	8	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014

Delivering goods by airplane is less economical than other modes of transport. Yet, air transport services play a vital role in supplying Canada’s remote Northern communities.^{54, 55} This is a key reason why products cost significantly more in relatively isolated regions such as Nunavut and Nunavik than in Canada’s more densely connected southern regions. Research indicates that greater benefits accrue to communities that are strategically positioned with respect to multimode transport systems that integrate air transport with other transport modes, such as roads and rail.

⁵⁰ No scheduled airline service available.

⁵¹ Scheduled airline service takes an indirect route to closest interregional air transit hub.

⁵² Schedule airline service takes a direct route to closest interregional air transit hub.

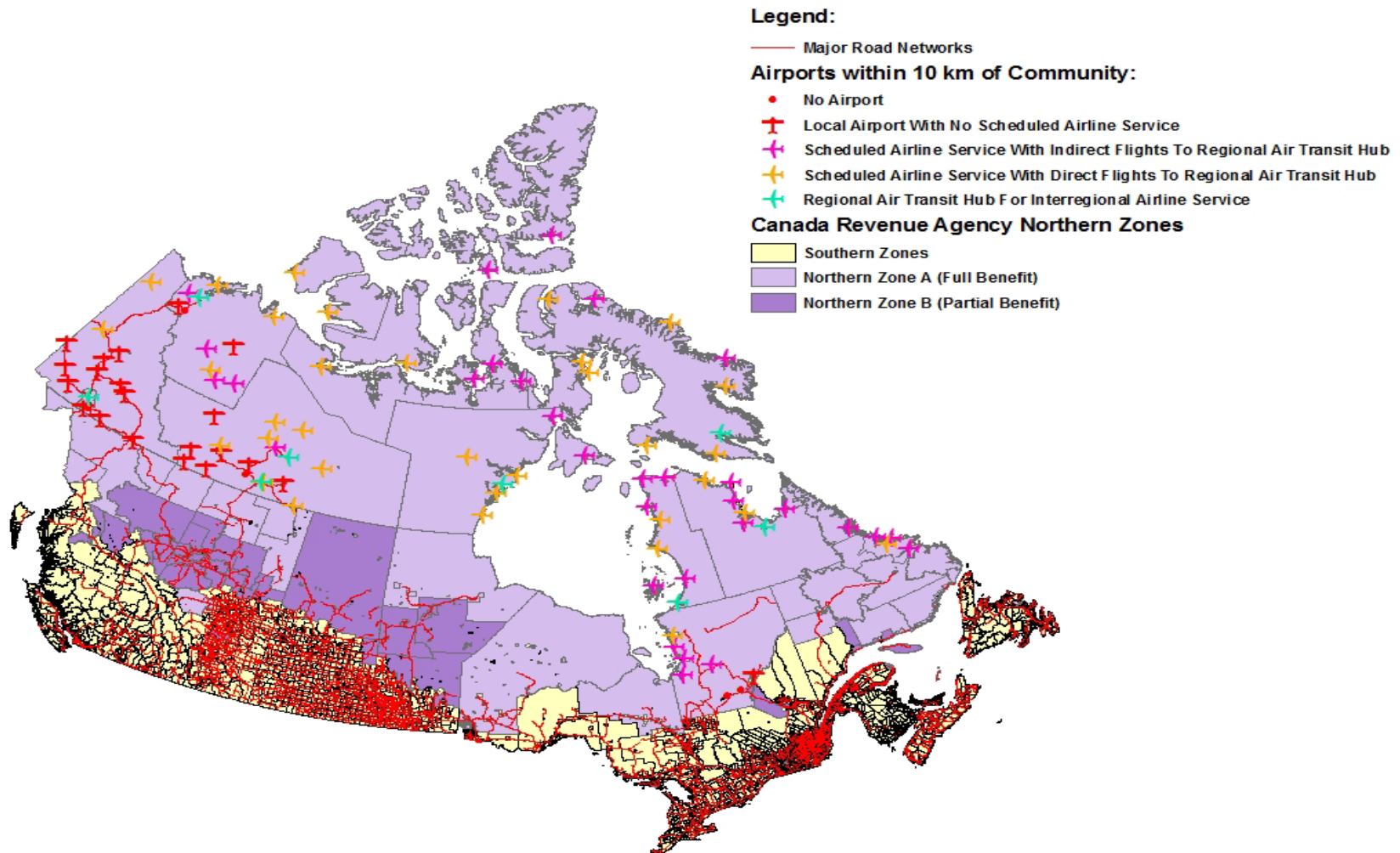
⁵³ Community is within 10 km driving distance of an interregional air transit hub.

⁵⁴ Braathen, Air Transport Services in Remote Regions, 5, 6.

⁵⁵ Rymanov and Fomin, “Air Passenger Services to Remote Regions.” 1039.



Exhibit 2: Map of Northern community access to air transport systems



Sources: Aboriginal Affairs and Northern Development, 2014 ; Canada Revenue Agency, "Northern Residents Deductions," 2014 ; Conference Board of Canada, 2014 ; Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Centre for Topographic Information, "National Road Network 2.0," 2007 ; Statistics Canada, Census Subdivisions Digital Boundary Files, 2011.



Marine transportation, relative to moving goods by air, is considerably more cost-effective method of shipping in the North. Marine transportation plays a pivotal role in most of the regions under analysis in this report. The vast majority of the communities in Nunavut, Nunavik, Nunatsiavut and the Beaufort/Inuvialuit region of the Northwest Territories, for instance, rely on sealift services for the supply of basic goods. Natural resource development sectors in these regions, such as mining, are also heavily dependent on marine shipping for moving product and bringing in supplies, particularly when all-season or winter roads are not available. The infrastructure associated with water transport activities – breakwater walls, floating pontoons, harbours, ports – allows for the flow of goods and services in Northern coastal and riverside communities. Such infrastructure is also important for local fishing activities and commercial fisheries.

As Table 5 and Exhibit 3, below, reveal, marine infrastructure in Canada's North is often bare-bones and rudimentary.⁵⁶ Though there are private deep-water ports that service the Raglan Mine near Deception Bay, Québec, and the Voisey's Bay nickel mine in Newfoundland and Labrador, Canada's only true deepwater port is located in Churchill, Manitoba – which is outside the regions of interest in this report. The Arctic Council's *Arctic Marine Shipping Assessment 2009 Report* states that there is marine infrastructure in the Canadian Arctic Archipelago at Resolute Bay which serves transportation, administration, and communications needs, but it can only accommodate vessels with drafts under five metres.⁵⁷

Some coastal communities appear to have the potential to support improved marine facilities. Though it is the capital of Nunavut – and a major gateway for freight transport to the Territory – Iqaluit has only rudimentary port facilities. As in all other Nunavut communities, ships must use barges (lightering) to unload cargo. Due to the tide, they are often subject to short loading and unloading windows.

According to data from Fisheries and Oceans Canada's Small Craft Harbours Program, there are also few small craft harbours throughout the North. The construction of Nunavut's first small craft harbour was completed in 2013, in Pangnirtung, after almost 30 years of planning and lobbying by community leaders.⁵⁸ At a total cost of approximately \$40.5 million, it includes dredged channels and a basin, a fixed wharf, a breakwater, a marshalling area, and a sealift ramp. Fisheries and Oceans Canada (DFO) also recognizes five facilities in Nunatsiavut and two in the Northwest Territories as small craft harbours. However, of these, only three – Nain,

⁵⁶ It should be noted that, when considering the number of communities that have only minimal water transport infrastructure, most are not strategically located along waterways that would necessarily make infrastructure improvements worthwhile.

⁵⁷ Arctic Council, *Arctic Marine Shipping Assessment 2009 Report*, 178.

⁵⁸ CBC News, "Pangnirtung's small craft harbour opens." <http://www.cbc.ca/news/canada/north/pangnirtung-s-small-craft-harbour-opens-1.1859764>



Makkovik (NL), and Hay River (NT) – have a DFO-recognized harbour authority in addition to facilities that support commercial fishing activities.

Despite the current sparseness of DFO-recognized marine facilities in Nunavut, there are several fish-processing plants in the territory. The largest is in Pangnirtung, and there are smaller plants in Iqaluit (Iqaluit Enterprises), Rankin Inlet, and Cambridge Bay. Several smaller-scale community facilities can also be found, such as those in Whale Cove, Chesterfield Inlet, and Gjoa Haven. Many of the plants also process wild game in addition to locally harvested fish, which the larger enterprises may export to regional, national, and even international markets. The marketing and distribution of the processed products is supported by the Nunavut Development Corporation (a Crown corporation of the Government of Nunavut) which has controlling interests in several of the more prominent plants, including Kitikmeot Foods Ltd. in Cambridge Bay (Arctic char and muskox); Kivalliq Arctic Foods in Rankin Inlet (Arctic char and caribou); Pangnirtung Fisheries Ltd. (Arctic char and turbot); and Papiruuq Fisheries Ltd. in Whale Cove (Arctic char). While Nunavut's fishing industry is still relatively small scale, it continues to grow. In particular, Pangnirtung's turbot fishery, off Cumberland Sound, shows considerable promise. In 2011 the plant processed 108,000 lbs of turbot during the winter ice-fishing season, which lasts from around mid-January to March/April. The seasonal catch grew to 575,000 pounds in 2012, and a record breaking 600,000 plus pounds in 2013 (despite a heavy winter storm that broke up the season in March).⁵⁹ During the 2013 winter season, Pangnirtung Fisheries Ltd. paid out approximately \$800,000 to the fishermen at a rate of \$1.30 per pound.⁶⁰ Plant operations cost an additional \$200,000, which included wages for 40 seasonal workers. In all, approximately 200 people, including fishermen helpers, were directly involved in harvesting the turbot in the 2013 winter season.⁶¹ In January 2014 the Canadian Northern Economic Development Agency announced it would allocate \$360,000 to Nunavut's fishing industry. Approximately 60% of the funding would go to studying potential expansions in turbot fishing and the rest was allocated to territorial strategy development and training initiatives.⁶²

Further East in Nunatsiavut, Torngat Fish Producer's Co-operative Society Ltd. maintains a seafood and fish processing facility in Makkovik. Nunatsiavut's marine facilities provide an important lifeline for the coastal Labrador communities. Two vessels regularly ship passengers and cargo under the Nunatsiavut Marine service (a division of the Nunatsiavut Group of Companies, which acts as a holding company for the Nunatsiavut government's various business interests). One weekly passenger and freight service loops from Happy Valley-Goose Bay to the coastal communities of Rigolet, Makkovik, Postville, Hopedale, Natuashish and Nain.

⁵⁹ Vela, "Winter fishery sets record." http://www.nnsi.com/frames/newspapers/2013-04/apr29_13fish.html

⁶⁰ Ibid.

⁶¹ Ibid.

⁶² Canadian Northern Economic Development Agency, "Investments Strengthen Nunavut's Fishing Industry – Three Projects Aim to Diversify 'Region's Fishery and Create Jobs." <http://www.newswire.ca/en/story/1289919/investments-strengthen-nunavut-s-fishing-industry-three-projects-aim-to-diversify-region-s-fishery-and-create-jobs>



An additional freight and cargo service loops from Lewisporte (NL), delivering cargo and goods to Black Tickle, Rigolet, Makkovik, Postville, Hopedale, Natuashish and Nain. This service is based on freight demand.

Finally, Prolog Canada notes that there is a natural semi-deepwater port in Tuktoyaktuk, on the Beaufort Sea in the Northwest Territories, though it has a shallow 32 kilometre channel approach that reportedly has sections where its depth is less than four metres.⁶³ There is talk about enhancing these facilities to create a kind of “Base for the Beaufort” – port infrastructure that could be used to support the offshore oil and gas development that is projected for the region, as well as transit shipping and tourism in the Western Arctic.⁶⁴

Table 5: Water transport infrastructure

Community access to water transport facilities								
		Number of communities per category						Total
		No resupply service (small boating facilities present)	Irregular resupply (barge)	Seasonal resupply (barge)	Seasonal resupply (sealift)	DFO-recognized small craft harbour	DFO-recognized small craft harbour (supports core fishing and resupply) ⁶⁵	
R e g i o n	Nunatsiavut	0	0	0	0	3	2	5
	Nunavik and Eeyou Istchee	5	1	2	15	0	0	23
	Nunavut	0	0	0	24	0	1	25
	Northwest Territories	18	1	7	4	1	1	32
	Yukon	13	2	0	0	0	0	15
Total		36	4	9	43	4	4	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014; Fisheries and Oceans Canada, <http://www.dfo-mpo.gc.ca/sch-ppb/list-liste-eng.htm>

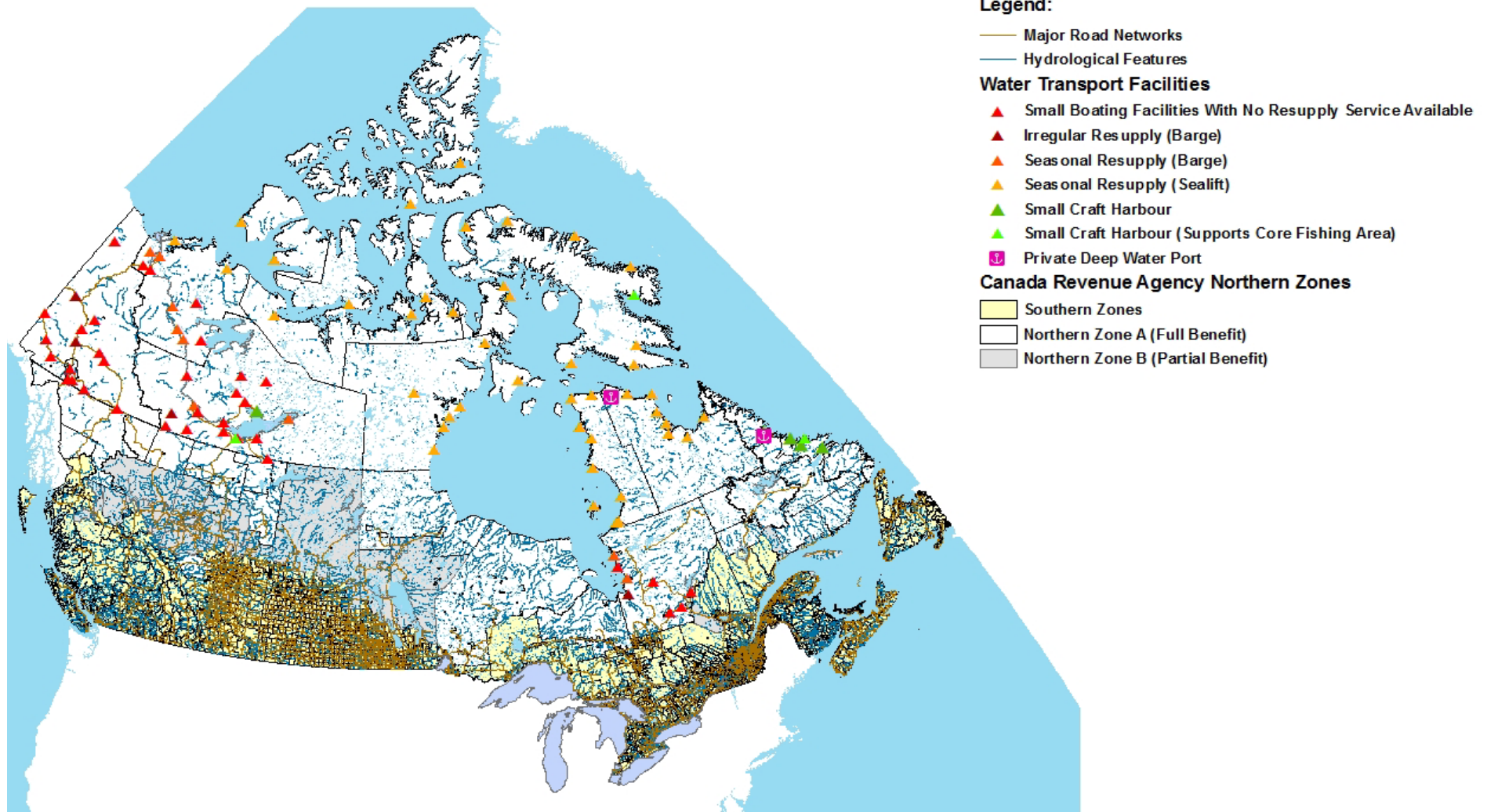
⁶³ PROLOG Canada, Inc., The Northern Transportation Systems Assessment. Phase 2 Report, 32.

⁶⁴ Jones, “Building a road to Open the Riches of Canada’s North.” <http://www.theglobeandmail.com/news/national/the-north/building-a-road-to-arctic-prosperity/article16396177/?page=all>

⁶⁵ Core fishing designation is based on Fisheries and Oceans Canada, Small Craft Harbours program. See <http://www.dfo-mpo.gc.ca/sch-ppb/home-accueil-eng.htm>



Exhibit 3: Map of Northern community access to water transport facilities



Sources: Aboriginal Affairs and Northern Development, 2014 ; Canada Revenue Agency, "Northern Residents Deductions," 2014 ; Conference Board of Canada, 2014 ; GeoBase Secretariat, "National Hydro Network, Canada." ; Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Centre for Topographic Information, "National Road Network 2.0," 2007 ; Statistics Canada, Census Subdivisions – Boundary Files, 2011.



Energy infrastructure

As noted in Chapter 2, another key type of infrastructure that supports both economic activity in Northern Aboriginal communities and in regional natural resource sectors, is energy infrastructure. The Government of Nunavut's mineral strategy – Parnautit – notes that reliable and sufficient sources of energy are essential to both mining operations and the daily requirements of local communities.⁶⁶ Yet energy infrastructure is an issue in Nunavut and across the North.

In Table 6 and Exhibit 4, below, we see that many of the study communities rely on local diesel generators to meet their energy needs. All of the 30 communities located in Nunatsiavut and Nunavut are powered by diesel generators. This is also true for the 14 Inuit communities in the Nunavik region of Québec. None of these regions have an integrated energy grid.

By contrast, the Eeyou Istchee region, directly south of Nunavik, is somewhat unique, due to the Crees' proximity to major hydro developments that resulted from the 1975 James Bay and Northern Québec Agreement (JBNQA) and the 2002 Paix Des Braves Agreement. These agreements established a business relationship between the Cree and Hydro Québec. The 2002 Paix Des Braves Agreement specifies conditions under which Hydro Québec will connect its network to the nine Eeyou Istchee communities.⁶⁷ (Eight of nine communities are now connected to the Hydro Québec grid.) Moreover, there is an expectation in the James Bay and Northern Québec Agreement, as in the 2002 agreement, that Hydro Québec's infrastructure will create economic development prospects for Cree beneficiaries. As section 4.3 of the Paix Des Braves Agreement indicates:⁶⁸

Québec will ensure that Hydro-Québec encourages partnerships and joint ventures with Cree Enterprises and enter into agreements with the Crees concerning remedial works, employment and contracts resulting from its activities in the Territory.

By contrast, though Nunavik was part of the 1975 JBNQA, the relative location of its communities has not been favourable for these types of trade-offs with hydroelectric developments.

