Thompson Nicola Regional District
Regional Broadband Strategy

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Approved by the TNRD Board: June 17, 2021

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Contents

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1 EXECUTIVE SUMMARY

The Thompson-Nicola Regional District ("TNRD") is comprised of ten Electoral Areas covering a large geographical area. It suffers from a widespread lack of adequate connectivity with many communities considered unserved and many well below the Universal Service Objective ("USO") established by the Canadian Radio-television and Telecommunications Commission ("CRTC") of 50/10Mbps.

The TNRD recognizes connectivity as critical to the region's economic future, including supporting the local initiatives of the region. The need to be connected reliably, anywhere, anytime, is only increasing and Canadians need the ability to function when faced with external forces. This is particularly true in remote and rural parts of Canada.

The impact of COVID-19, which recently further shifted education, healthcare and employment on-line, has laid bare significant internet service gaps in many parts of Canada, British Columbia and the TNRD. Our goal as Canadians should be to advance our ability to provide online access to these essential services. As highlighted by recent global events, connectivity is the foundation for providing these services in an ever-increasing online world. There is simply no reason with today's technology that residents residing anywhere in the TNRD should not be able to attend a high quality, two-way video and audio online education or healthcare session. Further, services like education and healthcare will continue to evolve in their capabilities and not having access to quality connectivity will continue to leave some people disadvantaged.

This project has identified and documented the state of connectivity throughout the region, though the focus is on the rural Electoral Areas' broadband connectivity. Less than 15% of households and businesses in the rural areas of the TNRD would be considered served at the USO level, the remaining 85% lacks connectivity that is consistent with the TNRD's vision and the USO. The project identified areas that would be considered underserved, resulting in nearly 100 identified areas representing a very large problem. Some initiatives are currently underway in the TNRD that will address some of these identified areas, but a large number will still exist even after these are addressed. While some are considered remote and perhaps are more realistically suited to evolving technologies such as emerging satellite technology, there are still many that are located along major corridors that would be viable candidates for leveraging already existing core infrastructure.

While infrastructure exists that can be leveraged, the challenge for the TNRD is how to address this problem considering the geography, vast area, remote locations, and lack of concentration of homes and businesses forming clusters of potential project areas that may provide a viable business case for third party providers. The problem of connecting these areas is a significant financial challenge as detailed in the ancillary document. Steps that the TNRD should take now include:

- Create criteria for prioritizing areas of concerns and apply those to the project areas identified to create a prioritized list.
- Ascertain the role TNRD will play in advancing those priority areas.
- Seek opportunities wherever possible for a focused effort for third party providers and potential industry partners.
- Consider establishing a dedicated resource that can focus on leveraging all the assets available and finding creative ways to finance and move the process forward in an effective way.

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2 INTRODUCTION

2.1 Purpose and Organization of Report

This report documents a strategy for the TNRD to connect residents and businesses that do not have broadband service at the USO. The project assesses the existing state of connectivity within the Regional District, identifies the service providers operating in the area, defines the gap between the current state and a fully connected TNRD and then provides a path forward to improve connectivity in the region along with high-level budgetary costs associated therewith.

The report is organized to step the reader through relevant background information about the TNRD, identifies what the TNRD wants its future state to look like and why, provides a summary of where TNRD is today and then discusses what can be done to improve connectivity in TNRD.

2.2 Intended Audience

This report is intended to be utilized internally by TNRD staff and Board of Directors for education, guidance, and planning purposes to support decision making and advocacy efforts to improve access to, and availability of, high speed connectivity throughout the TNRD. This regional connectivity strategy has been provided along with ancillary supporting information and documentation to the TNRD for its sole benefit and reference. This work may not be relied upon by any third parties without completing their own independent due diligence.

2.3 Project Scope & Assumptions

The project focused on the rural Electoral Areas of the TNRD and included an assessment of its existing broadband connectivity and development of a strategy for improvement. The scope of the project did not include an assessment of any member municipalities. Additionally, the information gathering on this project included efforts to reach out to rural First Nations in the area, to obtain information about connectivity on populated reserve lands, but assessing and creating a strategy for improved connectivity on First Nations lands was not within the scope of this project. Finally, the project included consideration of cellular coverage as it pertains to broadband connectivity, but creating a strategy specifically to increase cellular coverage was outside scope.

2.4 General Approach

Resources from both TANEx and the TNRD worked collaboratively to complete the strategy through various phases of the project. At a high level, developing this strategy included a series of activities including project kickoff, information gathering, public and stakeholder outreach, presentation of draft strategy to the Board of Directors, receiving feedback, and report preparation and finalization.

The current state of broadband connectivity in the TNRD was assessed by:

- undertaking public domain research;
- survey of area residents and businesses;
- direct outreach to service providers and stakeholders;
- direct outreach to rural area First Nations where possible.

An analysis of the difference between the current state of connectivity in the TNRD and the future desired state was completed. An analysis of alternatives to fill those gaps was completed and then a draft strategy was prepared and reviewed with the TNRD staff team. The draft strategy incorporated feedback from the TNRD project team and was then presented to the Board of Directors.

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2.5 Impact of COVID-19 on the Project

This project kicked off during the first wave of the COVID-19 pandemic and was completed in March of 2021. The pandemic impacted both the project and timeline. COVID-19 created challenges for the project as local government and their First Nation's peers were consumed with managing the very real health crisis created by COVID-19. In addition, outreach was delayed and more challenging as people were distracted with other real priority items.

On the positive side, COVID-19 did crystallize a better understanding of the critical nature of broadband connectivity regardless of where people reside. Even within the TNRD board itself, the ability of rural directors to easily participate in the new way of conducting government business was varied depending on where the rural director lived.

As Canadians, it should not be acceptable that some of our children's access to education has little impact from COVID-19 while others without access to suitable broadband connectivity at home fall further and further behind as the pandemic drags on. It should not be acceptable that some of our citizens go without access to healthcare services because the connectivity in their homes is not sufficient to have a video call with their doctor.

The restart of the economy and this country's recovery from the impacts of the COVID-19 pandemic is highly driven by the ability to work and be productive, remotely, if, and where, necessary. The right to do so and participate in the economy belongs to every Canadian and connecting rural Canadians to broadband service at the USO must be of the highest importance.

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3 TNRD SUMMARY

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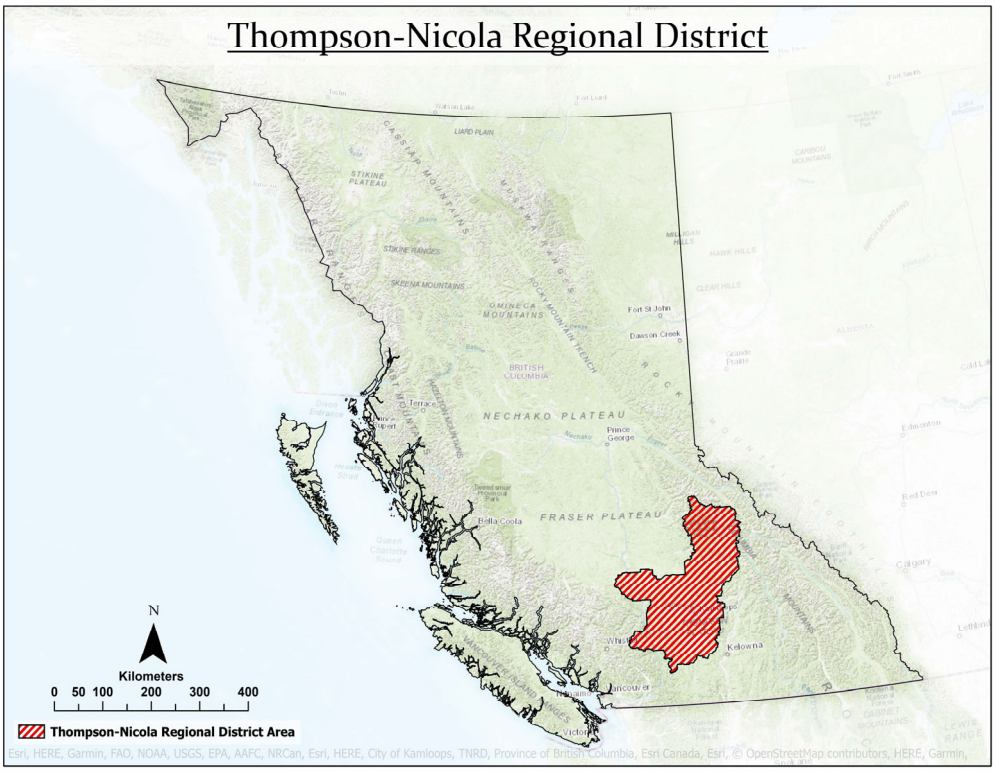
This section provides a background understanding of the Regional District as a whole and a lens through which to view this report, the strategy, and the recommendations.

3.1 Geographic Location

As shown below, the TNRD is situated in south central British Columbia. It is a sizable region spanning approximately 45,000 square kilometres. Because it is centrally located in BC, it has numerous highways that all converge in the centre of the TNRD around the City of Kamloops.



3.2 Population and Communities

Federal census population numbers at the time of this report are outdated as 2021 is a census year meaning that the published census numbers are now almost 5 years old. Those census numbers indicate the population of the TNRD as a whole is 132,663[1]. Updated estimates from British Columbia for 2019, however, estimate the region's population at 150,333[2].

The TNRD is comprised of 11 member municipalities, First Nations' reserves and rural communities. Population numbers noted below have been drawn from the census data. Electoral Area population numbers do not include population from within member municipalities nor from First Nations' reserve lands geographically located in that Electoral Area.

[1] Statistics Canada, 2016 Census Data, TNRD Census Profile
[2] B.C. Government, Population Estimates

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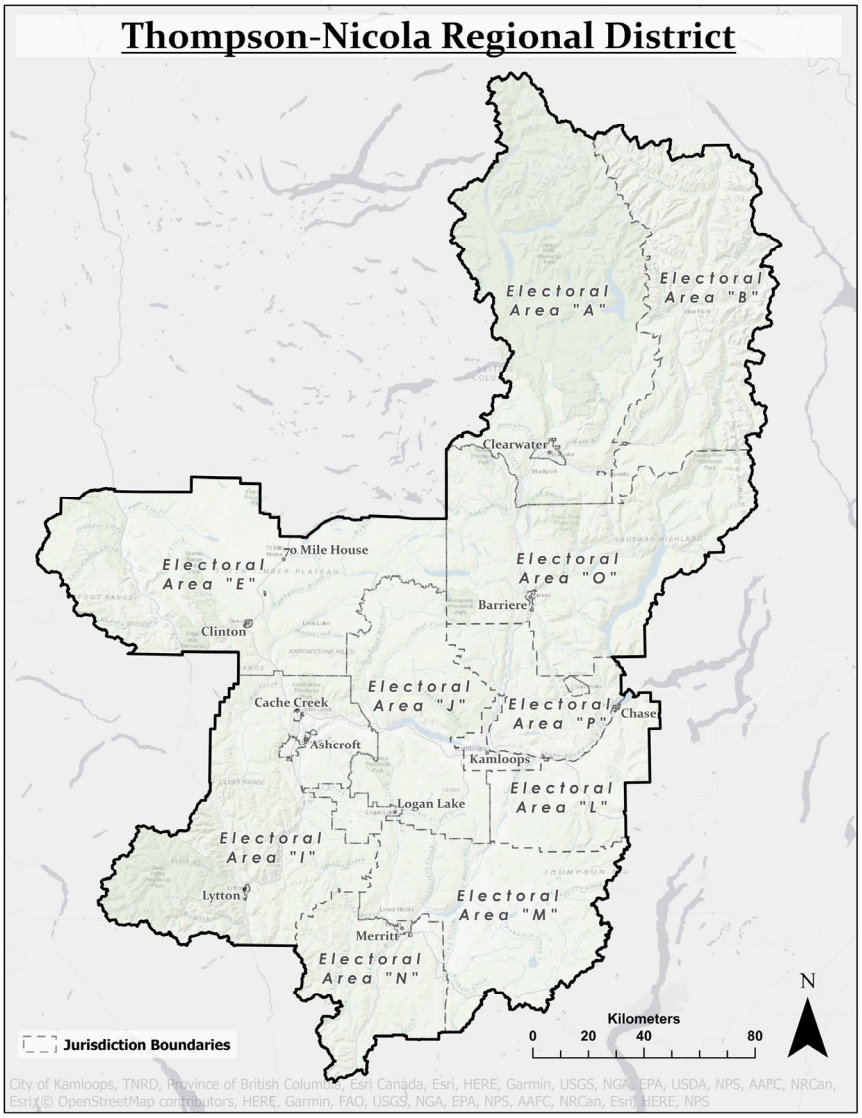
3.2.1 Electoral Areas

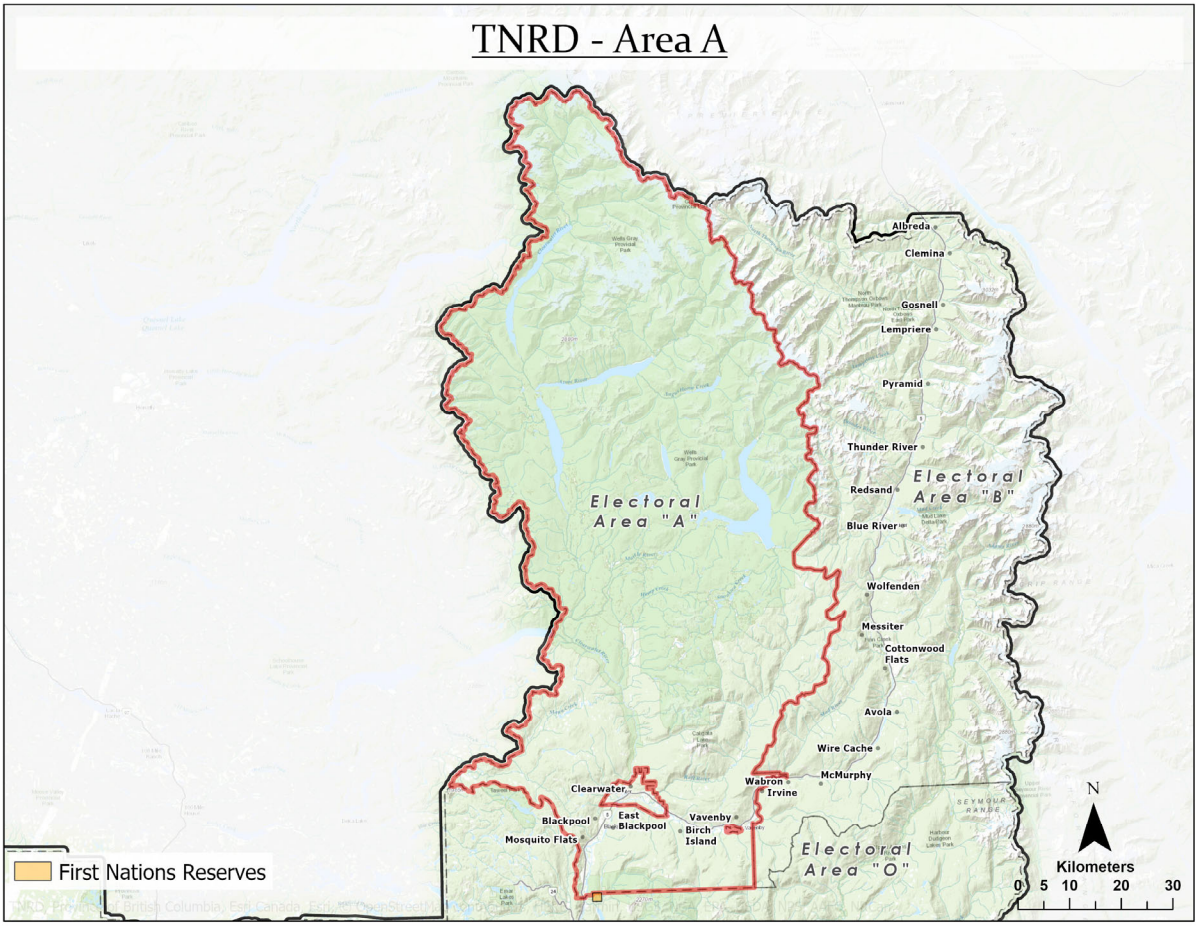
As shown on the map below, the TNRD is made up of ten Electoral Areas entitled “A”, “B”, “E”, “I”, “J”, “L”, “M”, “N”, “O”, and “P”. The rural Electoral Areas were the focus of the connectivity strategy as they are home to the rural communities that the strategy seeks to connect more effectively. Total population for all Electoral Areas is 15,972[3].



[3] Statistics Canada, 2016 Census Profile, Electoral Area Census Subdivisions

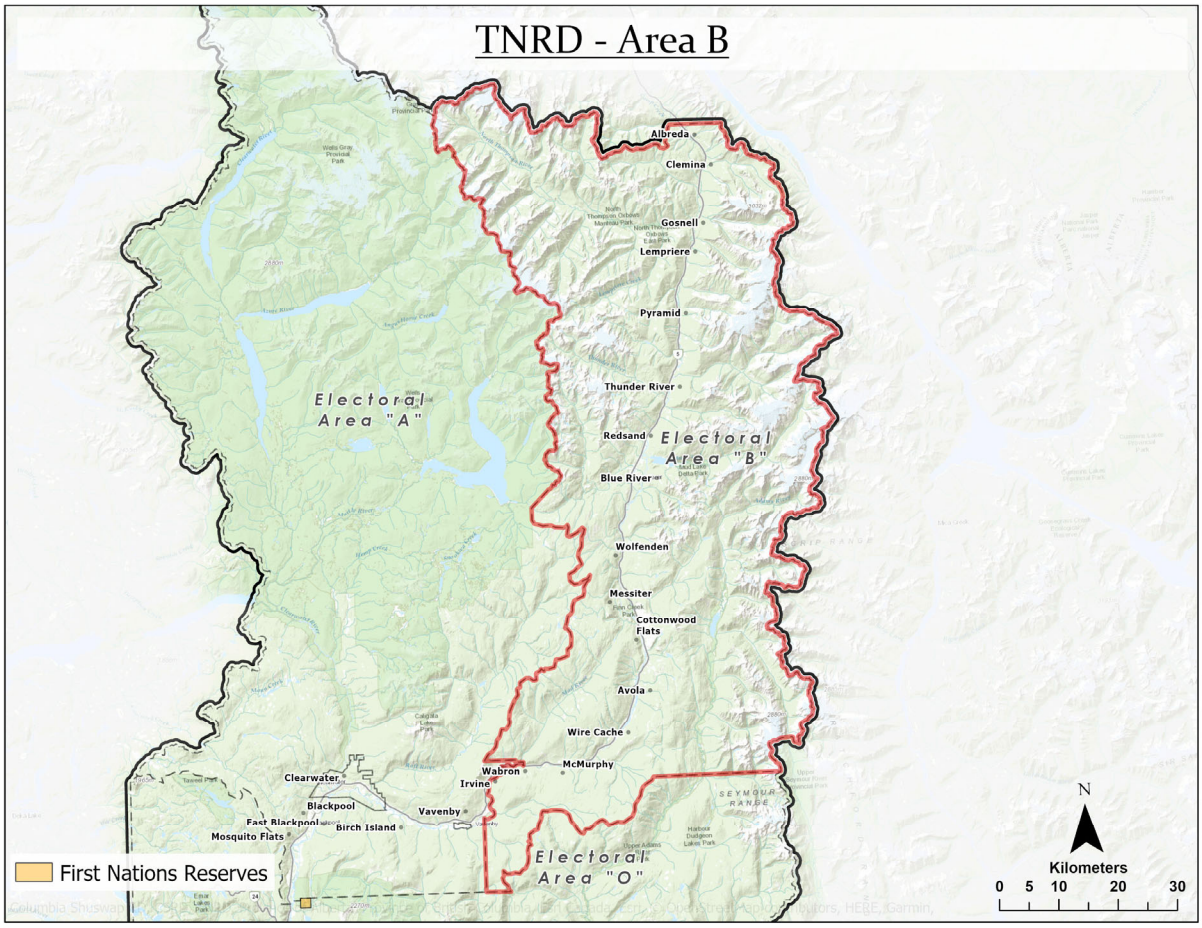
3.2.1.1 Electoral Area "A"

Electoral Area "A" is vast at over 7,000 km^2. It is located in the northern part of the Regional District. Most of its geographical area is filled by Wells Gray Provincial Park. The population of 1,493 live in communities such as Blackpool, East Blackpool, Birch Island, Upper Clearwater, and Vavenby. The member municipality of the District of Clearwater is in Area "A". Generally, from a connectivity perspective, there are serious concerns expressed with the lack of cellular service in much of the region with the lack of cellular coverage in Upper Clearwater and Wells Gray Park being front of mind from a public safety perspective.



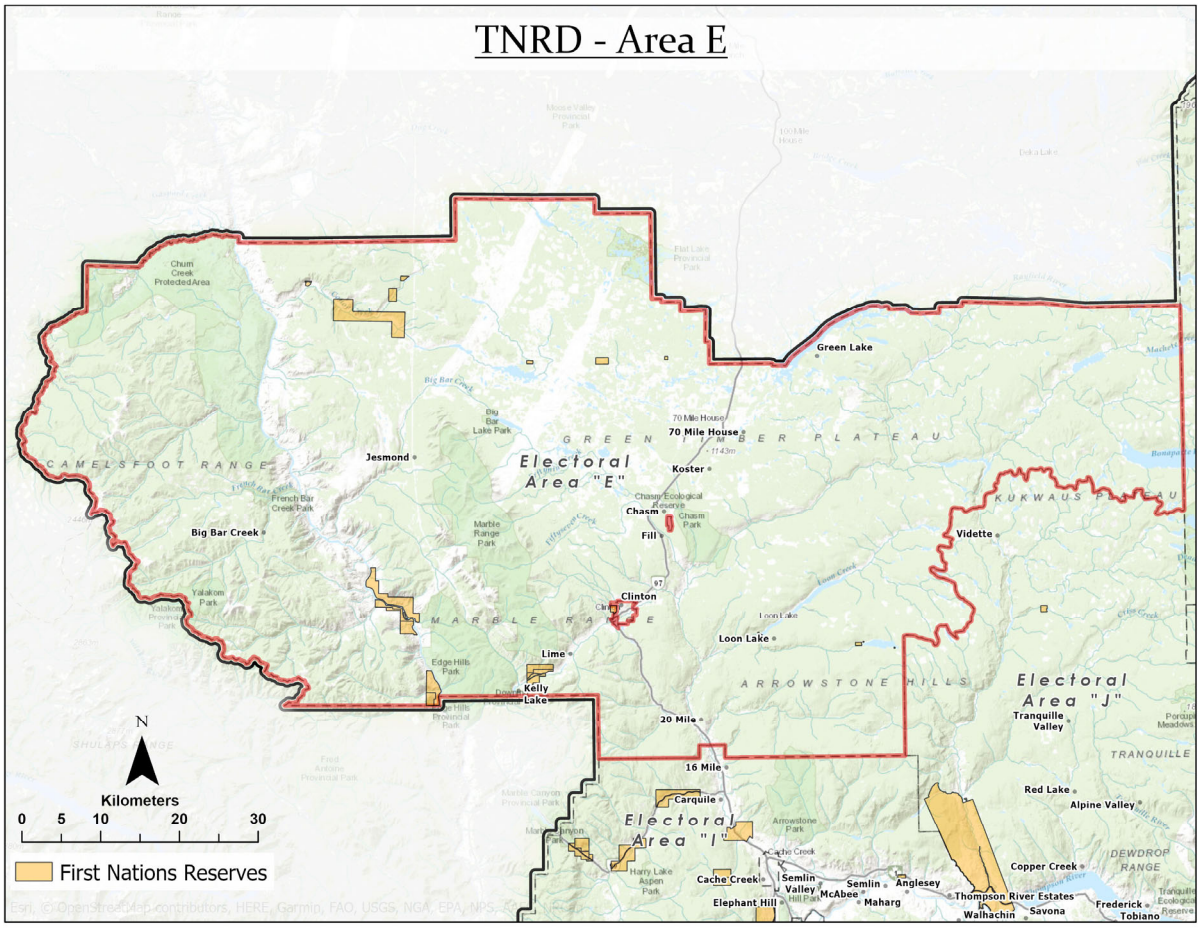
3.2.1.2 Electoral Area "B"

Electoral Area "B" is also located in the northern TNRD, immediately east of Area "A". It is roughly 5,150 km^2 and is home to a tiny rural population of about 233 people. It is highly rural and most people live in one of two main rural communities in the area, Blue River and Avola. Area "B" is home to an internationally acclaimed heliskiing operation. Highway 5 runs south to north through Area "B" and exits into the Regional District of Fraser-Fort George.



3.2.1.3 Electoral Area "E"

Electoral Area "E" is around 6,700 km^2 and located in the western portion of the TNRD. The member municipality of the Village of Clinton is located along highway 97 in the south-central part of this Electoral Area. The population of roughly 1,100 people are primarily clustered in 70 Mile House, South Green Lake, Loon Lake, 20 Mile, Big Barr, and Pressy Lake. Area mill closures mean that the main industry is now home-based businesses which require better connectivity to support them and economic development/diversification requires that connectivity be fast, reliable and affordable.



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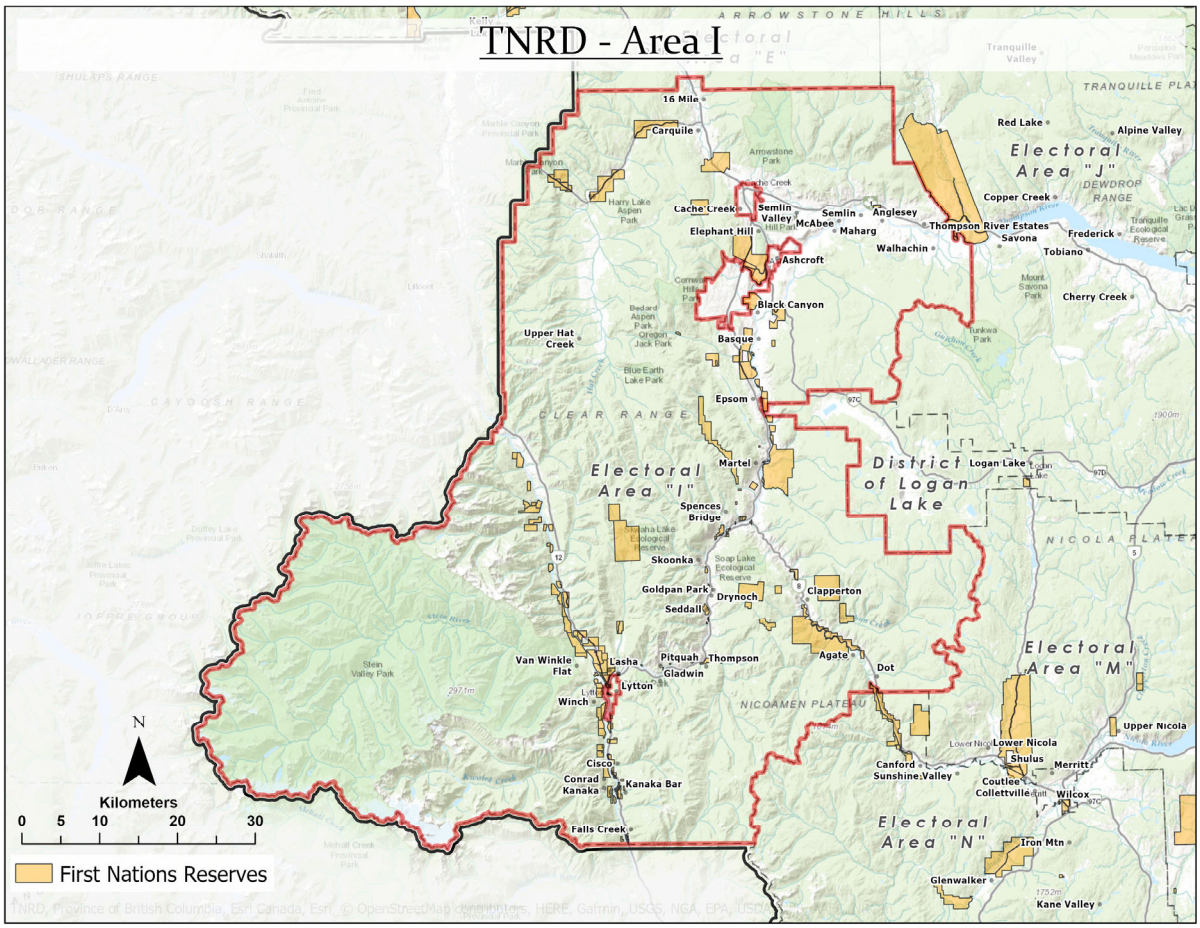
3.2.1.4 Electoral Area "I"

South of Electoral Area "E" in the south western part of the TNRD, is Area "I" with a population of nearly 1,300 who reside mainly in the rural communities of 16 Mile, Walhachin, and Spences Bridge. It is over 5,700 km^2 and also is home to the member municipalities of Cache Creek, Ashcroft, and Lytton with Logan Lake bordering it to the east. There are a number of First Nation Reserves throughout the area, especially along the highway corridors north and south of Lytton. The Trans-Canada Highway runs from the north east of the area through to the south west part of the area and exits into the Fraser Valley Regional District. The geography in Area "I" is very challenging for line-of-sight based connectivity technologies with sheer cliffs limiting cellular coverage.



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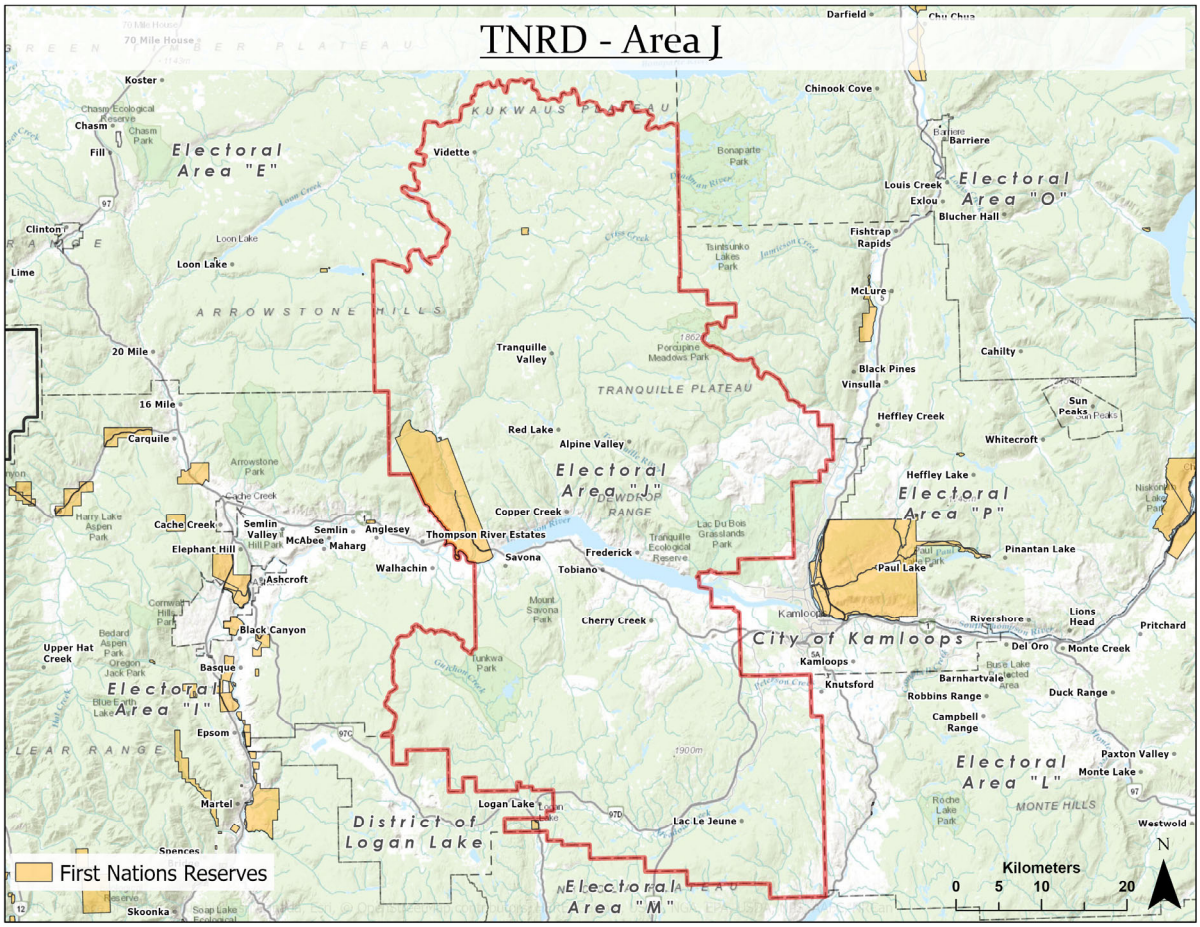
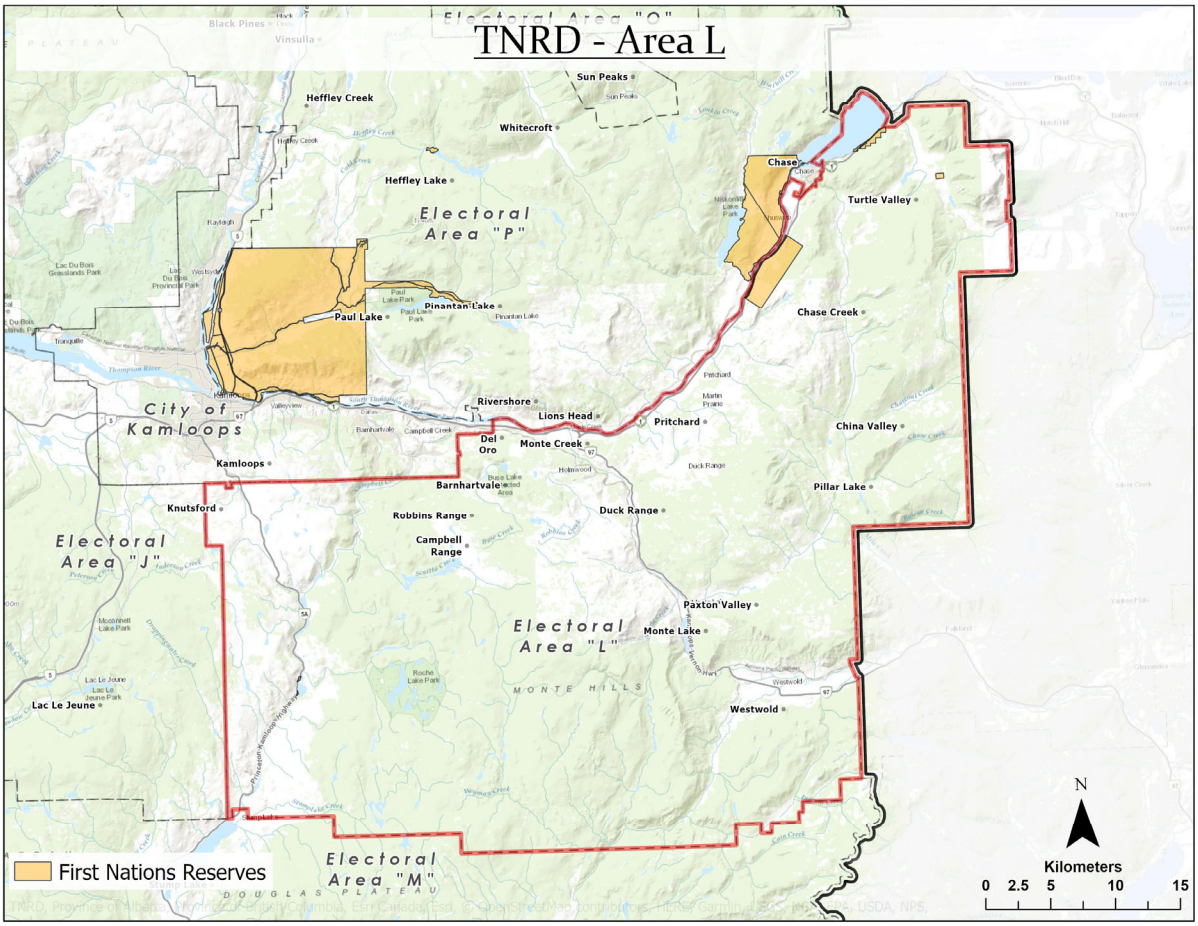
3.2.1.5 Electoral Area "J"

Electoral Area J is centrally located within the region and is bisected by Kamloops Lake which runs horizontally through the middle of the area. The area totals nearly 3,300 km^2 in size and is home to over 1,500 people many of whom live in the major communities of Cherry Creek and Savona located on the southern shores of Kamloops Lake along the Trans-Canada Highway. Rural population can also be found in Lac Le Jeune, Tobiano, and Alpine Valley among others. Cellular coverage is a concern in the area with extended sections of road with no coverage.



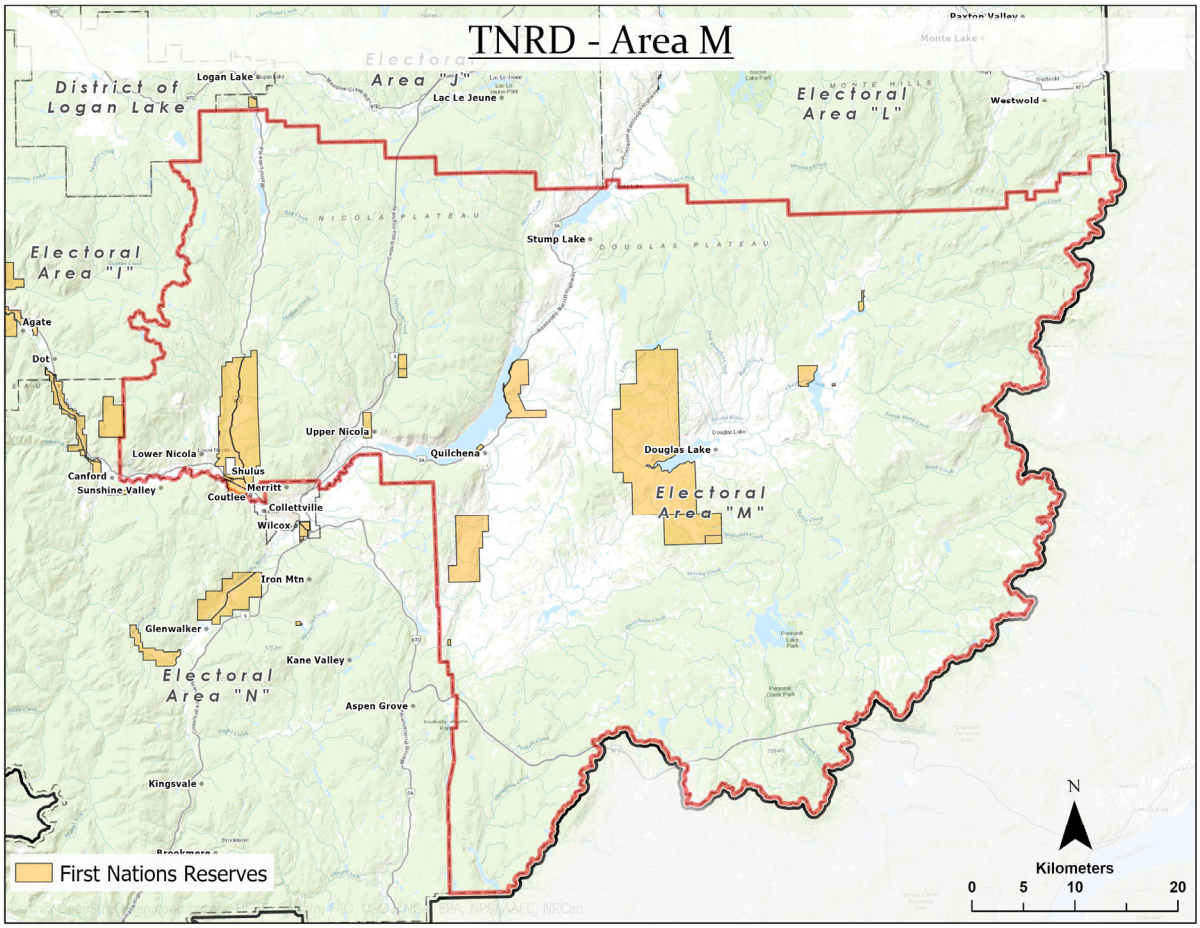
3.2.1.6 Electoral Area "L"

Electoral Area "L" is on the eastern border of the TNRD with the South Thompson River and Trans-Canada Highway running along its northern border. The City of Kamloops borders the northern boundary of Area "L". The area spans nearly 2,000 km^2 and is home to around 3,000 people. The town of Pritchard is sizable and located along the banks of the South Thompson River. Other rural communities include Westwold, Knutsford, Monte Lake, Pillar Lake, Duck Range, Chase Creek, and Turtle Valley. Difficulties are reported in participating in work from home activities such as video calls a very short distance outside of Kamloops as well as concerns about cellular coverage gaps.



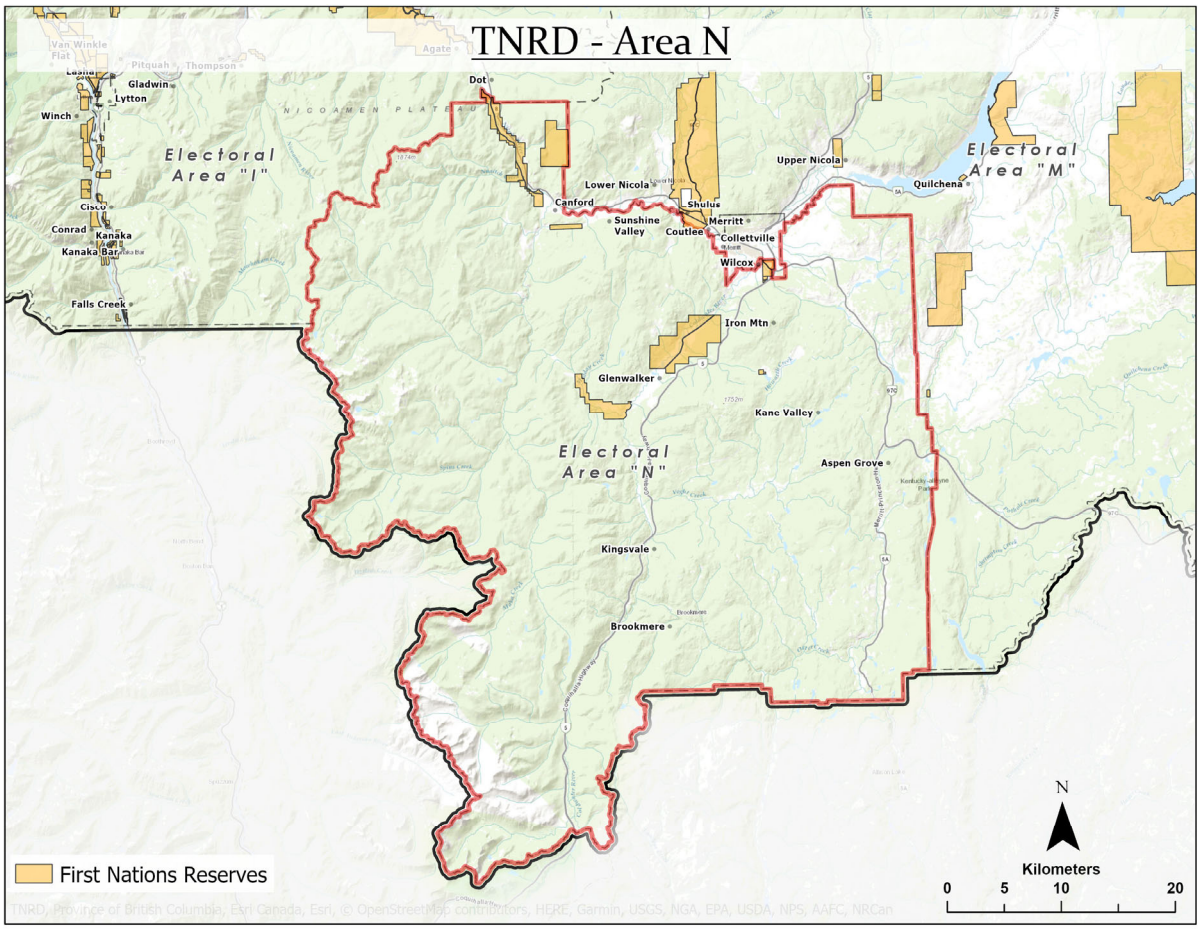
3.2.1.7 Electoral Area "M"

To the south of Electoral Area "L" is Area "M". Spanning almost 4,000 km^2, this southeastern area is home to around 1,600 people. Numerous highways run north to south and converge in the City of Merritt which is located on the southern border of Area "M". Rural communities include Douglas Lake, Stump Lake, Quilchena, Upper Nicola, and Lower Nicola. Quality of service is a concern so there is difficulty in attracting people to the area and the people who are there have difficulty working from home.



3.2.1.8 Electoral Area "N"

Electoral Area "N" is the southernmost Electoral Area in the TNRD. It is over 2,300 km^2 and its population is less than 1,000 people who are clustered throughout the area such as south of Merritt, east of Lower Nicola, and along the Coquihalla Highway which exits into the Fraser Valley Regional District to the south of the area.



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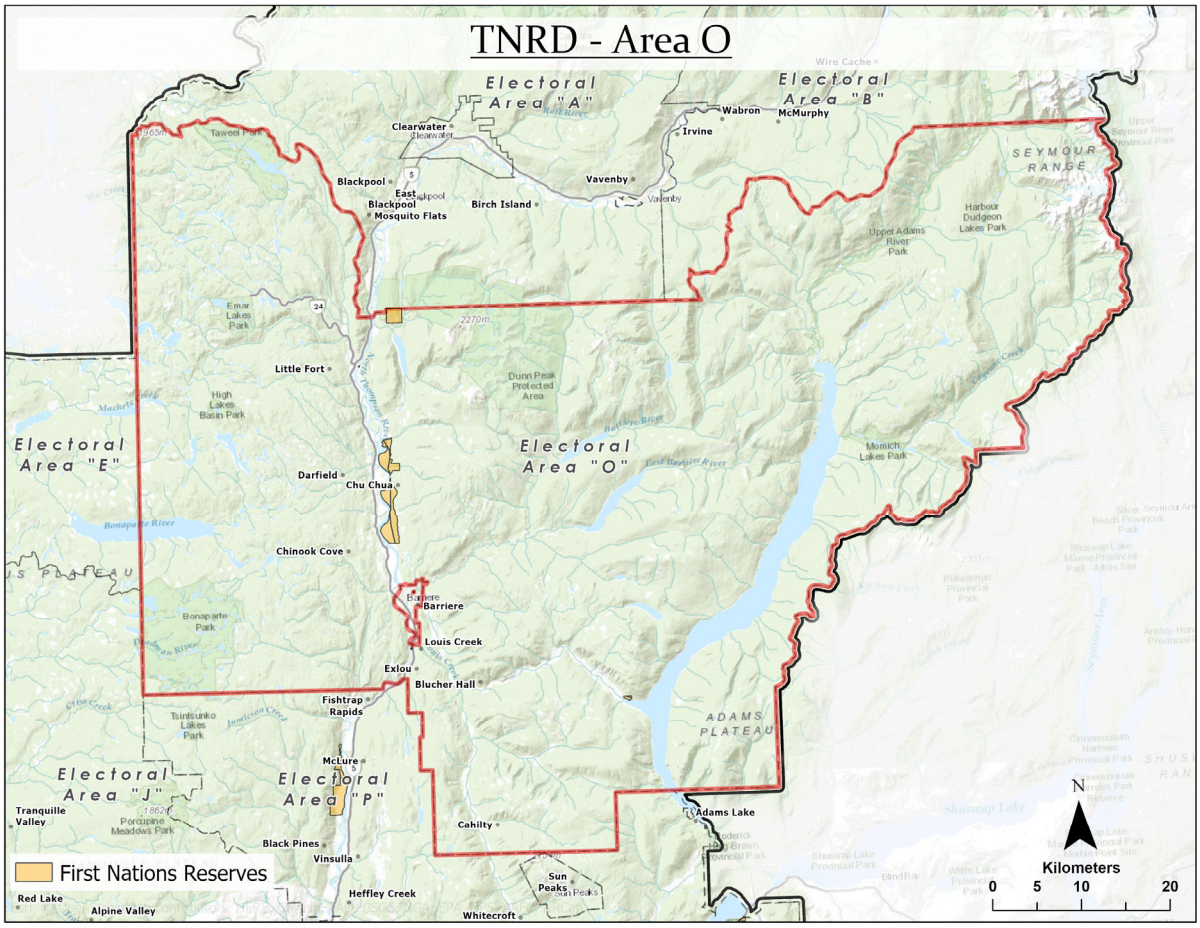
3.2.1.9 Electoral Area "O"

Electoral Area "O" is located south of Areas "A". A significant number of the roughly 1,300 people living in the area reside in communities such as Little Fort, Darfield, Chinook Cove, Louis Creek, Exlou, Blucher Hall, and Cahilty. The member municipality of the District of Barriere is located centrally within the region and is an important hub along Highway 5 and the North Thompson River. Outside the main corridors, connectivity is reported as very poor and public safety concerns are high.



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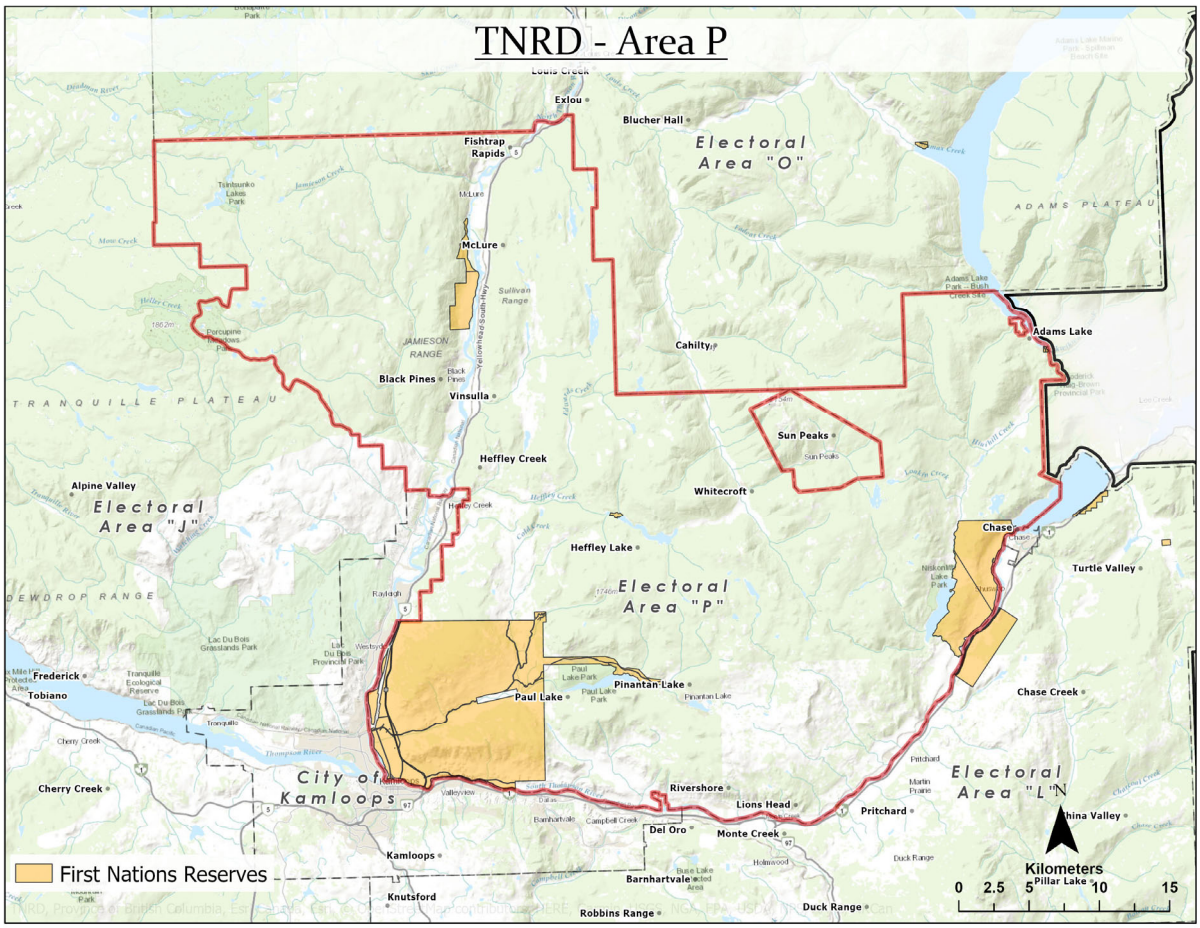
3.2.1.10 Electoral Area "P"

South of Area "O" and north of area "L", Electoral Area "P" is centrally located in the TNRD and is just over 1,500 km^2. The member municipalities of the City of Kamloops and Chase border the southwestern boundary and eastern boundary respectively. The member municipality of the Village of Sun Peaks is located in the northeastern section of Area "P". Much of the area's nearly 4,000 people live along the Trans-Canada or Southern Yellowhead Highways in communities such as River Shore, Black Pines, and McLure. Others reside in the lake side communities in the hills to the northeast, such as Pinantan Lake, Paul Lake or Heffley Lake. Cellular service is a big concern because of public safety issues.



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3.2.2 Member Municipalities

Along with the Electoral Areas noted above, there are eleven member municipalities within the TNRD:

Member Municipality	Population 2016 Census[4]
Kamloops	90,280
Merritt	7,139
Clearwater	2,324
Chase	2,286
Logan Lake	1,993
Barriere	1,713
Ashcroft	1,558
Cache Creek	963
Clinton	641
Sun Peaks	616
Lytton	249

As can be identified from the table above, many of the member municipalities are very small communities, similar to unincorporated rural communities.

3.2.3 First Nations Reserve Lands

The TNRD has a large number of First Nations neighbours with reserve lands in the rural areas of the TNRD which include:

Band Name	Population On/Off Reserve	Land Base (ha)
Adams Lake Indian Band	359/440	2908.80
Ashcroft Indian Band	72/203	1986.10
Bonaparte Indian Band	152/798	1878.60
Boothroyd Indian Band	64/220	1131.40
Stswecem'c Xgat'tem First Nation	296/477	No info listed
Coldwater Indian Band	328/526	2500.60
Cook's Ferry Indian Band	52/294	3983.50
High Bar First Nation	No info listed	No info listed
Kanaka Bar Indian Band	64/173	273.90
Little Shuswap Lake Indian Band	196/153	3112.70
Lower Nicola Indian Band	502/753	7128.20
Lytton First Nation	794/1233	6005.70
Neskonlith Indian Band	267/391	2811.20
Nicomen Indian Band	50/83	1175.70
Nooaitch First Nation	104/131	1693.40
Oregon Jack Creek Band	16/52	822.80
Shackan Indian Band	69/64	3873.70
Simpcw First Nation	No info listed	No info listed

[4] Statistics Canada, 2016 Census Profiles

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Siska Indian Band	91/226	357.50
Skeetchestn Indian Band	224/313	8042.50
Skuppah Indian Band	56/64	245.90
Tk'emlups Indian Band	553/781	13415.60
Ts'kw'aylaxw First Nation	197/373	2130.00
Upper Nicola Indian Band	372/598	12551.20
Whispering Pines Indian Band	52/158	565.20

Many of these communities do not have broadband internet service at the USO.

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4 VISION AND GOALS

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4.1 General Approach

Identifying where TNRD wants to go is key for knowing whether it has gotten there and identifying specific goals in connection with that vision allows TNRD to focus on how to get there.

The TNRD connectivity project team looped in some additional resources for a vision development session that was conducted remotely. Connectivity is seen as essential to ensuring that all residents and businesses in the TNRD enjoy the same advantages as more urban communities so that the Region can meet its full potential. A vision statement and specific goals were developed which are re-produced below. They should be considered for endorsement or amendment by the Board of Directors of the TNRD to formalize them as guiding tenets of the strategy.

4.2 Vision

The vision statement is:

> The Thompson-Nicola Regional District facilitates **rural lifestyles** with **widely available, affordable, reliable, high-speed broadband connectivity** in most of its rural communities giving full access to the same business, education, healthcare, and social services as its more densely populated communities. **TNRD businesses are supported by connectivity** which allows them to have access to the full range of information, services and opportunities that is available to their competitors and because of this, rural **TNRD businesses compete on a level playing field**, access on-going training and education, participate in the global economy and create local jobs.

4.3 Connectivity Goals

In conjunction with identifying what the future state of the TNRD looks like once connectivity is achieved, the connectivity project team also prepared some connectivity goals that could be used to identify success of the strategy as follows:

TNRD Connectivity Goals

Goal #1: Facilitate the competitiveness of business, sustainability and growth of rural communities in the TNRD and support remote working and access to education and healthcare by connecting 90% of residences and businesses within 250 m of an NBD road[5] with high-speed broadband connectivity at a minimum of 50/10 by the end of 2026.

Goal #2: Maximize the potential and value of TNRD anchor infrastructure such as Community Halls, Fire Stations, Libraries, Sewage Treatment Facilities, Transfer Stations, & Water Facilities located in the Electoral Areas by connecting a minimum of 90% of them with fibre service (where applicable) at a minimum of the USO by the end of 2026.

[5] 'NBD' – 'National Broadband Data' road from Innovation, Science & Economic Development Canada

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Goal #3: Increase public safety by increasing access to cellular service along major/minor roads[6] in rural TNRD such that 90% of such roads have coverage that is interrupted by gaps in coverage no greater than 50 km by the end of 2026[7].

[6] BC Government, Overview of B.C. Highway Functional Classification https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/planning/inventories/bc_numbered_hwy_functional_classes.pdf

[7] With respect to goal #3 with respect to cellular technology identified in goal 3 above, it is acknowledged that it is very difficult to accurately pinpoint existing coverage as the nature of the technology is that it can be spotty within an area shown as covered. Further, along roads, it is likely that there may be stretches of that road that do not have cellular coverage. This will make it more difficult to assess the success of the cellular goal. It is likely to be a qualitative assessment only.

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5 METHODOLOGY

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5.1 Methodology

This section describes the methodology used in gathering information used in the report for mapping and outreach. The information obtained will be summarized later in the document.

5.1.1 Mapping Methodology

Part of the information gathering process involved obtaining available GIS data from the TNRD, along with other sources, and using it to create maps. The methodology and discussion of elements used for creating the important layers in these maps is generally laid out below.

Sources – The sources used in the analysis include the TNRD, various stakeholders corresponding to the affected areas, the CRTC, Statistics Canada, Innovation, Science and Economic Development Canada ("ISED") and BC Open Data. The main dataset of analysis was sourced from the TNRD and included the Points which are discussed in more detail below. The material sourced from the CRTC/ISED included the hexagons that indicate which type of service is available in a location and the National Broadband Internet Service Availability Map (the "ISED Map") to show the speeds available.[8]. Examples of the types of service include cable, fibre, DSL, and wireless, among others. Data from Statistics Canada included census data that determined the number of people and the number of dwellings in certain communities within the TNRD. Another important layer sourced from the CRTC/ISED is the National Broadband Road Segments layer which is discussed in more detail below[9]. The existing infrastructure dataset that came from public sources that showed the location of existing cell towers[10]. Contextual information sourced from BC Open Data included anchor institutions such as schools, hospitals, and government buildings[11]. Road networks, administrative boundaries, and other layers were also sourced from BC Open Data and the TNRD.

Potential Subscriber Points – Potential subscriber points ("Points"), are one of the most important datasets in the analysis. TANEx used TNRD's GIS dataset of Address Points which is used to approximate a potential subscriber location which may be a single dwelling or multiple dwellings within one geographic location. The Points were then assigned both density and available internet speed characteristics which are discussed in more detail below. The combination of Point characteristics created the foundation for delineating proposed project areas and the overall characteristics of those project areas as discussed in the project areas section below.

Density & Density Buffer Areas – In order to gauge the density of certain areas, six buffer zones around the Points were created. The six buffer distances used were 25m, 50m, 100m, 200m, 1km, and 2km. Individual buffer zones emanating from the Points were then dissolved into contiguous areas. If any of the buffer zones contained only one Point, they were erased. The results are contiguous areas that contain two or more Points. If a Point falls within a buffer zone, it is designated as Type 1 (25m), Type 2 (50m), Type 3 (100m), Type 4 (200m), Type 5 (1km), or Type 6 (2km) density, defaulting to the higher designation if it falls within two or more of the buffer zones. If a Point does not fall within the lowest density buffer zone designation (Type 6), it is designated as Type 7 which means it is outside the 2km buffer area. Such Points are very remote and very rare.