Eeyou Istchee's strategic location notwithstanding, a general reliance on diesel indicates that the majority of focal communities in the study region lack a clean, reliable, and sustainable energy supply. Aboriginal Affairs and Northern Development Canada (AANDC) has estimated that in 2011, communities across the territories consumed at least 76 million litres of diesel fuel

⁶⁶ Government of Nunavut, Parnautit: A foundation for the future, 35.

⁶⁷ See for example, Section 4.22 for Waskaganish and Whapmagoostui; the latter which adjoins Nunavik's Kuujuaraapik in the furthest Northern reaches of Eeyou Istchee, remains to be connected.

⁶⁸ Gouvernement du Québec, "Agreement Concerning a New Relationship (Paix Des Braves) Between le Gouvernement du Québec and the Crees Of Québec", 26.



to satisfy energy needs, in addition to 219 million litres of propane for heating production. AANDC further estimated that over 800,000 tonnes of greenhouse gas emissions resulted from this fuel consumption.⁶⁹

What is more, these communities will find it a challenge to increase their energy capacity to meet growing community demands, including the needs of locally based economic development initiatives. The hamlet of Tuktoyaktuk, for instance, currently spends more than \$7 million a year on energy to serve a population of just under 900 people.⁷⁰ Changing resource and environmental conditions can also rapidly destabilize a community's energy system, as demonstrated by recent cases in the Northwest Territories. Technical disruptions at oil fields supplying natural gas to the town of Norman Wells temporarily forced the community onto diesel power in 2013.⁷¹ Similarly, in 2013–2014, harsh and lengthy winters compounded the effects of Inuvik's diminished natural gas supply, which resulted in increased imports of synthetic natural gas to meet local heating demands. In 2013, heating bills in Inuvik rose an estimated 83% for local consumers, with the cost per gigajoule of energy rising to \$35.34.⁷² By contrast, the average Alberta wholesale gas price benchmark was \$3.10 per gigajoule for the 2013 season.⁷³

Faced with increasingly vulnerable energy systems, many of these Northern communities also have to allocate resources to backup systems. Communities with regional and micro hydro grid access, such as is found in the Northwest Territories and Yukon, maintain backup diesel generators to support their primary systems. Some communities are also exploring the potential of alternative energy sources and hybrid systems such as wind-diesel or wind-diesel/liquefied natural gas.

Comparatively speaking, Yukon and the Northwest Territories appear to lead their peers in terms of comprehensive energy policy development. The Government of the Northwest Territories for example, is currently setting out to expand its regional energy grid and diversify its energy sources, with the hopes of providing needed capacity to mining projects while helping isolated "thermal" communities achieve more cost-effective solutions to their growing energy demands. Similarly, Yukon is looking to expand hydropower and adopt more alternative

⁶⁹ Catherine Conrad, Director, Aboriginal Affairs and Northern Development Canada, In Committee from the Senate of Canada – Energy, the Environment, and Natural Resources, April 29, 2014. <http://www.cpac.ca/en/programs/in-committee-from-the-senate-of-canada/episodes/32723170/>

⁷⁰ CBC News, "Tuktoyaktuk mayor wants to switch from diesel to natural gas." <http://www.cbc.ca/news/canada/north/tuktoyaktuk-mayor-wants-to-switch-from-diesel-to-natural-gas-1.1093085>

⁷¹ Puglia, "Disruption at oil fields puts Norman Wells on diesel power." Northern News Services ONLINE. http://www.nnsl.com/frames/newspapers/2013-12/dec18_13powP.html

⁷² CBC News, "Fuel solution has Inuvik residents struggling to pay bills." <http://www.cbc.ca/news/canada/north/fuel-solution-has-inuvik-residents-struggling-to-pay-bills-1.2500833>

⁷³ Natural Resources Canada, "North American Natural Gas Market: 2013–2014 Heating Season Outlook." <http://www.nrcan.gc.ca/energy/natural-gas/12432>



energy sources, and is also examining the potential to interconnect its systems with the North American power grid.

Furthermore, in recent years a number of communities in the study region, with the support of government programs, have been experimenting with alternative sources of power, including biomass, wind, and solar projects – often as part of hybrid diesel and backup systems. The governments of Yukon and the Northwest Territories, for example, have each mapped out comprehensive alternative energy pathways and prospects in partnership with their member communities and regional industries. At the same time, Northern industries are searching for energy solutions to ease the high cost of thermal energy sources such as diesel. In the Northwest Territories' non-renewable resource sector for example, the Diavik Diamond Mine has been actively testing the potential benefits of wind energy. In 2014, Diavik's installation of four wind turbines on its site has cut the mine's diesel fuel consumption by almost 10%, creating annual savings of approximately \$5 million.⁷⁴ Similar projects are being undertaken by resource companies in other Northern regions. Xstrata Nickel Inc.'s Raglan Mine in Nunavik recently partnered with TUGLIQ Energy Co. (a non-Aboriginal company) to test the feasibility of integrating wind energy into an existing diesel-based electricity system. The project was funded in part by Natural Resources Canada's ecoENERGY Innovation Initiative (introduced in 2011).⁷⁵ TUGLIQ Energy Co. has also proposed a strategy to replace Nunavik's various diesel generators with hybrid wind and liquefied natural gas energy systems.⁷⁶

⁷⁴ Varga, "Diavik mine's wind-driven power saves \$5 million a year in diesel costs."

http://www.nunatsiaqonline.ca/stories/article/65674diavik_mines_wind-driven_power_saves_5_million_in_diesel_costs/

⁷⁵ Prime Minister of Canada, "PM announces support for development of clean energy in Northern Québec."

<http://www.pm.gc.ca/eng/news/2013/08/23/pm-announces-support-development-clean-energy-northern-Quebec#sthash.3huCw0pV.dpuf>

⁷⁶ Rivard, "Le jumelage éolien-micro GNL: Une solution énergétique pour desservir les sites éloignés et les réseaux autonomes." http://consultationenergie.gouv.qc.ca/memoires/20130927_199_TUGLIQ_M.pdf



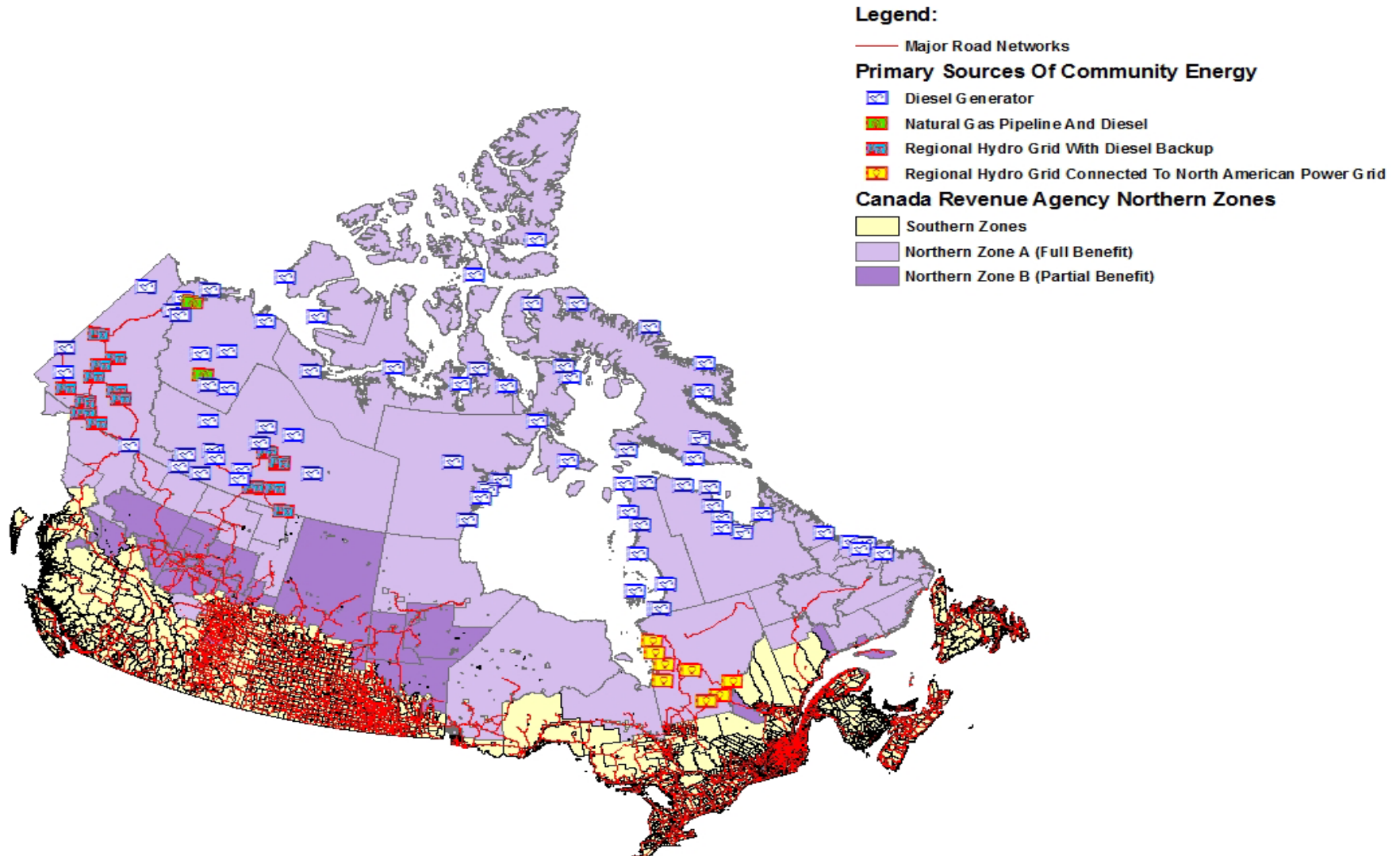
Table 6: Energy infrastructure

Primary sources of community energy						
		Number of communities per category				Total
		Diesel generator	Natural gas pipeline and diesel	Regional hydro grid and diesel	Regional hydro grid connected to North American power grid	
Region	Nunatsiavut	5	0	0	0	5
	Nunavik and Eeyou Istchee	15	0	0	8	23
	Nunavut	25	0	0	0	25
	Northwest Territories	23	2	7	0	32
	Yukon	4	0	11	0	15
Total		72	2	18	8	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2011



Exhibit 4: Map of Northern community energy infrastructure



Sources: Aboriginal Affairs and Northern Development, 2014 ; Canada Revenue Agency, "Northern Residents Deductions," 2014 ; Conference Board of Canada, 2014 ; Government of Canada, Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Centre for Topographic Information, "National Road Network 2.0," 2007 ; Statistics Canada, Census Subdivisions Digital Boundary Files, 2011.



Telecommunications infrastructure

In the information age, telecommunications infrastructure is needed to support both economic opportunities and social cohesion. Canada's Northern communities require connectivity infrastructure that is reliable, scalable, and supportive of affordable services. The state of telecommunications infrastructure varies widely, both across and within the study region. Yet many of the study communities continue to be vulnerable to "bottlenecks" and service disruptions, and their adoption of new information technologies and services can be severely limited by interrelated factors such as price, income, and technology supply.

As Table 7 and Exhibit 5, below, indicate, 51% of study communities are dependent on satellite transport facilities to support basic telecommunications and Internet access. Their present lack of scalable broadband transport facilities is a bottleneck that severely impedes their ability to participate in the digital economy or take advantage of innovative applications in emerging electronic service sectors such as e-learning and telemedicine.

Table 7: Telecommunications infrastructure

Community access to telecommunications backbone facilities				
		Number of communities per category		Total
		Access to terrestrial backbone (microwave or fibre)	Access dependent on satellite backbone	
Region	Nunatsiavut	5	0	5
	Nunavik and Eeyou Istchee	8	15	23
	Nunavut	0	25	25
	Northwest Territories	22	10	32
	Yukon	14	1	15
Total		49	51	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014

Remote Arctic regions, particularly Nunavut and Nunavik (Québec) are, at this point, entirely dependent on satellite backbone services. For these regions, commercial satellite backbone prices have made it almost impossible for independent Internet service providers to serve residents and local businesses without some form of government support. In the mid-2000s, the federal government introduced the National Satellite Initiative (NSI) to help establish networks such as Tamaani (in Nunavik) and Qiniq (in Nunavut). Later, in 2009, it introduced a program called Broadband Canada which these networks have depended on to subsidize residential Internet services (for example, for Qiniq's residential users, a broadband speed of 1.5 Mbps (download speed) at \$80/month would cost \$200/month without subsidies in place). By 2016 Broadband Canada's related funding will be depleted, and by 2019 the National



Satellite Initiative will have run its course for most of these networks. The operators of Tamaani and Qiniq will have to find new funding agreements and sources or run the risk of raising consumer rates beyond what many residents might be able to afford. These issues have spurred interest in the potential for alternative network transport technologies such as undersea fibre-optic systems, terrestrial microwave, and High Throughput Satellites in Nunavut and Nunavik. Arctic stakeholders are looking for better options and hoping that some of the promising developments of the past few years pan out in the near future.

According to a 2013 study of the Northern Communications and Information Systems Working Group (NCIS WG) – a joint federal and pan-territorial initiative to improve communications in Arctic regions – Northern users require a minimum broadband speed of 9 Mbps (download speed) and 1.5 Mbps (upload speed)⁷⁷, and that rate will continue to grow as technology and new service demands evolve. In 2014, this benchmark rate is not available to the majority of communities in Nunavut. For residents in Iqaluit, it would cost approximately \$79.95 per month to acquire a download speed that meets or exceeds 9 Mbps, and \$110.95 per month to meet or exceed the benchmark for upload speeds (through a service offered by incumbent NorthwesTel). In Nunavik communities served by Tamaani (a unit of the Kativik Regional Government), neither benchmark is currently attainable under available residential Internet service packages.

The NCIS Working Group's study concluded that for all three territories combined, a total capital expenditure for required network upgrades ranges from \$622.68 million (for main link upgrades alone) to \$2.2 billion. However, Nunavut's portion of the total cost amounts to over 92% of the main link upgrades – primarily due to its satellite dependence. The capital expenditure associated with access network equipment to enable communities to take advantage of the proposed infrastructure was estimated to add another \$16.08 million on top of the projected capital expenditures.⁷⁸ The bottom end of the estimated costs – at \$622.68 million – would constitute more than 81% of the combined Territorial Base Fund Agreement's allocation to infrastructure in these three regions under the federal Building Canada Plan (from 2007 to 2013).

By comparison, the Government of Nunavut's total annual revenue in 2013–2014 was approximately \$1.69 billion with 83% derived from federal transfers.⁷⁹ Without additional and new sources of funding and finance, this level of telecommunications development would require substantial trade-offs from other types of regional and community infrastructure development. As many Northern communities equally require improvements to their infrastructure such as water and sewage systems, road work, and airport improvements, funding constraints may force major projects of potential – but not necessarily immediate – benefit to the side.

⁷⁷ Northern Communications and Information Systems Working Group, "Northern Connectivity: Ensuring Quality Communications." <http://Northernconnectivity.ca/>

⁷⁸ Northern Communications and Information Systems Working Group, "Northern Connectivity: Ensuring Quality Communications." <http://Northernconnectivity.ca/>

⁷⁹ Department of Finance Canada. "Federal Support to Provinces and Territories."



The NCIS Working Group estimated that among the territories, the Northwest Territories could make the greatest gain in its GDP from enhanced connectivity. The Kativik Regional Government in Nunavik, which faces similar prospects as Nunavut and is entirely satellite dependent, estimated that its network upgrade costs were in the range of \$65 to \$158 million depending on the solution, with enhanced connectivity making a potential GDP contribution of \$55 million to Nunavik between 2016 and 2023.⁸⁰ Such predictions can be disputed – on the basis of being too low or too high – depending on how one chooses to evaluate related economic activities. It could be that portions of the North’s information economy are not being adequately captured by existing economic indicators and models; but it could also be that Northerners, and Northern Aboriginal communities in particular, require additional capacity development to fully take advantage of new information technologies.⁸¹ More substantial research is required.

There is no single type of telecommunications investment that is most appropriate for all Northern regions. Some provincial Northern regions have benefited from service upgrades funded by their incumbent telecommunications service providers – such as TELUS, SaskTel, MTS, or Bell Aliant.

In the Territories, the incumbent NorthwesTel is undertaking a five-year modernization plan, earmarked at \$233 million, to upgrade mobile, fixed Internet, and other telecommunications services in communities across the Yukon, Northwest Territories, and Nunavut. NorthwesTel is not without its critics, and many would like to see more competition in the territories, to push innovation further and possibly reduce rates and ease caps on data. Unfortunately, the geographic challenges of interconnecting remote communities to adequate backbone and backhaul facilities – their sparse populations and distance from each other and from regional hubs – will not simply go away. Some Internet providers, most notably XplorNet, are able to find economies of scale by delivering satellite services across a national footprint (albeit with limited territorial coverage and capacity). Others try to find linkages with projects that can deliver greater economies of scale. There is interest in the plans of Arctic Fibre a company which plans to deploy an intercontinental submarine cable linking Europe, North America, and Asia through Arctic waters. If proven feasible, the Arctic Fibre project could, as a secondary service, deliver scalable fibre optic backbone services to coastal communities in several Northern regions including Alaska, Nunavut, and Nunavik. The company estimates that this secondary service could be established by a contribution of approximately \$161 million (likely through a combination of federal, territorial, Aboriginal, and other sources).⁸² It is the intention of Arctic Fibre that this intercontinental project be financed through global partnerships and not depend solely on Canadian sources.

⁸⁰ Dumoulin, “Connect Nunavik!” <http://www.Northernlightsottawa.com/presentations/2014/KRG.pdf>

⁸¹ See for example, results of the 2012 Programme for the International Assessment of Adult Competencies (PIACC) in Canada, which includes territorial coverage.

⁸² Fiser, “Mapping the Long-Term Options for Canada’s North: Telecommunications and Broadband Connectivity,” 31.