Speeds & Speed Buffer Areas – Innovation, Science and Economic Development Canada (ISED) maintains a dataset of national broadband road (NBD) segments which designate the internet speed a

[8] Government of Canada, *National Broadband Data Information*, Hexagonal Grid of Canada
[9] Government of Canada, *National Broadband Data Information*, National Broadband Data Road Segments
[10] Steven Nikkel, 2020, *Canadian Cell Towers Map*
[11] Government of British Columbia, BC Data Catalogue

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person could expect if they lived in the area of that road. ISED notes that the data collected and used internally by ISED is, in most cases, accurate to within 250 metres[12]. This data is based on information provided annually by service providers[13].

Based on the accuracy ISED denotes, as referenced above, a Point was assumed to have a speed equal to the closest road within 250m of it. The range of speed combinations (download speed/upload speed) in Mbps are as follows: 50/10, 25/5, 10/2, 5/1, Less than 5/1, or No Service. If a Point did not fall within 250m of a NBD road segment, its speed was undeterminable and was designated "Unknown".

Project Areas – Project areas were created from the Points and the density buffers. Minor project areas were delineated 1km around the densest clusters of Points with a number of things in mind: Point characteristics for density, speed, topography, and distance between clusters. Lower density Points such as those 2km or further away from another Point were omitted from project areas. Large, consistent clusters of Points with speeds of 50/10 Mbps were also omitted since they already have service at the USO. Points and clusters of Points separated by natural boundaries (e.g. cliffs, water bodies, etc.) were either omitted or split into different areas where necessary. Clusters of Points far away from others were not determined to be logical groupings unless absolutely necessary such as when they fall along corridors where existing or future fibre lines may run. Minor project areas were then grouped together into major project areas based on proximity to one another and connecting features such as fibre lines/highways.

Fibre Lines – The routes of fibre lines were sourced from public domain. Fibre lines and an understanding of where they are situated are important since they form a key element of the network infrastructure needed to serve potential customers.

Cell Towers – Cell tower locations and data were also sourced from public domain. Cell towers are another important element in providing existing and potential future internet service to underserved areas and their constituents.

Service Provider Coverage – Service provider coverage was sourced from ISED databases and where possible, verified with the service provider. The databases derive their information directly from individual service providers. Some of the information is older and may be out of date but nonetheless gives a sense of which service providers operate in which area and what types of technology they utilize in those areas. Examples of such technology include coaxial cable, DSL, fixed wireless, or Fiber-to-the-Premises/Home.

UTM Zone 10N – The geographic coordinate system used for analysis and mapping was the Universal Transverse Mercator Zone 10N. This coordinate system was chosen since it covers and aligns nicely with the entire TNRD and therefore the distances between geographic features are relatively reliable and accurate.

Limitations of Data – The data used for the analysis has a number of drawbacks. ISED has created coverage maps using 25km^2 hexagons upon which they base certain assumptions about connectivity within that hexagon. This creates a geographically large area which may well have varying degrees of connectivity but the ISED assumptions are such that service within that hexagon is uniformly at the highest level achieved in the hexagon. ISED has also developed 250m NBD road segments that depict Mbps speeds in that area. These are more accurate geographically speaking but lack specificity in terms of which ISPs operate in the area or what the technology type is available there.

[12] Innovation, Science, & Economic Development Canada
[13] Government of Canada, *National Broadband Data Information*, National Broadband Data Road Segments

5.1.2 Outreach Methodology

5.1.2.1 Public

Public outreach was addressed by developing a survey with the TNRD connectivity team to gain an understanding of the extent of internet availability, satisfaction and use throughout the region. Further details about the promotion efforts undertaken to advertise the survey are detailed later in this report.

The survey was available online and in paper form. Public surveys were available to residents, businesses, organizations, First Nations, and institutions and delivered feedback about different aspects of internet and cellular service. The survey asked the respondents if they were interested in further communication on the topic. Respondents who responded in the affirmative were sent a further follow up email to get more granular information about their connectivity experience and impacts.

A summary of the results of the surveys are available later in this report. Reported results are simply as reported by the participants with it being beyond the scope of this report to undertake any form of validation including with respect to cost and speed of service.

5.1.2.2 Key Stakeholders

Key stakeholders were identified by the TNRD and telephone or email contact was made (or attempted to be made) with those stakeholders to schedule a one-on-one call to obtain information and views on the state of connectivity, future goals, benefits, and challenges from their perspective. Stakeholders included Electoral Area Directors, community leaders, community champions, business and industry representatives, emergency services representatives and other parties holding valuable insight into the connectivity challenge. A summary of the feedback obtained from those key stakeholders is contained later in this report.

5.1.2.3 Internet Service Providers

A list of service providers was created from information provided by the TNRD as well as research of publicly available sources identifying providers in the area. TANEx conducted or attempted to schedule one-on-one telephone interviews with each known area service providers and almost every service provider participated along with some providers not currently providing services in the TNRD.

5.1.2.4 First Nations

A written briefing note on the connectivity project was prepared by TANEx and sent to each rural First Nation. Thereafter, TANEx requested one-on-one telephone interviews with each First Nation to obtain information on connectivity in an effort to ascertain whether there were areas of the TNRD where a joint project could be pursued with an area First Nation. Follow ups were made by telephone or email.

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6 TNRD CURRENT STATE

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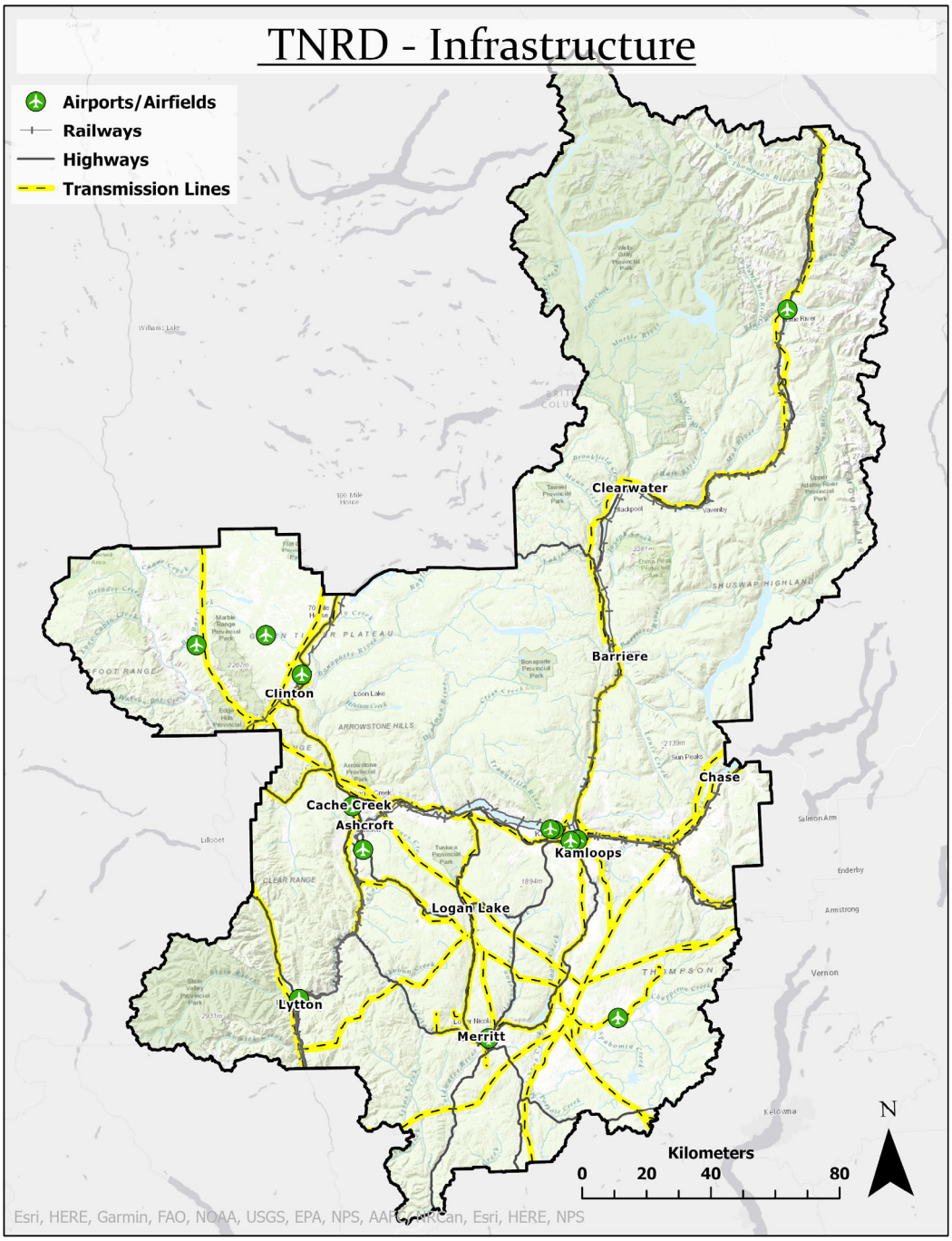
In order to formulate a strategy for the Regional District, the current state of the region must be clearly understood to identify the gaps and define the steps that must be taken to improve connectivity to underserved areas.

6.1 Infrastructure and Institutions

As noted earlier, TNRD covers 44,448 km^2 of British Columbia with a population of 132,663 primarily residing in Kamloops, with over 90,000 residents. Merritt is the second largest community with 7,000 residents. There are five municipalities with populations on the order of 2,000 including: Chase, Clearwater, Logan Lake, Barriere and Ashcroft. The rest of the population is located in about 16 smaller municipalities and unincorporated communities generally scattered along the transportation corridors.

TNRD is a rugged geography on the interior plateau between the Coast Mountains to the west and the Rocky Mountains to the east. The Regional District is largely defined by the watershed of the Thompson River and its two branches, the North and South Thompson. The climate ranges from relatively arid in the south to relatively wet in the north (e.g., Kamloops averages ~220 mm rainfall and ~75 cm snowfall annually, versus Blue River averages ~700 mm of rainfall and ~425 cm of snowfall).

6.1.1 Transportation



6.1.1.1 Road Transport

Three major highways transit TNRD with Kamloops at a strategic junction of all three. Most traffic from population centers in the lower mainland of British Columbia transit through the Regional District to connect to points north within the province and to points east in Alberta and the rest of Canada. As

shown on the sketch map above: Highway 5 provides a north-south connector - from the lower mainland in the south and connecting to Highway 16 and Edmonton in the north. Highway 1, the "Trans Canada," connects the RD in the south then cuts across the RD through Kamloops and runs east across Canada, passing through Calgary. Highway 97 connects the RD in the south-east to the Okanagan (Vernon and Kelowna), runs through Kamloops, then west and north to Prince George in the Cariboo Regional District.

6.1.1.2 Rail Transport

Both CN and CP Rail have lines that traverse TNRD[14]. Like the road transportation, the rail lines converge on Kamloops. A CN line runs north from Kamloops, generally paralleling Highway 5. The CP line runs east from Kamloops generally paralleling Highway 1. Both CN and CP lines run west from Kamloops along Highway 1 on the way to the lower mainland population centers. There is also a CN line that cuts across the south-west part of the Regional District. This line, originally built by BC Rail, connects Vancouver with the Prince George and points north.

6.1.1.3 Air Transport

The Kamloops Airport, Fulton Field (YKA) is a regional airport located within the City of Kamloops and is capable of handling Boeing 737 class flight operations[15]. A range of airlines have scheduled flights to and from Kamloops including WestJet, Air Canada and Central Mountain Air. There is also an airport in Merritt, Saunders Field (YMB) with a 1200 m (4,000 ft) paved runway[16]. There is a paved runway at the Cache Creek - Ashcroft Regional Airport (YZA, CAZ5). There are several other airstrips in the region including an all-weather runway near Blue River (CYCP), a seaplane terminal adjacent to the Kamloops airport and a few turf strips such as Knutsford (CA-0451) and Quilchena (CBT6).

6.1.2 Industry

Regional industries include agriculture, energy, forestry, manufacturing, mining, motion picture production, and tourism.

6.1.2.1 Energy

Although not a primary energy producer, the Regional District provides critical energy corridors for electricity and oil movements in the province.

The primary oil pipeline is the Trans Mountain Pipeline (“TM”) that runs north and south through the Regional District. This line is the major western outlet for liquid petroleum products moving from Alberta to the lower mainland and generally parallels Highway 5. The Pembina Oil Pipeline generally follows Highway 97 down from Prince George and connects to the TM in Kamloops[17]. The primary natural gas pipeline moving product from the gas fields in the north east corner of the province to the lower mainland generally parallels Highway 97 with a spur into Kamloops and across to Vernon in the Okanagan Valley[18]. An important upgrade and expansion project for the TM is underway that will twin the line from Edmonton to Burnaby (“TMX”).

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[14] Railway Association of Canada, Canadian Rail Atlas
[15] Kamloops Airport
[16] OurAirports.com, BC
[17] BC Energy, Oil Infrastructure in British Columbia Map
[18] BC Energy, Natural Gas in British Columbia Map

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Of interest from a connectivity perspective is regulatory Condition 115 of the Certificate of Public Convenience and Necessity (CPCN) issued by the Canada Energy Regulator (previously the National Energy Board) for the TMX that requires an improved leak detection system[19]. Although still under study, it is likely that the leak detection system will utilize distributed fiber-optic sensing technology[20]. This involves placing optical fiber in the trench with the pipe and provides an opportunity to include additional fiber strands for telecommunication purposes. It is expected that telecommunications network operators would be interested in securing some of the communications fiber under an Indefeasible Right of Use Agreement. Although there are regulatory hurdles to this, the benefits of communications fiber on this right of way are considerable and represent a timely opportunity that requires serious consideration by the relevant regulatory bodies, the Regional District, service providers and senior levels of government.

Most communities in the TNRD are part of the BC Hydro integrated electrical grid[21]. Although there is only a minor amount of power generation in TNRD, the Regional District is crossed by a variety of high voltage transmission lines. This is because TNRD is centrally located between demand centers in the lower mainland and bulk power generating stations in the north and east part of the province. The power generation in the Regional District includes the following generating plants: Kamloops Green Energy biomass plant (76 MW capacity); Savona Generating Station waste heat plant (5.9 MW capacity); Bone Creek run of river hydro plant (19 MW); and Merritt Green Energy biomass plant (40 MW capacity).

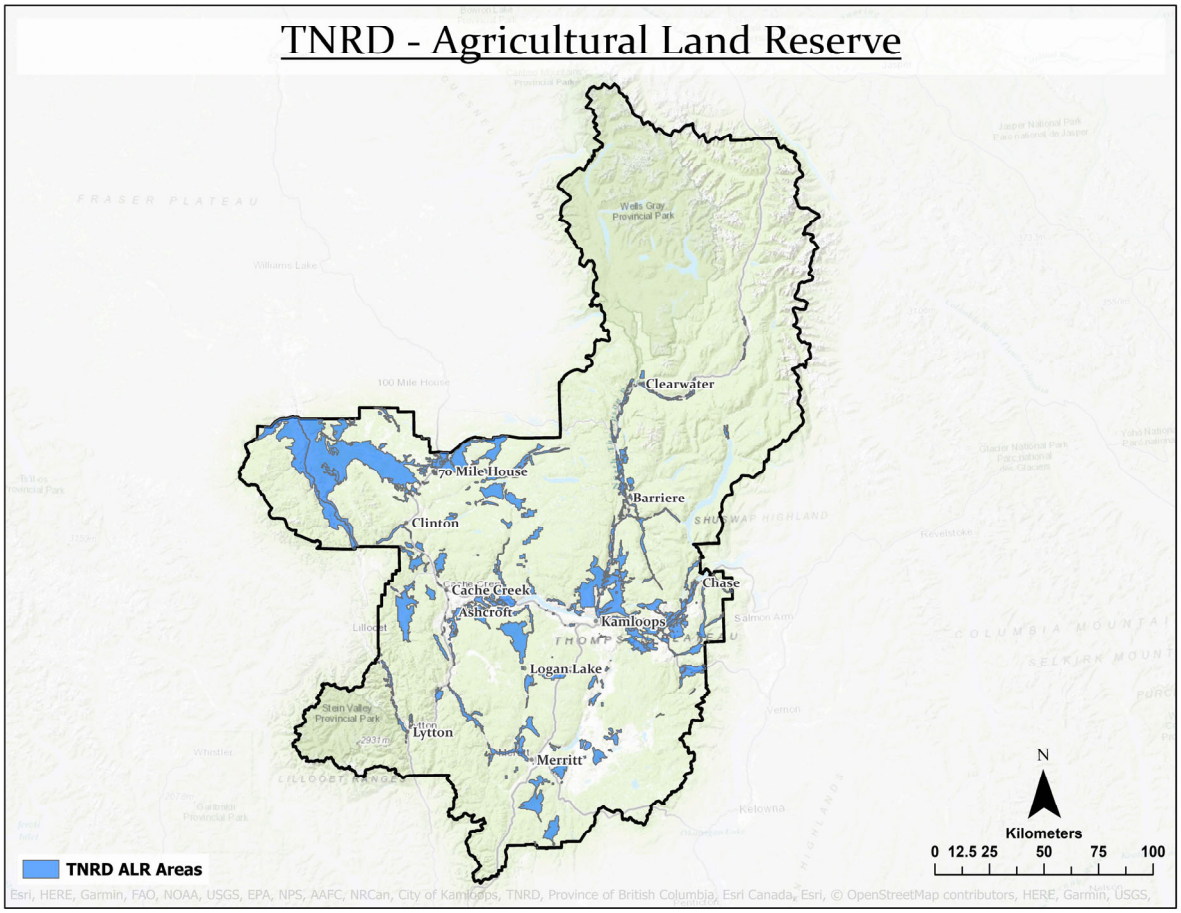
6.1.2.2 Agriculture

The TNRD has a significant and diverse agriculture industry which includes farming and ranching. It generates significant economic activity and supports BC's food security. There are large numbers of farms and ranches in the TNRD including the largest ranching operation in Canada which is supported by an abundance of natural grass lands in the area. The agriculture sector is considered a growth industry[22].

Agricultural activity is a marginally growing part of the economy with relatively large tracts suitable for grazing and cattle ranching. Other types of farming are becoming viable in the region as land prices in the lower mainland and Okanagan continue to rise. Although most farms in the region are not viable without other sources of income, the number of these hobby farms has begun to decline relative to larger and more commercial operations.

Agricultural land within the region that is designated as part of the Agricultural Land Reserve (ALR) is protected by the provincial Agricultural Land Commission (ALC). Agriculture is the priority use for ALR areas. Applications for non-agricultural use are screened by the ALC.

[19] Trans Mountain Pipeline ULC, Application for the Trans Mountain Expansion Project, NEB reconsideration, MH-052-2018, February 2019.
[20] Submission by Trans Mountain to the CER re Condition 115: SCADA and Leak Detection System Design, NEB File OF-Fac-Oil-T260-2013-03 061.
[21] Energy BC, Electricity Generating Stations in British Columbia Map
[22] Invest in Thompson Nicola Website



6.1.2.3 Forestry and Mining

Traditional industries in the region included forestry and mining. These are falling in importance relative to other regional economic activities. Forestry continues to suffer from declining fiber stocks, leading to mill closures and logging operations scaling back. The region has accessible deposits of copper, gold and other metals but is hampered by high costs and low ore grade compared to competing areas. Mining and mineral extraction operations are also subject to cycles tied to global commodity prices.[23]

The combined labour market for forestry, logging, mining and agriculture makes up barely 5% of the total labor market. It is noted that the top seven occupations in order by the numbers employed are: (i) health care and social assistance (~17%); (ii) retail trade; (iii) construction; (iv) education; (v) accommodation & food services; (vi) manufacturing; and (vii) professional services (closing in on 5%). The most recent Regional Growth Strategy 2020 Monitoring Report notes that while the urban population is growing, the population in the Electoral Areas continues a slow decline[24].

6.1.3 Health

[23] The Ashcroft-Cache Creek Journal, *Highland Valley Copper hopes to extend mine life until 2040*
[24] TNRD Development Services Department, Regional Growth Strategy 2020 Monitoring Report

Most of the TNRD falls within the Interior Health Authorities jurisdiction. There are three hospitals in the region[25]:

- Royal Inland Hospital is a Tertiary Referral Hospital at 311 Columbia Street, Kamloops, BC, Kamloops, BC.
- Dr. Helmcken Memorial Hospital is a Community Level 1 Hospital at 640 Park Drive, Clearwater, BC, North Thompson, BC.
- Nicola Valley Hospital and Health Centre is a Community Level 1 Hospital at 3451 Voght Street, Merritt, BC, Merritt, BC.

Outside these urban centers, there are primary and community health centers in the following locations:

- Ashcroft Community Health Centre
- Barriere Community Health Centre
- Blue River Community Health Centre
- Chase Primary Health Care Clinic
- Clinton Community Health and Wellness Centre
- Logan Lake Primary Health Centre
- St. Bartholomew's Health Centre, Lytton
- Sun Peaks Community Health Centre

Some of these centers provide a range of services such as immunization, community nursing, radiology, telehealth, etc. The primary health centers are more comprehensive than the community health centers and generally address a broader range of health issues and contributing factors with a wider range of strategies (including prevention, education, community engagement, etc.).

6.1.4 Educational Institutions

The Kamloops-Thompson School District (SD 73) is in TNRD along with parts of Gold Trail (SD 74) and Nicola-Similkameen (SD 58). Of the 73 schools in the region, the vast majority are located inside municipal boundaries and are identified in the following table[26]. As students from these elementary schools enter secondary, they must travel to a bigger center. Secondary school graduates can stay in the region for post-secondary education as there are several post-secondary institutions located in the municipalities.

[25] Interior Health, Hospitals Map
[26] BC Education, School District Contacts Map

Rural schools in the region

SD	School name	Address	Type
58	Lower Nicola Band School	201 Horn Rd, Merritt, BC	Elementary
58	Nicola Canford Elementary	2311 Postell St, Lower Nicola, BC	Elementary
58	Nkwala School	9410 Nkwala Rd, Douglas Lake, BC	Elementary Secondary
73	Blue River Elementary	5917 3rd Ave, Blue River, BC	Elementary
73	Pinantan Elementary	3205 Holbrook Rd, Pinantan Lake, BC	Elementary
73	Savona Elementary	600 Tingley St, Savona, BC	Elementary
73	Vavenby Elementary	5157 Galiano Rd, Vavenby, BC	Elementary
73	Skeetchestn Community School	278 Deadman Vidette Road, Savona, BC	Elementary Secondary
74	Stein Valley Nlakapamux School	1675 St George S Rd, Lytton, BC	Elementary Jr Secondary
74	Fountainview Academy	7615 Lytton Lillooet Highway, Lillooet, BC	Secondary

SD is the School District number: 58 is Nicola-Similkameen, 73 is Kamloops/Thompson and 74 is Gold Trail.

Kamloops is home to two post-secondary institutions: Thompson Rivers University and Sprott Shaw College. Thompson Rivers University has a large, 250-acre, campus with about 20,000 on-campus and online students. Sprott Shaw College is a private college with 16 campus locations across the province, including the campus in downtown Kamloops.

The Nicola Valley Institute of Technology (NVIT) is located in Merritt. This public post-secondary institute was formed as a private institute in 1983 by the First Nations bands of Coldwater, Nooaitch, Shackan, Upper Nicola and Lower Nicola. In 1995, NVIT became a Provincial Institute under the British Columbia College and Institute Act. In 2002, facilities expanded with the opening of the Eagles Perch campus.

6.2 Telecommunications

6.2.1 Service Provider Overview

Provider	Summary
ABC Communications	Primarily provides fixed wireless services in some regions of the TNRD. ABC was recently acquired by Telus but at this time still operates as ABC Communications.
Bell	Primary interest in mobile cellular services and has no infrastructure other than some high capacity backbone services. Bell does provide private services to its enterprise customers (eg. national banking organizations). All cellular services are deployed using roaming agreements with other providers.

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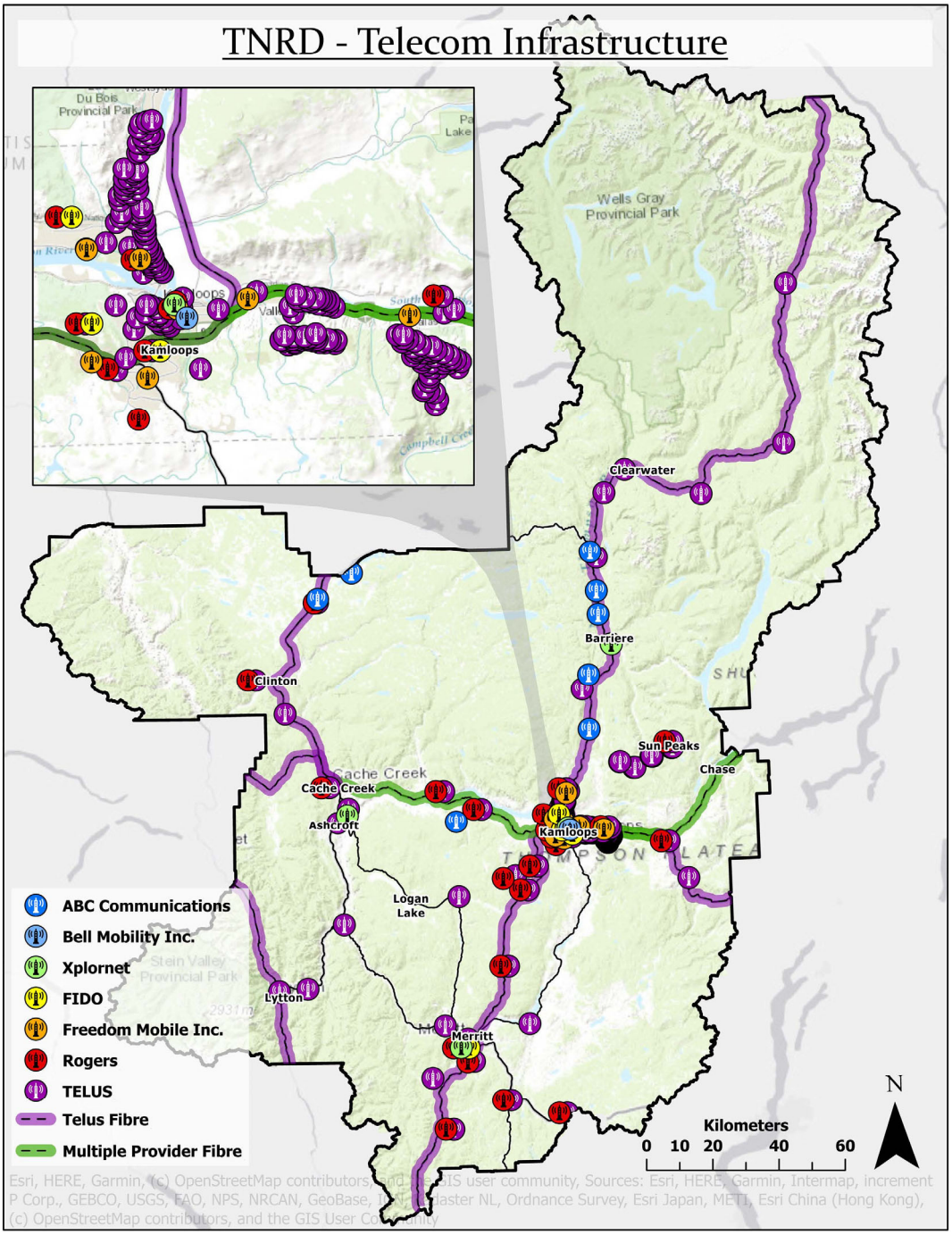
Lookie Loo	Provided fixed wireless services over unlicensed bands in the Spences Bridge region. Lookie Loo has recently ceased providing services in some areas due to competitive service offerings.
Lyttonnet	Non-profit internet society located in Lytton, BC. Provides fixed wireless services over unlicensed bands in the Lytton area and south into the Fraser Canyon. Recently obtained funding to deploy fibre from Boston Bar to Lillooet, BC, passing Lytton, BC.
Mascon	Provides internet and CATV services in the Cache Creek and east areas of the TNRD. While several attempts were made to have a more detailed discussion with Mascon, no detailed information was obtained.
MyBC Datacom	Provides internet in the eastern region of the TNRD. While several attempts were made to have a more detailed discussion with MyBC Datacom, no detailed information was obtained.
Nicola Net	Provides fixed wireless services over unlicensed bands in the areas of Merritt, Mamit Lake Corridor, Logan Lake and rural areas between Merrit and Knutsford south of Kamloops.
Raftview	Formerly Raftview but now a subsidiary of Mascon / Telus providing service in the Clearwater area.
Rhicom	Provides fixed wireless services over unlicensed bands in the areas of Walhachin, Savona, Cherry Creek, Pritchard and Blue River.
Rogers	Primary interest in cellular services along the main highway corridors. Rogers is involved in some fibre backbone projects in the TNRD.
Shaw	Provides wired connectivity using primarily coaxial cable infrastructure in Merritt and Kamloops regions of the TNRD.
Telus	Provides services throughout the Regional District deployed using a mix of fixed wireless, fibre optics and DSL infrastructure and is considered the incumbent provider.
Xplornet	Provides direct to home internet service from a satellite in geostationary earth orbit.
Starlink	Currently (2021 March) provides pre-commercial beta-test internet service from a constellation of low earth orbit satellites. Later this year, full commercial service should be available.

6.2.2 Internet Connectivity



6.2.3 Cellular Services

According to the ISED data, cellular coverage along the major corridors in the TNRD is generally well covered except for areas north of Blue River and north of Lytton. Outreach and survey responses, however, contradict this and report areas of poor or no service, even along the major corridors. Areas and communities outside of the major corridors have poor or in some cases, no, connectivity including

numerous lake communities and Wells Gray Provincial Park which attracts approximately 350,000 visitors each year. As pointed out in the methodology section above, ISED's cellular coverage area is derived from the 25km^2 hexagons which generalize coverage over a large area with ISED's assumption that if coverage is available anywhere in the hexagon, then coverage is presumed to be available everywhere else within the hexagon. Further, while coverage may be shown in a region according to the ISED data, suitable coverage may vary widely within a certain area based on a number of factors that are not considered in the ISED data.

6.2.4 Current Initiatives

While not necessarily a complete list, there are a number of initiatives active in the TNRD. Due to the confidential nature of these projects, detailed information is contained in the confidential addendum to this document.

6.3 Public Feedback on State of Connectivity

As part of the information gathering, a survey of the residents and businesses located in the TNRD was completed. The survey was intended to gather information from Electoral Area residents and businesses including about available service, costs, satisfaction, and service providers. Municipal residents and businesses were not prevented from completing the survey, but analysis focused on the responses from the Electoral Areas so the analysis below is filtered for responses from the Electoral Areas. A paper copy of the survey was available from the TNRD as well as being online through the TNRD website. It remained open for 64 days. The survey was promoted to Electoral Area residents and businesses by:

- Email by Electoral Area directors;
- TNRD publication on its website;
- TNRD social media promotions;
- Making paper copes of the surveys available;
- Mailing an information sheet about the survey to each mailbox located outside a municipality.

With more than 2,000 responses (all respondents) from communities across the TNRD, there was a clear desire from residents to make a statement about the state of internet connectivity in the region.

The following provides a brief summary of the survey results and a complete detailed summary of the survey results are contained in ancillary documents.

6.3.1 Summary of Electoral Area Residential Survey Results

Overview

Of the over 2000 responses, 800 came from the Electoral Areas (EA respondents), which represents just over 17% of the Electoral Area population. Since the scope of this project is the Electoral Areas, the following summary is focused on the responses from the Electoral Areas. Virtually every respondent (95%) said that internet was either very important or critical to them.

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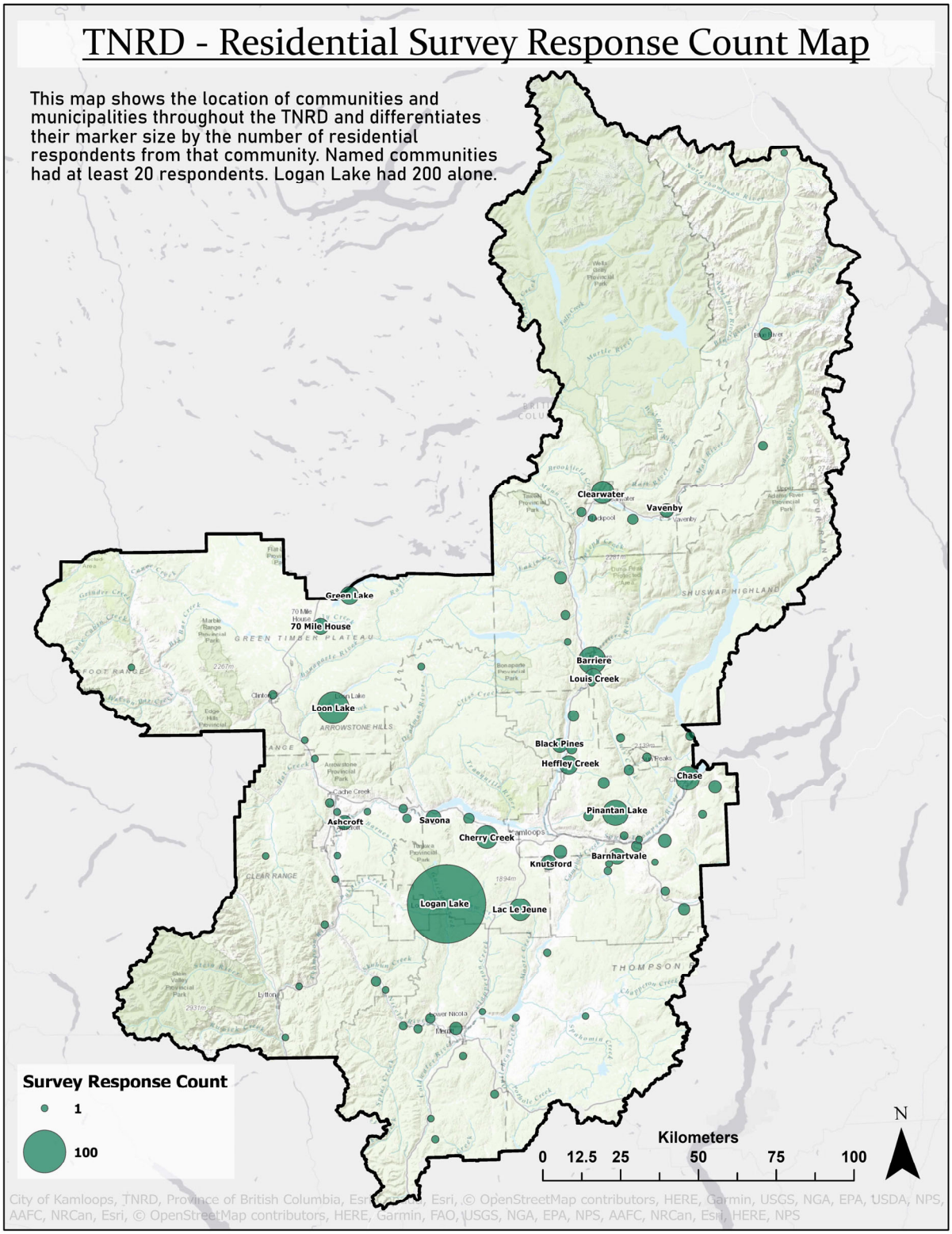
TNRD - Residential Survey Response Count Map



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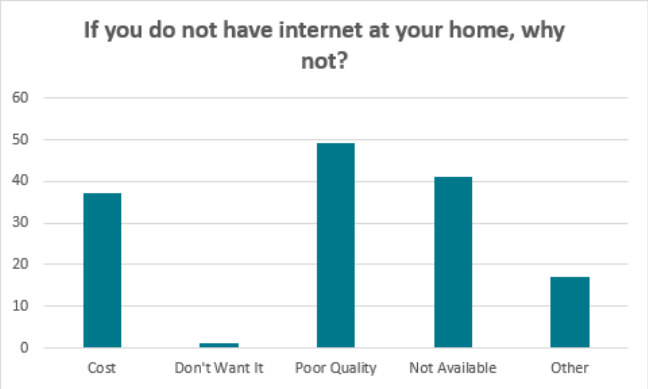
Quality and Cost

For those who do not have internet, most cited quality, cost, and lack of availability as the reason, regardless of whether or not they live in a municipality.



Over 90% of EA respondents have downloads speeds that do not meet the USO and 64% of EA respondents said this was due to higher speed internet access not being unavailable. Correlating to this, 74% of EA respondents stated that they were dissatisfied with the internet service speeds in general.

The average cost per month for most respondents is between $50-$150 per month. However, over half of respondents say they incurred overage charges as well. Overall, 75% of all respondents stated that they are dissatisfied with the value they get from internet access for cost they pay for it. Despite this, about 40% of respondents stated they would be willing to switch to an internet service with higher speeds even if that meant paying $50 more per month.

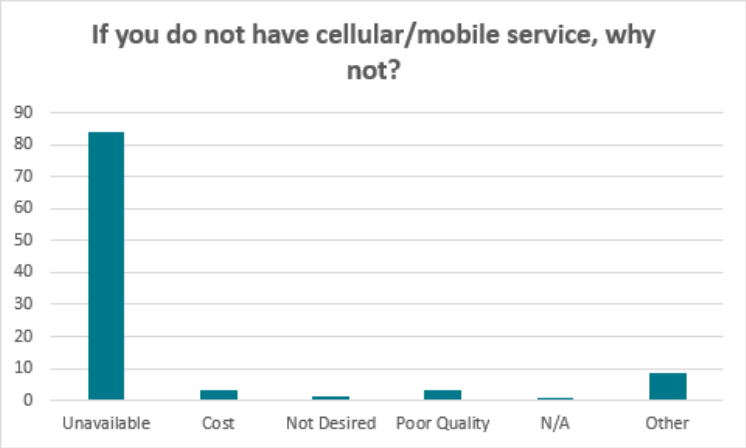
74% of respondents stated that they thought the overall quality of their internet services was poor or fair at best and 63% said they were dissatisfied with the reliability of their service whether they are within a municipality or not.

Choice and Need for Improvement

Despite many internet service providers operating in the TNRD, nearly half of all respondents said they didn't have a choice of providers. This correlates to over 60% of respondents saying they are dissatisfied with the choice of internet service providers.

The overwhelming majority of respondents – 95% – said there is a need to improve internet service in the TNRD. The percentage of respondents said that internet is an essential service and 88% agreed that improved internet would result in greater economic activity and significant benefits.

Cellular Service

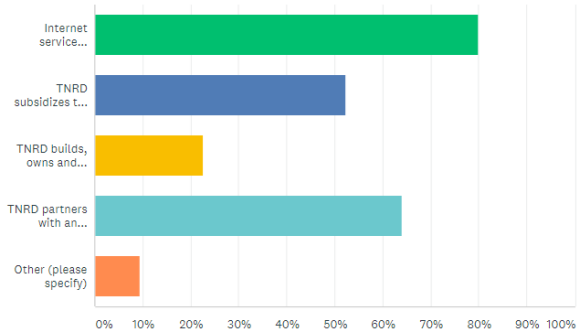


Despite most respondents saying they have cellular service plan, the 27% that don't, say this was almost exclusively because the service is unavailable. Well over half of respondents are dissatisfied with the cell coverage they have access to and almost as many are dissatisfied with the reliability of their service in general. 60% thought the cost of cellular was too high. A high number of respondents cited safety as a primary use and 76% said that they were concerned about safety due to a lack or quality of cellular service. This may be alarming given that 52% said they found themselves in an emergency situation without the ability to call for help due to a lack of cell phone coverage.

Summary

All in all, from respondents' point of view there is a clear need, desire, and willingness to bring better internet and cellular service to the TNRD. Internet connectivity is especially on the minds of respondents currently given that 56% of them indicated that they or a member of their household could be considered vulnerable to Covid-19. The need for better connectivity in the TNRD has been brought into focus because of this and other factors as seen in the survey.

In order to improve connectivity, and whether or not they reside in a municipality, the majority of respondents would prefer to see a private initiative or private-public partnership.



ANSWER CHOICES		RESPONSES	
Internet service provider (like Telus) covers the cost of the anticipated infrastructure and owns it;		79.86%	579
TNRD subsidizes the cost (through federal grants, ie. gas tax or other) but TNRD DOES NOT own the infrastructure. All future responsibilities are the responsibility of a 3rd party;		52.28%	379
TNRD builds, owns and maintains an internet utility (through federal grants, ie. gas tax or other) BUT the taxpayer pays for any shortfalls for ongoing operations and maintenance. A new ongoing taxpayer funded TNRD service would be established;		22.62%	164
TNRD partners with an internet service provider and provides infrastructure and financial support as required;		64.00%	464
Other (please specify)	Responses	9.38%	68
Total Respondents: 725			

6.3.2 Summary of Electoral Area Business/Organization Survey Results

General Overview

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Business respondents were located throughout the municipalities and rural areas of the TNRD. This relatively equal distribution gives a good indication of connectivity trends and status among businesses in rural and urban areas overall.

76% of respondents operate their business full time throughout the year with the other 24% being seasonal. Nearly 60% have between 2-5 employees and around 21% employ more than this. Only 6% of the respondents said they do not have internet access at their business. They cited poor quality and unavailability as the main reasons why.

Service Overview

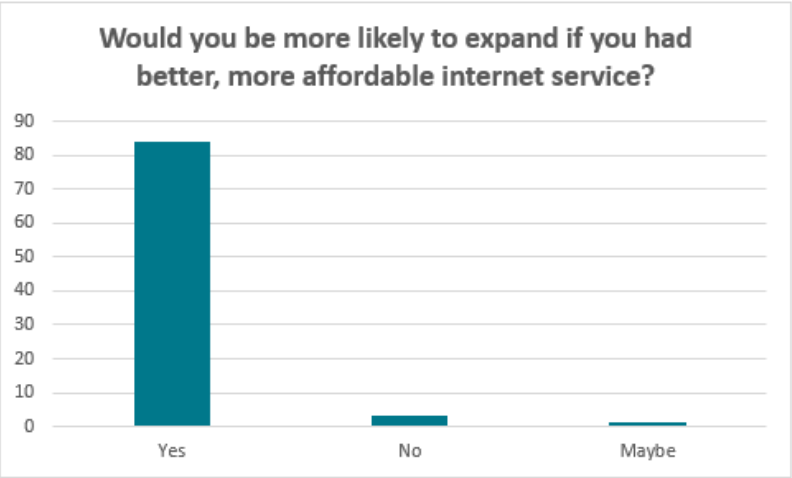
Around 32% have Telus as its current ISP and 47% are served by Xplornet. The rest are served by ABC, Mascon, NicolaNet, Rhicom, and Shaw. Nearly 85% said they have either wireless, cellular, or satellite internet service with less than 5% stating they have optical fibre.

Less than 2% of business respondents said they get internet speeds of over 50 Mbps in terms of internet download speed with 83% have download speeds of 20 Mbps or less. Almost 90% said they have speeds less than they require for their business and cited the lack of availability of higher speeds as the main cause.

The vast majority (approximately 68%) rated their overall quality of internet service as less than good. Over 94% stated that internet is either very important or critical to their business operations and 79% said their internet service or the lack there of negatively impacts their business.

Over half of business respondents said they are dissatisfied with the choice of internet service providers, the internet speed they receive, the overall cost versus value they pay for, and the reliability of such services.

Need for Connectivity



91% strongly agreed that internet is an essential service and nearly as many strongly agreed that there is a need to improve internet service in the TNRD. Nearly 90% agreed that improved internet will make the TNRD more attractive to potential residents and businesses, improve economic activity in the region, and have significant benefits for the region overall.

Almost 34% of business said they do not have cellular service for their business. The majority of businesses who do not have cellular service did not have service available to them. 76% of respondents were dissatisfied with the cellular coverage and reliability in the TNRD.

Summary

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The majority of respondents stated they would support the TNRD taking either a hands-off, subsidizing, or partnership role in improving internet service. Much less preferred the more hands-on approach where the TNRD would build, own and maintain an internet utility.

6.3.3 Stakeholder Response

In addition to the survey outreach, key stakeholder information was provided by the TNRD and augmented by TANEx and an attempt was made by TANEx to contact the stakeholders by direct telephone contact to have a one-on-one interview to gather insight and additional detail about the challenges or successes of connectivity in the area. The following provides a summary of the themes identified in these discussions where contact was made.

Stakeholder Summary: Elected Officials
Summary of Information Reported: • Belief in working together to aggregate the problem and move a solution forward. • Certain member municipalities, as well as rural communities, have poor connectivity. • The northern part of the TNRD has a huge issue with cellular service which creates a public safety issue particularly in the Wells Gray Provincial Park which sees 350,000 visitors a year who have no ability to call for emergency assistance. • Public safety concerns arising out of a lack of cellular coverage are a widely held concern for many Directors not only for regular highway emergencies like accidents or rockslides but also for emergencies like forest fires and flooding. • Concerns about unserved or underserved communities being able to continue to sustain themselves. • Widespread concerns about COVID-19 impacts to residents without adequate connectivity, in terms of ability to work from home, access healthcare, education and other government services. • Economic diversification is very difficult in areas with poor internet or cellular connectivity. There is a clear sense that lack of connectivity makes it very difficult to create opportunities in those areas. Home based businesses offer opportunity but need to be supported with adequate connectivity. • Small to very small communities make it very difficult to gain the attention of the service providers. • Loss of mills creates a need for economic diversification which requires connectivity.

Stakeholder Summary: First Nations
Summary of Information Reported: • Strong alignment with elected officials' concerns expressed with respect to economic development and public safety issues. • Similar concerns with respect to working from home and participating in the remote working environment through the pandemic. Online education is very difficult to access. • Poor cellular service restricts access to emergency services. • Concerns expressed with respect to the grant of rights to telecommunication companies on territorial lands of First Nations. Some believe that such companies should be required to serve the First Nation communities of the Band whose territorial lands the infrastructure is placed on.

Stakeholder Summary: Emergency Services
Summary of Information Reported: • In certain areas of the Regional District, trunking for 911 calls is reported to be problematic causing delays to dispatch because of lack of cellular coverage.

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- Reliance on cellular service for emergency responders is challenging.
- Volunteer training courses are very difficult to access in certain areas because of lack of internet service.
- Police officer and public safety is a large concern in many areas because of a lack of cellular service.
- A number of areas are one road in and one road out and that creates danger for first responders and residents where up to date status cannot be communicated.

Stakeholder Summary: Community Representatives
Summary of Information Reported: • Poor connectivity negatively impacts business' ability to carry on business online as required. • Concerns with tourism development with no or poor connectivity. Echoes of concerns about public safety in the absence of connectivity. • High levels of frustration about communities that have no cellular service and no or poor high-speed broadband. • Frustration with over-sold services by providers inhibiting quality of the service.

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7 SITUATIONAL ANALYSIS

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7.1 Moving from Current State to Vision

Earlier in the report, the TNRD's vision of itself as a highly connected region was articulated followed by the analysis of its current state. In order to achieve the vision, a number of logical steps must be completed from documenting the current state through to achieving the vision as shown below.

7.2 Identify the Gap

7.2.1 TNRD Connectivity Factors

Understanding the TNRD connectivity situation and creating a strategy to address the gap requires the identification of the strengths and weaknesses of the Region from a connectivity perspective. The TNRD's strengths, weakness, opportunities, and threats have been summarized below:

STRENGTHS
• TNRD is centrally positioned geographically surrounded by other Regional Districts with similar connectivity concerns. • A major east-west rail and highway transportation corridor is present through the TNRD. The rail line has existing fibre with numerous carriers already present. Three major highways and both CN and CP Rail lines transit the region and intersect at Kamloops centrally connecting BC and providing transportation to the rest of Canada. • Around 91% of structures outside member municipalities are within 200 m or less of another structure. • Kamloops is a major hub point for connectivity with numerous carriers, datacenters and connectivity to other parts of BC. • There is existing activity by internet service providers ("ISPs") in the region. Eg. Rogers/Shaw • There is a strong desire within the TNRD and residents to solve the connectivity challenge. • There is a diversity of industries that can benefit from improved connectivity including agriculture which supports Canada's independent food security. • Major oil and gas transportation infrastructure carrying liquid petroleum products from Alberta to the lower mainland and international markets, and natural gas from fields in northeastern BC to the Okanagan, lower mainland and US markets, runs through the TNRD. • TNRD has existing major electrical power transmission infrastructure with several high voltage transmission lines connecting generating stations on the Peace River to the lower mainland population centers. • Fiber optic transmission lines along the major transportation corridors that are owned and operated by several competing national communication ISPs run through the TNRD. • Significant connectivity resources and capabilities exist in TNRD, such as CanShield (data center and hosting) and Cortex (assessment, solution, training and construction with focus on First Nation communities). • TNRD has an existing Regional Growth Strategy ("RGS"), completed in 2013, which is monitored on a periodic basis.

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- Some of TNRD's geographic area falls within the expected service area to be developed through deployment of new low earth orbit (LEO) satellite technology (initial StarLink commercial service will reach to the 52nd parallel, i.e. to about Blue River).

WEAKNESSES

- TNRD covers a large geographic area which has very remote areas and is expensive to build infrastructure. Outside the two urban concentrations of Kamloops and Merritt, population density is very low. This means a challenging business case for rural broadband due to higher infrastructure build costs. The more remote the area, the more acute the issue. This is particularly damaging for progressive agriculture initiatives such as smart farming.
- Only about half of structures outside of member municipalities are located within 200 m of a road served with 50/10 service.
- TNRD's RGS has not specifically identified improvement of connectivity as a foundation for reaching the RGS goals.
- There are large numbers of small rural communities that are spread apart and that are under-served. TNRD has 91 minor project areas identified as served with less than 50/10 which are widely dispersed throughout the Regional District.
- High number of rural seasonal residents in some areas which may exacerbate the weakness of the business case.
- No established coordinated effort to address connectivity with other Regional Districts, local governments and First Nations in order to aggregate the connectivity problem to a size that attracts industry interest.

OPPORTUNITIES

- Existing transport fiber routes offer opportunities to continue and accelerate initiatives to deliver fixed broadband and cellular mobile service to many under-served communities close to that infrastructure reducing the cost of serving that community.
- Advanced awareness of the importance of connectivity arising from effects of the COVID-19 pandemic may be leveraged to improve connectivity to rural and remote communities for services like education and medical care.
- Federal and provincial subsidy funding sources exist for various industry sectors as well as for broadband internet infrastructure development. There are funding programs which support modernization of agriculture for example. Projects which provide better connectivity which supports the modernization of the agriculture industry may be able to leverage funding from multiple programs.
- Advancing satellite technologies such as LEO are in development and may provide greater support in future for very remote areas that cannot viably be served with wireline or wireless technologies.
- A number of First Nations communities in the TNRD are also in need of improved broadband connectivity, providing the opportunity to partner on projects and access multiple funding streams for mutual benefit.
- ISPs generally express willingness to cooperate and partner to improve service in under-served areas.
- Cooperation can result in leveraging resources and government subsidies to solve a bigger problem for more people.
- TNRD's central location allows it to facilitate greater cooperation among area stakeholders both within TNRD and outside.
- Potential desire by large industry to leave a legacy may represent an opportunity to be exploited. Example, Trans Mountain Pipeline expansion.

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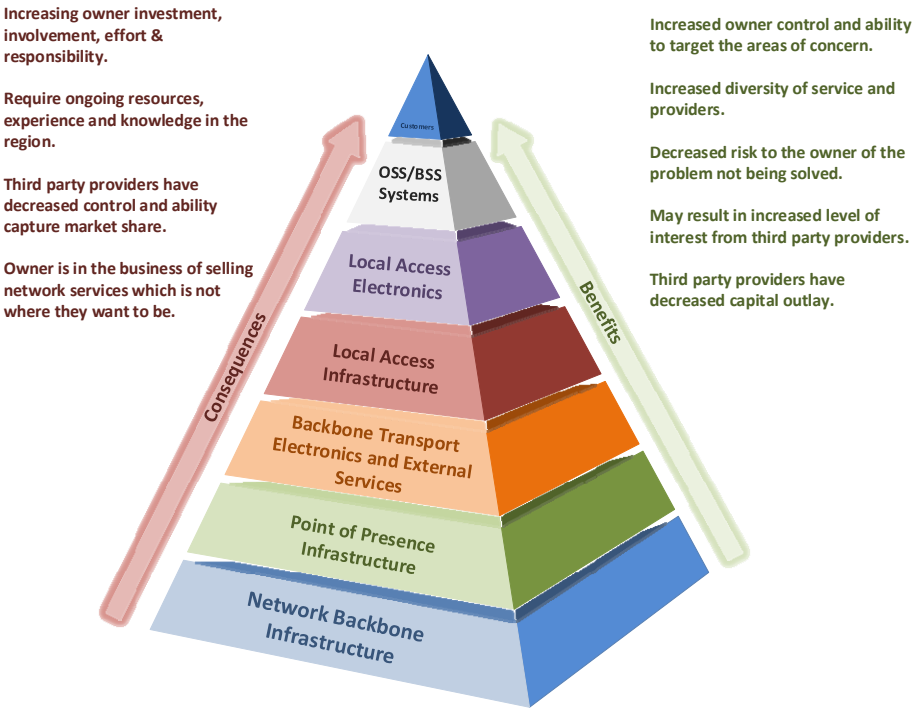
- TNRD can create economic diversification and sustainable rural communities through better connectivity.
- Canada's increased awareness of the importance of food security as a result of COVID-19 may strengthen TNRD's argument for better connectivity in its rural areas that support farming and ranching.
- There is widespread political consensus on the importance of improved connectivity which provides an opportunity to collaborate on solving a bigger problem for more people.
- All of the national ISPs as well as a number of smaller regional and community ISPs are already present in TNRD which indicates a strong interest in the region and provides an opportunity to leverage existing infrastructure.
- TNRD is an attractive region to re-locate to, given its wide-open spaces and desirable lifestyle (especially in light of the pandemic).
- LEO satellite service from Starlink is expected be commercially available across the TNRD this year (2021).

THREATS

- The economic impact of commodity market weakness in general, closure of major industry, small businesses and other COVID-19 related concerns impacting the business market threaten the economic well-being of the region.
- The COVID-19 pandemic has had a significant impact on tourism revenues which may have ripple effects throughout the economy.
- The incumbent ISP may leverage its dominant position in the market to maintain its dominance.
- Although network operators have expressed a willingness to cooperate and facilitate access networks, the difficulty of achieving cooperation should not be under-estimated when it involves other Regional Districts and multiple parties that usually do not cooperate, or that are fundamentally competitors.
- Applications for subsidy funding are complex and involve significant effort. Further, applications to different funding sources often need to be combined in order to create a viable business case; increasing the complexity and effort required.
- There may be insufficient levels of local operations and maintenance capability and commitment that are necessary for community networks to be sustainable in the long-term, particularly in smaller communities or where the economic base is small, eroding, or has limited growth potential.
- Complete end to end transport and last mile project planning is required to implement a solution that makes a difference in a timely fashion. In cases where end to end connectivity is not part of the same project, actual benefits to the public are delayed and that creates frustration and cynicism within network operators and the public at large.
- TNRD has no established service for providing broadband connectivity services, so to do so means breaking new ground.
- There is widespread lack of understanding of connectivity, its potential, and its challenges, within elected officials, TNRD staff and the public at large.
- Subscribers are fickle, making the foray into service delivery a difficult business decision

7.2.2 Service Delivery Pyramid & Technology

From a technical aspect, solving the connectivity challenge for rural and remote areas is the same as an urban environment and requires a service delivery model that encompasses a number of layers that all need to be addressed. The following Service Delivery Pyramid ("SDP") provides a visual depiction of the layers of infrastructure that must be present to solve the connectivity issue:



The diagram above outlines the SDP and delineates the individual layers that must be provided and the relative levels of responsibility the network owner must address to satisfy the goal of improved services to the residents and businesses. Solving the connectivity problem requires that all layers of the SDP be provided, either by one entity or by the collaborative efforts of numerous parties.

As the network owner commits to, and moves up the layers of the pyramid, increasing levels of complexity and involvement are required. Although this may seem intimidating, the benefit of increased control and influence on improvement of services may outweigh the hurdles.

The layers of the SDP are as follows:

Backbone Infrastructure: This is the physical infrastructure required to bring long distance connectivity to a community. For high-capacity modern networks, this would typically be fibre optic cable but in some cases, high-capacity microwave may also be suitable. The term backbone is also synonymous with "transport infrastructure".

Points of Presence: POPs are the infrastructure required in each community (or along the backbone route) used to locate the electronic components required to enable connectivity as well as act as a termination point for the backbone infrastructure. For example, in the case of a fibre optic backbone, the physical cable would be installed inside the POP and the cable connected to the electronic components within the POP. A POP houses sensitive electronic components so suitable environmental controls are including, but not limited to, air conditioning, battery, backup power, and security.

Backbone Transport Electronics and External Services: This layer represents the electronic components and services required for the POP to enable connectivity outside of the local area to other POPs and ultimately, the global internet.

Local Access Infrastructure: This includes the physical assets required to connect the local POP to the subscriber's home or business. There are numerous choices for technology, but for modern, high capacity, scalable networks, fibre optic connectivity is the preferred option. Different options for local access technology are detailed in supplementary documentation.

Local Access Electronics: This layer of the SDP represents the electronic components required in the POP and in the subscriber's home or business that enable connectivity to underlying layers of the SDP. This is the final physical component required to enable connectivity.

OSS/BSS Systems: All the lower levels of the SDP require management to ensure they are operating correctly and to provide the business operations of the network. These operations include, but are not limited to, network monitoring and management systems, billing, provisioning (adding equipment and configuration required to activate a service), technical support, customer service support, maintenance, among others.

Customers: The final layer to a successful broadband network is the existence of customers subscribing and paying for services on the network. In the case of rural and remote networks, anchor tenants or institutional customers can be particularly beneficial in supporting the sustainability of the network.

Greater detail on the technical aspects of the Service Delivery Pyramid and a comparison of technology can be found in Appendix D.

7.2.2.1 Low Earth Satellite Technology

While Appendix D of this document provides additional detail on different technologies, LEO technology has been specifically addressed because of its emergence in the market, and as it provides a viable alternative for remote connectivity.

Satellite based communications have been characterized as "distance-insensitive" because there is no linear chain of terrestrial cables or radio links between the end points, only the radio link through the satellite network. Satellite networks designed to serve directly to the customer's premises combine the transport and access (last mile) network functions into a single network. Xplornet is an example of such a network based on geostationary earth orbit satellites. Unfortunately, transmission delay and the relatively high cost for normal consumer broadband usage levels are significant limitations for Xplornet and other service providers using geostationary earth orbit satellite networks.

A new generation satellite network is being planned and deployed into low earth orbit (LEO), which vastly reduces the delay performance and may address the data usage affordability issue. The Starlink system, being launched by Spacex, is first-to-market. As of the writing of this section (February 2021), beta test service is available from Starlink in northern US and southern Canada. Currently, the service coverage is good as far north as Blue River in the TNRD. Over the next few months, coverage should improve and extend all the way through the region. The beta service is proving popular for isolated customers and is available for approximately $800 for the terminal (self-installed) after shipping and taxes and then $130 per month. So far, the beta test results support Starlink claims of 50 - 150 Mbps downlink speeds and 10 - 30 Mbps uplink speeds with round trip delay in the 20 - 40 msec range. Whether the system will retain these performance figures as the system and subscriber base scales up

is unknown at this time. Other broadband LEO systems are also planned, but service is at least one or two years out and these may not be direct to home services (e.g. they may be used to backhaul access networks such as cell sites, remote camps and remote communities).

7.2.2.2 Cellular Technology

The scope of this project does not provide a comprehensive cellular strategy but given the importance of cellular for public safety and the desire of large carriers to deploy cellular for solving internet connectivity, it is important to understand the differences and dependencies in cellular deployments.

All wireless technology, including cellular, has a basic characteristic which is that the technology operates in a specific frequency band. Cellular service is delivered over a variety of licensed frequencies which are allocated by, and are under the control of, Industry Canada. Industry Canada's process for allocating licensed frequencies ultimately results in those frequencies being generally controlled for the exclusive use of large carriers such as Telus and Rogers. Among other factors, the frequency band that the cellular service operates in has a direct correlation to the coverage and available capacity for cellular service. A summary of the frequency bands is provided below.