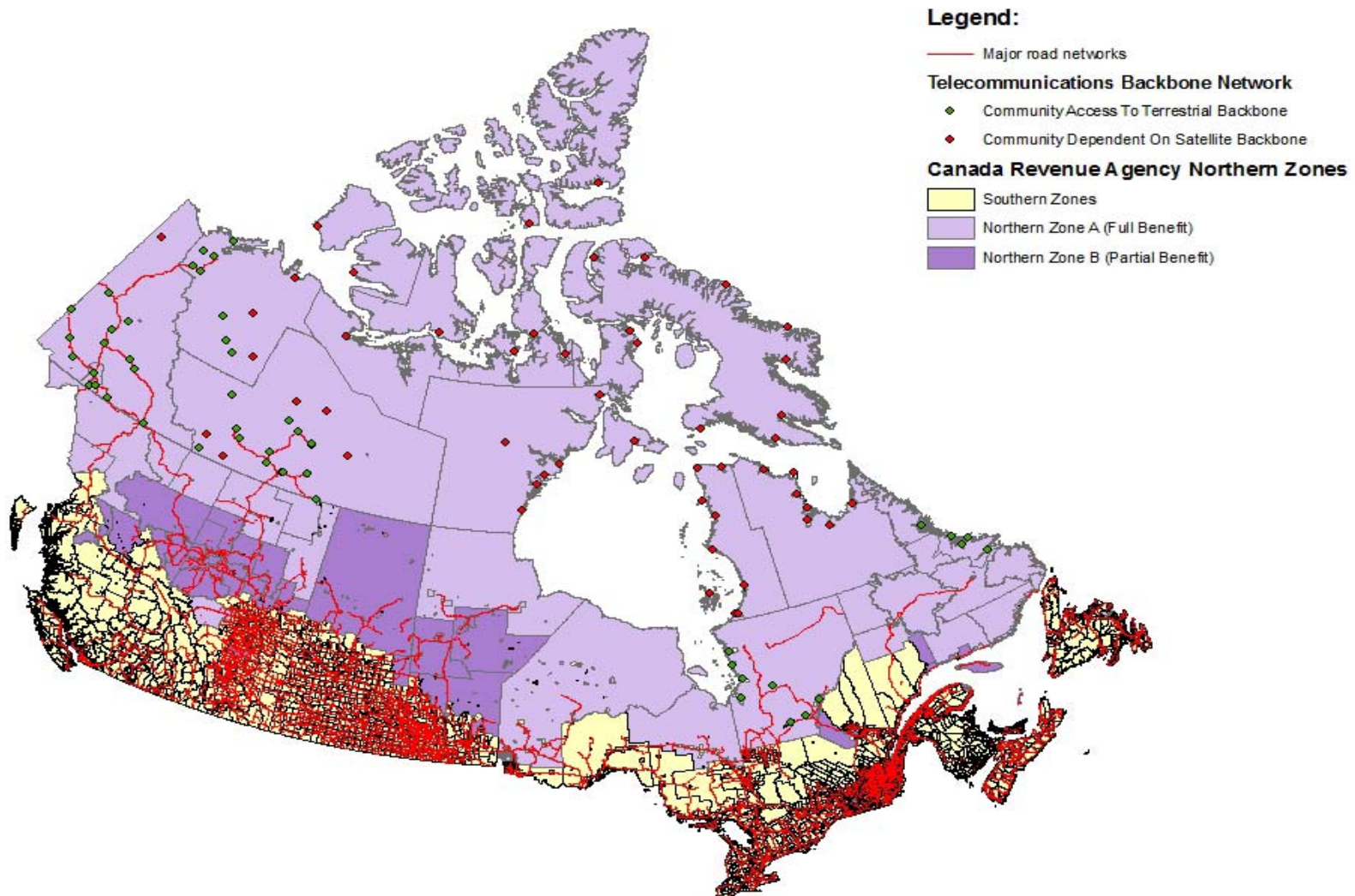


To varying degrees the provincial incumbents can draw from their more densely populated southern markets to cross-subsidize Northern infrastructure investments; but they too rely on provincial and federal investments to push infrastructure upgrades into sparsely populated remote regions. This has been the case, for example, with Bell Aliant in Labrador. However, for NorthwTel and its competitors, the territorial “urban” markets are limited to Whitehorse, Yellowknife, and on a lesser scale Iqaluit. Yet, by contrast, regions such as Nunavik lack even a population base equivalent to the territorial capitals, which is why a public sector role in service development and delivery can be an important source of innovation, as seen in the Kativik Regional Government’s deployment and management of its Tamaani Internet service.

Strategic government investments – of various kinds – therefore have an important role to play in the Northern telecommunications landscape. In some cases this could mean not simply subsidizing but co-investing in open access networks that provide shared critical infrastructure which multiple service providers can use and be responsible for. The Government of the Northwest Territories may be heading in this direction with its plans to develop a Mackenzie Valley Fibre Link. In Northern Québec, we have seen a similar approach, just south of Nunavik, with a carrier class fibre optic network developed by the Eeyou Istchee – James Bay Cree – in partnership with neighbouring Jamésien municipalities, and Hydro Québec, and with funding support from the federal government and province of Québec.



Exhibit 5: Map of Northern connectivity infrastructure (access to terrestrial or satellite backbone)



Sources: Canada Revenue Agency, "Northern Residents Deductions," 2014 ; Conference Board of Canada, 2014 ; Government of Canada, Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Centre for Topographic Information, "National Road Network 2.0," 2007 ; Statistics Canada, Census Subdivisions Digital Boundary Files, 2011.



Infrastructure that supports education

An absence of educational facilities in a community can deter outside investment and dissuade professionals and families from relocating to the area. It can also cause families and friendships to split apart as people leave their community to pursue learning and educational opportunities elsewhere. Conversely, the availability of schools and other educational facilities can work to enhance community development, well-being, and the overall attractiveness of a community to businesses.⁸³ A report by the Conference Board of Canada concluded that better educational outcomes are pivotal to improving the socio-economic well-being of Canada’s Northern Aboriginal communities.⁸⁴

Table 8, below, indicates that most communities do in fact have K-12 education facilities. The exceptions in this case are seven communities in Yukon and 11 in the Northwest Territories. Yet even these communities have access to high schools located in nearby communities.

Table 8: Educational infrastructure - Community access to on-site high school facilities

Community access to high school facilities				
		Number of communities per category		Total
		No High School On-site	High School On-site	
Region	Nunatsiavut	0	5	5
	Nunavik and Eeyou Istchee	0	23	23
	Nunavut	0	25	25
	Northwest Territories	11	21	32
	Yukon	7	8	15
	Total	18	82	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014

⁸³ The Canadian Chamber of Commerce and GE Canada, The Business Case for Investing in Canada’s Remote Communities.
⁸⁴ Sisco and others, Lessons Learned: Achieving Positive Educational Outcomes in Northern Communities.



A look at Table 9, however, imparts a very different impression with regards to post-secondary education. There are no universities in the five regions examined in this report, with the possible exception of Memorial University's Labrador Institute, based in Happy Valley-Goose Bay (which is approximately 370 kilometres by air south of Nain). In 2014 the Nunatsiavut government and Memorial University signed a memorandum of understanding (MOU) to develop "opportunities for collaboration in culture, arts, fine arts, social sciences and humanities." Areas of potential collaboration cited in the MOU include "helping the Nunatsiavut Government build capacity in primary research and analysis, developing digital archives of the social history and culture of Labrador Inuit and further developing research and educational opportunities."⁸⁵

There are usually only one or two post-secondary institutions delivering college level and/or vocational programs in the study region. Several of these, including Yukon College, which has the largest distribution of college campus facilities per region, have working program partnerships with southern universities. By contrast, none of the communities in Nunatsiavut and in Nunavik and Eeyou Istchee have college campus facilities on-site. In some cases, members of these communities may access distance education programs online. However, as discussed earlier, the current state of Internet connectivity in Nunavik impedes the widespread adoption of e-learning scenarios. Studies also indicate that blended learning facilities – which pair independent learners with local mentors or facilitators and peers – lead to better outcomes than pure e-learning applications where students work in physical isolation.⁸⁶

All five of the Nunatsiavut communities, eight of the 32 communities in the Northwest Territories, and 22 of the 23 communities in Nunavik and Eeyou Istchee have no access to college level programs through campus facilities or an on-site community learning centre. By contrast, Yukon stands out with 12 out of 15 communities having access to college level programs via a local college campus or community learning centre. Yukon College is able to maintain a greater range of community level, post-secondary services than its peer. This may be the result of Yukon's more favourable geography and road network infrastructure. Faced with considerably greater geographic challenges, Nunavut's Arctic College stands out for the number of community learning centres it supports.

⁸⁵ Memorial University, "Partnering for enhanced cultural research and collaboration."
<http://today.mun.ca/news.php?id=8813>

⁸⁶ Garrison and Kanuka, "Blended learning: Uncovering its transformative potential in higher education."
<http://anitacrawley.net/Articles/GarrisonKanuka2004.pdf>



Table 9: Educational infrastructure – Community access to college facilities (physical or virtual)

Community access to college facilities					
		Number of communities per category			Total
		No facilities on-site	Physical college campus on-site	Community Learning Centre (access to virtual campus and distance learning)	
Region	Nunatsiavut	4	0	1	5
	Nunavik and Eeyou Istchee	22	0	1	23
	Nunavut	0	5	20	25
	Northwest Territories	8	3	21	32
	Yukon	3	11	1	15
Total		78	11	11	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014

In general, land claims agreements across the regions of interest provide important frameworks for the development of post-secondary support services in the study communities. Land claims beneficiaries in the Yukon and Northwest Territories claims areas benefit from post-secondary support services under their respective agreements. In Eeyou Istchee, Northern Québec, the Cree School Board provides its Post Secondary Student Services to help Cree beneficiaries of the James Bay and Northern Québec Agreement (JBNQA) acquire post-secondary level education and/or professional qualifications. Similarly, the Kativik Regional Government in Nunavik provides post-secondary support services to Inuit beneficiaries of the JBNQA, while the Nunatsiavut government supports Inuit beneficiaries of the 2005 Labrador Inuit Land Claims Agreement. However, training costs can be a considerable hurdle for some remote communities.

Table 10, below, provides an example of the cost challenges that arise in Inuit Nunangat. The table summarizes the costs incurred in sponsoring an individual from a community in the Kitikmeot region of Nunavut, to participate in a 12-week, out-of-town vocational training program. This particular example assumes that the individual requires child-care support while away. It indicates that more than 50% of the total individual sponsorship is spent on child-care support, a living allowance, and transportation. Airfare alone comprises almost 7% of the total cost.



Table 10: Cost of sponsoring an individual from Kugluktuk in the Kitikmeot region of Nunavut to participate in a 12-week, out-of-town training program in Yellowknife, Northwest Territories

Component of training program costs	Cost	Percentage of total cost
Training allowance	\$5,940.00	39.4%
Tuition and books	\$1,500.00	10.0%
Living away from home allowance	\$2,400.00	15.9%
Airfare (Kugluktuk to Yellowknife)	\$1,019.40	6.8%
Child care	\$4,200.00	27.9%
Total cost per individual	\$15,059.40	

Source: Kitikmeot Inuit Association and Inuit Tapiriit Kanatami

Finally, industrial sectors in the regions can also be important sources of vocational training. Nunatsiavut's beneficiaries, for example, have benefited from the agreement between Vale and the Nunatsiavut government, which stipulates that Inuit be employed at the Voisey's Bay nickel mine. The mine has a comprehensive human resources development program on-site that is tailored to meet the learning needs of Nunatsiavut beneficiaries. Representatives of the mine also regularly visit local community schools and take high school students on field trips to visit the mine site and experience different job roles and career possibilities.



Housing infrastructure and vital amenities (water, sewage, and solid waste management)

The shortage of affordable, adequate, and suitable housing is a concern for several of Canada's Northern regions, such as Nunavut and Nunavik, and is particularly acute for their Aboriginal populations. As of 2006, the incidence of core housing need⁸⁷ amongst Aboriginal households was consistently higher than the rate for non-Aboriginals across the country – and this discrepancy was especially pronounced in Northern regions.⁸⁸ For instance, 44.2 percent of Nunavut's Aboriginal population was deemed to be in core housing need, compared to 12.9 percent of the territory's non-Aboriginal population. In the NWT, 26.3 percent of Aboriginal households were identified as being in core housing need, with only 9 percent of non-Aboriginal households facing the same predicament. And in Yukon, the ratio of households in core housing need stood at 24.7 percent for Aboriginals versus 14 percent for non-Aboriginals.⁸⁹ The Northern Aboriginal housing deficit is has systemic effects on community development and well-being. Indeed, alongside employment and education, housing is a social determinant of child (and family) health, even after controlling for other social, behavioural, and genetic indicators.⁹⁰ As a 2012 Conference Board of Canada report concluded, "the availability of affordable housing plays a significant role in supporting employment and economic development in the North, in addition to supporting the health, well-being, and positive educational outcomes of Northerners."⁹¹

Table 11 and Exhibit 6, provide regional breakdowns of the availability of suitable housing for Canadian Aboriginal households and populations (based on the 2011 National Household Survey). The tables clearly indicate that of the five regions in our study, two are facing serious housing challenges. While Aboriginal housing is poor in Canada as a whole (Manitoba, Saskatchewan, and Alberta are all indicating that there are housing challenges for First Nations), Nunavik stands out as having the most severe housing crisis in the country. Not far behind Nunavik is Nunavut. 52% of Nunavimmiut live in housing that is "not-suitable," followed closely by 48% of Nunavummiut. By contrast, 26% of Nunatsiavut's population, and 22% of the Inuvialuit region's population experience similar housing conditions. The latter is below the ratio of unsuitable housing for Aboriginal communities across the NT as a whole, where 33% of

⁸⁷ A household is determined to be in "core housing need" if it does not meet one or more of the adequacy, suitability, or affordability standards, and it would have to spend 30 per cent or more of its before-tax income to pay the median rent of alternative local market housing that meets all three standards. "Adequate housing" refers to houses that are deemed not to be in need of any major repairs by their residents, and "affordable housing" costs less than 30% of total before-tax household". See Canada Housing and Mortgage Corporation, *Housing in Canada Online*.

⁸⁸ Will Dunning Inc., *Dimensions of Core Housing Need in Canada*, 17.

⁸⁹ Will Dunning Inc., *Dimensions of Core Housing Need in Canada*, 17.

⁹⁰ Pulla, *Framing Sustainable Options for Housing in Canada's North*, 38. See also Vaillancourt and Ducharme, *Social Housing*, 6.

⁹¹ Pulla, *Framing Sustainable Options for Housing in Canada's North*, 38.



the population occupies housing that is not-suitable. In the Yukon, only 18% of Aboriginal (First Nations) peoples reside in housing deemed not suitable.

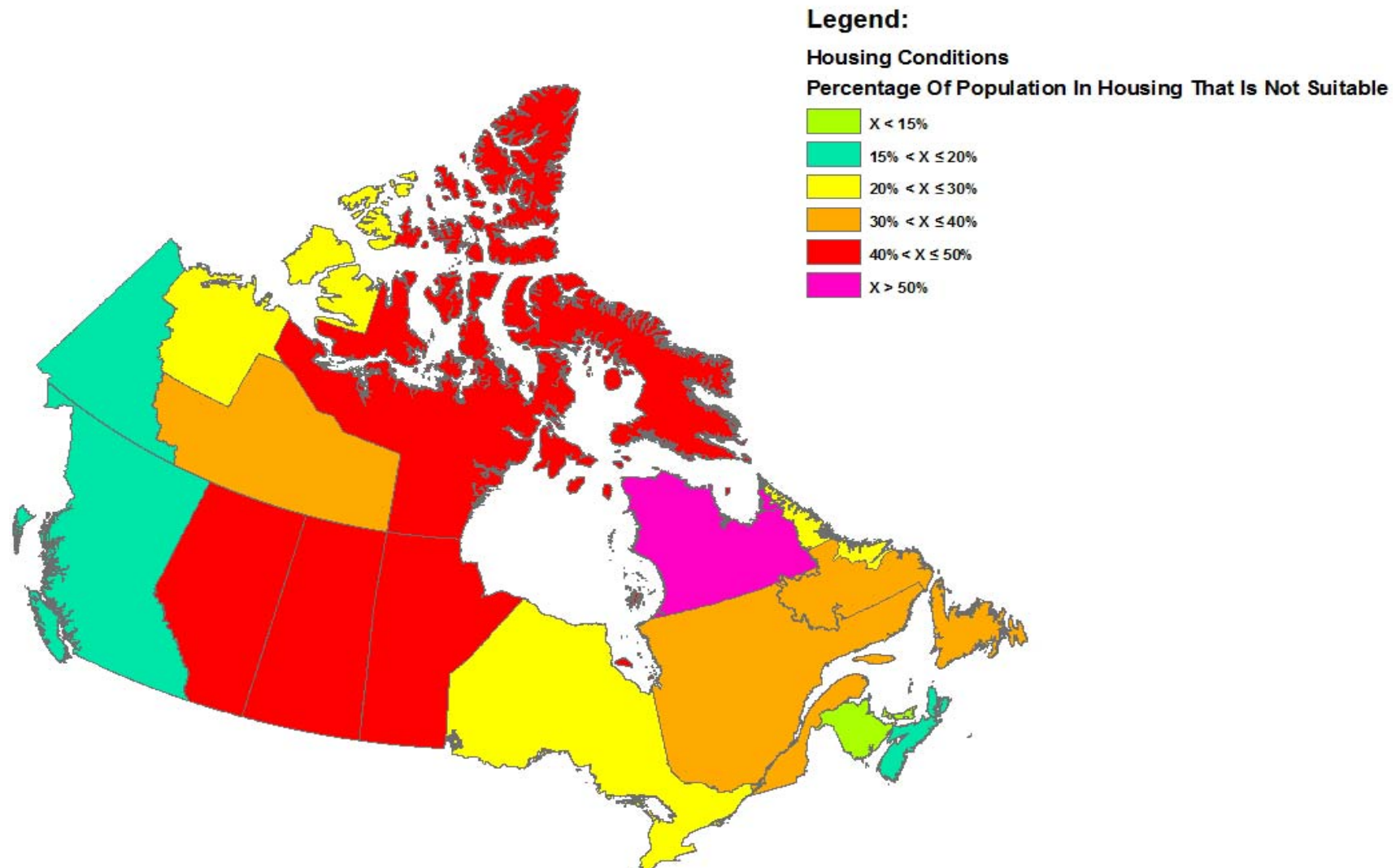
Defining housing suitability

Housing suitability⁹² refers to whether a private household is living in suitable accommodations according to the National Occupancy Standard (NOS). Under the NOS, housing suitability assesses the required number of bedrooms for a household based on the age, sex, and relationships among household members. Housing suitability and the National Occupancy Standard (NOS) on which it is based were developed by the Canada Mortgage and Housing Corporation (CMHC) through consultations with provincial housing agencies.

⁹² Statistics Canada, "Housing Suitability: Definition." <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/dt-td/Av-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=1&FL=A&FREE=0&GC=0&GID=1118283&GK=0&GRP=0&PID=107555&PRID=0&PTYPE=105277&S=0&SHOWALL=0&SUB=0&Temporal=2013&THEME=94&VID=23094&VNAMEE=&VNAMEF=>



Exhibit 6: 2011 National Household Survey: Inuit Nunangat, Territorial First Nations, and Provincial First Nations On-Reserve



Sources: Statistics Canada, Census Divisions Digital Boundary Files, 2011; Statistics Canada, 2011 National Household Survey, Statistics Canada Catalogue no. 99-011-X2011035, 2014.



Water, sewage, and solid waste management

The provision of basic residential amenities such as water, wastewater/sewage treatment, and solid waste management can be particularly challenging in Northern environments. As Table 13 below, indicates, the majority of communities across our five regions of interest rely on trucking for their water distribution. A few piped systems also exist, as might be expected in larger cities such as Yellowknife and Whitehorse, but also in some smaller Cree villages in Eeyou Istchee. A few mid-sized Northern communities have also innovated solutions such as piping water via above-ground utilidors⁹³, as is the case in Inuvik and Norman Wells (NT).