- 600 MHz Allocations. 600 MHz and 700/800 MHz bands are ideal for rural areas due to their ability to pass through obstacles and cover large areas. The downside to this band is lack of capacity for internet services and the inability to achieve speeds at the USO.

- 3.5 GHz. ISED is currently considering putting this band up for auction to carriers in the June 2021 timeframe. This band is well suited for shorter range communications but suffers from poor performance through trees and other obstacles. The band will likely be used for 5G service to obtain higher speeds than those available using the lower 600-800 MHz bands. However, to provide coverage similar to the lower bands, additional towers and backbone infrastructure (likely fibre) will be needed.

- mm-Wave (> 24 GHz). Due to the high frequency and large amount of spectrum available, services in this band support very high data rates. The challenge however is that the range is extremely limited, and service requires direct line of sight (i.e. no obstructions). The consequence of this is that there needs to be a very large number of towers and the supporting backbone infrastructure to achieve wide area coverage. While this frequency can support services at the USO and beyond, it may not be well suited to rural deployment and the cost comparison between a wired fibre solution and a cellular solution in this band, will start to become closer reducing cost benefit of wireless deployment over a wired fibre deployment.

In summary, as the TNRD entertains the support of additional cellular services to solve the connectivity challenge, consideration for the technology, service area and available capacities needs to be understood to ensure the proposed solution solves the goals on the TNRD.

7.2.3 Potential Project Areas

The TNRD is a vast region with a population that is spread out and challenging to connect. Considering the connectivity challenge on a large region wide scale is overwhelming, and to understand the magnitude of the problem and ultimately achieve TNRD's vision, it is helpful to break down the rural TNRD connectivity gap into smaller components so that projects can be understood and prioritized.

The following provides a summary map showing all the major project areas identified according to the methodology described earlier in this document.

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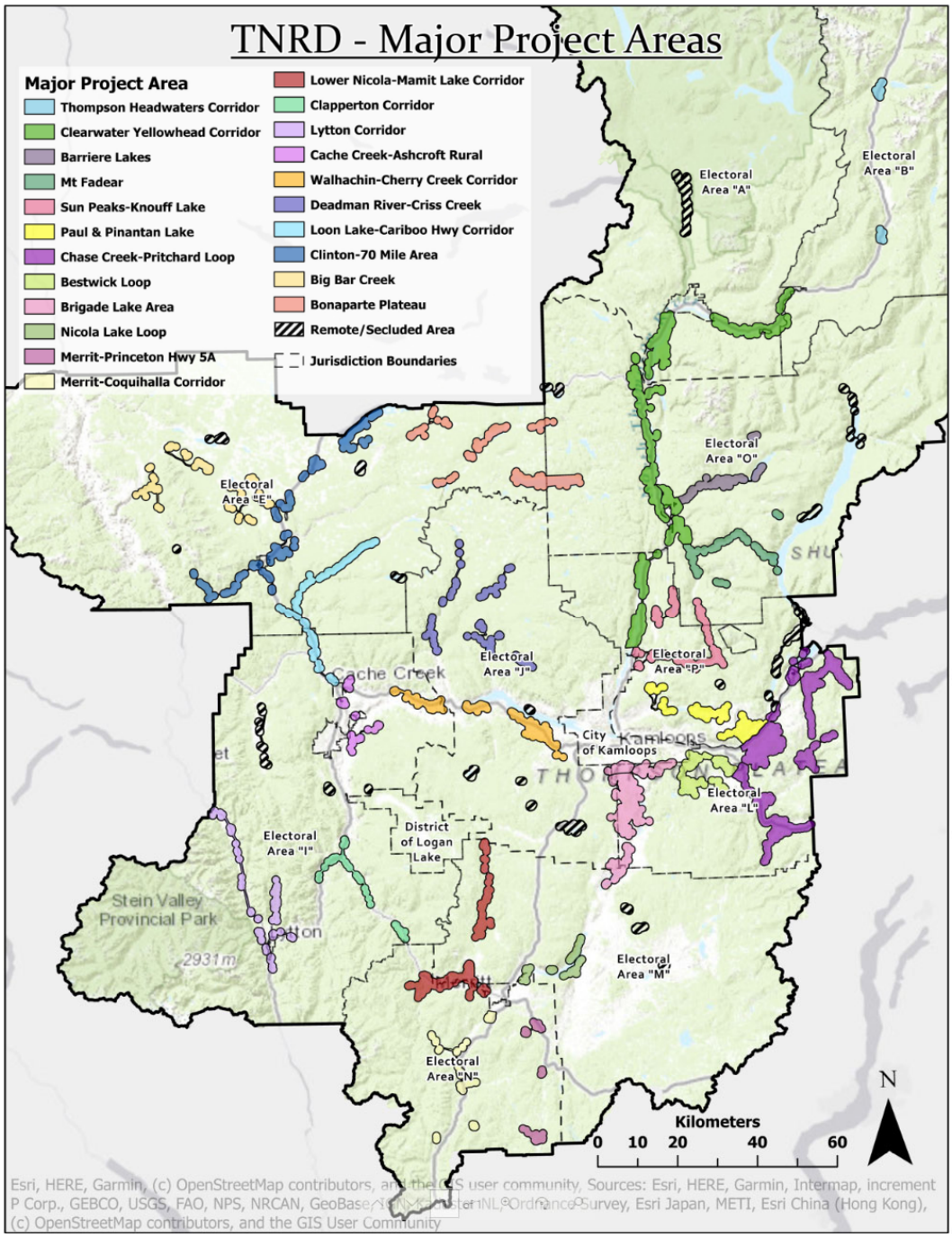

The map above provides a visual depiction of the project areas identified that are considered under served and identifies the gaps that need to be addressed. The map represents over 20 major project areas that each contain numerous sub-projects. There are approximately 100 sub-projects identified in the TNRD. Sub-projects may have any number of potential subscribers from as few as a few dozen or up to several hundred. Combined, these project areas represent nearly 10,000 identified points that would be considered served at less than the USO of 50/10Mbps.

Additional detail is provided later in this document and in the ancillary documents.

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8 STRATEGY IMPLEMENTATION

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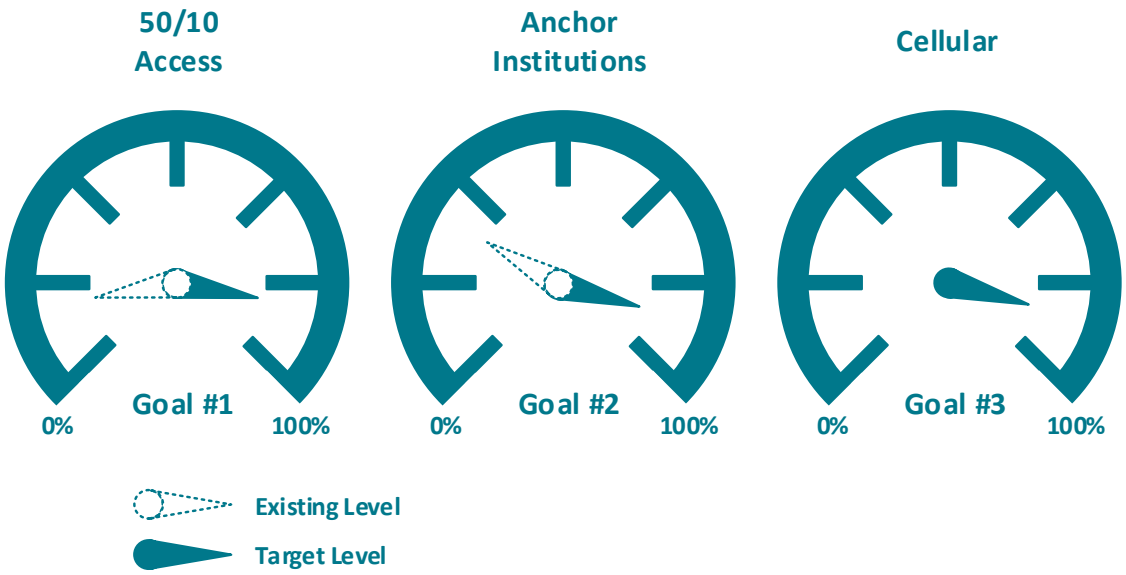
8.1 TNRD Role and Areas of Focus

One of the key components to the strategy is understanding the role that the Regional District desires to play in advancing the connectivity initiative. The TNRD connectivity goals were highlighted earlier in this document and in order to understand the recommendations put forward, it is important to understand where the TNRD currently sits in relation to those goals. The following graphic provides a snapshot of the estimated progress towards these goals.



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8.2 Bridging the Gap

The following table provides a summary of the TNRD and provides a total of the Points in the project areas identified. A detailed breakdown of the project areas per Electoral Area has been provided in Appendix A.

Areas identified in the table as “Points at the USO” are potential subscriber locations already served at 50/10Mbps. Points identified as “Remote Points” are points that are very sparse and not easily combined into a suitable project area or Points that may not be a potential subscriber location.

A summary of the entire TNRD Regional District is as follows:

Project Area Summary Mar 01, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
			Totals		9,961	100%		5,990	574	2,071	1,326
								60%	6%	21%	13%

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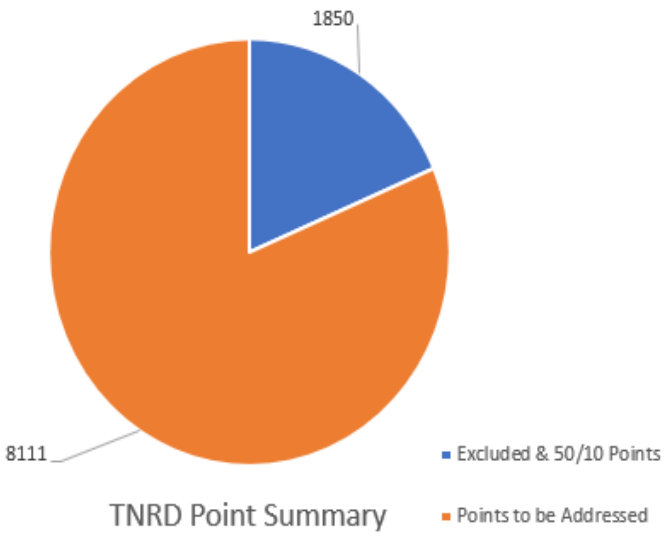
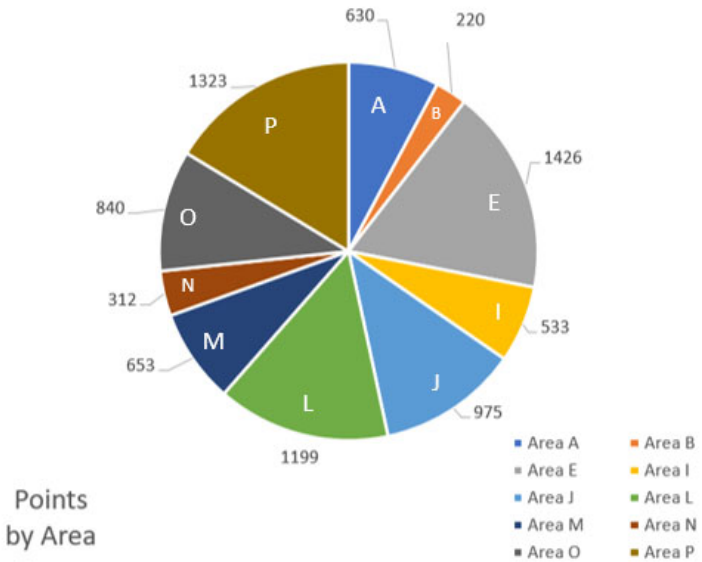
To provide further detail, the TNRD has been broken down into the following project areas summarized by Electoral Area.





Project Area Summary Conclusions

The above table, charts and information provided in Appendix A provide the following conclusions:

- There are nearly 10,000 Points outside municipalities and First Nations in the TNRD.
- Of these points, only 13% (total of 1326) have connectivity at the USO.
- Approximately 524 have been excluded due to their highly remote nature. This brings the total number of Points that are considered served and/or excluded to a total of 1850.
- Approximately 8,100 Points would be considered as those that require improved service.
- 60% or approximately 6,000 Points have connectivity at 5/1Mbps or less.
- Approximately 2,000 Points are served with technology suitable for 25/5Mbps representing decent service but not at the USO.

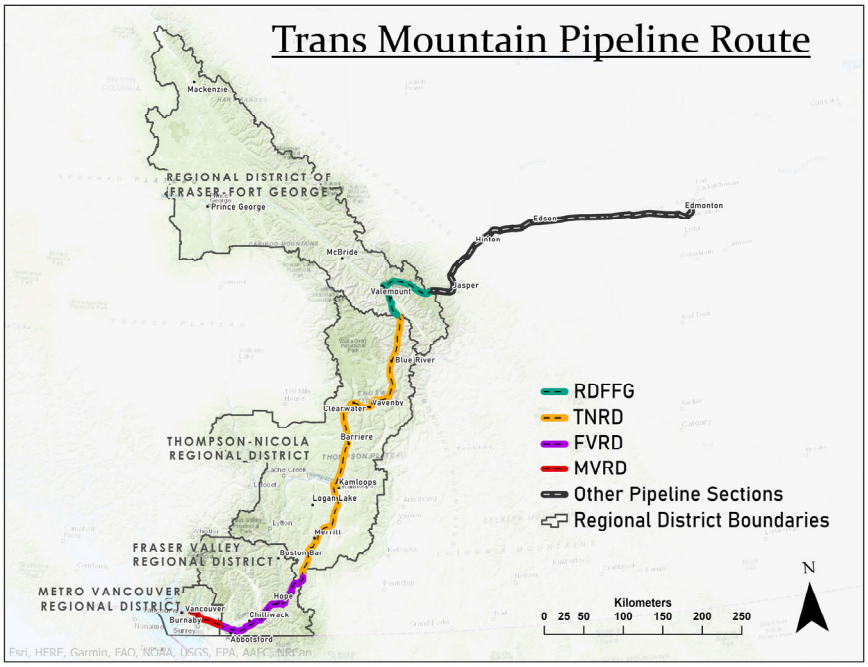
8.3 Trans Mountain Pipeline Expansion Fibre Opportunity

As part of the pipeline expansion, Trans Mountain is required to construct infrastructure for monitoring and leak detection as a condition of the Certificate of Public Convenience and Necessity (CPCN) issued by the Canada Energy Regulator (CER)[27]. Fibre optic infrastructure is a logical solution to that requirement, and the potential for constructing fibre optic infrastructure for the purpose of serving rural connectivity should be considered at the same time.

[27] Trans Mountain Corporation, Trans Mountain Pipeline Route Map

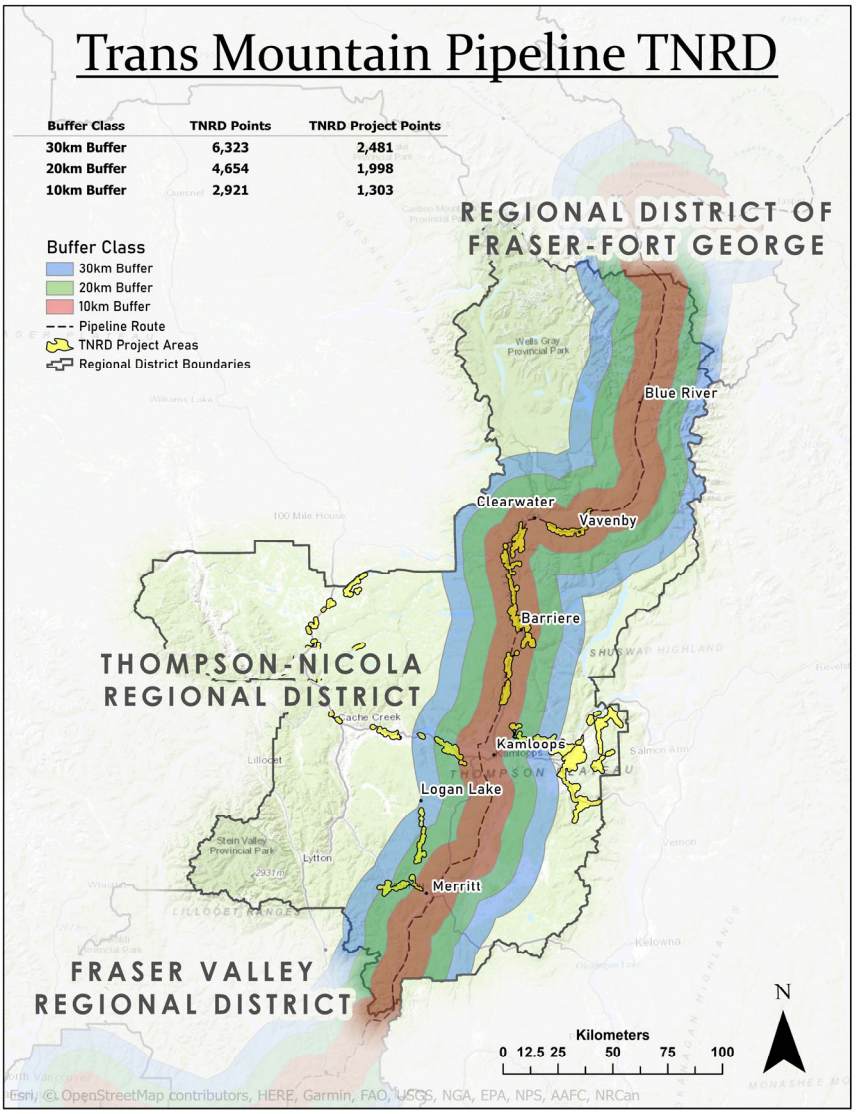
As identified in the SDP, “backbone” or “transport” fibre is critical for delivering internet and cellular services to rural areas because it provides high-capacity connectivity between communities, within the province, across Canada and globally. Without reliable, cost effective backbone capacity, a provider is unable to bring service to these communities in a way that makes business sense.

As part of the regional connectivity strategy, TANEx views the ability to obtain access to backbone capacity along the Trans Mountain right of way as a major opportunity for the TNRD. Leveraging every opportunity to remove major cost barriers is critical to achieving connectivity for rural and remote areas.



Local governments need to organize to speak with a single voice to advocate for a publicly controlled fibre optic communications backbone along the Trans Mountain pipeline. To do this, local government needs to work collaboratively with other stakeholders including neighbouring Regional Districts, interested municipalities, First Nations and industry where possible, to solve a bigger problem for more people. As a federal Crown corporation, Trans Mountain represents an opportunity to leverage the existing project to advance other federal government priorities such as rural and remote connectivity.

As a preliminary overview, TANEx completed a brief study to understand the potential benefit of obtaining access to backbone capacity along the Trans Mountain Pipeline right of way. To quantify the benefit, potential subscribers were plotted along the pipeline right of way within 10, 20 and 30 km buffer zones. The point count depicted in the map below includes the total points (not including First Nations or municipalities) located within the buffer zones in the TNRD as well as a subtotal of those points that have been included in a potential project area. It is expected that there would be a number of First Nations communities who would benefit from such a project as well.



Fibre optic connectivity along the Trans Mountain right of way, especially if positioned in a manner that supports the greater good, has the ability to impact a significant number of potential subscribers across a number of neighboring regional districts along the pipeline route. Not only does this represent a significant capital and operating cost component to the solution, but it provides an opportunity for rural subscribers and service providers along the pipeline route to obtain connectivity to the major centers of Vancouver and Edmonton that provide access to an Internet Exchange critical to connecting to the global internet and providing cost effective internet connectivity.

Third parties may already be in discussions with Trans Mountain to obtain access to fibre optic capacity along this important route. While this may indicate progress, how, or if, it benefits the TNRD rural and remote connectivity challenge remains to be seen and will be determined by those third parties. A fibre backbone through many of these communities already exists through some major providers but that

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does not mean that those rural communities get appropriate connectivity. Communities along this route continue to suffer from poor to no connectivity. To solve the connectivity challenge, the business opportunity must be opened for competitive providers to obtain access to the potential market without being encumbered by high-cost backbone connectivity.

At a minimum, the opportunity presented by Trans Mountain must be explored further at the earliest possible time by the Metro Vancouver, Fraser Valley, Thompson-Nicola and Fraser-Fort George Regional Districts, along with interested municipalities and First Nations along the route. Combined, these government organizations represent a significant presence with a direct interest in the Trans Mountain construction. The opportunity presented with access to the Trans Mountain right of way may benefit not only the local governments in their quest to address the rural connectivity challenge but a potential win for all parties including Trans Mountain.

Participating governments should nominate a representative to create a collaborative, coordinated approach to discussions with Trans Mountain and potentially, service providers that may have secured or wish to secure access to the fibre capacity along the pipeline route. The first step will be for the interested governments to form a working group to lead a joint initiative. As a result of the work throughout this project, this kind of coordinated and collaborative has already commenced with TNRD the lead and it is important to continue to stay close to TMX and their plans around connectivity to ensure that the TNRD priorities are addressed.

8.4 Strategic Direction

The following provides considerations of the strategic direction the TNRD should take in advancing the connectivity solution. There are a number of recommendations, but one of the first decisions that will need to occur, is to establish the role that the Regional District will play in advancing rural connectivity for the major project areas in the TNRD. Connectivity is a challenge in the identified project areas because those areas do not represent a viable business case for third parties. As a result, the Regional District may need to play a more active role to address those areas. The role of the TNRD may be determined on a project-by-project basis.

8.4.1 Determine the Role of the Regional District

One of the first considerations that the Regional District must complete in addressing the connectivity challenge is to assess the role of the TNRD. This role may be different depending on the project area that is being considered. In some cases, the path forward will depend heavily on the TNRD's appetite for increased involvement, and this may also have impacts on the Regional District's ability to access federal and provincial funding.

For example: If the TNRD determines that its role is one of advocacy only, then next steps will reflect those recommendations that are applicable for the chosen role.

The spectrum of roles is depicted in the following diagram.

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8.4.2 Establish TNRD Resourcing

Like most initiatives, making tangible progress towards the goal requires dedicated effort by the stakeholders. Like many organizations, Regional Districts suffer from an abundance of regional needs, and a lack of time and resources to address the needs. In order to effectively move the connectivity challenge forward, the Regional District needs to seriously consider a dedicated resource that can manage the TNRD priorities and ensure progress to the goal. Some of the tasks for this resource may be as follows:

- Recommending the best role for the TNRD and establishing working parameters to guide the effort.
- Recommending TNRD priorities.
- Communicating the priorities to external providers, partners and other stakeholders.
- Creating a method to measure and ensure progress.
- Researching, gathering information and obtaining access to funding.
- Resolving eligible areas for funding.
- Working with other experts to create solutions.
- Gaining community support for initiatives.

8.4.3 Collaboration

The federal, provincial and other local regional and municipal governments have initiatives underway to improve rural and remote connectivity. Of particular attention are municipalities in the TNRD and neighbouring Regional Districts, who are actively addressing the same kinds of issues. Collaboration across local and First Nations governments, where possible, may assist in speaking with a single voice, accessing multiple funding sources and aggregating the problem to solve a bigger problem for more people.

Solving the connectivity challenges in remote and rural communities cannot be considered one community at a time, as the business case will likely never make financial sense for private industry service providers. Considering multiple communities, project areas and collaboration with neighboring Regional Districts and municipalities may increase the capital cost, but it also increases the potential subscriber base and provides an opportunity for economies of scale. Grouping areas also allows for subsidization of projects, allowing ones with higher cost per subscribers to benefit from those that make more financial sense.

In fact, some project areas identified in the TNRD may be better served in a coordinated effort with a neighbouring Regional District that is also placing a high importance on resolving the connectivity challenge. Where project areas are close to Regional District boundaries, there is potential to advance the project by pushing the initiative together with those neighbouring governments (i.e. First Nations or Regional District). One such example in the TNRD is the project area of Green Lake which is situated on the border of the Cariboo Regional District. While this project considers a potential solution within the TNRD jurisdiction area of Green Lake, it may be more efficiently resolved by including it in a Cariboo Regional District Green Lake initiative.

8.4.4 Establish Project Priorities

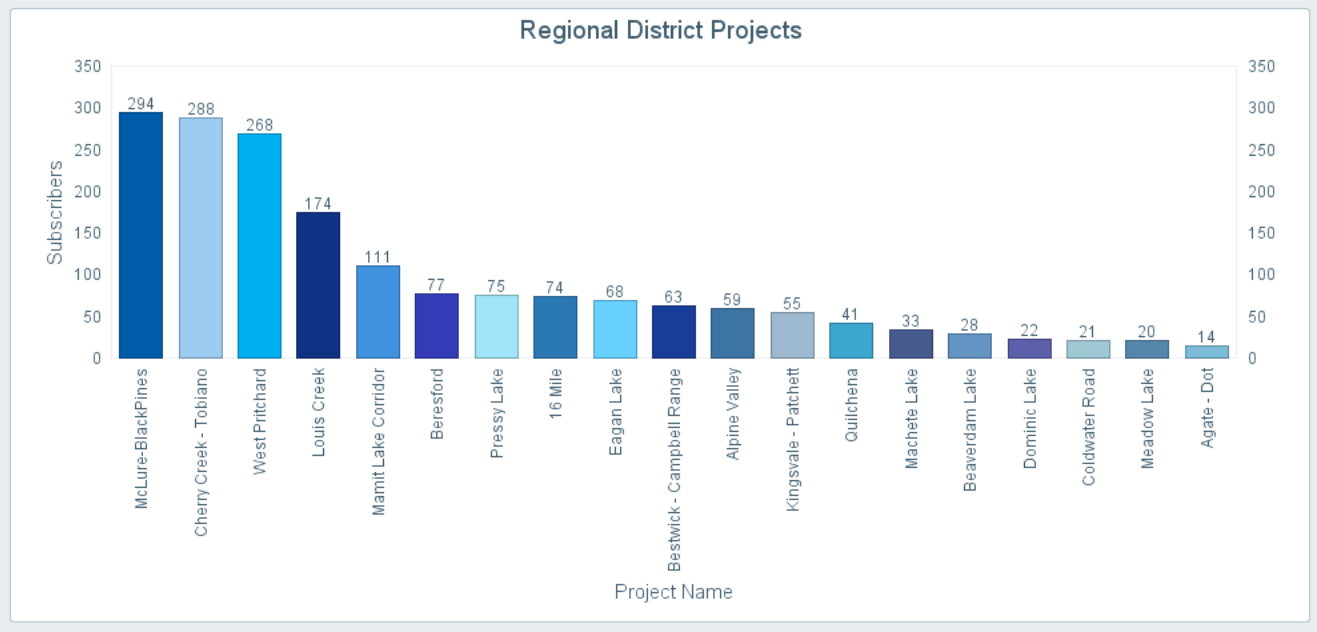
The TNRD has a large number of project areas defined. As a result, these will need to be prioritized to establish a logical sequence for implementation and realistic goals. Considerations for establishing priorities include:

- Logical sequencing of construction.
- Largest impact for the highest number of residents.
- Largest need for improvement. Areas that have the worst service may need it the most.
- Lowest cost per subscriber.
- Easiest to implement. Look for the quick wins.
- Areas that are eligible for federal and provincial funding.
- TNRD focus on areas that are unlikely to be constructed by third parties.

To provide a starting point for this discussion, this study defined just over 90 minor project areas of varying numbers of Points. To establish priorities, consider the following:

Logical Construction Sequence

Networks need to be constructed in a logical sequence. This usually means that services are constructed in a fashion from the core of the network outward as there is little point in constructing a network that cannot connect to anything. The project areas defined in the TNRD have been ranked by dependencies which assists in establishing a logical build sequence. The following projects are ones that are likely to be constructed first as they allow future projects to leverage the infrastructure.



Largest Number of Points Served

The following projects represent the highest total number of Points at speeds less than 50/10Mbps for projects over 100 Points. This represents the project areas that will present the TNRD with the largest opportunity to solve the connectivity problem for the highest number of homes.