The wastewater treatment systems in our five regions of interest are generally small systems engineered to be simple to operate and to work at a scale that reflects the smaller populations of many remote Northern communities. The majority of wastewater/sewage treatment systems are also classified as primary, meaning that they typically remove particulate matter from domestic wastewater by allowing the solid materials to settle as a result of gravity.⁹⁴

As Table 11 indicates, a smaller number of communities have secondary or tertiary systems in place. The rapid growth of populations in Northern regions such as Nunavut and Nunavik is putting pressure on existing systems and leading to greater challenges for the treatment of waste water and sewage. Currently, the coastal communities of Nunatsiavut discharge their untreated wastewater into the sea. Local residents know to avoid certain areas when fishing or swimming, but community and regional governments also recognize that this approach may no longer be appropriate.

As Table 13, below, indicates, open landfills are the primary form of solid waste management for the majority of the focal communities in our study. Yet, some individual communities are dedicated to establishing more extensive systems of waste management. The Cree village of Wemindji in Eeyou Istchee, for example, developed an “eco-centre” in the mid-2000s that includes incinerator facilities and an award-winning recycling program.⁹⁵ At a broader level, the governments of Yukon and the Northwest Territories have each made concerted efforts to encourage waste diversion and recycling. Most communities in these regions have a bottle diversion policy in place. Some, due to their access to road networks and available processing facilities in the capital cities, are able to participate in more complex recycling programs.

⁹³ A utilidor is an enclosed and insulated conduit for sewage, water and other utilities that is placed above the level of permafrost.

⁹⁴ According to Aboriginal Affairs and Northern Development Canada, “primary treatment plants generally remove 25 to 35% of the Biological Oxygen Demand (BOD) and 45 to 65% of the total suspended matter.” (Source: Aboriginal Affairs and Northern Development Canada, “National Assessment of First Nations Water and Wastewater Systems.” <http://www.aadnc-aandc.gc.ca/eng/1314114777838/1314115028769>)

⁹⁵ Wemindji won the Prix Phénix de L'Environnement in 2007.



Regional governments may also manage waste management services on behalf of smaller outlying communities, as is the case with Yukon communities such as Pelly Crossing.

But the cost of the increased complexity of solid waste management can be too great for a small Northern community or even a regional government to bear. The Government of Nunavut for example, decided to abandon its regional recycling program in 2010 after pilot tests in select communities proved the programs too costly for the municipal and regional governments.⁹⁶ In 2007, the Government of Nunavut launched pilot projects in Iqaluit, Rankin Inlet, and Kugluktuk. Based on project data, government staff calculated it would cost approximately \$18.2 million to set up a recycling program in each of the 25 Nunavut communities, on top of operating and maintenance costs. The major challenges proved to be infrastructure (such as heated buildings for collecting and sorting materials), transportation, recycling legislation/enforcement, and the fact that the territory's relatively small population did not generate enough volume of recyclable materials for the recycling program to break even. Between 2007 and 2010, it was estimated that per year, approximately 900,000 to one million containers had been returned. Halfway through 2010 the recycling program had shipped out close to 45 metric tons of aluminum, the equivalent of approximately 12 sea containers of aluminum cans, in addition to eight sea containers of plastic materials.⁹⁷ Thus the relative accessibility of major ground transport networks such as roads, help explain why some regions are successful at waste diversion while others fail.

Some challenges of waste management have more to do with consumer attitudes than with better infrastructure. Yukon, which has one of the best developed road networks in our five regions of interest, has encountered waste diversion challenges. Yukon's Mount Lorne facility, for example, which serves Carcross/Tagish and smaller settlements, recycles about 40% of materials (compared to about 30% for Canada as a whole). But in 2008, the Mount Lorne Garbage Management Society, which operates the facility, ran out of money and wasn't able to ship materials to Whitehorse for processing.⁹⁸ With increased acceptance and use, the costs of waste diversion increases which can result in challenges if funding does not increase concurrently.

In the absence of regional government waste diversion programs, local businesses have in some cases taken on the responsibility and partnered with community governments to establish recycling projects. The NorthMart store in Iqaluit (NU), for example, has partnered with the municipality to divert cardboard materials from the city landfill and ship them to southern

⁹⁶ Gagnon, "GN cancels recycling program." http://www.nnsi.com/frames/newspapers/2010-10/oct4_10rec.html

⁹⁷ Ibid.

⁹⁸ Yukon News, "Raven and Carcross/Tagish play government for Mount Lorne recycling depot." <http://yukon-news.com/news/raven-and-carcross-tagish-play-government-for-mount-lorne-recycling-depot>



processing facilities.⁹⁹ Community governments have also developed bylaws and incentives to encourage residents and businesses to divert waste materials. The City of Whitehorse for example, offers landfill diversion credits. In 2008, the Northern Village of Kuujuaq (Nunavik) banned single-use plastic shopping bags.¹⁰⁰ Regional governments can also play an important role in bolstering local technical skills. The Northwest Territories' Department of Municipal and Community Affairs for example, administers an innovative School of Community Government that offers operator training and certification courses to community government staff on a range of subjects including vital community infrastructure. The school's 2014 calendar year includes courses on solid waste management/small systems wastewater, in addition to airport summer maintenance, outdoor leadership, and municipal law.

Out of the five regions of interest, Nunavut appears to face the most serious challenges for waste management. In 2011, the engineering firm Arktis Solutions reported on the state of Nunavut's community landfills as part of its work to advise the Government of Nunavut on reducing its ecological footprint and increasing local waste diversion efforts. The Arktis study concluded that the Government of Nunavut's expenditure would be more than \$9 million per community.¹⁰¹ To date, it appears that the Government of Nunavut's limited infrastructure funds have primarily been diverted to other critical areas including wastewater and sewage systems, airport renovations, and community recreational facilities. However, in 2014, the hamlet of Cambridge Bay (NU) initiated a new waste management program that includes household recycling, segregation of waste (e.g., hazardous materials such used batteries), and an upgrade of waste collection and disposal for both sewage and solid waste. The program was made possible by a contribution of \$6 million from Nunavut's Community and Government Services department.¹⁰² If successful, this initiative could become a model for other small Nunavut communities. It also demonstrates the importance of local policy as a source of innovation and responsibility when larger scale regional projects fail.

⁹⁹ The Northwest Company, "NorthMart Partners with the City of Iqaluit as part of Greener Tomorrow Campaign." <http://www.northwest.ca/community/community-engagement-story.php?id=102>

¹⁰⁰ Renewable Resources, Environment, Lands and Parks Department. Nunavik Residual Materials Management Plan

¹⁰¹ Rogers, "From landfills to local environment how to curb Nunavut's toxic waste."

http://www.nunatsiaqonline.ca/stories/article/65674from_landfills_to_local_environment_how_to_stop_the_flow_of_nunavuts_t/

¹⁰² Varga, "Cambridge Bay lays groundwork for new waste management plan."

http://www.nunatsiaqonline.ca/stories/article/65674cambridge_bay_lays_groundwork_for_new_waste_management_plan/



Table 11: Water distribution, wastewater/sewage treatment, and solid waste management

Region	Number of communities per category								
	Drinking water ¹⁰³			Wastewater/sewage treatment			Solid waste management ¹⁰⁴		
	Trucked water distribution	Piped water distribution	Untreated	Primary ¹⁰⁵	Secondary ¹⁰⁶	Tertiary ¹⁰⁷	Incinerator	Landfill	Waste diversion
Nunatsiavut	2	5	5	0	0	0	0	5	1
Nunavik	13	1	0	14	0	0	0	13	1
Eeyou Istchee	0	9	0	2	7	0	1	9	2
Nunavut	22	3	0	25	0	0	0	24	31
Northwest Territories	26	8	1	16	15	0	Unknown	32	15
Yukon	7	8	0	7	7	1	Unknown	15	15

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014

¹⁰³ Trucked and piped water distribution systems are not mutually exclusive and may coexist in certain communities.

¹⁰⁴ Solid waste management categories are not mutually exclusive.

¹⁰⁵ Primary Wastewater Treatment refers to the "removal of particulate materials from domestic wastewater, usually done by allowing the solid materials to settle as a result of gravity. Typically, the first major stage of treatment encountered by domestic wastewater as it enters a treatment facility. Primary treatment plants generally remove 25 to 35 percent of the Biological Oxygen Demand (BOD) and 45 to 65 percent of the total suspended matter. Also, any process used for the decomposition, stabilization, or disposal of sludges produced by settling." (Source: Aboriginal Affairs and Northern Development Canada, "National Assessment of First Nations Water and Wastewater Systems." <http://www.aadnc-aandc.gc.ca/eng/1314114777838/1314115028769>).

¹⁰⁶ Secondary Treatment refers to "the biological process of reducing suspended, colloidal, and dissolved organic/inorganic matter in effluent from primary treatment systems and which generally removes 80 to 95 percent of the Biochemical Oxygen Demand (BOD) and suspended matter. Secondary wastewater treatment may be accomplished by biological or chemical-physical methods. Activated sludge and trickling filters are two of the most common means of secondary treatment." (Source: Aboriginal Affairs and Northern Development Canada, "National Assessment of First Nations Water and Wastewater Systems." <http://www.aadnc-aandc.gc.ca/eng/1314114777838/1314115028769>).

¹⁰⁷ Tertiary Treatment refers to "selected biological, physical, and chemical separation processes to remove organic and inorganic substances that resist conventional treatment practices. Tertiary Treatment processes may consist of flocculation basins, clarifiers, filters, and chlorine basins or ozone or ultraviolet radiation processes. Tertiary techniques may also involve the application of wastewater to land to allow the growth of plants to remove plant nutrients. Can include advanced nutrient removal processes." (Source: Aboriginal Affairs and Northern Development Canada, "National Assessment of First Nations Water and Wastewater Systems." <http://www.aadnc-aandc.gc.ca/eng/1314114777838/1314115028769>).



Health care infrastructure

The lack of facilities that support the health care of local residents is another area of concern for Canada's Northern Aboriginal communities. While there is a clear recognition of the importance of adequate health care services, and a concomitant desire and dedication on the part of the federal and regional governments to address the health care needs of Northern Aboriginal communities, the appropriate infrastructure and equipment is not consistently available and is often severely limited, particularly in small communities. As a policy analyst for the Government of Nunavut commented in a 2014 Conference Board of Canada report, "our current funding arrangement with Health Canada doesn't support capital projects... We can support the wage for a coordinator, we can support healthy snacks for a cooking program, we can buy sports equipment for that youth centre, but we can't buy a building; we can't pay to renovate the building.... the barrier is not because we don't have the people who want to do it, or the other key elements; it's the infrastructure that's really a barrier, and funding for infrastructure."¹⁰⁸

Table 12, below, indicates that hospitals are few and far between in our five regions of interest. Our focal communities across these regions rely largely on Community Health Centres (CHC) to consult health practitioners and access emergency medical services. All five of Nunatsiavut's communities, 96% of Nunavut's, as well as 87% of focal communities in the Nunavik and Eeyou Istchee rely on CHCs to meet their health care requirements. In the Northwest Territories, four focal communities have hospitals, with another 20 having CHCs. Yet the remaining eight Northwest Territory communities have no hospital or CHC on-site. With improvement to telecommunications systems, there has been an increase in the amount of services that can be provided remotely – through available digital infrastructure – to support telemedicine consults and e-health applications. The right digital infrastructure can enhance possibilities and opportunities for health care delivery in Canada's North. However, as we have seen earlier, the focal communities that lack local access to robust medical services may also face other infrastructure challenges.

¹⁰⁸ Pulla, *Building on Our Strengths*, 117.



Table 12: Healthcare infrastructure

Community access to health care facilities					
		Number of communities per category			Total
		Hospital on-site	Community Health Centre (CHC) on-site	No hospital or CHC on-site	
Region	Nunatsiavut	0	5	0	5
	Nunavik and Eeyou Istchee	3	20	0	23
	Nunavut	1	24	0	25
	Northwest Territories	4	20	8	32
	Yukon	3	10	2	15
Total		11	79	10	100

Source: Aboriginal Affairs and Northern Development Canada 2014; Conference Board of Canada 2014



Chapter 4: Opportunities and challenges in addressing the infrastructure needs of Northern Aboriginal communities

Public and private decisions to finance infrastructure projects will play a pivotal role in determining whether Canada's regions and communities are able to meet their infrastructure needs. Depending on the methodology employed, the dollar figure attributed to the current infrastructure deficit in Canada stretches from \$50 billion to \$570 billion.¹⁰⁹ This lack of precision at the national scale is discomfiting though perhaps understandable given the immensity of Canada's geography and the diversity of its regions and communities.

In addition to the need for sufficient financial resources, it will be important to offer context-sensitive financing options to projects, particularly in communities in Northern regions. This means identifying and financing "infrastructure projects and plans with strong economic, social and environmental returns on investment" that are relevant and appropriate to Northern communities.¹¹⁰ In 2012, the NAEDB released a report which found that financing options for infrastructure on reserve lands – many of which are remotely located – were not sufficiently flexible to meet the specific needs and situations of individual communities. Moreover, the NAEDB noted that investment plans for First Nations infrastructure needed to be integrated into long-term comprehensive community planning processes.¹¹¹ Similar can be said of the need of financing options for Northern Aboriginal communities as well.

A key component of infrastructure finance is the distribution of roles and responsibilities. The private sector has long been an important player with respect to infrastructure development in Canada. Indeed a significant portion of critical infrastructure, particularly in densely populated urban areas, is privately owned and operated.¹¹² This is particularly true for services such as telecommunications and energy distribution. At smaller scales, local municipal works can be successfully contracted out to private operators; trucked water distribution and garbage pick-up in several of our focal Northern communities, for example, are opportunities for local business. Nevertheless, there is an important social equity argument to be made for strong public leadership roles in infrastructure finance,¹¹³ particularly in remote Northern regions where market failures related to sparse populations and other geographic challenges act as disincentives for private investment. In Chapter 3 we touched on several areas of infrastructure development where local and regional budgets simply cannot handle current demands. Suitable

¹⁰⁹ Canadian Chamber of Commerce, *The Foundations of a Competitive Canada*, 8.

¹¹⁰ Lewis and Tomaszewska, *Canada's Infrastructure Network Needs, New approaches to Investment and Finance*, 6,7

¹¹¹ NAEDB, *Recommendations on Financing First Nations Infrastructure*.

¹¹² Munn-Venn and Archibald, *A Resilient Canada: Governance for National Security and Public Safety*, 3.

¹¹³ Grigg, *Infrastructure Finance: The Business of Infrastructure for a Sustainable Future*, 3.



housing and waste management, for example, appear to be particularly affected by budgetary constraints in several Northern regions, such as Nunavut and Nunavik.

With these considerations in mind, one might assume that the public sector is relatively more consistent and predictable than the private sector in terms of how it allocates funds to capital and repair expenditures. For Northern regions however, this is not necessarily the case. Exhibit 7, below, compares total annual public and private expenditures on capital and repairs (adjusted to 2013 dollars), aggregated across all industry sectors, for the territories and the Nord-du-Québec region (where Nunavik and Eeyou Istchee are located, comprising approximately 67% of the region's population according to the 2011 National Household Survey)¹¹⁴. Two countervailing patterns in public sector spending are apparent from the available data (adjusted to 2013 dollars¹¹⁵). Annual public expenditures on capital and repairs – across all industry sectors – between 1999 and 2012 in Yukon, the Northwest Territories, and Nunavut appear to grow at a relatively steady measured pace. Yukon and the Northwest Territories both peak between \$400 and \$440 million, with Nunavut peaking at \$254 million, after a decade of growth (starting at \$163, \$204, and \$143 million, respectively). Though their coefficients of variation (CV)¹¹⁶ range between 21 and 32%, this does not appear extraordinarily volatile for a series of annual public infrastructure expenditures (across all industry sectors). The average annual public expenditures on capital and repairs in the territories (across all industry sectors) were, respectively:

- \$248 million in Yukon from 1999 to 2012 (with a CV of 26%¹¹⁷);
- \$275 million in the Northwest Territories from 1999 to 2012 (with a CV of 32%¹¹⁸); and
- \$170 million in Nunavut from 1999 to 2012 (with a CV of 21%¹¹⁹).

In sharp contrast, public expenditures on capital and repairs in the Nord-du-Québec region (across all industry sectors) rapidly rose from a 1999 starting point of \$183 million to exceed \$2.3 billion by 2006, and peak at \$2.36 billion in 2007, thus creating an average annual public expenditure of \$1.3 billion from 1999 to 2011¹²⁰ (with a CV of 67%¹²¹). This volatility in Nord-du-Québec's public expenditures on capital and repairs (across all industry sectors) indicates

¹¹⁴ Data for Nunatsiavut in Labrador were not available at the time of this writing.

¹¹⁵ Data older than 2013 were adjusted to 2013 dollars using historical annual average Consumer Price Index values published by Statistics Canada. 2014 data were adjusted to 2013 dollars using Statistics Canada's January 2014 Consumer Price Index value. (Source: Statistics Canada, "The Consumer Price Index for Canada, all-items CPI, not seasonally adjusted, historical data.")

¹¹⁶ The coefficient of variation can be interpreted as representing the volatility of a series of investments. In its simplest form it represents the ratio of a data series' standard deviation to its mean x 100 to create a percentage.

¹¹⁷ Standard Deviation of \$64 million.

¹¹⁸ Standard Deviation of \$87 million.

¹¹⁹ Standard Deviation of \$35 million.

¹²⁰ Data were not available for 2012.

¹²¹ Standard Deviation of \$836 million.



that the intensity of public spending on Northern infrastructure can rival that of the private sector. Shifting our lens to the private sector, the average total annual public expenditure on capital and repairs in Nord-du-Québec almost doubles the respective average for the private sector during the same time period (at \$680 million from 1999 to 2011, but with a similarly volatile CV of 60%¹²²). By contrast, average annual private expenditures on capital and repairs in the territories (across all industry sectors) reversed the pattern observed in Nord-du-Québec by exceeding that of their counterpart public sector expenditures, with average annual expenditures as follows:

- \$452 million in Yukon from 1999 to 2012 (with a CV of 44%¹²³);
- \$1.46 billion in the Northwest Territories from 1999 to 2012 (with a CV of 31%¹²⁴); and
- \$574 million in Nunavut from 1999 to 2012 (with a CV of 61%¹²⁵).

Looking at the coefficients of variation we see that, in the Northwest Territories, the private sector expenditures on capital and repairs – across all industry sectors – are much greater (\$1.46 billion versus \$275 million) but also slightly less volatile than their public sector counterparts (31 versus 32%). By comparison, private sector investments in Yukon and Nunavut, on capital and repairs, exhibit greater volatility (at 44 versus 26%, and 61 versus 21% respectively). This data appear more similar to Nord-du-Québec's private sector profile, both in terms of magnitude and volatility.

Two key messages from these patterns of capital and repair expenditures are that Northern regions exhibit both differences and similarities in infrastructure financing activities, and that the infrastructure financing activities of public and private sectors may be equally volatile. In terms of the latter observation, instead of expecting fixed financing roles for public and private entities, one would be better off to consider how the interactions of public and private financing decisions form interdependent systems of investment in Northern regions that overlap with other systems, including institutional arrangements such as land claims agreements and land-use frameworks. One example of such overlap is in the formation of new roles and responsibilities for regional Aboriginal governments, as we will discuss next.

¹²² Standard Deviation of \$401 million.

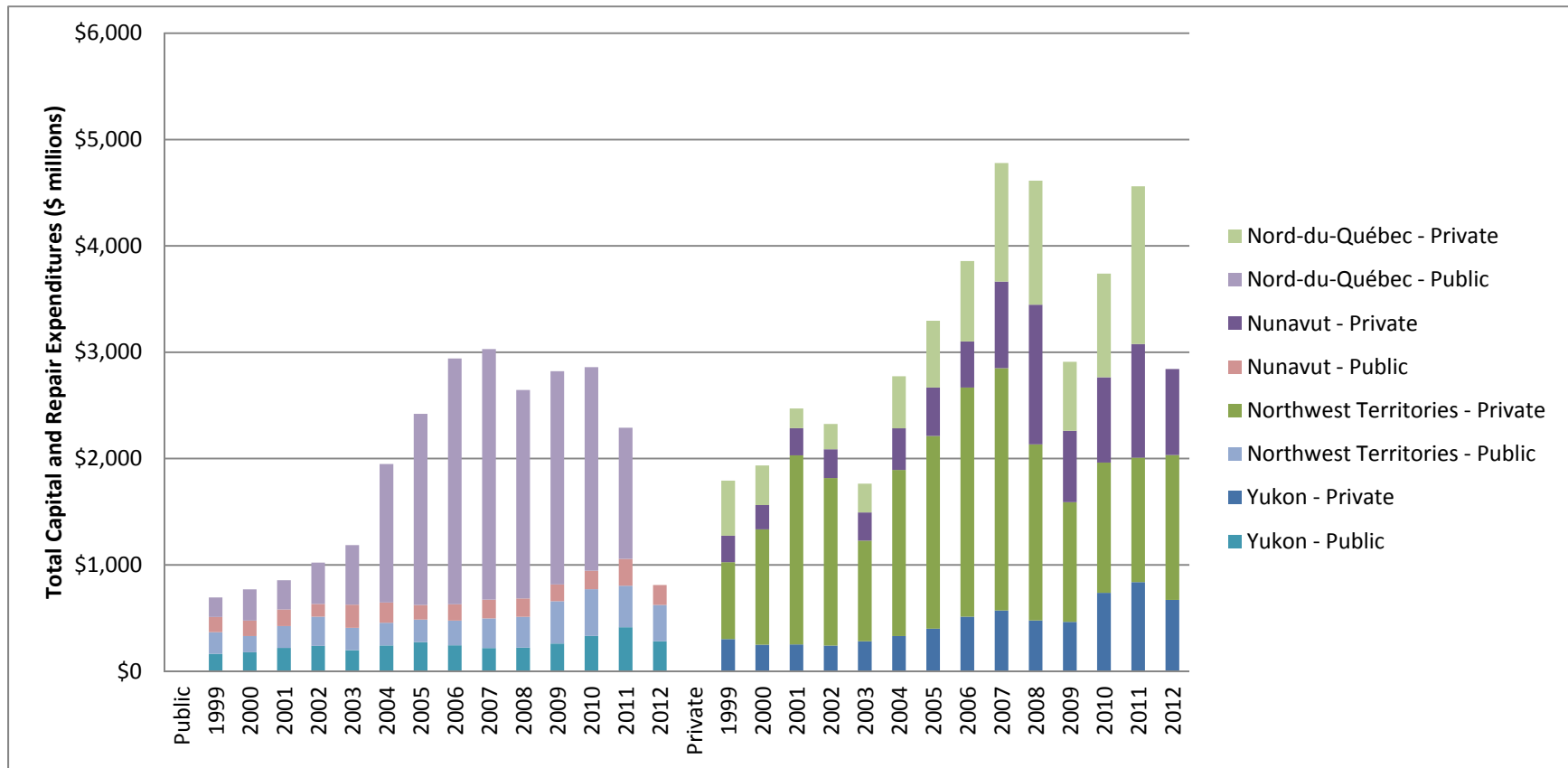
¹²³ Standard Deviation of \$195 million.

¹²⁴ Standard deviation of \$452 million.

¹²⁵ Standard Deviation of \$345 million.



Exhibit 7: Annual capital and repair expenditures for public and private sectors across four Northern regions (\$ millions, adjusted to 2013 dollars)



Source: Statistics Canada. "Private and Public Investment in Canada, Intentions (CANSIM table number 032-0002)." (accessed: 2014-05-20)



To deepen our perspective on the Northern public sectors' own internal systems of infrastructure finance, we now consider public expenditures on capital (construction and equipment) – at all levels of government (including Aboriginal and non-Aboriginal). Exhibit 8, below, indicates steady and relatively measured growth in public sector capital expenditures (including construction and equipment) for all levels of government in the territories, compared again, to explosive and volatile growth in comparable public expenditures in the Nord-du-Québec region (where Nunavik and Eeyou Istchee together comprise the majority population). Based on available data from 1998 to 2014 (adjusted to 2013 dollars¹²⁶), this translates to average annual capital expenditures of:

- \$148 million for all levels of government in Yukon from 1999 to 2014 (with a CV of 31%¹²⁷);
- \$137 million for all levels of government in the Northwest Territories from 1999 to 2014 (with a CV of 30%¹²⁸);
- \$87 million for all levels of government in Nunavut from 1999 to 2014 (with a CV of 35%¹²⁹); and
- \$71 million for all levels of government in Nord-du-Québec from 1999 to 2013 (with a CV of 98%¹³⁰).

The extreme volatility apparent in the Nord-du-Québec region is attributable to the rapid growth in capital expenditures for public administration at the tail end of the series (1999 to 2013). While in the late 1990s to mid-2000s, the investment pattern fluctuates between \$15 and 50 million, by 2009 it exceeds \$80 million and grows to over \$200 million by 2012 and 2013. One partial explanation for this intensity can be attributed to provincial development initiatives such as Plan Nord and its predecessors. Another partial explanation is in the expanding roles and responsibilities of the Cree Nation Government (Eeyou Istchee) after the signing of a major socio-economic agreement between the Cree and the Government of Québec in 2002 (La Paix des Braves). The Paix des Braves agreement provides for the sharing of revenues derived from mining, hydroelectric development, and forestry carried out on Cree lands. It also creates new expectations for how the Cree will administer public services on their lands. Most recently, in 2013 the Cree of Eeyou Istchee have amalgamated with neighbouring non-Aboriginal

¹²⁶ Data older than 2013 were adjusted to 2013 dollars using historical annual average Consumer Price Index values published by Statistics Canada. 2014 data were adjusted to 2013 dollars using Statistics Canada's January 2014 Consumer Price Index value. (Source: Statistics Canada, "The Consumer Price Index for Canada, all-items CPI, not seasonally adjusted, historical data.")

¹²⁷ Standard Deviation of \$45 million.

¹²⁸ Standard Deviation of \$40 million.

¹²⁹ Standard Deviation of \$30 million.

¹³⁰ Standard Deviation of \$69 million.

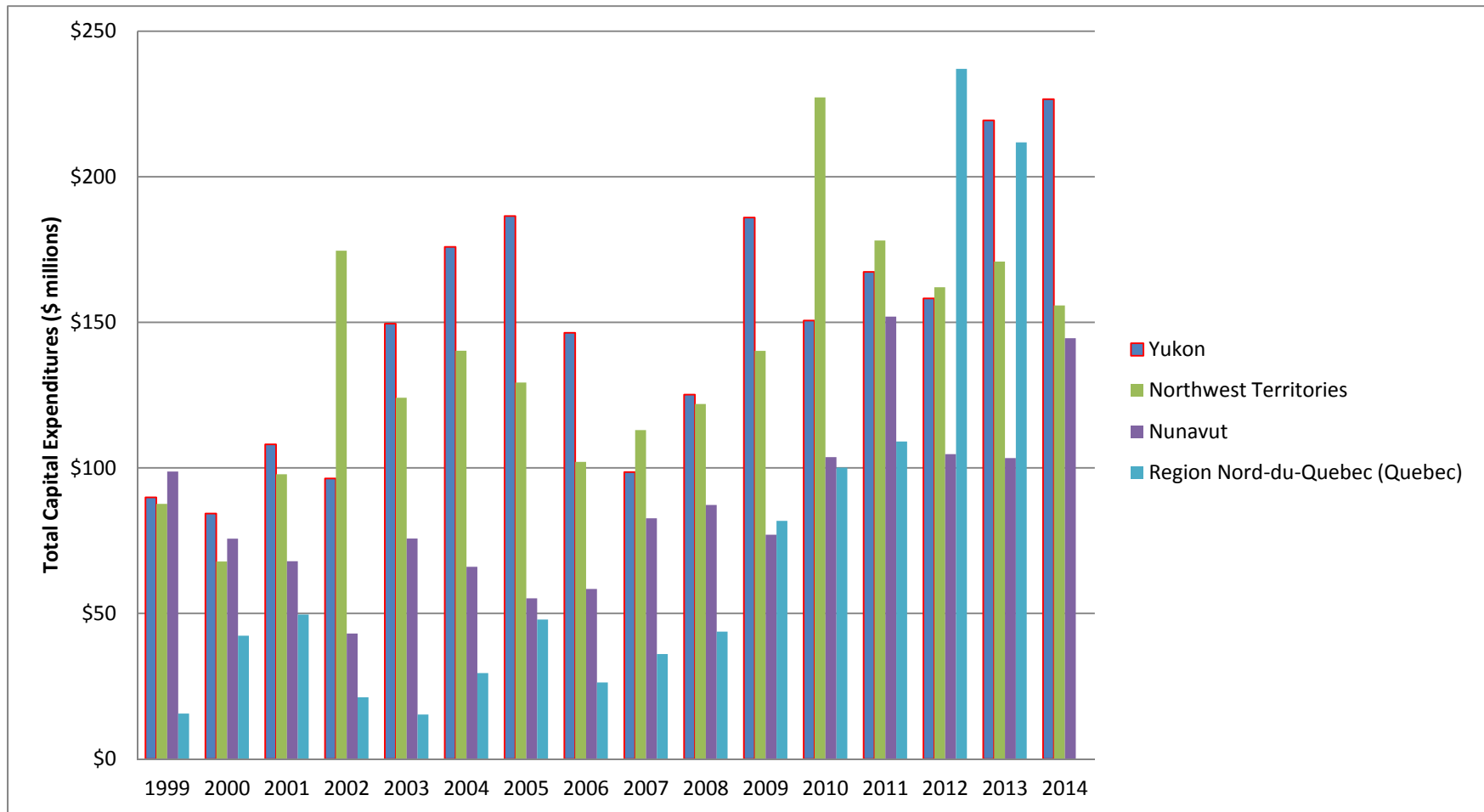


communities to form the Eeyou Istchee James Bay Regional Government.¹³¹ This kind of evolving governance process creates new roles for regional government entities to establish administrative offices, public facilities, and other forms of infrastructure that support their services to local constituents. Given that the Cree of Eeyou Istchee helped bring Canada's first modern treaty to life in 1975, with the signing of the James Bay and Northern Québec Agreement (JBNQA), we suspect that similar patterns of investment may arise in other Northern regions if/when their respective land claims agreements mature into more robust forms of regional government.

¹³¹ Québec National Assembly, "Bill 42: An Act establishing the Eeyou Istchee James Bay Regional Government and introducing certain legislative amendments concerning the Cree Nation Government."
<http://www2.publicationsduQuébec.gouv.qc.ca/dynamicSearch/telecharge.php?type=5&file=2013C19A.PDF>



Exhibit 8: Annual industry sector capital expenditures: Public administration - all levels of government (\$ millions, adjusted to 2013 dollars)



Source: Statistics Canada, "Private and Public Investment in Canada, Intentions (CANSIM table number 032-0002)." (accessed: 2014-05-20)



Now, shifting our focus to the evolving landscape of private sector activities, it is well understood that compared to communities and cities in Canada's South, Northern Aboriginal communities have far fewer opportunities to foster competitive markets. In this economic environment, alternative business entities, such as cooperatives and social enterprise, appear to have a more prominent role to play in developing regional markets and maintaining core infrastructure. Moreover, the evolving role of business entities formed under Northern Aboriginal land claims organizations, such as Eeyou Istchee and the Cree Regional Authority, may also provide important options for financing, owning, and operating infrastructure in Northern regions (See Text Box).

Eeyou Communications Network demonstrates the value of Aboriginal business leadership, regional cooperation, and social enterprise

In 2010, the Cree of Eeyou Istchee partnered with neighbouring Jamésien municipalities, and Hydro Québec, to develop a carrier-class fibre-optic network, with funding support from the federal government and the province of Québec. Local/regional, provincial, and federal government partners each paid a third of the total cost of approximately \$29 million.¹³² The resulting Eeyou Communications Network is a not-for-profit social enterprise that wholesales essential telecommunications backbone services to support private sector service providers, while providing critical infrastructure for regional public services (such as connectivity for schools, health centres, and public offices). In this way public and private interests can mutually benefit from shared infrastructure – and mutually invest in sustaining the Eeyou Istchee James Bay region's critical telecommunications infrastructure. Moreover, the not-for-profit Eeyou Communications Network can set wholesale rates based on cost-recovery and a broader vision of socio-economic development, rather than have to satisfy shareholder profit motives that may be dissociated from the Northern region it serves.

Aside from a few case studies and regional news articles profiling entities such as the Eeyou Communications Network, described above, there continue to be large gaps in our comparative knowledge of the capabilities of these increasingly complex and influential Northern Aboriginal business entities. It should come as no surprise that the business entities of Aboriginal land claims organizations, including regional economic development corporations such as the Inuvialuit Development Corporation (IDC) and national organizations such as the Nunasi Corporation (created by Inuit Tapiriit Kanatami in 1976) have (or have had) majority shares in leading Northern logistics and transport companies. IDC and Nunasi, for example, bought the Northern Transportation Company Limited (NTCL) in 1983. NTCL maintains important barging and marine shipping operations that resupply communities along the Western Arctic coast and Mackenzie River. That company has since grown into NorTerra, an investment and

¹³² Fiser, Mapping the Long-Term Options for Canada's North: Telecommunications and Broadband Connectivity, 44.



management company which, aside from NTCL, includes in its portfolio a major Northern air carrier, another logistics company, a heavy equipment attachments manufacturer, and a supply chain coordinator and sales provider of industrial, janitorial, and building supplies to Northern industries. In 2014, Nunasi sold its shares to IDC which now owns 100% of NorTerra.

As a uniquely pan-Inuit business entity, Nunasi has at least 17 different companies within its portfolio, several of which provide critical logistics and operational support for Northern telecommunications, military operations, major construction projects, and seasonal resupply systems, among other major Northern projects. Regional economic development corporations, such as the Makivik Corporation, which represents Inuit beneficiaries in the Nunavik region of Northern Québec, are similarly diversified across Northern economic sectors; Makivik is invested through businesses and joint ventures in Arctic fishing operations, transport and logistics, Arctic cruises, geomatics, and cellular communications. Furthermore, entities such as Makivik, alongside regional government, directly support local community efforts to improve ground, air, and water transport infrastructure. The dominant air carriers in Canada's North are all owned or co-owned by leading Aboriginal business entities; IDC's NorTerra owns Canadian North, and the Makivik Corporation owns rival, First Air¹³³ as well as a smaller regional carrier, Air Inuit. The Vuntut Development Corporation – the for-profit economic arm of the Vuntut Gwitchin First Nation – is a 49% co-owner of Yukon's Air North (which in 2013 introduced scheduled flights between Whitehorse, Yellowknife, and Ottawa, in addition to regularly servicing the Vuntut Gwitchin's remote community of Old Crow, YT). These are only a few examples of Aboriginal-owned ventures that provide critical Northern infrastructure and transport systems. Yet, despite the evident presence and influence of such business entities in the Northern infrastructure landscape, what is less clearly understood is the extent to which they provide Northern infrastructure financing and how they might evolve and expand their influence in the future.

Infrastructure spending on capital and repairs is also of great interest to industry players in the North's growing non-renewable resource sectors. Exhibit 9, below, plots annual capital expenditures for mining and oil and gas sectors in the territories, and Nunavik and Eeyou Istchee. Available Statistics Canada time series data from 1998 to 2014 (adjusted to 2013 dollars¹³⁴) show substantial growth and volatility in capital expenditures (including construction and equipment), with annual investments exceeding \$1 billion in the Northwest Territories in 2001 and 2002 and then again from 2005 to 2008, and similarly for Nunavik and Eeyou Istchee from 2011 to 2013. While comparative data for the other regions are unreliable due to gaps in Statistics Canada's reporting, coefficients of variation for these two regions' sector specific

¹³³ In 2014, NorTerra and Makivik confirmed plans to merge Canadian North and First Air; See: CBC News, "Canadian North, First Air plan 'merger of equals.'" <http://www.cbc.ca/news/canada/north/canadian-north-first-air-plan-merger-of-equals-1.2607324>

¹³⁴ Data older than 2013 were adjusted to 2013 dollars using historical annual average Consumer Price Index values published by Statistics Canada. 2014 data were adjusted to 2013 dollars using Statistics Canada's January 2014 Consumer Price Index value. (Source: Statistics Canada, "The Consumer Price Index for Canada, all-items CPI, not seasonally adjusted, historical data,")



expenditures indicate substantially greater volatility for Nunavik and Eeyou Istchee over the 15 annual time periods when data were available with 41%¹³⁵ for the Northwest Territories' combined mining and oil and gas sector (based on an average annual investment of \$961 million between 1999 and 2014), and 108%¹³⁶ for Nunavik and Eeyou Istchee's respective sector (based on an average annual investment of \$555 million between 1998 and 2013). Looking at these patterns one might wonder if capital investment decisions in the Northern non-renewable resource sectors are tightly coupled to global commodity markets. Yet how these investment patterns relate to the bigger picture is not self-evident from the data at hand. For example, the investments in the Northwest Territories described above only weakly cross-correlate with the Bank of Canada's annual Commodities Index – a composite that includes metals and energy – and convey an even weaker relationship when cross-correlated with the Bank of Canada's narrower Metals and Minerals Index. By contrast, and notwithstanding our limited data series, both indexes show potential as leading annual indicators of private sector capital investments in Nord-du-Québec; but here too doubts arise upon controlling for substantial autocorrelations in the series. Without a deeper understanding of regional industry dynamics and decision-making constraints, it would be ill-advised to try to predict what investments may occur next in either region.

Northern-focused forecasting models such as the Conference Board of Canada's Territorial Outlook¹³⁷ expect increased mid-to-long-term productivity in non-renewable resource sectors such as mining and oil and gas, particularly in regions such as Nunavut and the Northwest Territories. If the conditions are right, there may follow an expanding role for private finance in related infrastructure developments, particularly to support production activities and industry logistics. Site-specific investment activities in the non-renewable resources sectors may also have a positive impact on the infrastructure of neighbouring communities by contributing to, for example, regional road systems, airports, ports, and regional energy grids.