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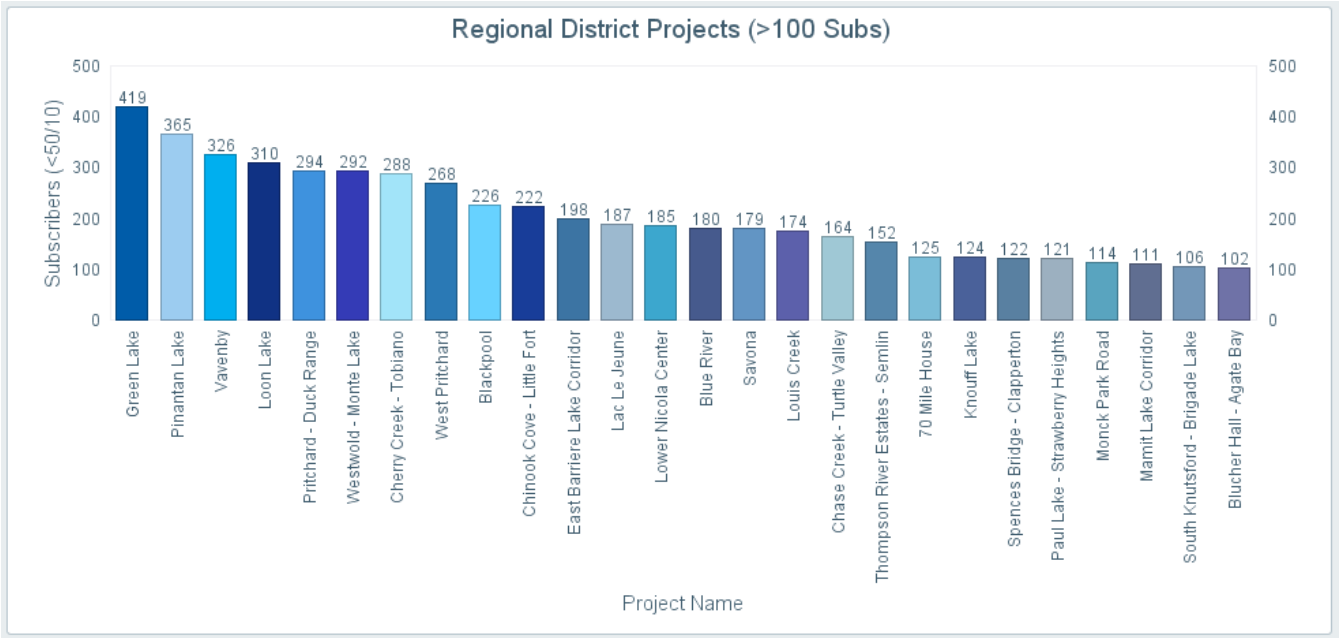

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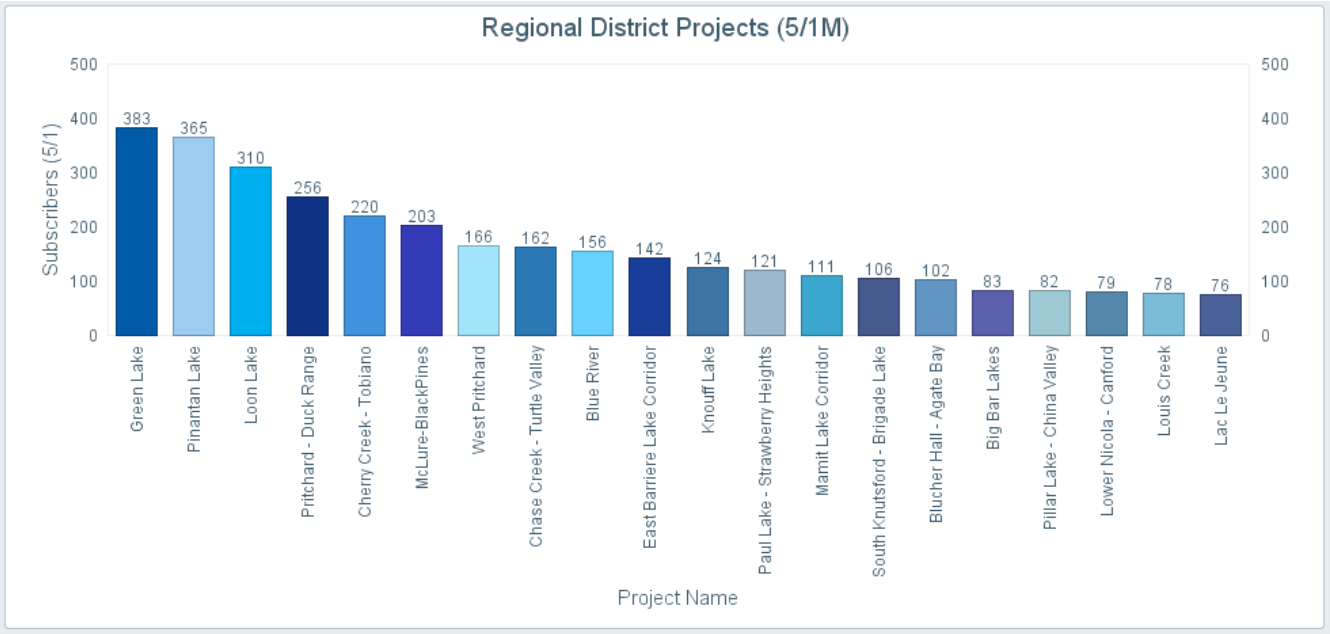
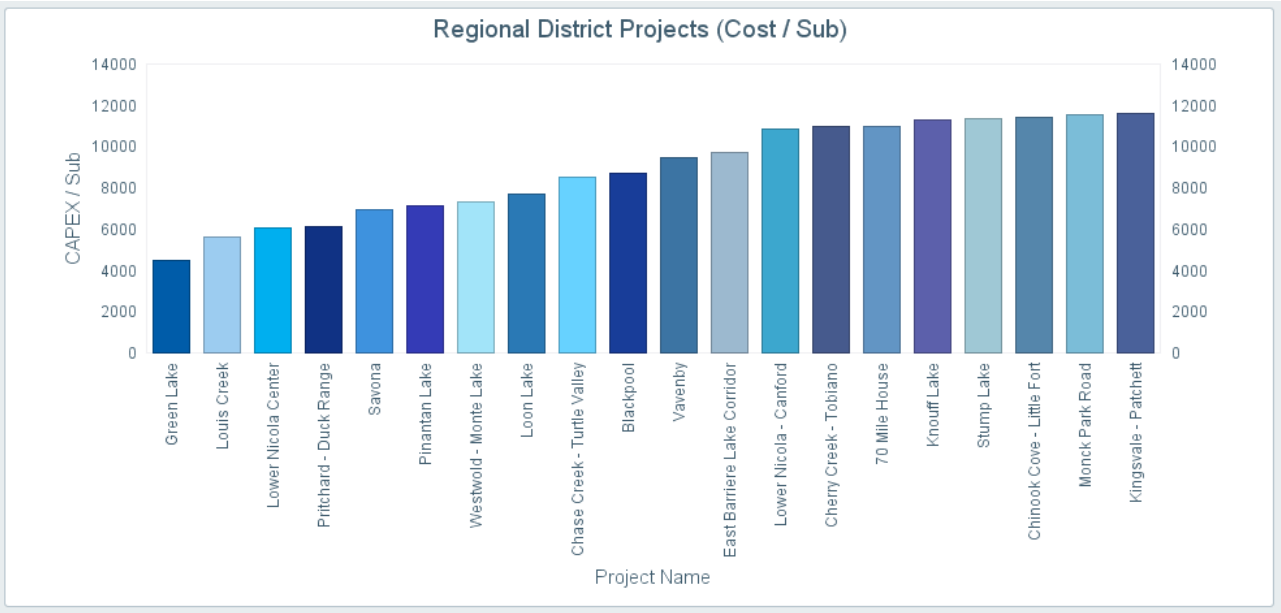
Worst Existing Service

The following projects represent the highest total number of Points at the worst speeds of 5/1Mbps or less and that have over 75 Points.



Lowest Cost per Subscriber

The following provides the top projects based on lower cost per subscriber that serve more than 50 Points.



8.4.5 Present Project Priorities to Providers

Regardless of the role of the TNRD, the Regional District must establish those projects that it wishes to prioritize and communicate them to the providers that can participate in solving them. An advocacy role makes cooperative participation with providers a key action by the Regional District. Providers engaged as part of this project expressed interest in working with the TNRD to resolve its areas of focus. Participation by the TNRD needs to be addressed in cooperation with the provider(s) and may range from providing letters of support for project funding to a full partnership and potentially a financial contribution.

Where a proper business case of improved connectivity simply cannot be made, some providers indicate that these can still be addressed, but it will require a financial contribution by local government or governments.

Letters of support are often requested by providers and these letters need to be considered carefully to ensure the proposed project aligns with the goals and priorities of the Regional District. Further, funding programs often have eligibility criteria and care needs to be taken to ensure that projects are positioned for future scalability, and do not provide marginal improvement which result in disqualifying the area from future funding. By establishing an improved service, but not consistently throughout the community at the USO, an area may be disqualified from future opportunities. Investments in infrastructure, particularly if Regional District funding is required, should be scalable to meet the current USO minimums and be positioned to support future capabilities that will be required.

Considerations for the letter of support should include:

- Definition on the specific projects area(s).
- Inclusion of other surrounding project areas and priorities that may not be the intended focus, but could be addressed more efficiently by inclusion in the requested scope.
- Defined project timelines.
- Defined levels of service and technology. Ideally projects that are requesting funding should be completed with technology that meets or exceeds the current USO, as while this may be considered sufficient for today's needs, technology continues to evolve and requirements for connectivity are likely always increasing.
- Definition of the services desired. This is discussed more in the next section.

In addition to the communication of project priorities and support for third party initiatives, the TNRD may have Regional District owned buildings/locations that can be leveraged by providers to reduce the barrier to entry in the priority areas. The Regional District may have access to a number of buildings, locations, rights of way, etc that it may be available to contribute to a project. Fire halls provide a good example of a Regional District asset that could be used as a Point of Presence ("POP") required in delivery improved connectivity.

The Regional District should inventory its available assets in an effort to make them available where required to reduce the barrier to entry for a provider.

8.4.6 Establish a Timeline for Improvement

As the TNRD considers its role, it should consider a timeline for noticeable action and improvement. Almost all problems can be solved in a timely manner with a large enough supply of money. Federal and provincial funding programs have an inherent problem of slow response to the problem. Often, funding programs are announced, time is given to obtain funding applications, time is allotted for evaluation, announcements are made, clarifications and questions are required, funding is deployed, detailed construction plans are drafted, approvals are required for access to existing infrastructure and finally construction begins. The problem is that the time to complete this is measured in years rather than months. Further contributing to this problem is that of federal, provincial and local government changes in leadership that may stop advancing the solution due to changing views.

The TNRD must establish an action plan that provides a predefined escalation plan. As project priorities are established realistic timelines should be set for service providers' engagement, assessment of options, and the decision on the path forward. For example, a timeline may be established that if provider engagement has not been received with 3 months of initial engagement, the TNRD knows the next step that it must do to escalate the initiative to the next stage.

The TNRD has numerous defined project areas and in defining a timeline for each priority, projects can be prioritized, and progress can be measured. An example is as follows:

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Sub Project Milestones

Project Name	Priority	Start	Providers Engaged	Proposal Received	Proposal Evaluation	Action Plan Defined	Project Established
Avola		May 01, 2021	Aug 01, 2021	Sep 01, 2021	Oct 01, 2021	Nov 01, 2021	Dec 01, 2021
Blue River		May 01, 2021					
Blackpool		May 01, 2021					
Vavenby		May 01, 2021					
Paul Lake - Strawberry		May 01, 2021					
Pinantan Lake		May 01, 2021					
West Pritchard	1	May 01, 2021					

A complete list of all defined projects in the TNRD has been provided in the ancillary document.

8.4.7 Future Direction of Services

As the Regional District (or other parties) may be asked or required to provide a financial contribution to fulfill improved connectivity, when meeting this request local government must make efficient use of that contribution. As such, the following provides some considerations that should be addressed as part of a capital contribution program.

Services continue to evolve, and connectivity to the internet should be considered as one of many services. As part of the defined vision and benefits, constituents of the TNRD are demanding better access to services that are considered essential. While this is a desirable goal, the current models of funding and service deployment do not lend themselves to effectively providing access to the essential services. As discussed in other material provided as part of this project, true access to essential services can be provided regardless of whether the other benefits of internet connectivity such as entertainment and social media are deployed or not. For example, access to online education may be considered essential and services need to be deployed in manner so that residents of the TNRD can cost effectively obtain access to online education.

As a general rule, in today's deployment model, networks are constructed in a manner that provides exclusive use of the infrastructure to a single provider. When infrastructure such as fibre is deployed, it is more efficient and makes better use of the capital deployed if it is constructed in a manner to provide equal access to all providers and services that wish to utilize the infrastructure. The industry term for this model is Open Access and while there are variations on this general theme, the general premise is that all services can be deployed over the same infrastructure, providing for the most effective use of capital funds, but also providing consumer choice of providers and services.

Finally, when significant capital is required to facilitate improvements in connectivity, these projects need to be constructed in a manner to ensure scalability and sufficient capacity to not only meet today's USO but future requirements. There are many services and considerations for future requirements, and particularly if the local government is being asked to make a financial contribution, these items need to be considered so minimal future contributions are required. The 50/10Mbps USO may be

suitable for today's needs but demand in capacity is only going to increase, so a scalability plan needs to be created. For example, making a local government financial contribution to improve connectivity for a network that utilizes DSL technology may provide some immediate relief, but the long-term suitability is suspect, and making a financial contribution for improved DSL may not be the most effective use of public funds.

Further, the technology used by the internet continues to evolve. Today's internet technology in Canada uses an underlying communications technology called Internet Protocol version 4 (IPv4). However, this technology is quickly becoming obsolete as more and more connections to the internet are realized and in fact, new deployments may already or soon will have difficulty in obtaining the necessary address space to continue with IPv4. A newer technology called IPv6 is already available and has been deployed in other countries around the world. Canada is behind in these deployments and at some point, will be forced to begin the transition. Investments in networks must consider future requirements and ensure support for technologies such as IPv6, which is readily available today, so there is not another financial contribution required due to lack of planning now.

8.4.8 Seek P3 Partners

One of the options that is becoming more readily available for local governments to utilize in solving the connectivity challenge, is the engagement of Public Private Partnerships ("P3'). While the TNRD may not have considered these opportunities in solving the connectivity challenge, there are some very real possibilities that need to be explored with varying degrees. These can range from well established incumbent providers to more creative models involving private funding and in a variety of forms. This may also include a simple financial contribution with no established method for sharing of revenue, control or ownership, to a more active role of participating in the ownership and sharing of the revenue to make the investment sustainable.

8.4.9 Leverage Trans Mountain Pipeline Fibre

As discussed earlier in this report, Trans Mountain represents a significant asset and realistic opportunity to the TNRD to leverage as much as possible. The TNRD must engage with this initiative to ensure assets are placed along the pipeline for immediate and/or future use. Considerations must include:

- Ability for the TNRD and/or other providers to gain access to high-capacity backbone capacity along the pipeline right of way.
- Establishing improved coverage for cellular and mobile along of the right of way.
- Establish POPs and fibre breakout locations along the right of way that align with TNRD priorities.
- Definition of a business model that encourages competitive services from other providers.
- Establish a migration strategy timeline.
- Definition of technology to ensure future capacity and scalability.

8.4.10 Active TNRD Involvement

As discussed earlier, solving connectivity challenges requires that all layers of the SDP be solved in some fashion. This does not mean that the TNRD must own and manage every layer of the pyramid or have a detailed understanding of telecommunications and network troubleshooting, but rather that it

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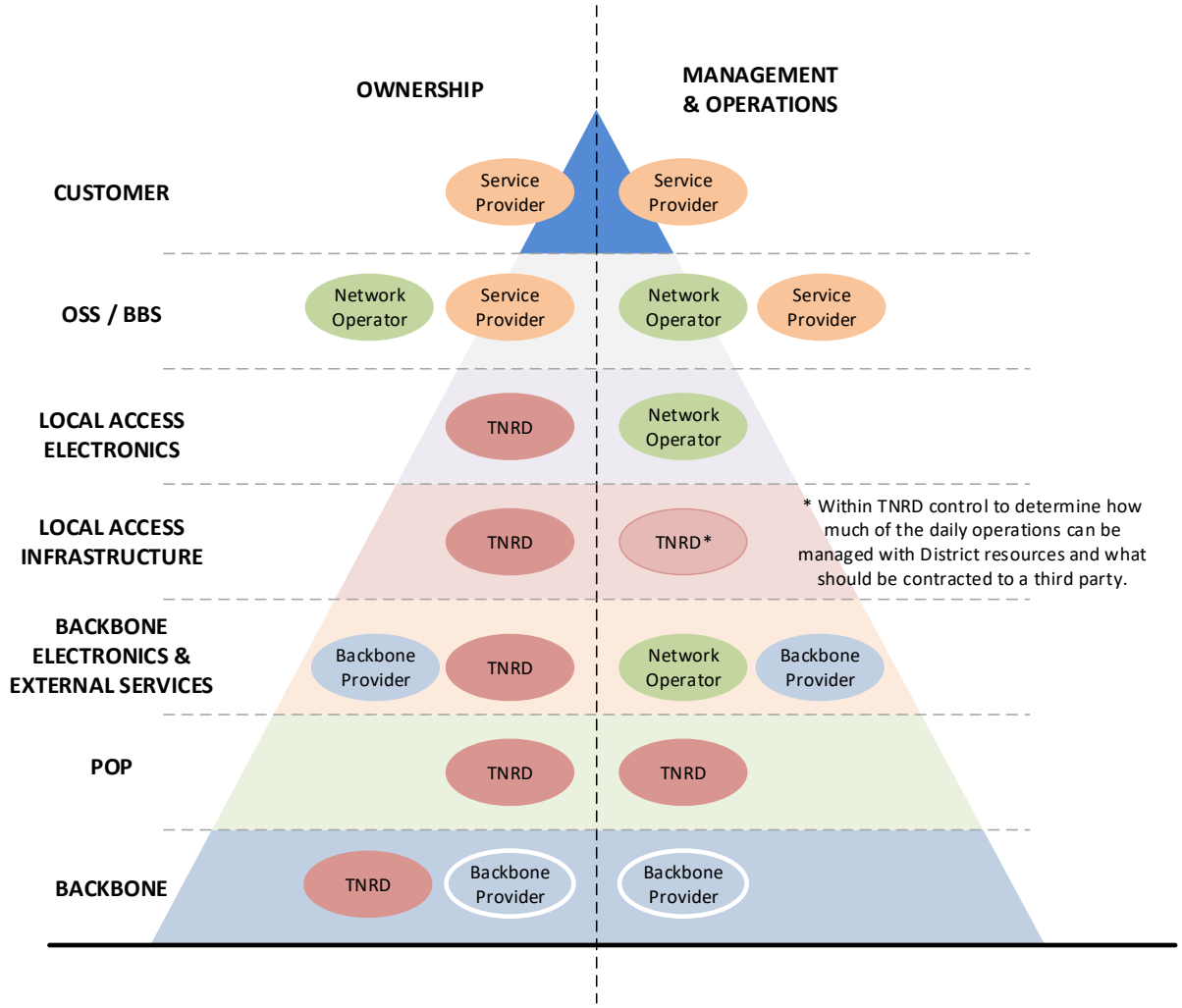
actively participates in a model in which multiple parties collaborate to resolve the pyramid, each bringing a set of skills and resources. To solve the pyramid, there are four main parties involved, each with a discrete role and responsibility. A single organization may fill multiple roles or, different aspects may be fulfilled by more than one party. The main parties are:

- The TNRD – Owns (either by itself or together with others) the network and has ultimate control over it. To provide service, the TNRD contracts with the parties below to provide the specified parts of the network.
- Backbone Provider – Third party that provides the backbone and global connectivity to the network.
- Network Operator – Third party that manages, operates, and maintains the network on behalf of the TNRD and can provide technical escalation path to Service Provider.
- Service Provider(s) – Third party that provides the customer facing services, operations, billing, collections, and technical and customer support.

This structure is overlaid on top of the SDP that was introduced earlier in this report.



8.5 Cost Estimate

Cost estimates for identified projects are found in the project summary ancillary document and are intended for internal TNRD use and not intended for sharing with third parties including service providers.

8.6 Funding

Funding for rural broadband is a priority item for government, particularly considering the on-going COVID-19 pandemic. Remote and rural broadband projects are unlikely to be implemented by service providers without financial support as those service providers have business requirements that drive where, and when, they will invest their own funds to construct additional network capacity. Rural and

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remote capacity often does not meet those requirements, so there will be a financial gap between what a provider is willing to invest, and the cost of construction. This financial gap will need to be filled if service is to be provided in these areas.

Sources of funding in place at the time of writing for projects of this nature have been identified below. Funding programs have been included even if there is no currently open intake to identify places to look for funding options once a project is moving forward. **A detailed review of the application guide materials will be necessary to identify the specifics of the proposed project and the requirements for applying.** That detailed review should be a priority item so that appropriate work is commissioned in time to be "shovel ready" if, and when, a decision is made to proceed with a project either through the Regional District itself or through a third-party provider or some combination of the two. It should be noted that as program intakes close, there are sometimes iterations of the funding requirements that apply in subsequent intakes so each phase or intake should be reviewed closely.

- Universal Broadband Fund (the "UBF") is a $1.75 billion fund through ISED (2021 budget adds $1.00 billion to this fund) for the expansion of affordable, reliable, high-speed internet service in areas of Canada that have been identified by ISED as not already having access to service at the USO or for mobile projects primarily benefitting Indigenous peoples. Funding is available until March 31, 2027. Applicants can request funding for up to 75% (or 90% in the case of highly remote areas or mobile projects primarily benefiting Indigenous peoples) of total eligible costs as defined in the program. The first intake just closed on March 15, 2021.

- Connecting British Columbia is a BC government funding program administered by the Northern Development Initiative Trust which is open to local, regional, or national service providers, local governments; First Nations or BC not-for-profits. The program has a number of focus points described below.

    - Last-Mile, Transport Infrastructure:

        - This program is in its third phase and has, as its objective, the acceleration of the delivery of internet connectivity at the USO to homes and businesses in rural and Indigenous BC communities. The program will accept applications through successive intakes until funds are exhausted. The fifth intake just closed on March 15, 2021. Projects that are already ready to go will rank more favourably than ones which rely on other steps to be taken first. A pre-screening process is required which ensures that an applicant either has the experience requirement (3 years' experience deploying and operating the proposed broadband infrastructure in Canada) for an application or will work with an ISP that does. In addition, the applicant must agree to own, operate, and maintain the resulting network for 3 years after the project is complete otherwise some repayment of the funds will be required.

            - Transport Infrastructure – 50% of eligible costs for transport infrastructure. Fibre project are highly preferred over other transport technologies such as microwave. In some cases, project will require a partnership with a facilities-based provider that provides confirmation that the proposed network design meets their standards for future expansion of cellular coverage along the route. Transport projects should achieve at least one of the following:
                - new or upgraded transport infrastructure that provides open-access for transport and internet gateways at affordable wholesale rates to last-mile service providers in those underserved regions;

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- improve network resiliency and provide redundancy;
- provide future services such as cellular, public Wi-Fi or future technology;
- increase competition in areas with high prices and low capacity;
- enable government services in rural areas.

▪ Last-Mile Project - 50% of eligible costs to improve last mile connectivity in underserved rural and Indigenous areas in BC but follows a baseline funding level of $250,000 per community. Last mile infrastructure is to provide potential for long-term usage and expansion through technologies such as fibre, coaxial cable and fixed-wireless LTE. The project is to align with the region's plans to show that the project is a priority for the communities it serves. It should be noted that the application documentation provides a list of BC rural and Indigenous communities along with whether that community does or does not have connectivity at the USO. The application guide states however, that if a project is also seeking funding from a federal connectivity fund, then the federal program will dictate whether the project is qualified. This is important to note as there are examples where the Connecting BC list includes a community, but the federal map shows it as served in some fashion.

- Economic Recovery:
  - ▪ A one-time $90 million infusion to encourage rapid expansion of connectivity to "drive regional economic development in rural areas, Indigenous communities and along BC highways." Funds were to be fully allocated by March 31, 2021 for connectivity infrastructure projects that would be completed by October 31, 2021. This funding stream prefers projects that deliver 50/10 but considers projects that provide 25/5 as eligible. Compared to the regular Connecting BC program above, it has increased funding ratios (90% rather than the 50% through the regular Connecting BC program) and supports a wider range of technologies as well as highway connectivity projects.

- Core UBF:
  - ▪ An intake intended to leverage the main federal Universal Broadband Fund. Now closed to intake.

- Rapid Response UBF:
  - ▪ An intake intended to leverage the Rapid Response Universal Broadband Fund. Now closed to intake.

▪ The Broadband Fund (the "BBF"). – In connection with upgrading infrastructure to meet the USO, the BBF was established by the CRTC to provide funding of $750 Million over five years. The second call for applications closed on June 1, 2020 so this fund is not currently open for applications at the time of writing. This fund provides funding for backbone projects, local access projects and mobile wireless projects. The Broadband Fund has committed up to $156.5 million of the fund to date[28].

[28]CRTC – Broadband Fund – *Projects selected for funding*

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TNRD can apply to the BBF directly or as a member of a joint venture, partnership, or consortium with other eligible entities – eligible entities include other regional districts, first nations, municipal governments and private for-profit or not for profit service providers. BBF requires that "**the applicant, or at least one member of a partnership, joint venture, or consortium must have at least three years of experience in deploying and operating broadband infrastructure and must be eligible to operate as a Canadian carrier**." If this criterion is not met by the applicant or a member of the consortium, the applicant must enter contract with an entity that does.

- Gas Tax Fund – permanent funding normally provided twice a year by Infrastructure Canada. In BC, there is a tri-partite agreement between Canada, BC and the Union of British Columbia Municipalities ("UBCM"). Infrastructure Canada flows the funds to UBCM who then flows them to local governments for investment in local infrastructure priorities, specifically including use for broadband and connectivity.

- Trusts or non-profits that have support for TNRD as part of their mandate.

- Private industry partners that may support a public/private partnership infrastructure project.

- Lenders such as the Canada Infrastructure Bank which has $2 billion in loans and equity for new broadband infrastructure projects.

- Local government taxation where possible.

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9 NEXT STEPS

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9.1 Next Steps

Based on the information gathered during the course of this project, the following provides a summary of the recommended next steps for the Regional District.

Fundamental Tasks

- Establish an internal broadband working group focused on the connectivity challenge.
- Identify a lead internal staff resource to manage and advance connectivity initiatives.
- Inventory TNRD assets that may lower barriers to service delivery.
- Reach out and collaborate with other local governments, including municipalities, other Regional Districts and First Nations to identify and solve a larger problem for more people.
- Align with other TNRD initiatives that may be ongoing.
- Actively provide intervenor feedback to the CRTC in collaboration with other local governments for all topics that pertain to rural and remote connectivity.
- If not already, become a member of the BC Broadband Association.
- Participate in broadband conferences, especially those focused on rural and remote communities.

Determine the Role of the Regional District

- Identify what contribution the Regional District will make to solving the connectivity challenge. The defined role may vary based on the project area.
    - Advocate/facilitate/lobby
    - Contribute capital to third party
    - Partnership with a service provider
    - Construct and own infrastructure
- Determine specifics of how that role will be fulfilled.
    - If, for example, TNRD decides that its role is to contribute capital, what are the mechanics of that?

Prioritize the Project Areas

- Create criterion for prioritizing the potential projects identified in this report, including:
    - an assessment of community support;
    - identification of project champions;
    - opportunities where collaboration with First Nations or neighbouring Regional Districts is available (ie. Green Lake); and,
    - considerations raised in the previous section.
- Complete the prioritization of the potential projects.

Create an Action Plan

- Identify project specific steps to address each priority area.
- Communicate priorities to service providers.
- Provide information about TNRD's priority areas to providers for internet and cellular.
- Develop a process and minimum service levels for responding to requests for letters of support to ensure that TNRD's priorities are being addressed.
- Identify the specific barriers to service delivery in each priority area and determine whether the TNRD can do anything to lower or remove them.
- Obtain proposals with pricing for priority project areas.

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9.2 About TANEx Engineering

TANEx is a professional engineering firm located in British Columbia, Canada focused on providing engineering consulting services specializing in telecommunications and networking. TANEx provides design, commissioning and operational services to its clients from varied industries and has a wide variety of expertise in connectivity technologies, infrastructure and services. For more information, please refer to our website at www.tanexengineering.com.

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10 APPENDICES

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Appendix A – Summary of Electoral Areas

The following tables provide a breakdown of the proposed project area per Electoral Area. For reference the following provides the definition for the headers in the table:

Major Project Name: The name used to identify the project area that contains a number of smaller sub-projects.

Sub-Project Name: The name used to identify the small sub-project areas.

Area: Refers to a specific area within the region usually the Electoral Area.

BB: Refers to the Backbone layer of the SDP and provides an indication if the project area contains a backbone component.

Local Access: Refers to the Local Access layer of the SDP and provides an indication if the project area contains a local access component.

Total Subs: Refers to the total number of subscribers or Points in the defined area.

Primary Service: Provides an indication of he primary existing service level in the project area.

Current Service Levels: Provides the breakdown of the number of Points with each level of service shown.