Sometimes, improvements can be more local but equally significant. For example, when Agnico-Eagle Mines Ltd. (AEM) opened its Meadowbank gold mine in Nunavut's Kivalliq region, it undertook several community-based projects to develop goodwill in the nearest hamlet of Baker Lake (located 86 kilometres south of the mine site). In one particular instance, the community's landfill was contaminated by hazardous materials such as used batteries, but the local government had no resources to clean up the site. In turn, AEM paid to have the contaminated materials sorted and shipped away.

Potential synergies have to be considered during the planning and negotiation process of new Northern industrial developments; while industry representatives are keen to have the public sector provide investment incentives such as tax breaks, simplified regulations, grants, loans,

¹³⁵ Standard Deviation of \$386 million.

¹³⁶ Standard Deviation of \$589 million.

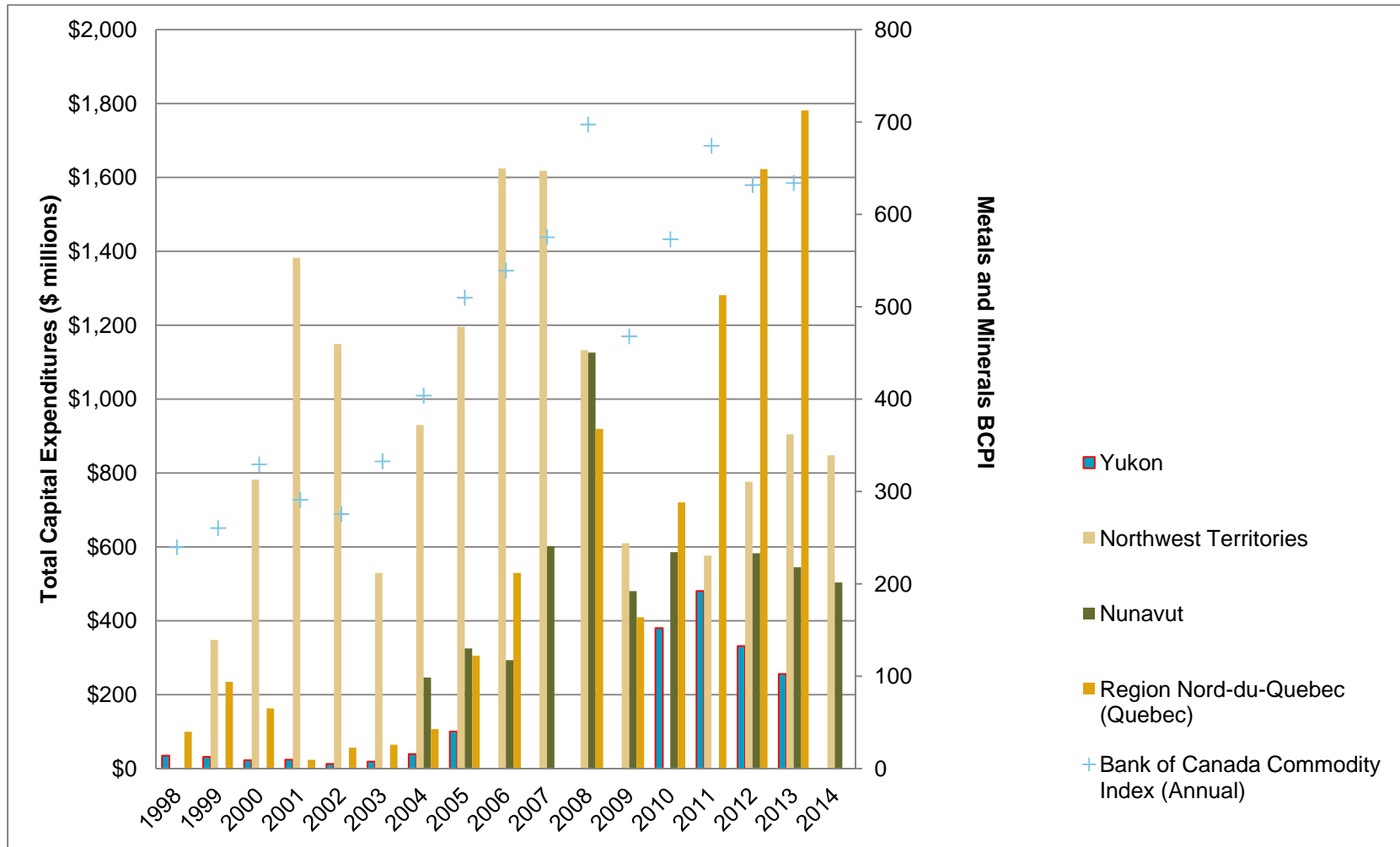
¹³⁷ The Conference Board of Canada, "Territorial Outlook: Spring 2014 – Economic Forecast."



and partnership opportunities, the Northern public sectors must equally attend to the infrastructure needs of their constituents, and particularly the North's permanent residents.



Exhibit 9: Annual industry sector capital expenditures: mining and oil and gas (\$ millions, adjusted to 2013 dollars) plotted against Bank of Canada Commodity Price Index (annual – metals and minerals BCPI)



Source: Statistics Canada. Table 029-0005 Capital and repair expenditures, by sector and province, annual (dollars), CANSIM (database). (accessed: 2014-05-20)



Beyond addressing narrower industry needs, private finance, in the form of investors seeking investments, may also find opportunities to partner with the public sector in Northern infrastructure development. Such arrangements may involve multiple stakeholders – as was seen in 2013 with the Government of Nunavut’s first public–private partnership and inaugural entry into the bond market to finance renovations to the Iqaluit International Airport, a \$330 million project.¹³⁸ While such large-scale public–private partnerships may specify roles for Aboriginal stakeholders – including, for example, labour opportunities – less clear is the financial role that Aboriginal investors, such as trusts, and regional economic development corporations can play.

¹³⁸ Gutscher and Miller, “Cold War Bomber Hub Gets a Makeover in Arctic Bond Debut.”
<http://www.bloomberg.com/news/2013-08-26/cold-war-bomber-hub-gets-a-revamp-in-arctic-bond-debut.html>



The largest capital project in Nunavut's history

Faced with much needed renovations to expand the Iqaluit International Airport, the Government of Nunavut decided for the first time, in 2013, to enter the bond market through a public private partnership (P3) that will finance almost half of the airport project's estimated \$330 million total cost.

In July 2013, the Government of Nunavut selected Arctic Infrastructure Partners, a consortium consisting of engineering firms, Bouygues Building Canada Inc. and its subsidiary ColasCanada Inc., as well as the Winnipeg Airports Authority Inc., and global investment firm InfraRed Capital Partners Ltd. to design, build, operate, and maintain the airport over a projected span of 34 years. Given this was a first for Nunavut, the Government of Nunavut also retained the services of Partnerships BC, a private company wholly owned by the Province of British Columbia, to advise the Government of Nunavut on how to structure the deal and manage the P3 process. Another party to the venture has been the federal Crown corporation P3 Canada, which contributed \$77 million to the project.

Although none of the principal partners are directly Inuit owned, there are still a variety of roles for Inuit business entities as the airport project unfolds. Interestingly, in 2013, the Nunavut Trust – which manages the \$1.1 billion endowment to Nunavut's Inuit land claims beneficiaries – reported an investment in an InfraRed Capital Partners' fund on the order of USD \$25 million. The fund is not directly linked to InfraRed's commitment to the Iqaluit Airport project, but it signals a potential financing role for land claims entities like the Nunavut Trust. More concretely, the Government of Nunavut has encouraged Nunavut businesses to forward expressions of interest to the partnership, to, for example, participate as subcontractors during the infrastructure build. The Government of Nunavut has also structured the project to include goals for Inuit employment, beginning at 15% during early construction phases with expectations to peak at around 60% as the build nears completion. Training and apprenticeship programs are also included in the project terms to help Inuit workers develop skills with the prospect of acquiring industry qualifications. Since the mid-2000s, Nunavut has budgeted approximately \$110 million annually for capital expenditures, and its borrowing is limited by a federally imposed \$400-million debt cap (which doubled from its previous level in 2012). Without the financial leverage afforded by the P3, the Government of Nunavut would have had very little recourse to undertake what amounts to its largest capital project to date. The P3 enables the Government of Nunavut to continue maintaining its capital plan while funding the airport project incrementally over the long term.



Northern infrastructure finance and environmental adaptation

While Northern infrastructure finance is evolving into an increasingly complex system of public and private interactions, including Aboriginal and non-Aboriginal business entities, the Northern physical environment is becoming increasingly complicated due to forces beyond any single groups control. Climate change provides a prominent set of examples. The physical integrity of infrastructure across the North is being undermined due to such ecological forces as permafrost reduction, which is causing ground subsidence, and severe weather events, which are affecting seaside infrastructure through coastal erosion. As a result, there is a need not only for new capital investments and repairs, but also for new technologies, structural designs, and climate adaptations. These issues and innovations come with associated costs that introduce new dimensions to infrastructure finance – including how to handle regular maintenance, repairs, and insurance transactions.

Of course, these new and evolving environmentally caused constraints add to the challenging existing conditions of the Northern built environment. One cannot assess the cost of building and maintaining infrastructure in Northern Aboriginal communities without first considering the longstanding logistical challenge of geographical remoteness. Moreover, such relatively hard factors are compounded by softer challenges such as the lack of capacity within many Northern Aboriginal communities to manage the construction, operation, and maintenance of local and regional infrastructure. The relative absence of various technical skill sets can prove a challenge for both sustaining infrastructure in the field and for developing the required but increasingly complex financing arrangements to support its sustainability.

Given these issues, the following section will undertake to identify the predominant funding mechanisms and areas of need that presently shape infrastructure development in Northern Aboriginal communities, particularly in our five regions of interest.

Overview of the funding environment for infrastructure in Canada's Northern Aboriginal communities

The primary goal of this study is to understand the availability and status of infrastructure in and around Canada's Northern communities. We will therefore narrow our focus around the funding mechanisms in place to support infrastructure that is of relevance to Northern Aboriginal communities, the types of infrastructure profiled in Chapter 3. With respect to the focal communities and regions of interest to this study, the bulk of funding mechanisms for infrastructure is attributable to federal funding sources. That said, variations exist between the regions, particularly with regards to how funds are allocated, and by which entities. For example, whereas funding from some of the main sources that will be identified below funnels through joint federal and territorial/provincial agreements, infrastructure funding to certain areas, such as the Eeyou Istchee region of Québec, also flows through special arrangements involved in meeting the conditions of land claims agreements. These special arrangements are



not always transparent to outsiders, and we therefore caution readers that the following discussion is not intended to be an exhaustive account: our goal is to discuss important funding mechanisms that will have a dominant impact on infrastructure development in and around Northern Aboriginal communities in the near to medium term, alongside a comparison of historical funding mechanisms that have had an impact on current infrastructure development decisions in our Northern regions of interest.

Key federal funding sources under Building Canada

In 2006, infrastructure was identified by the federal government as a fundamental joint priority with the provinces and territories. In keeping with this general approach, Budget 2007 introduced the Building Canada Plan (BCP). This plan determined that \$33 billion would be dedicated to “a comprehensive and integrated suite of infrastructure initiatives” across Canada, including

- base funding in support of infrastructure for municipalities including the \$11.8 billion Gas Tax Fund (extended to 2013–14) and an estimated \$5.8 billion under the Goods and Services Tax Rebate, which represents the benefit of raising the rebate from 57% to 100%;
- a \$2.275 billion provincial and territorial Base Funding initiative (“Base Funding”) to provide each jurisdiction with \$25 million per year over seven years;
- Program funds, including the \$8.8 billion Building Canada Fund, the \$2.1 billion Gateways and Border Crossings Fund, a \$1.25 billion Public–Private Partnerships Fund, and an additional \$410 million for the Asia-Pacific Gateway and Corridor Initiative, bringing the total federal investment to \$1 billion for that initiative.¹³⁹

We will examine some of the Northern priorities and outcomes of this first Building Canada Plan later in this chapter.

¹³⁹ Governments of Canada and Northwest Territories, *Infrastructure Framework Agreement*.



The federal government then launched the New Building Canada Plan (NBCP) in early 2014. This initiative builds on its predecessor, and is touted as being the “the largest long-term infrastructure plan in Canadian history, providing stable funding for a 10-year period”¹⁴⁰ (see Table 13: Federal funding under the New Building Canada Fund and its predecessor). The plan includes \$32 billion under the Community Improvement Fund, which is itself comprised of the Gas Tax Fund and the incremental Goods and Services Tax Rebate for Municipalities. An additional \$1.25 billion is available through the P3 (Public–Private Partnerships) Canada Fund. And \$6 billion remains under existing infrastructure programs.¹⁴¹ The \$14-billion New Building Canada Fund is made up of the:

- \$4 billion National Infrastructure Component (NIC) to support projects of national significance; and the
- \$10 billion Provincial-Territorial Infrastructure Component (PTIC) for projects of national, regional, and local significance. Of this amount, \$1 billion is dedicated to projects in communities with populations of fewer than 100,000 residents.¹⁴²

Table 13: Federal funding under the New Building Canada Fund and its predecessor

Current BCF components	NBCP components
• 7-year plan, no review period	• 10-year plan with a 5-year review
• \$2 billion/year – Gas Tax Fund, permanent	• \$2 billion/year plus a 2% index beginning 2014–15, Gas Tax Fund, permanent
• \$900 million – 100% Municipal GST Rebate, permanent	• \$900 million – 100% Municipal GST Rebate, permanent
• \$8.8 billion over 7 years – Building Canada Fund, expires 2014	• \$14 billion over 10 years – New Building Canada Fund
• \$1.25 billion over 5 years – P3 Canada Fund	• \$1.25 billion over 5 years – P3 Canada Fund

Source: Federation of Canadian Municipalities, “Highlights of the New Building Canada Plan” <http://www.fcm.ca/home/issues/infrastructure/highlights-of-the-new-building-canada-plan.htm>

¹⁴⁰ Infrastructure Canada, “The New Building Canada Plan.” <http://www.infrastructure.gc.ca/plan/nbcp-npcc-eng.html>

¹⁴¹ Infrastructure Canada, “The New Building Canada Plan.” <http://www.infrastructure.gc.ca/plan/nbcp-npcc-eng.html>

¹⁴² Infrastructure Canada, “The New Building Canada Plan.” <http://www.infrastructure.gc.ca/plan/nbcp-npcc-eng.html>



To better understand the current federal funding framework's implications for Northern Aboriginal communities, it is worth examining some of the key federal funding initiatives in greater detail. The Provincial Territorial Infrastructure Component (PTIC), for instance, provides a total of \$10 billion for projects of national, regional, and local significance. The territories, for example, are expected to benefit as follows:¹⁴³

- Yukon's portion of the New Building Canada Fund includes \$257 million alongside an estimated \$163 million under the Gas Tax Fund;
- The Northwest Territories' portion of the New Building Canada Fund includes \$258 million alongside an estimated \$163 million under the Gas Tax Fund; and
- Nunavut's portion of the New Building Canada Fund includes \$256 million alongside an estimated \$163 million under the Gas Tax Fund.

Local level projects are targeted through a specific sub-component of the plan – the Small Communities Fund – which ensures that 10% (\$1 billion) of the PTIC flows to communities with fewer than 100,000 people.¹⁴⁴ The Federation of Canadian Municipalities notes that “this is certainly an important inclusion within the NBCF to recognize the unique challenges that rural, remote and Northern communities face in providing infrastructure in their communities.”¹⁴⁵ The PTIC is available for projects that target economic growth, build stronger communities, and ensure a clean environment. Eligible applicants include a broad array of public sector groups, from the community level to regional, provincial, and territorial governments. Private sector organizations are also eligible, provided their application is supported by a municipal or regional government. Notably, band councils “within the meaning of section two of the *Indian Act*; or a government or authority established pursuant to a Self Government Agreement or a Comprehensive Land Claim Agreement,” are also eligible.¹⁴⁶ The PTIC can be applied to a wide variety of infrastructure projects, including a category it calls “Northern Infrastructure” (see Text Box: Eligible Categories under the PTIC–SCF). Moreover, unlike the previous funding opportunities introduced under Building Canada 2007, this new roster of funding does not require framework agreements to be in place with each eligible funding partner's provincial or territorial government. These past requirements were a potential obstacle for project sponsors operating outside of government and/or below the provincial/territorial level.

¹⁴³ Infrastructure Canada, “Provincial–Territorial Fact Sheets.” <http://www.infrastructure.gc.ca/plan/nbcp-npcc-eng.html>

¹⁴⁴ Infrastructure Canada, “New Building Canada Fund: Provincial–Territorial Infrastructure Component Small Communities Fund.” <http://www.infrastructure.gc.ca/plan/sc-cp-eng.php>

¹⁴⁵ Federation of Canadian Municipalities, *The New Building Canada Fund*, 5.

¹⁴⁶ Infrastructure Canada, “New Building Canada Fund: Provincial–Territorial Infrastructure Component Small Communities Fund.” <http://www.infrastructure.gc.ca/plan/sc-cp-eng.php>



Eligible categories under the PTIC–SCF

- Public transit
- Drinking water
- Waste water
- Solid waste management
- Green energy
- Innovation
- Connectivity and broadband
- Brownfield redevelopment
- Disaster mitigation infrastructure
- Local and regional airports
- Short-line rail
- Short-sea shipping
- Highways and major roads
- Northern infrastructure (applies to Yukon, Nunavut, and Northwest Territories only)

In this case Northern Infrastructure refers to fixed capital assets of public benefit, though health infrastructure such as nursing stations, hospitals, convalescent and senior centres are excluded. Moreover, to be eligible, applications must demonstrate that projects will benefit Canadians by achieving “one or more of the following objectives:

- improving accessibility to and from remote communities in the North;
- improving access for Canadians in the North to basic public services, including emergency services;
- improving the quality of life of Northern Canadians; or
- supporting competitiveness and sustainable economic and resource development in the North.”