Project Area Summary for Electoral Area "A"

Project Area Summary May 28, 2021

		Project Definition						Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Clearwater	Blackpool	A	Yes	Yes	298	2.99%	25/5	42	0	184	72
Clearwater	Vavenby	A	Yes	Yes	326	3.27%	25/5	26	63	237	0
Excluded Points	Electoral Area A	A	No	No	7	0.07%	5/1	6	0	1	0
Wells Gray	Wells Gray	A	Yes	Yes	78	0.78%	5/1	78	0	0	0
		Area A SubTotal			**709**	**7%**		**152**	**63**	**422**	**72**

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Project Area Summary for Electoral Area "B"

Project Area Summary

May 28, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Thompson	Avola	B	Yes	Yes	40	0.40%	25/5	40	0	0	0
Thompson	Blue River	B	Yes	Yes	180	1.81%	25/5	156	0	24	0
Excluded Points	Electoral Area B	B	No	No	17	0.17%	N/A	9	0	8	0
		Area B SubTotal			**237**	**2%**		**205**	**0**	**32**	**0**

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Project Area Summary for Electoral Area "E"

Project Area Summary

May 28, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Big Bar Creek	Lower Big Bar Road	E	Yes	Yes	16	0.16%	5/1	16	0	0	0
Bonaparte Plateau	Bonaparte Lake	E	Yes	Yes	34	0.34%	5/1	34	0	0	0
Bonaparte Plateau	Eagan Lake	E	Yes	Yes	68	0.68%	5/1	68	0	0	0
Bonaparte Plateau	Machete Lake	E	Yes	Yes	33	0.33%	5/1	33	0	0	0
Bonaparte Plateau	Pressy Lake	E	Yes	Yes	75	0.75%	5/1	75	0	0	0
Bonaparte Plateau	Young Lake	E	Yes	Yes	42	0.42%	5/1	42	0	0	0
Clinton-70 Mile Area	70 Mile House	E	Yes	Yes	125	1.25%	25/5	34	4	87	0
Clinton-70 Mile Area	Chasm	E	Yes	Yes	36	0.36%	5/1	36	0	0	0
Clinton-70 Mile Area	Clinton Creek	E	Yes	Yes	28	0.28%	5/1	27	1	0	0
Clinton-70 Mile Area	Green Lake	E	Yes	Yes	419	4.21%	25/5	383	0	36	0
Clinton-70 Mile Area	Kelly Lake - Lime	E	Yes	Yes	72	0.72%	5/1	52	5	15	0
Loon Lake-Cariboo	16 Mile North	E	Yes	Yes	19	0.19%	5/1	19	0	0	0
Loon Lake-Cariboo	Loon Lake	E	Yes	Yes	310	3.11%	5/1	310	0	0	0
Excluded Points	Electoral Area E	E	No	No	74	0.74%	5/1	74	0	0	0
Big Bar Creek	Meadow Lake	E		No	20	0.20%	5/1	19	0	1	0
		Area E SubTotal			**1500**	**15%**		**1,348**	**10**	**142**	**0**

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Project Area Summary for Electoral Area "I"

Project Area Summary

May 28, 2021

		Project Definition						Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Cache Creek-Ashcroft	16 Mile	I	Yes	Yes	74	0.74%	5/1	59	0	15	0
Cache Creek-Ashcroft	Back Valley Road	I	Yes	Yes	10	0.10%	25/5	1	0	9	0
Cache Creek-Ashcroft	Barnes Lake	I	Yes	Yes	28	0.28%	5/1	25	0	1	2
Cache Creek-Ashcroft	Boston Flats	I	Yes	Yes	16	0.16%	25/5	8	0	8	0
Cache Creek-Ashcroft	North Ashcroft	I	Yes	Yes	12	0.12%	25/5	3	0	9	0
Cache Creek-Ashcroft	Thompson River Estates -	I	Yes	Yes	152	1.53%	10/2	5	86	61	0
Clapperton Corridor	Agate - Dot	I	Yes	Yes	14	0.14%	5/1	14	0	0	0
Clapperton Corridor	Spences Bridge -	I	Yes	Yes	123	1.23%	25/5	19	0	103	1
Lytton Corridor	Botanie Creek	I	Yes	Yes	43	0.43%	5/1	43	0	0	0
Lytton Corridor	Gladwin - Lasha	I	No	Yes	13	0.13%	5/1	11	0	2	0
Lytton Corridor	Lillooet Rural Corridor	I	Yes	Yes	25	0.25%	5/1	22	0	2	1
Lytton Corridor	Lytton Rural South	I	Yes	Yes	7	0.07%	5/1	7	0	0	0
Lytton Corridor	Van Winkle Flat	I	No	Yes	20	0.20%	25/5	3	0	17	0
Excluded Points	Electoral Area I (Excluded)	I	No	No	73	0.73%	5/1	72	0	1	0
		Area I SubTotal			**610**	**6%**		**292**	**86**	**228**	**4**

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Project Area Summary for Electoral Area "J"

Project Area Summary

May 28, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Deadman River-Criss	Alpine Valley	J	Yes	Yes	59	0.59%	5/1	59	0	0	0
Deadman River-Criss	Criss Creek	J	Yes	Yes	14	0.14%	5/1	14	0	0	0
Deadman River-Criss	Dead Man Valley	J	Yes	Yes	16	0.16%	5/1	16	0	0	0
Deadman River-Criss	Mowich Lake - Deadman	J	Yes	Yes	18	0.18%	5/1	18	0	0	0
Deadman River-Criss	Red Lake	J	Yes	Yes	55	0.55%	5/1	55	0	0	0
Walhachin-Cherry	Cherry Creek - Tobiano	J	Yes	Yes	288	2.89%	25/5	220	0	68	0
Walhachin-Cherry	Savona	J	Yes	Yes	225	2.26%	25/5	0	15	164	46
Excluded Points	Electoral Area J (Excluded)	J	No	No	68	0.68%	5/1	61	2	5	0
Tunkwa-Lac Le Jeune	Dominic Lake	J	No	No	22	0.22%	5/1	22	0	0	0
Tunkwa-Lac Le Jeune	Lac Le Jeune	J	Yes	Yes	187	1.88%	25/5	76	0	111	0
Tunkwa-Lac Le Jeune	Paska Lake	J	Yes	Yes	74	0.74%	5/1	74	0	0	0
Tunkwa-Lac Le Jeune	Tunkwa Lake	J	Yes	Yes	34	0.34%	5/1	34	0	0	0
Walhachin-Cherry	Frederick	J	Yes	Yes	29	0.29%	5/1	19	0	10	0
		Area J SubTotal			**1089**	**11%**		**668**	**17**	**358**	**46**

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Project Area Summary for Electoral Area "L"

Project Area Summary

May 28, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Bestwick Loop	Bestwick - Campbell	L	Yes	Yes	63	0.63%	5/1	63	0	0	0
Bestwick Loop	Holmwood	L	Yes	Yes	47	0.47%	5/1	41	0	6	0
Brigade Lake Area	Beresford	L	Yes	Yes	82	0.82%	5/1	69	0	8	5
Brigade Lake Area	Napier Lake	L	Yes	Yes	13	0.13%	5/1	13	0	0	0
Brigade Lake Area	South Knutsford - Brigade	L	Yes	Yes	110	1.10%	5/1	106	0	0	4
Chase Creek-	Chase Area	L	Yes	Yes	65	0.65%	25/5	38	2	21	4
Chase Creek-	Chase Creek - Turtle	L	Yes	Yes	164	1.65%	5/1	162	2	0	0
Chase Creek-	Pillar Lake - China Valley	L	Yes	Yes	82	0.82%	5/1	82	0	0	0
Chase Creek-	Pritchard - Duck Range	L	Yes	Yes	297	2.98%	25/5	256	5	33	3
Chase Creek-	Westwold - Monte Lake	L	Yes	Yes	301	3.02%	25/5	60	31	201	9
Excluded Points	Electoral Area L (Excluded)	L	No	No	192	1.93%	N/A	30	0	2	160
		Area L SubTotal			**1416**	**14%**		**920**	**40**	**271**	**185**

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Project Area Summary for Electoral Area "M"

Project Area Summary

May 28, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Lower Nicola-Mamit	Lower Nicola Center	M	Yes	Yes	214	2.15%	25/5	38	0	147	29
Lower Nicola-Mamit	Mamit Lake Corridor	M	Yes	Yes	111	1.11%	5/1	111	0	0	0
Stump Lake	Monck Park Road	M	Yes	Yes	134	1.35%	25/5	19	0	95	20
Stump Lake	Quilchena	M	Yes	Yes	51	0.51%	25/5	3	0	38	10
Stump Lake	Stump Lake	M	Yes	Yes	72	0.72%	5/1	72	0	0	0
Excluded Points	Electoral Area M	M	No	No	340	3.41%	5/1	55	0	6	279
Stump Lake	Douglas Lake	M	Yes	Yes	25	0.25%	10/2	0	25	0	0
Stump Lake	Glimpse Lake	M	Yes	Yes	61	0.61%	5/1	61	0	0	0
Stump Lake	Peter Hope Lake	M	Yes	Yes	44	0.44%	5/1	44	0	0	0
		Area M SubTotal			**1052**	**11%**		**403**	**25**	**286**	**338**

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Project Area Summary for Electoral Area "N"

Project Area Summary

May 28, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Merrit-Coquihalla	Brookmere	N	Yes	Yes	41	0.41%	5/1	41	0	0	0
Merrit-Coquihalla	Coldwater Road	N	Yes	Yes	21	0.21%	5/1	21	0	0	0
Merrit-Coquihalla	Kingsvale - Patchett	N	Yes	Yes	55	0.55%	5/1	54	0	1	0
Merrit-Coquihalla	Murray Lake	N	Yes	Yes	22	0.22%	5/1	22	0	0	0
Merrit-Princeton Hwy	Aspen Grove	N	Yes	Yes	11	0.11%	5/1	11	0	0	0
Merrit-Princeton Hwy	Iron Mountain	N	Yes	Yes	45	0.45%	5/1	44	0	1	0
Merrit-Princeton Hwy	Voght Valley	N	Yes	Yes	18	0.18%	5/1	18	0	0	0
Spius Creek	Lower Nicola - Canford	N	Yes	Yes	103	1.03%	5/1	79	0	20	4
Excluded Points	Electoral Area N	N	No	No	132	1.33%	N/A	33	0	13	86
		Area	**N SubTotal**		**448**	**4%**		**323**	**0**	**35**	**90**

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Project Area Summary for Electoral Area "O"

Project Area Summary

May 28, 2021

			Project Definition					Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Barriere Lakes	East Barriere Lake Corridor	O	Yes	Yes	198	1.99%	5/1	142	56	0	0
Barriere Lakes	North Barriere Lake	O	Yes	Yes	43	0.43%	5/1	43	0	0	0
Little Fort-Barriere	Barriere	O	Yes	Yes	61	0.61%	10/2	4	55	2	0
Little Fort-Barriere	Chinook Cove - Little Fort	O	Yes	Yes	240	2.41%	10/2	36	115	71	18
Little Fort-Barriere	Louis Creek	O	Yes	Yes	174	1.75%	10/2	78	96	0	0
Mt Fadear	Blucher Hall - Agate Bay	O	Yes	Yes	102	1.02%	5/1	102	0	0	0
Mt Fadear	Cahilty	O	Yes	Yes	22	0.22%	5/1	22	0	0	0
Mt Fadear	Fadear Creek	O	Yes	Yes	8	0.08%	5/1	8	0	0	0
Mt Fadear	Johnson Lake	O	Yes	Yes	10	0.10%	5/1	10	0	0	0
Excluded Points	Electoral Area O	O	No	No	102	1.02%	5/1	97	0	0	5
		Area O SubTotal			**960**	**10%**		**542**	**322**	**73**	**23**

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Project Area Summary for Electoral Area "P"

Project Area Summary

May 28, 2021

		Project Definition						Current Service Levels			
Major Project Name	Sub-Project Name	Area	BB	Local Access	Total Subs	% of Total	Primary Svc	5/1	10/2	25/5	50/10
Paul & Pinantan Lake	Paul Lake - Strawberry	P	Yes	Yes	121	1.21%	5/1	121	0	0	0
Paul & Pinantan Lake	Pinantan Lake	P	Yes	Yes	365	3.66%	5/1	365	0	0	0
Paul & Pinantan Lake	West Pritchard	P	Yes	Yes	268	2.69%	5/1	166	0	102	0
McLure-BlackPines	McLure-BlackPines	P	Yes	Yes	296	2.97%	25/5	203	0	91	2
Sun Peaks-Knouff	Heffley Creek	P	Yes	Yes	49	0.49%	5/1	49	0	0	0
Sun Peaks-Knouff	Knouff Lake	P	Yes	Yes	124	1.24%	5/1	124	0	0	0
Excluded Points	Electoral Area P	P	No	No	615	6.17%	5/1	35	0	14	566
Niskonlith - Adams	Little Shuswap Lake	P	Yes	Yes	15	0.15%	5/1	4	11	0	0
Niskonlith - Adams	Adams Lake - Loakin-Bear	P	Yes	Yes	71	0.71%		54	0	17	0
Niskonlith - Adams	Niskonlith Lake	P	Yes	Yes	16	0.16%		16	0	0	0
		Area P SubTotal			**1940**	**19%**		**1,137**	**11**	**224**	**568**

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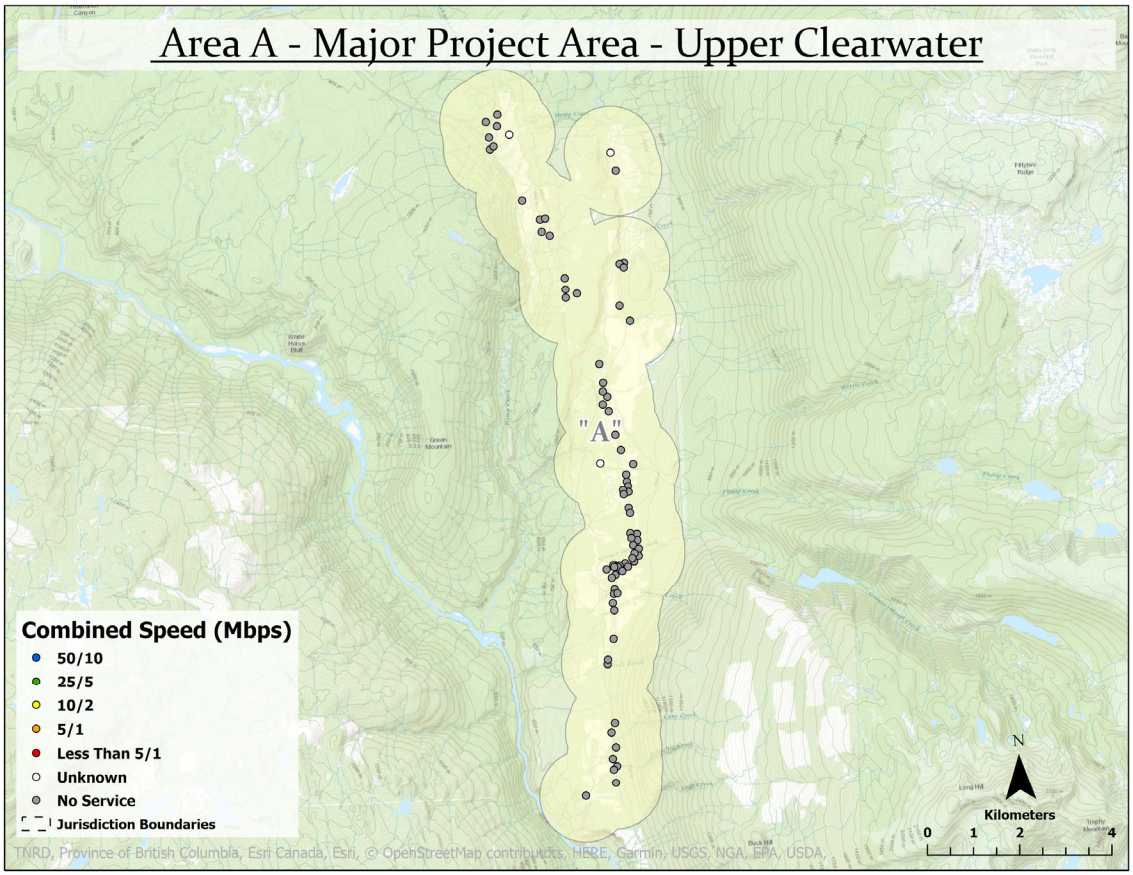
Appendix B - Mapping - Internet Speeds Available

As part of the development of this report, a number of maps were created to provide a visual depiction of various aspects of the TNRD. The following maps depict available speeds in the Electoral Areas of the TNRD.

Detailed Project Area Maps



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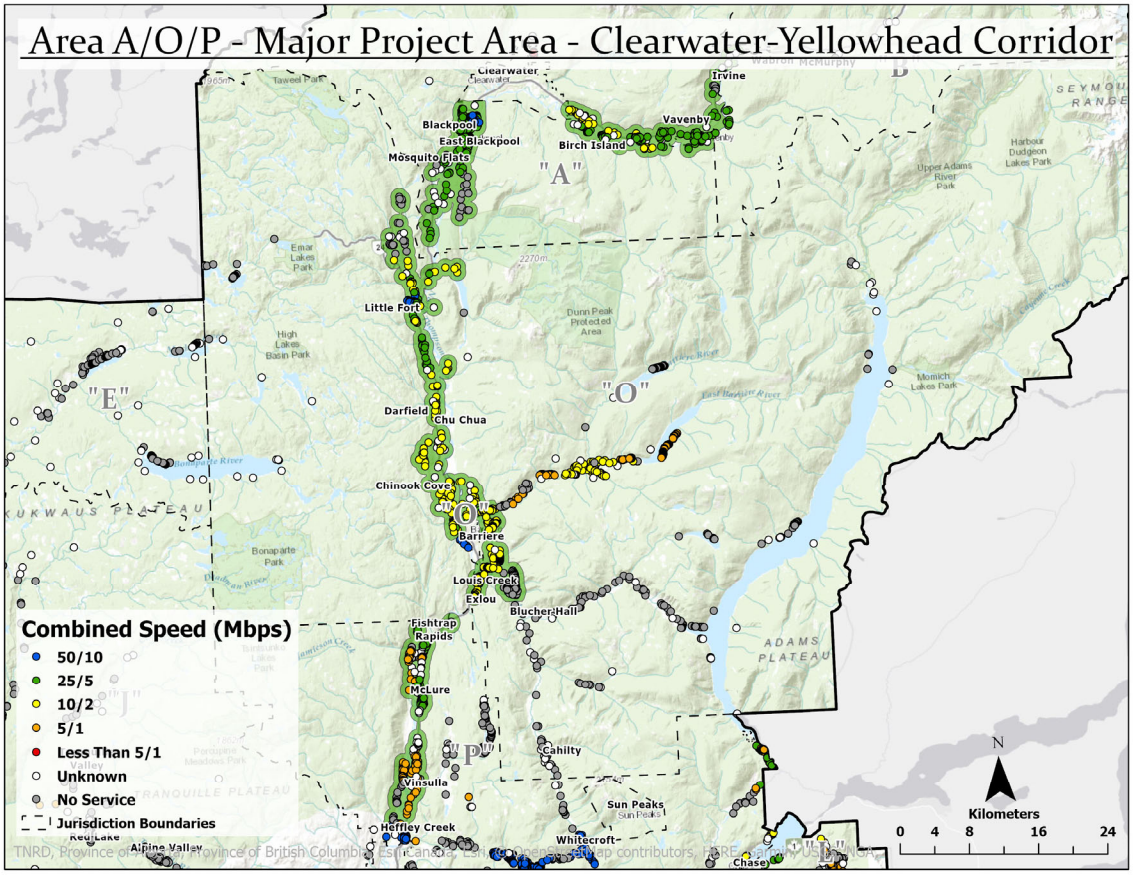

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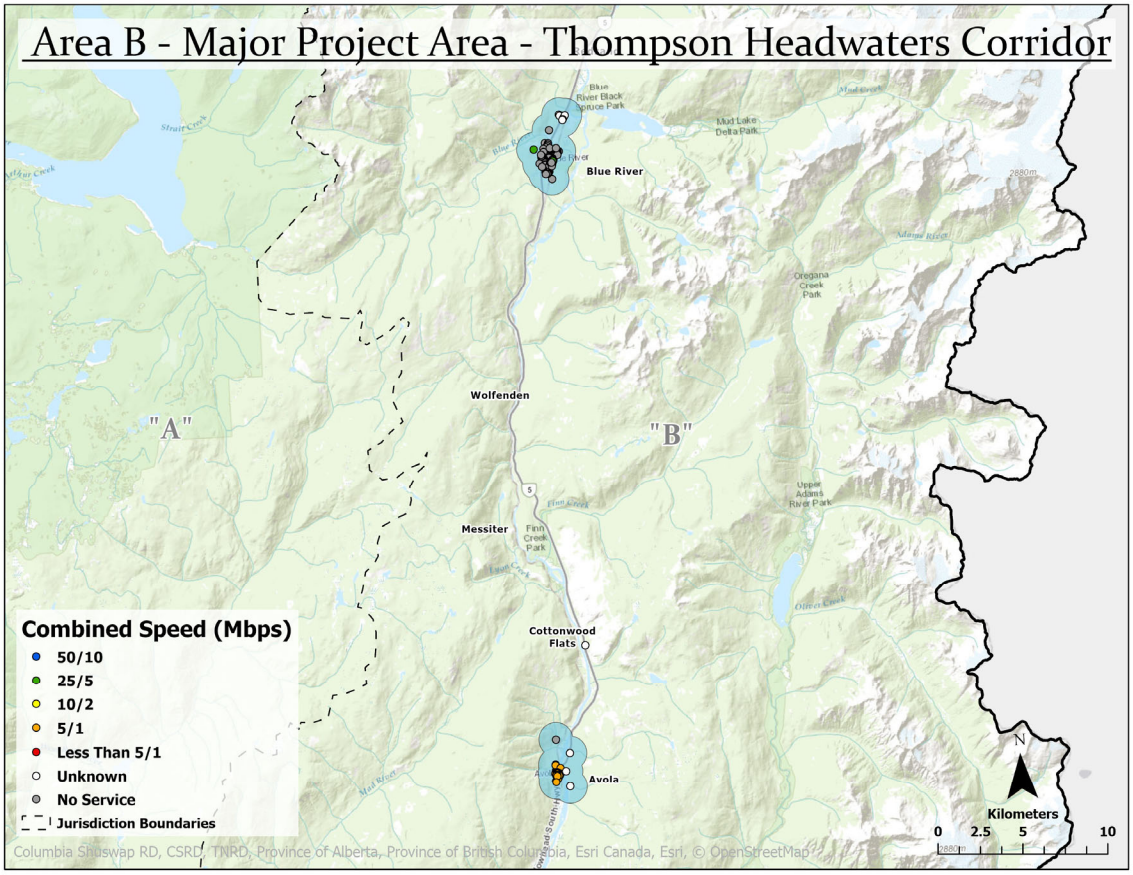

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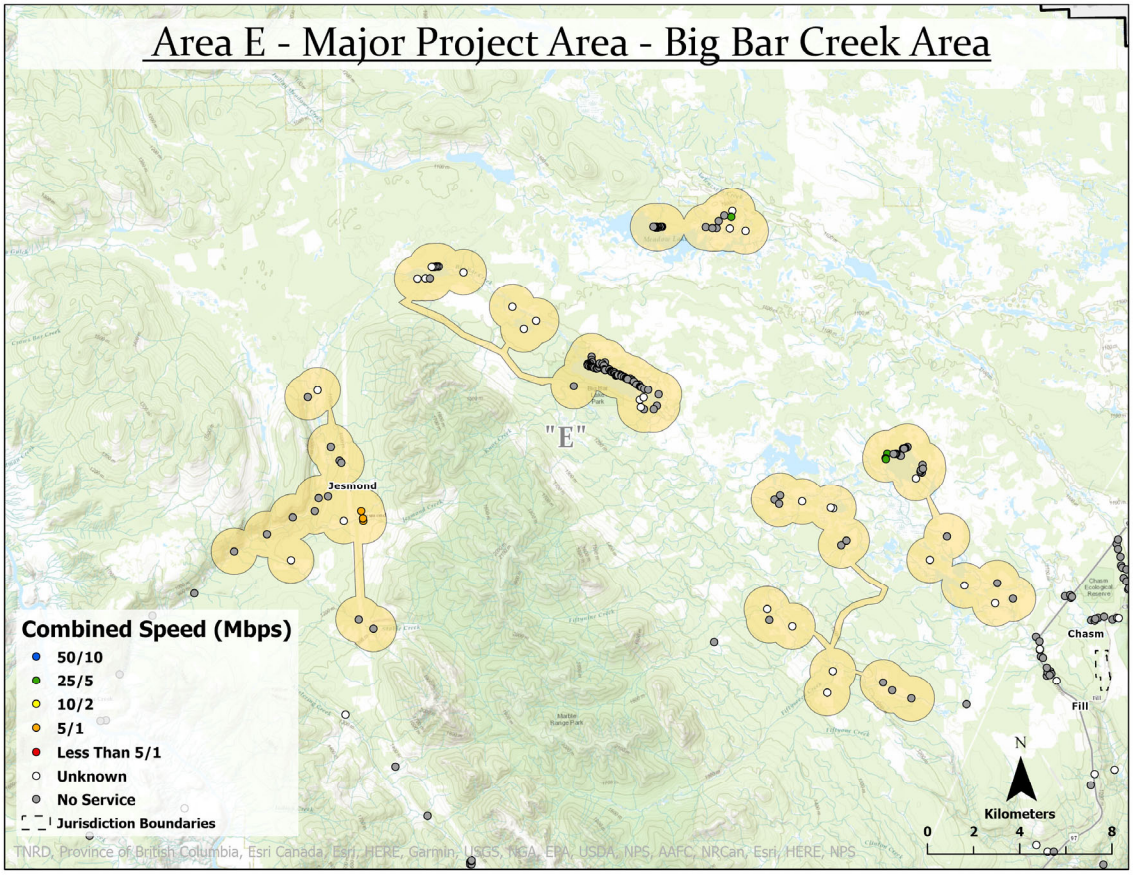

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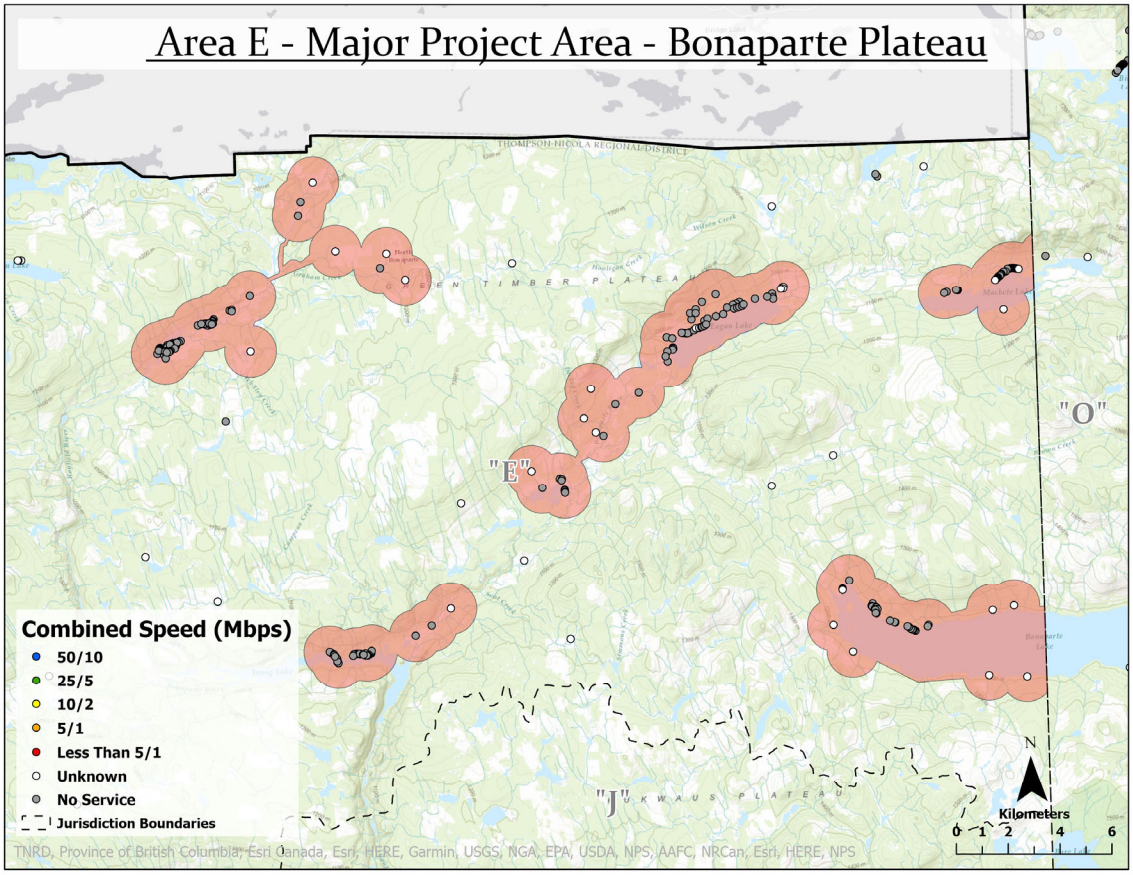

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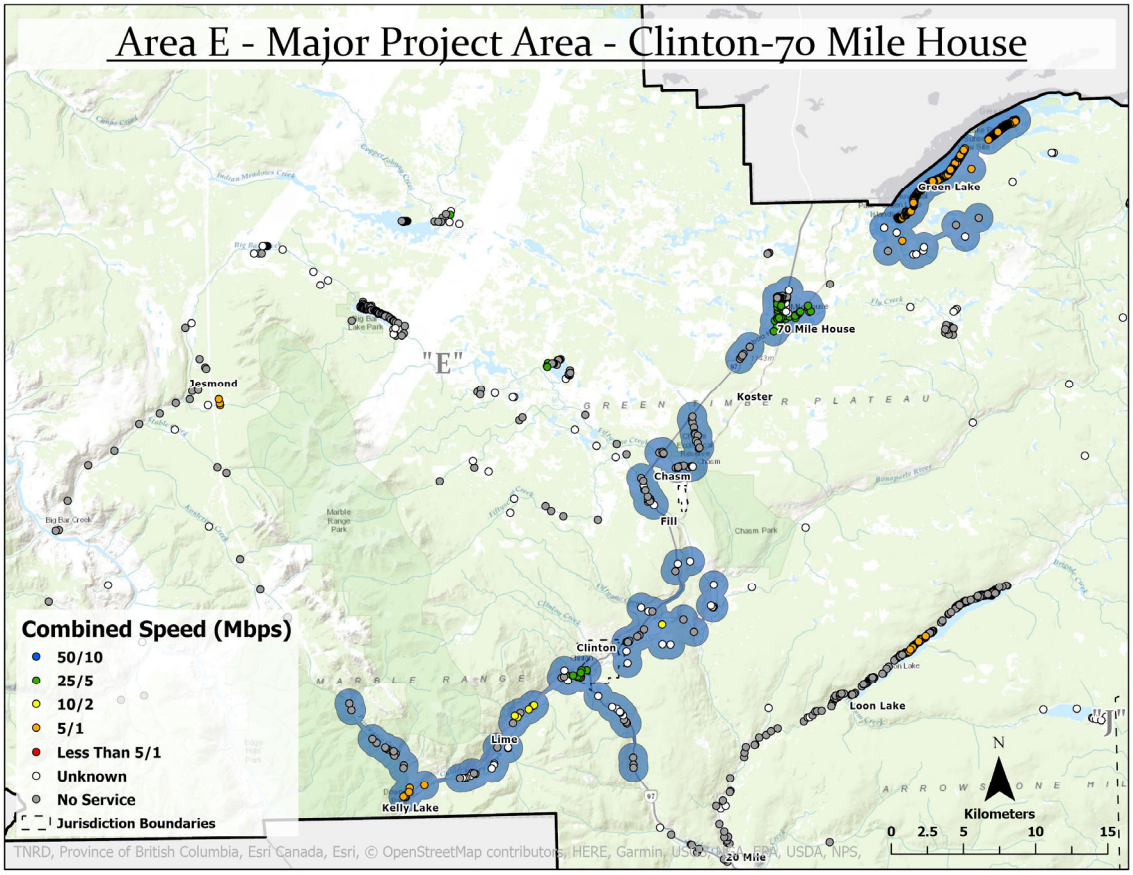