Source: Infrastructure Canada, *Overview of Eligible Categories*, <http://www.infrastructure.gc.ca/plan/sc-anna-cp-eng.html>

The NBCP also modifies the federal Gas Tax Fund (GTF), a program designed to ensure communities have access to long-term, consistent, and predictable funding for infrastructure.¹⁴⁷ While originally structured under the BCP to provide \$5 billion in stable funding to Canadian municipalities and communities over a period of five years, the NBCP extends the GTF; it also increases its annual transfer amounts from \$1 billion to \$2 billion, indexes it at two% per year (to be transferred in \$100 million increments, effectively growing the fund by \$1.8 billion between 2014-2024), with the intention of making it permanent.¹⁴⁸ Since 2006, Canadian

¹⁴⁷ Infrastructure Canada, “The Federal Gas Tax Fund.” <http://www.infrastructure.gc.ca/plan/gtf-fte-eng.html>

¹⁴⁸ Infrastructure Canada, “The Federal Gas Tax Fund.” <http://www.infrastructure.gc.ca/plan/gtf-fte-eng.html>



communities and municipalities have received roughly \$13 billion through transfers from the GTF. Almost \$22 billion is expected to flow to communities over the next 10 years, beginning in 2014, under the NBCP.¹⁴⁹ Along with the incremental GST Rebate for Municipalities, the GTF is one of the two main components of the Community Improvement Fund, which was introduced by the federal government in response to demands from Canadian mayors and recommendations by the Federation of Canadian Municipalities.¹⁵⁰

Another source of new federal funding is the Public Private Partnership Fund (PPP). As discussed earlier, and highlighted in our case study of the Iqaluit Airport project, public-private partnerships (P3) involve roles and responsibilities for both the public and private sectors, and may specify desired outcomes of investment, including, for example, local labour force participation and skills development on any funded projects.¹⁵¹ Under P3 models, the private sector takes on a significant share of the responsibilities and risks associated with the design, funding, and construction of infrastructure projects – though the infrastructure assets may remain publicly owned. Moreover, the private sector typically assumes responsibility for the operation and maintenance of the asset once construction is completed. The rationale underpinning the value of P3s is that they are better able to ensure value for taxpayers because of their potential to deliver projects in a timely and cost-effective manner.¹⁵² Given that Canada's North has the potential to become a site for substantially more non-renewable resource development projects of increased scale and complexity over the coming decades, P3s may offer a promising mechanism for industry-specific infrastructure development going forward.

Working against the smaller scale needs of community infrastructure is the \$100 million minimum value for infrastructure projects associated with the Public Private Partnership Fund. The Northern regions' relatively small private sector and market base across dispersed, often remote communities, do not readily lend themselves to major infrastructure financing initiatives. The P3 Fund does, however, mitigate some of the impact of these challenges by allowing for a greater federal share in the funding of projects, at least in the territories. Whereas the maximum contribution from all federal sources will be capped at 25% of the total eligible costs for the provinces, up to 75% may be provided by the federal government in the territories.¹⁵³

In the 2014 budget, the federal government also announced that it would extend the Strategic Investments in Northern Economic Development (SINED) program for an additional two years,

¹⁴⁹ Nunavut Department of Executive and Intergovernmental Affairs, "Federal Funding Now Available for Nunavut Communities."

¹⁵⁰ Government of Canada, Community Improvement Fund. <http://actionplan.gc.ca/en/initiative/community-improvement-fund>

¹⁵¹ Infrastructure Canada. "Public-Private Partnerships."

¹⁵² Ibid.

¹⁵³ Ibid.



providing it with \$40 million in new funds over that time frame.¹⁵⁴ SINED “focuses on enhancing the economic infrastructure of the Territories; developing the capacity of Northern organizations and individuals to help them take advantage of economic opportunities; promoting economic diversification; and increasing dialogue between Northern Aboriginal and non-Aboriginal stakeholders on Northern economic development issues.”¹⁵⁵ This program is delivered via the Canadian Northern Economic Development Agency (CanNor), which coordinates its efforts with the territorial governments and other stakeholders.¹⁵⁶ Funding for infrastructure under SINED tends to focus on strategic feasibility studies, small scale capital investments for communications and technological developments, and business case development for larger public private partnerships. Excluded from its scope are major capital projects and construction initiatives, such as roads, airports, dams, harbours, and ports.¹⁵⁷

Of course infrastructure funding is not solely a federal responsibility. Indeed, the maximum contribution from *all* federal sources of funding in the territories is 75% of the total eligible costs of any given project. This stands in contrast to the maximum amount of federal funding attributable to projects located in the provinces, which is 33%.¹⁵⁸ Accordingly, cost sharing is a pivotal aspect of infrastructure funding in Canada – including in the regions and communities of interest to this study. What is not covered via federal sources and programs is made up through provincial and territorial programs as well as *own-source revenue*. The latter includes revenue generated through such sources as commercial, business, and investment activities, fees, royalties, and taxation (in the case of applicable local and regional governments). Self-governing Aboriginal groups established through comprehensive land claims and/or self-government agreements for example, may have “own-source revenue agreements” with territorial/provincial and federal governments built into their fiscal relationship and included within broader agreements.¹⁵⁹ As discussed earlier in this report, these Aboriginal entities may hold considerable regional influence and contribute to major project partnerships. They may also benefit from the activities of related regional economic development corporations.

The diversity of regional contexts and focal communities being examined in this paper precludes us from systematically analysing territorial and provincial programs, or the different manifestations and applications of Northern Aboriginal own-source revenues. This does not, however, imply that such regional sources of infrastructure funding are not an important part of the broader discussion surrounding the infrastructure needs of Canada’s Northern Aboriginal communities.

¹⁵⁴ Department of Finance Canada, *The Road to Balance: Creating Jobs and Opportunities*, 152.

¹⁵⁵ *Ibid.*

¹⁵⁶ Canadian Northern Economic Development Agency, “Strategic Investments in Northern Economic Development.”

¹⁵⁷ *Ibid.*

¹⁵⁸ Infrastructure Canada, “Cost Sharing.” <http://www.infrastructure.gc.ca/plan/cs-pc-eng.html>

¹⁵⁹ Aboriginal Affairs and Northern Development Canada, “The Government of Canada’s Approach to Implementation and Inherent Right.” <https://www.aadnc-aandc.gc.ca/eng/1100100031843/1100100031844>



Historical trajectory of the Building Canada Plan – What Northern Aboriginal community needs and priorities did it address?

To better understand the role key funding mechanisms play in the development of infrastructure in and around Northern Aboriginal communities we shall reflect on some patterns from the original Building Canada Fund (from 2007 to 2014) and complementary federal Gas Tax Fund (2006 to 2013).

For their communities to be eligible to receive Building Canada funds, provinces and territories were first required to sign a provincial–territorial Base Fund agreement with the Government of Canada. This included the submission of a capital plan detailing initiatives for federal cost-sharing. The Building Canada Fund was originally established to provide each province and territory with \$25 million per year, over seven years (from 2007 to 2014), for a total of \$175 million per jurisdiction. Then, in 2009, Canada’s Economic Action Plan created an accelerated payments option for infrastructure projects that had near-term implementation schedules; provinces and territories could choose to accelerate all or part of the funding, to be spent by March 31, 2011.

Table 16 and Exhibit 10, below, indicate several distinct patterns of investment across our five regions of interest, which reflect different priority areas for their governments, regional entities, and local communities between 2007 and 2014. Although available data did not permit us to separate project costs from the territorial Base Fund agreements, we were able to categorize discrete funded projects according to their intended outcomes for infrastructure development.

There are several observable patterns of investment across our Northern regions of interest. Taken in their entirety, the greatest number of distinct Building Canada funded projects focused on improvements to ground transportation and water, sewage, and solid waste management. But drilling down, we can observe distinctly regional patterns of projects focused on particular infrastructure categories that reflect many of the regional endowments and deficits that we explored in Chapter 3:

- Yukon: Out of 88 projects totalling \$180.4 million, 45% focused on roads, and 43% focused on improvements to water, sewage, and solid waste management systems. The remaining projects addressed community energy systems (1%), community recreational facilities (7%), and regional and local capacity building (3%).
- Northwest Territories: Out of 81 projects totalling \$185.8 million, 27% focused on roads, 25% focused on community recreational facilities, and 23% focused on water, sewage, and solid waste management. In addition, 15% focused on regional and local capacity building, 7% focused on airports, and 2% focused on climate change adaptation.
- Nunavut: Out of 41 projects totalling \$182.7 million, 32% focused on airports, 29% focused on local and regional capacity building, and 20% focused on water, sewage,



and solid waste management. In addition, 17% focused on community recreational facilities, and 2% focused on local roads.

- Nunavik/Eeyou Istchee: Nunavik received over \$45 million in airport infrastructure improvements for the Northern Village of Puvirnitug. The Puvirnitug project involved \$30 million from the provincial Base Fund agreement and \$14 million from the Québec government, and an additional \$1 million from the federal Airports Capital Assistance Program. Although Eeyou Istchee communities did not directly receive funding through the Building Canada Fund, a bridge reconstruction project in the surrounding James Bay region received \$2.2 million.
- Nunatsiavut: There was one project in Nunatsiavut focusing on improvements to local water treatment systems in Nain (valued at \$4.1 million).

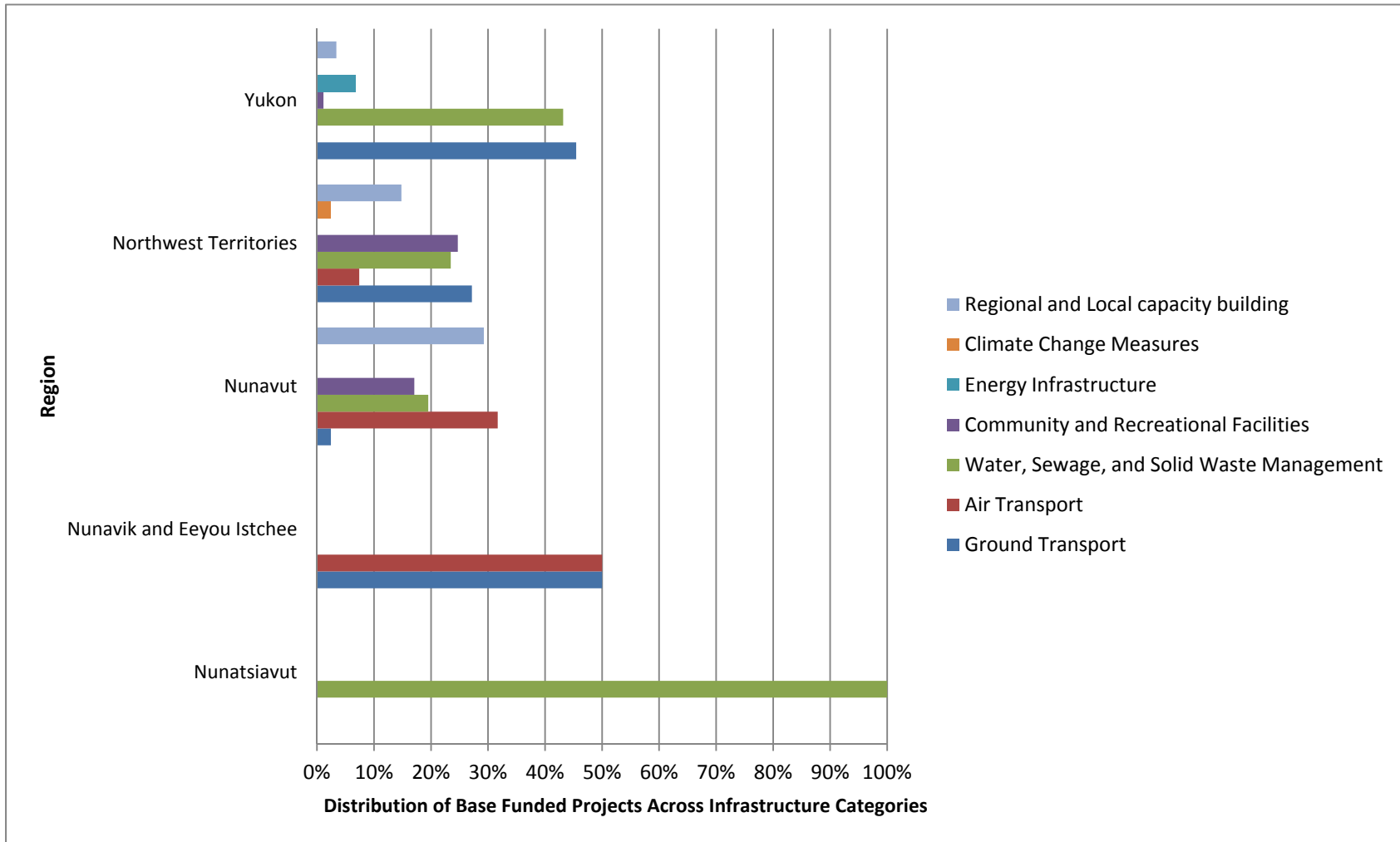
Table 14: Building Canada Fund – Regional prioritization of investments for territorial Base Fund projects (2007–2013)

Prioritization of project investments									
		Number of funded projects per category							T o t a l
		Ground transport	Air transport	Water, sewage, and solid waste management	Community and recreational facilities	Energy infrastructure	Climate change measures	Regional and local capacity building	
R e g i o n	Nunatsiavut	0	0	1	0	0	0	0	1
	Nunavik and Eeyou Istchee	1	1	0	0	0	0	0	2
	Nunavut	1	13	8	7	0	0	12	41
	Northwest Territories	22	6	19	20	0	2	12	81
	Yukon	40	0	38	1	6	0	3	88
Total		64	20	66	28	6	2	27	213

Source: Conference Board of Canada based on Infrastructure Canada. "Infrastructure in my Province–Territory."
<http://www.infrastructure.gc.ca/regions/regions-eng.html>



Exhibit 10: Building Canada Fund – Regional prioritization of investments for territorial Base Fund projects (2007–2013)



Source: Conference Board of Canada based on Infrastructure Canada, "Infrastructure in my Province-Territory." <http://www.infrastructure.gc.ca/regions/regions-eng.html>



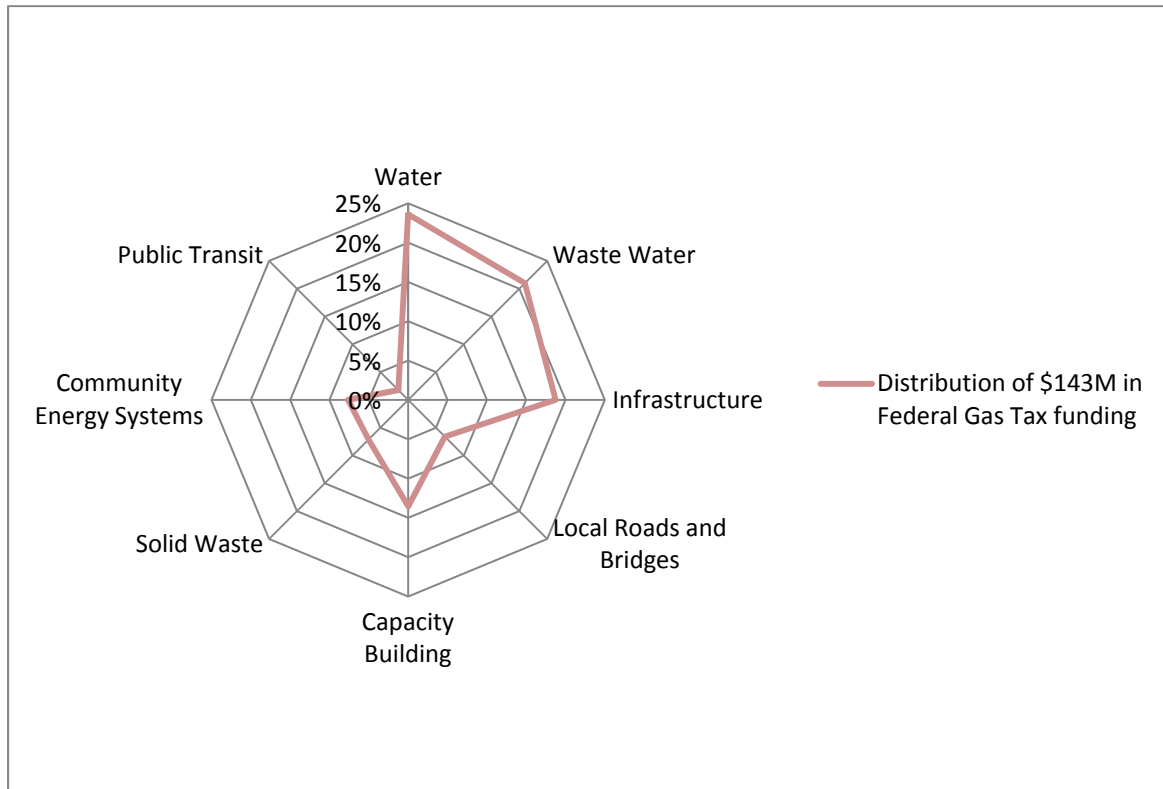
In addition to the Base Fund projects, funded from 2007 to 2014, there were a number of federal Gas Tax Fund projects developed in the study region during the 2006 to 2013 time period. The distribution of federal Gas Tax Fund monies to the five regions, affecting 83% of our 100 focal communities, offers similar insight into the priorities of regional entities and Northern Aboriginal communities at this time period (2006 to 2013). Exhibit 11, below, provides an combines all regions, while Exhibit 12 provides regional comparisons. In this case, the available data, collected by the Federation of Canadian Municipalities (FCM)¹⁶⁰, allows us to categorize projects and total their attributed funding allocations. In particular, the FCM focused on separating regional and municipal funded projects based on eight categories (see Exhibit 11), including a general “infrastructure” category for projects that combined multiple elements of the seven finer-grained categories, and/or supported general public works such as municipal garages and similar physical assets. In Exhibit 11 we see that the majority of \$143 million in federal Gas Tax Funds dedicated to projects in the study region focused on vital community facilities such as water and waste water treatment (almost 50% of the total allocation). Drilling down, we can observe common Northern needs as well as different regional project priorities based on the FCM’s eight categories, again mirroring areas discussed previously in Chapter 3:

- Yukon: Out of \$63 million in GTF funds allocated to our focal communities in YT, 29% went to drinking water systems, followed by 16% to general infrastructure projects, and 14% to community energy systems.
- Northwest Territories: Out of \$41 million in GTF funds allocated to our focal communities in NT, 32% went to general infrastructure projects, followed by 21% to drinking water systems, and 18% to wastewater systems improvements.
- Nunavut: Out of \$37 million in GTF funds allocated to our focal communities in NU, 40% went to wastewater systems improvements, 25% went to capacity building, and 19% went to drinking water systems.
- Nunavik and Eeyou Istchee: While no GTF funds flowed directly to Eeyou Istchee communities, \$1.2 million went to Nunavik for general infrastructure projects.
- Nunatsiavut: Out of \$206 thousand in GTF funds allocated to projects in Nunatsiavut, 67% went to general infrastructure, 22% went to local road improvements, and 11% went to drinking water systems.

¹⁶⁰ Federation of Canadian Municipalities, “Gas Tax Fund Current Investment Calculator.”



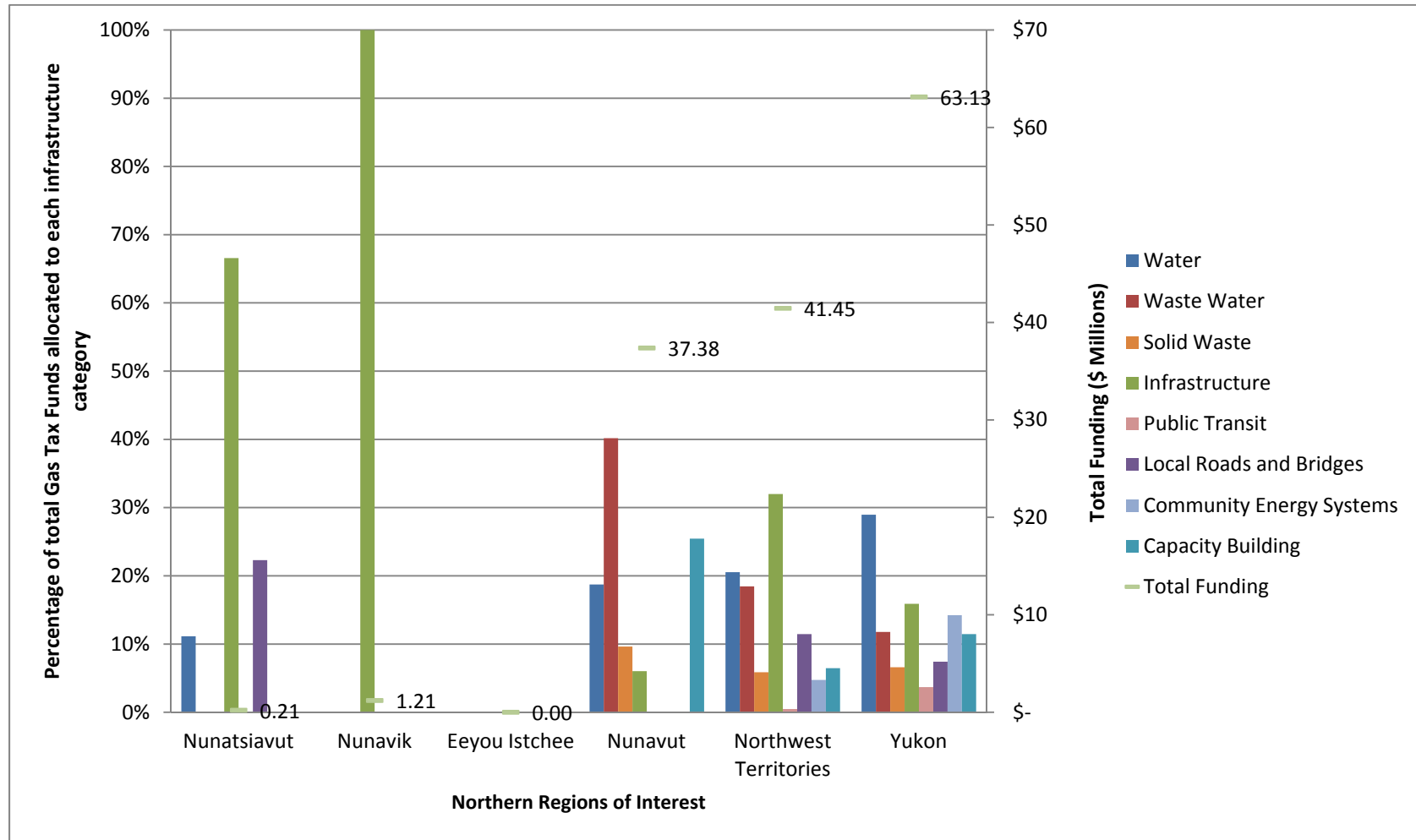
Exhibit 11: Distribution of monies under the federal Gas Tax Fund to 83% of communities included in the present study, by major project categories (2006–2013)



Source: Federation of Canadian Municipalities, "Gas Tax Fund Current Investment Calculator."
<http://www.fcm.ca/home/issues/infrastructure/federal-gas-tax-fund/gas-tax-fund-current-investment-calculator.htm>



Exhibit 12: Allocation of federal Gas Tax Fund (2006–2013) to Northern regions of interest, with allocation breakdowns (%) by major infrastructure project categories



Source: Federation of Canadian Municipalities, "Gas Tax Fund Current Investment Calculator." <http://www.fcm.ca/home/issues/infrastructure/federal-gas-tax-fund/gas-tax-fund-current-investment-calculator.htm>



As was observed in our analysis of the Base Fund prioritizations, conspicuously absent from these federal GTF funding patterns are projects for communications and broadband connectivity. There are also no projects specifically dedicated to climate change adaptation. Moreover, the available data from Infrastructure Canada and the Federation of Canadian Municipalities indicate that the majority of project funding allocated under the Base Fund and GTF focused on improving vital community facilities such as water and wastewater systems, as well as relevant transport systems (such as ground and air transit infrastructure).

Funding mechanisms – The challenge to understand and address evolving needs

With these sources of funding allocation as a backdrop, it is tempting to ask whether current financing for infrastructure is sufficient to meet Canada's needs, including the needs of Northern Aboriginal communities. Our observations of infrastructure in and around Canada's Northern Aboriginal communities in Chapter 3 encountered numerous examples of deficits in transportation, energy, and basic community amenities such as housing, water, and sewage/solid waste management. In this regard one may hypothesize that the costs associated with addressing the evolving infrastructure needs of Northern Aboriginal communities are growing in size and scope. At the same time, as Chapter 4 discussed, a sizeable amount of funding is being directed towards infrastructure – with a general acknowledgement that current funding is necessary, if not unprecedented, regardless of whether it is sufficient. Our snapshot of current projects under the 2007–2014 Building Canada Fund and related federal Gas Tax Fund allocations indicates a heavy concentration of public funding on addressing basic community amenities as well as core transportation systems vital to each region, such as roads in Yukon and airports in Nunavut.

Moreover, the growing relevance of new and complex financing arrangements to support the evolving requirements of climate change adaptation, the logistical support for future industry growth in the non-renewable resources sectors, and the immediate need for investments in Northern communications infrastructure, all call for innovation in Northern infrastructure finance.

Coming to grips with the scale and scope of Northern infrastructure finance is a challenge, particularly for outsiders. Bumping up the costs associated with infrastructure in Canada's North are the greater regional and location-specific challenges that complicate the construction and maintenance of infrastructure, such as the effects of climate change and the North's difficult environment. Even small scale projects can be remarkably expensive. The small craft harbour in Pangnirtung, Nunavut, for example, received approximately \$42 million in federal financing.¹⁶¹ Including projected expenditures for 2014–2015, the airport in Cambridge Bay will have been

¹⁶¹ Fisheries and Oceans Canada, "Opening of Pangnirtung Small Craft Harbour." <http://www.dfo-mpo.gc.ca/media/back-fiche/2013/hq-ac49a-eng.htm>



the recipient of \$16 million worth of improvements and maintenance since the inception of the BCP in 2007.¹⁶² In Nunavik, Puvirnitug's airport improvements cost over \$45 million.

Despite having a more favourable infrastructure and maintenance environment, on average, than the other four regions under analysis in this paper, projects are nevertheless expensive in the Yukon region too. For example, a listing of potential infrastructure projects by Yukon's Department of Community Services estimates that the cost of building a bridge across the Pelly River in the community of Ross River would be \$35 million.¹⁶³ In the Northwest Territories, a proposed 1,100 kilometre fibre-optic link between Inuvik and Fort Simpson is projected to cost between \$60 and \$70 million. On a broader scale, the Northwest Territories is interested in expanding its regional energy grid, with the intent of lowering the price of energy in certain communities and unlocking new mining projects in the region. Projections surrounding that initiative show it could cost as much as \$700 million.¹⁶⁴

Measuring a country or region's aggregate infrastructure needs and attributing a specific dollar figure to the construction, maintenance, and operation of all its infrastructure assets is a difficult and potentially fruitless task. This makes identifying whether funding mechanisms are sufficient both problematic and political. Costs surrounding infrastructure needs can be difficult to measure for a variety of reasons. It is hard to know where to draw the line with respect to which variables affect costs. Even factors that lie at the margins of cost considerations may affect or influence measurements. These include such factors as the fluctuating costs of capital, costs incurred due to monopoly constraints, and the costs of inefficiencies; as well, sources of social and environmental costs may be more difficult to account for.¹⁶⁵

One of the more significant barriers to determining needed investment in infrastructure is the issue of trade-offs. Indeed, you can measure a deficit in 'needed investment,' but you must be sure that the need is valid and cannot be met by trade-offs.¹⁶⁶ For example, calculating the costs of putting in roads to increase the continental access of rural or remote communities may reveal a figure that does not accurately reflect the true costs of needed investment if it turns out that establishing a port in the region could achieve a similar outcome at a lower cost. Therefore, it is necessary to find ways of determining, with as much accuracy as possible, infrastructure needs and their associated costs as well as the particular constraints on their evolving infrastructure conditions.

¹⁶² Government of Nunavut, *Capital Estimates 2014–2015*, A-IV-4.

¹⁶³ Yukon Government, *Yukon Infrastructure Plan*, 132.

¹⁶⁴ Wingrove. "NWT plans to borrow millions for massive power grid expansion."
<http://www.theglobeandmail.com/news/politics/NT-plans-to-borrow-millions-for-massive-power-expansion/article15980786/>

¹⁶⁵ Grigg, *Infrastructure Financing: The Business of Infrastructure for a Sustainable Future*, 228.

¹⁶⁶ Grigg, *Infrastructure Financing: The Business of Infrastructure for a Sustainable Future*, 228.



Conclusion

There is significant evidence of various Canada-wide infrastructure deficits, but the challenge of developing critical infrastructure as evident as in Canada's Northern regions and in the Aboriginal communities located within them is particularly pressing. The purpose of this study was to contribute to developing a detailed understanding of the state of infrastructure in and around Northern Aboriginal communities, and of the role of infrastructure in economic development; and identify infrastructure deficits that act as key barriers to economic development in and around Northern Aboriginal communities, and recommend strategies for addressing them.

Table 15, below, summarizes some key differences in critical infrastructure endowments between our five regions of interest. Some comparative infrastructure deficits are closely associated with geographical differences and the relative environmental challenges that are more prevalent in some Northern regions versus others. Nunavut's various remote island formations, for example, make it extremely difficult to engineer a road network that could comprehensively link the territory's 25 communities to one another and to points south. Yet, if economic conditions continue to improve for Nunavut's Kivalliq region, partial road networks to Manitoba may prove viable.

In the nearer term, other types of transport infrastructure may be more feasible for Nunavut, but they too are costly. Despite its marine environment and active local fishing activities in several sub-regions, Nunavut has no deepwater ports and few harbour facilities. Economic projects such as the Mary River Project (an iron ore mine), or the small craft harbour in Pangnirtung – both in Nunavut's Qikiqtaaluk region – may demonstrate the feasibility of building new marine infrastructure. Due to limited public funds and a relatively nascent private financing environment (with Nunavut entering its first public-private partnership in 2013), trade-offs are also likely in any decision to invest in new transportation infrastructure. Across the North there appear to be multiple contending needs; funds that could be allocated to ports or harbours could instead be allocated to improving airports or some other infrastructure category where needs exist.

Deficient transportation, telecommunications, and energy infrastructure are features of many Aboriginal communities located across our Northern regions of interest. Nunavut's communities rely on diesel generators for their energy supply and expensive satellite systems for telecommunications and Internet connectivity. The state of critical community infrastructure such as housing is also deficient in many communities across the North, particularly in Nunavut and Nunavik. In many cases, pressing local needs for improvements to vital amenities such as housing and water, sewage, and solid waste management, force governments to choose between improving near-term conditions and taking bigger risks on longer-term economic prospects that may or may not improve local living conditions. Given that other intervening



factors may need to be considered before long-term prospects can be achieved, such as capacity building, education, and the development of new markets, an immediate need for improved housing and sewage treatment may take priority over potential initiatives to, for example, enhance broadband Internet connectivity and related digital infrastructure. This appears to be the general case for our 100 focal communities under the 2007–2013 Building Canada Plan, where vital community facilities (such as water, sewage, solid waste) and transportation attracted the most funding allocations from the Provincial–Territorial Base Fund and federal Gas Tax Fund.

Coastal communities across Inuit Nunangat, from Inuvialuit region in the Western Arctic to Nunavut, Nunavik, and Nunatsiavut in the Eastern Arctic, all face changing environmental conditions associated with climate change. These emerging environmental threats to Northern infrastructure will result in an increase in the demand on existing funding bases. A warming climate is leading to permafrost reduction which, in turn, is causing ground instability and subsidence. Rising sea levels, in conjunction with severe weather and storm surges, are having a detrimental impact on Northern seaside communities through coastal erosion. Increasingly severe weather also poses a threat to the structural integrity of buildings and other physical assets – including to how community and industrial waste materials are treated and contained. These and other effects of climate change require innovative approaches to the construction and upkeep of infrastructure.

Our results from Chapter 3, indicate that some regions are relatively better endowed than their peers. Yukon stands out on a number of dimensions, including its possession of all-season regional roads, the shorter travel times to regional hubs, and its regional connectivity to energy grids and terrestrial telecommunications facilities. Here again, geographic conditions may contribute to favourable outcomes. The relatively greater proximity between Yukon's communities, compared to their peers in other Northern regions, helps explain why more college campuses can be distributed and maintained across the territory's peripheral and satellite communities, and why comprehensive waste diversion programs can more easily be undertaken.



Table 15: Summary of comparative distribution of Aboriginal households by availability of select critical infrastructure, across five Northern regions

		Regional Aboriginal population (NHS 2011)	Number of Aboriginal households (NHS 2011)	Percentage of households by availability of select critical infrastructure			
				All-season regional road access	Access to regional energy grid	Access to interregional air transit hub by direct flights or local ground transport ¹⁶⁷	Percentage of Aboriginal households with suitable housing, based on CMHC definition (NHS 2011)
Region	Nunatsiavut	2,360	730	0	0	10	84
	Nunavik	10,880	2,535	0	0	65	58
	Eeyou Istchee	15,725	3,485	95	95	24	74
	Nunavut	27,365	6,820	0	0	75	62
	Northwest Territories	21,155	7,525	78	51	72	84
	Yukon	7,705	3,575	97	85	55	90
Totals (N. or %) across five regions		56,225	24,670	51	41	61	75

Source: AANDC 2014, Conference Board of Canada 2014, GeoSuite, 2011 Census, Statistics Canada Catalogue no. 92-150-XBB; Statistics Canada, 2011 National Household Survey, Statistics Canada Catalogue no. 99-011-X2011

Smaller regions, such as Nunatsiavut on the coast of Labrador, may also benefit from interactions with larger regional systems. Like its peers in Eeyou Istchee, Nunatsiavut can use provincial connections to overcome the limitations of remoteness. Thus, while the region has limited road access, and currently depends on diesel power generation, its housing conditions are substantially better than either Nunavik or Nunavut's. New hydroelectric development along the lower Churchill River in Labrador, under the \$7.7 billion Muskrat Falls hydroelectric project, could parallel the James Bay Cree's experience, where the hydroelectric project in their region has been a source of conflict, trade-offs, and benefits. However, there are significant differences between the Cree's current situation with Québec and Hydro Québec and the position of the Nunatsiavut government. While Nunatsiavut beneficiaries occupy settlements downstream of the Muskrat Falls site (particularly in the Lake Melville region), the project does not technically overlap with Inuit lands. No substantial agreements with the Nunatsiavut

¹⁶⁷ Scheduled airline service takes a direct route to closest interregional air transit hub.



government were therefore required for the project to proceed. Innu lands, by contrast, have considerable overlap with the project, an issue which formed the basis of the Innu Nation's 2008 New Dawn Agreement with the Government of Newfoundland and Labrador and Nalcor Energy (Energy Corporation of Newfoundland). While the Innu Nation communities of Labrador are outside the scope of our study, they may be in a position to negotiate an arrangement similar to the 2002 Paix Des Braves Agreement signed between Eeyou Istchee and the Government of Québec. Of course, as the Cree have encountered with Québec's hydroelectric development, such a major project is not without potentially significant trade-offs and local concerns (such as flood risks and waste management issues). The Government of Nunatsiavut, for example, fears the increased risk of mercury poisoning in Lake Melville's fish habitats. As well, the benefits of a new hydraulic energy source will not likely reach coastal communities, such as Nain or Makkovik. Nevertheless, a regional model of cooperation, such as represented by Québec's newly formed Eeyou Istchee James Bay Regional Government, or the Eeyou Communications Network (formed in partnership with Hydro Québec), might benefit Labrador's Aboriginal and Non-Aboriginal stakeholders as they seek new policies and technology solutions for economic growth. Since both the Nunatsiavut and Innu agreements are less than a decade old it may simply be too early to tell whether the Eeyou Istchee's path of development will be a useful example for other regions.

By contrast, a region such as Nunavik currently has fewer opportunities than its southern and eastern peers to connect with provincial networks and systems. More effort may be required for better systems integration between southern and remote Northern partners, without however, sacrificing the goals of regional autonomy that Northern Aboriginal communities and their representative governments desire.

In a region characterized by remoteness and a challenging geography, it becomes especially important for local and regional governments, as well as regional economic development corporations, to function as catalysts for innovation, capacity building, and knowledge transfer. The Kativik Regional Government and Makivik Corporation in Nunavik, for example, have introduced Nunavik's 14 remote communities to satellite Internet and cellular phone services (notwithstanding technological limitations), in addition to helping local Northern villages improve living conditions through public works projects and training initiatives. Limitations on public funding sources force local trade-offs, but the vitality of these civic initiatives is apparent.

We find sources of community resilience in many of the pilot projects undertaken by community and regional stakeholders that test for possible solutions to prevailing infrastructure deficits and constraints. Nunavut's current challenges with solid waste management could turn into a source of strength and inspiration if communities such as Cambridge Bay continue to build on past experiments with waste diversion and establish effective solutions for their environment. Similarly, the various local community energy projects testing the feasibility of micro-grids and renewable energy sources may introduce valuable data for regional governments and businesses alike as they search for better ways to fuel Northern economies.



Going forward, discussion of the relationship between infrastructure and economic development in Canada's Northern Aboriginal communities will involve the issue of natural resource development. It is paramount, then, to carefully manage natural resource development prospects so that, whenever practically feasible, investing in economic infrastructure will help (at least incrementally) to promote regional economic diversification, sustainable growth, and the overall well-being of Northern Aboriginal communities.

Indeed, investments in infrastructure will have meaningful local impacts, and create greater sociopolitical certainty, if they can simultaneously enhance natural resource development in and around Northern Aboriginal communities and enable the participation of Aboriginal peoples in co-managing the projects.

Optimizing the impact of infrastructure development on Northern Aboriginal economic development requires careful planning. The types of infrastructure that are best suited to each Northern region and community (particularly those that are strategically located in the vicinity of projects), must be determined. Understanding the economic potential of Northern communities, in addition to the specific strengths, limitations, and local policies of each participating community is paramount. The building of a small craft harbour on a coastal community in Nunavut or Inuvialuit in the Northwest Territories, for instance, might catalyze more local economic development than a road network might.

Thinking strategically about infrastructure investment also requires thinking about complementary forms of infrastructure. As discussed in Chapter 2, research has found that different types of infrastructure can be combined to form systems that are economically greater than their individual parts. Some infrastructure, such as electrical grids, fibre-optic networks, and roads, can be bundled along corridors. Others have synergistic effects that enhance productivity and create new efficiencies, such as when various combinations of ports, airports, roads, and rail form multimodal transport networks. Of course, such potential outcomes may play out differently in each Northern region due to its particular geographic endowments and constraints.



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