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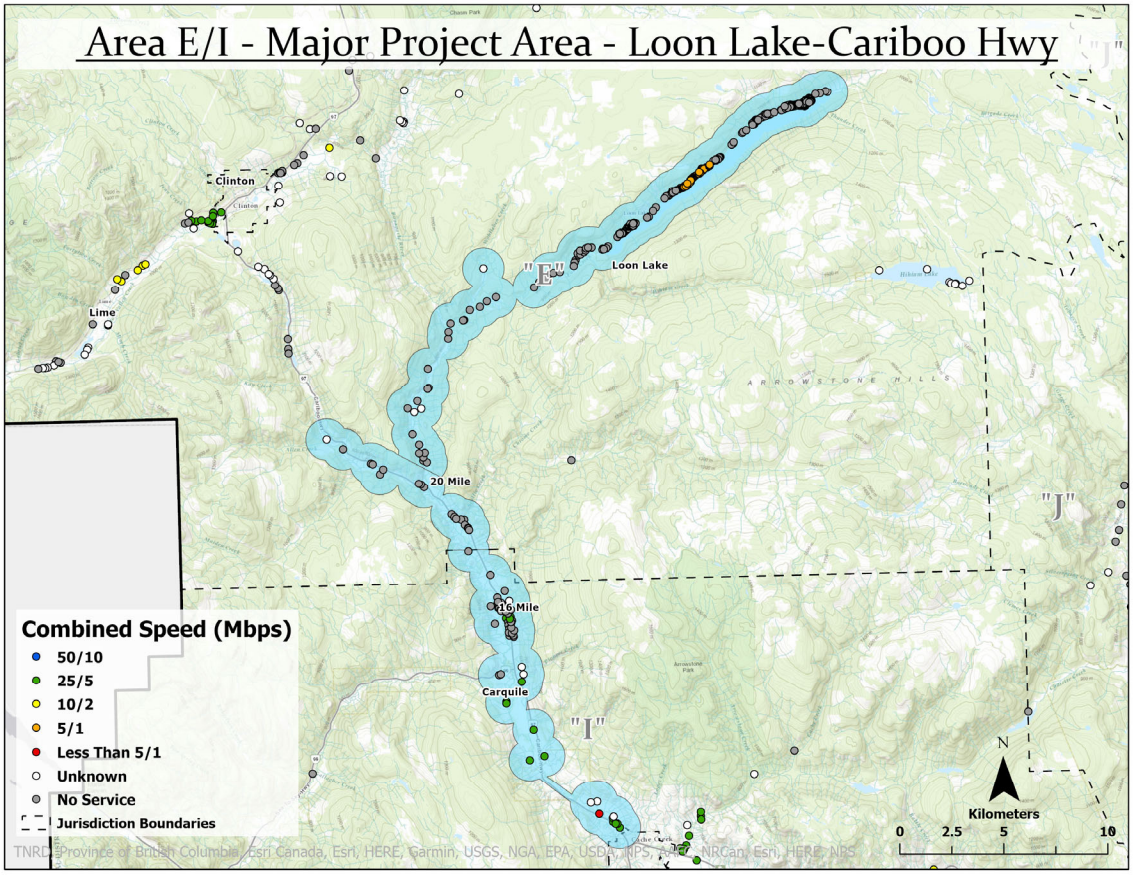

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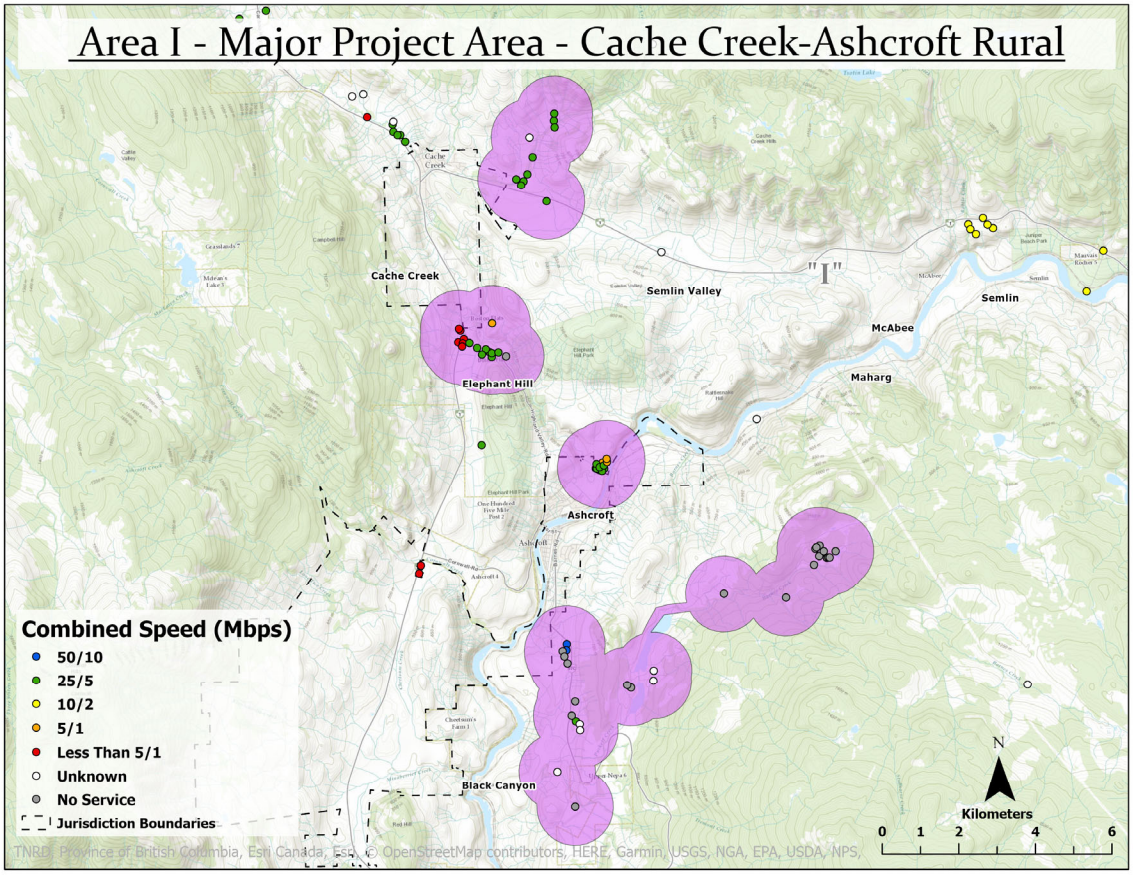

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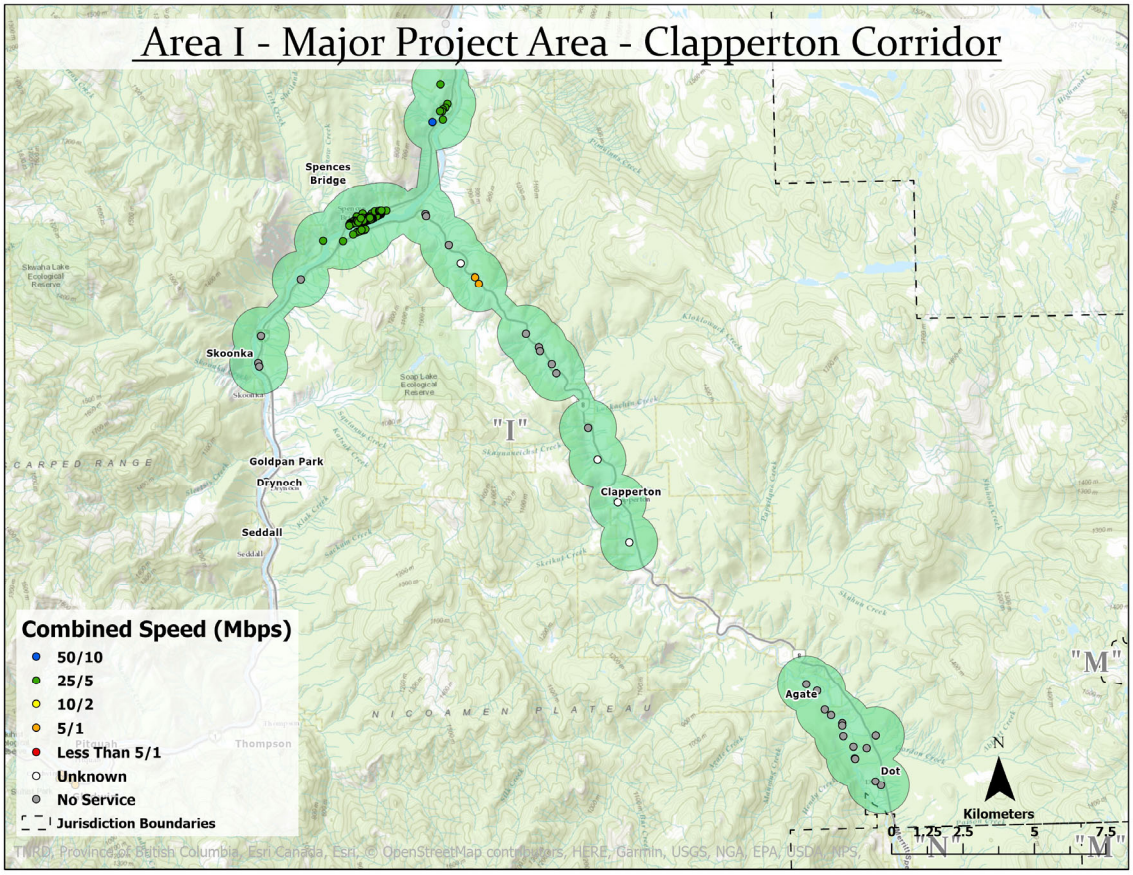

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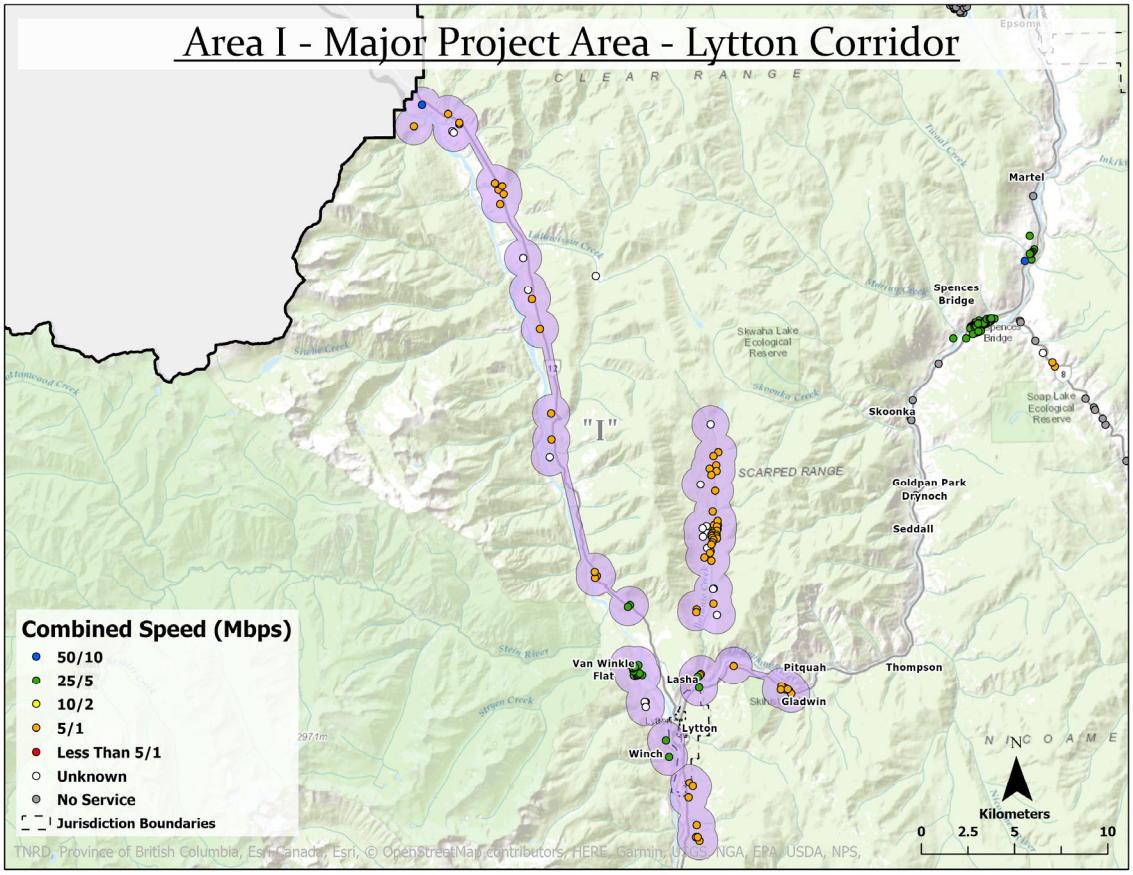

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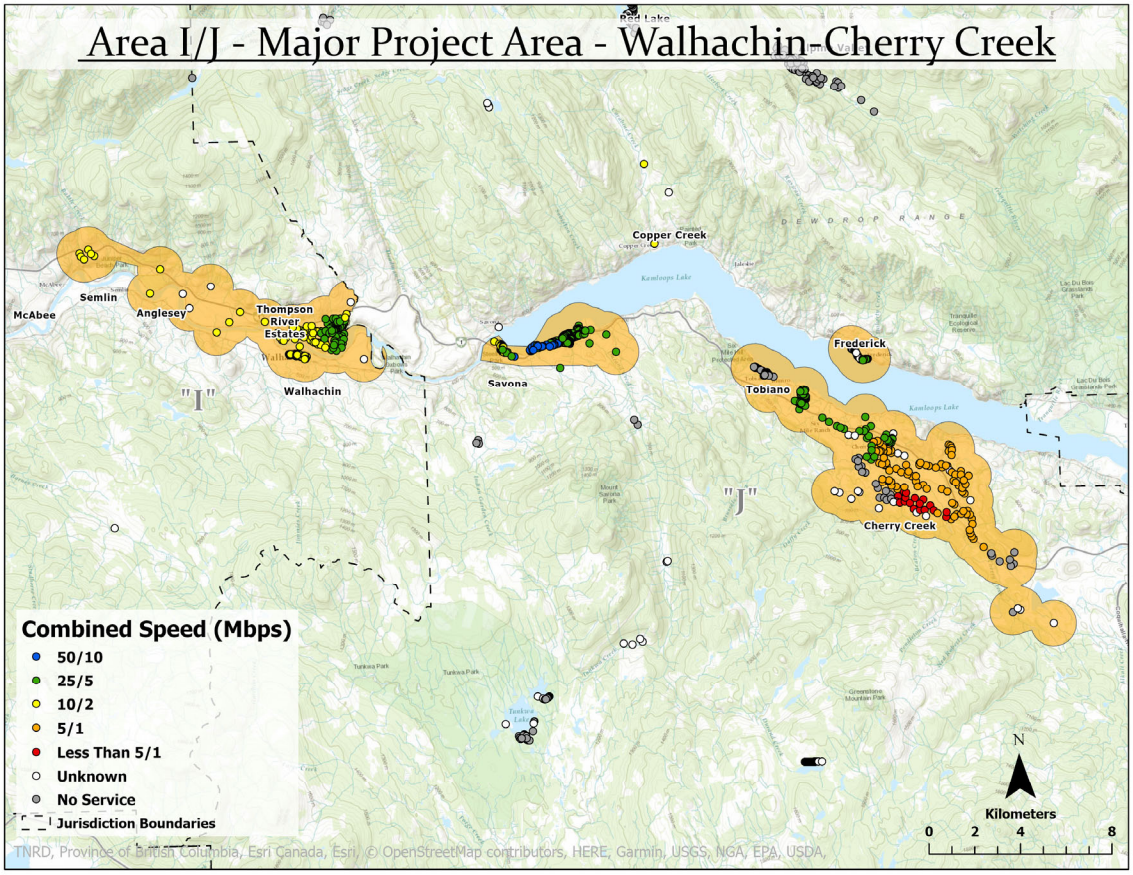

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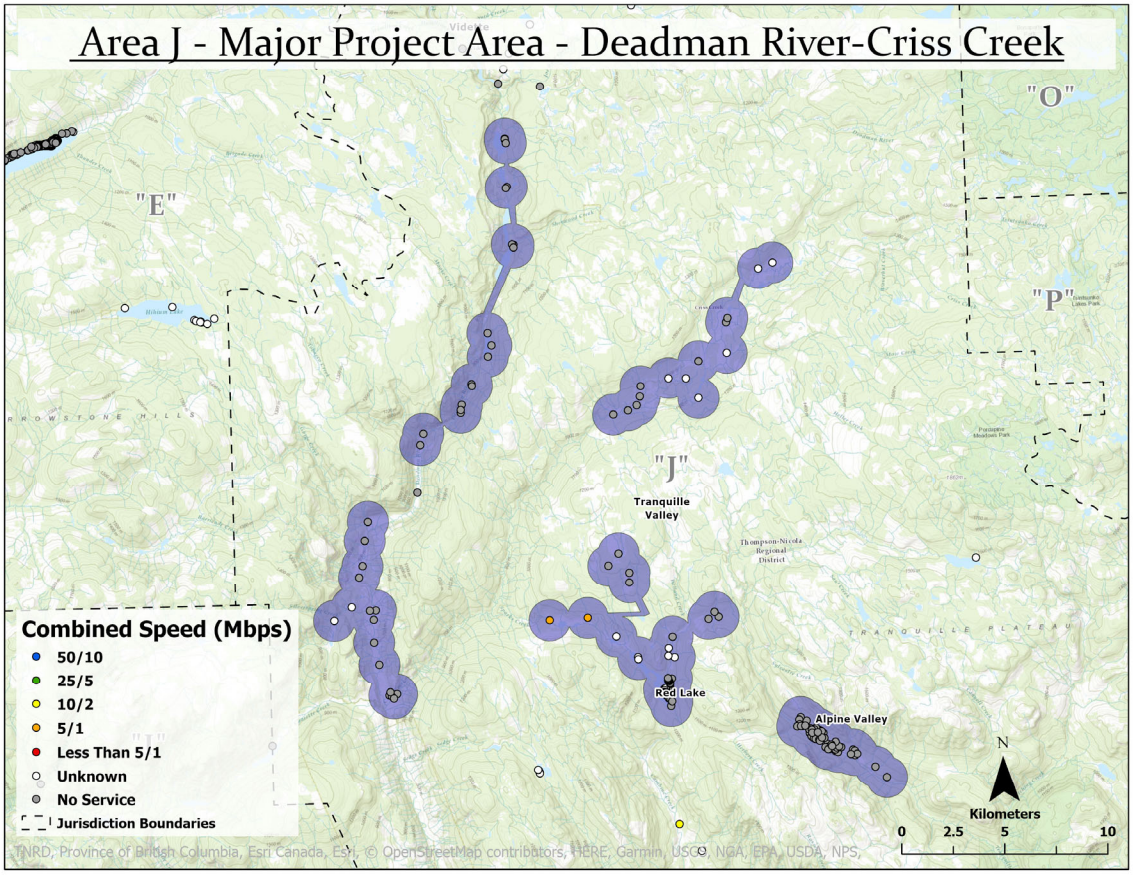

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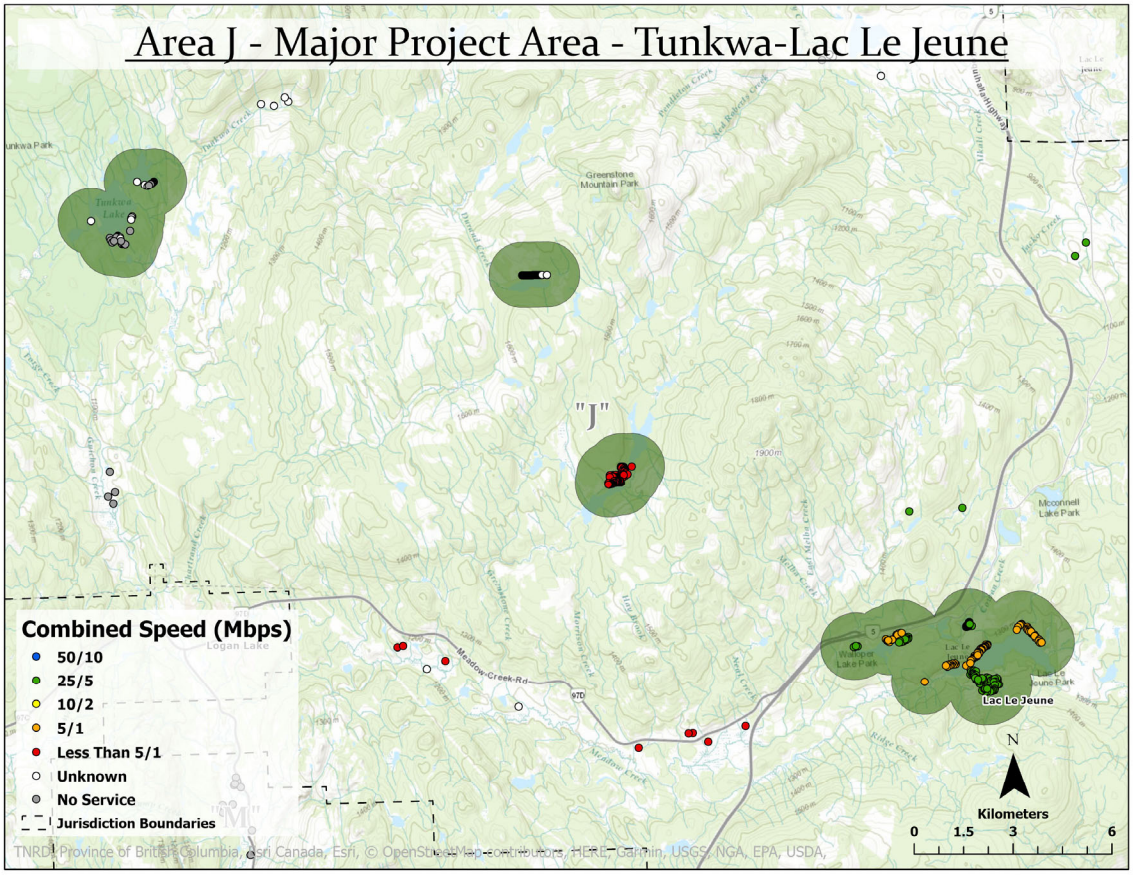

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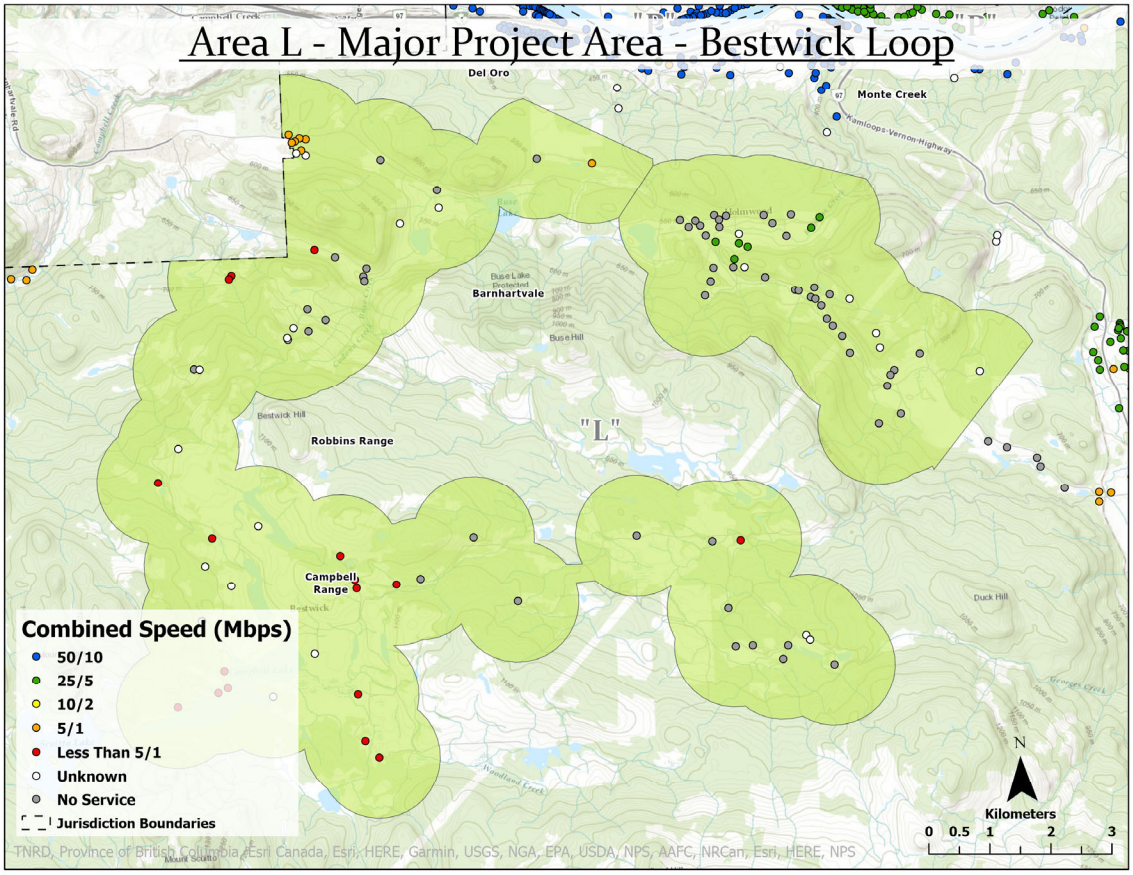

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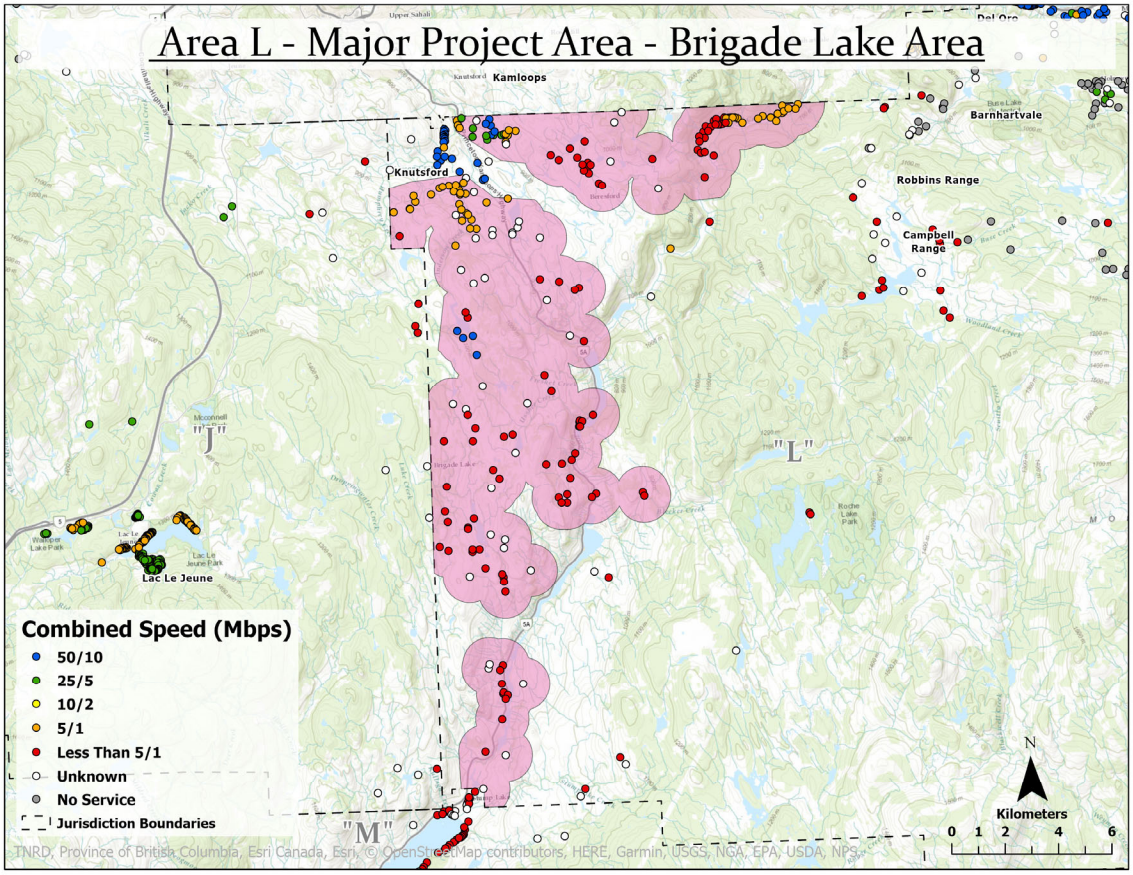

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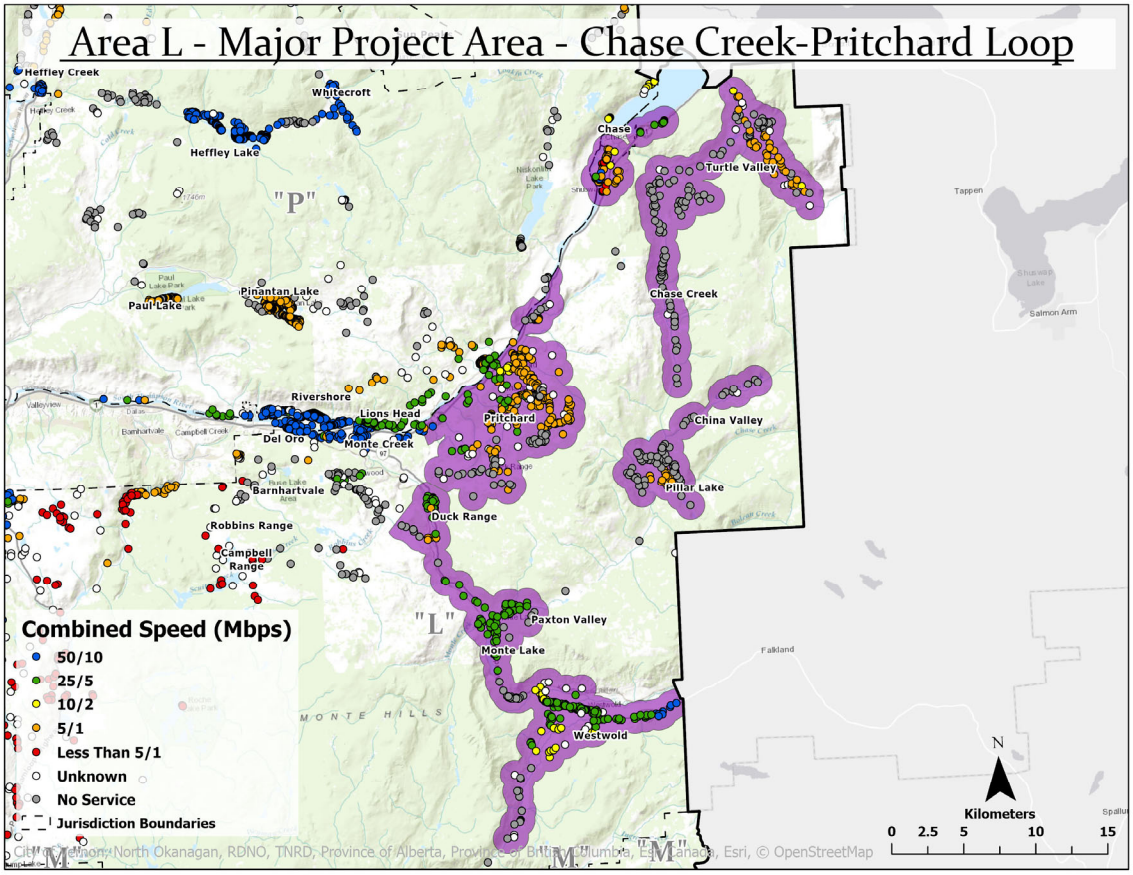

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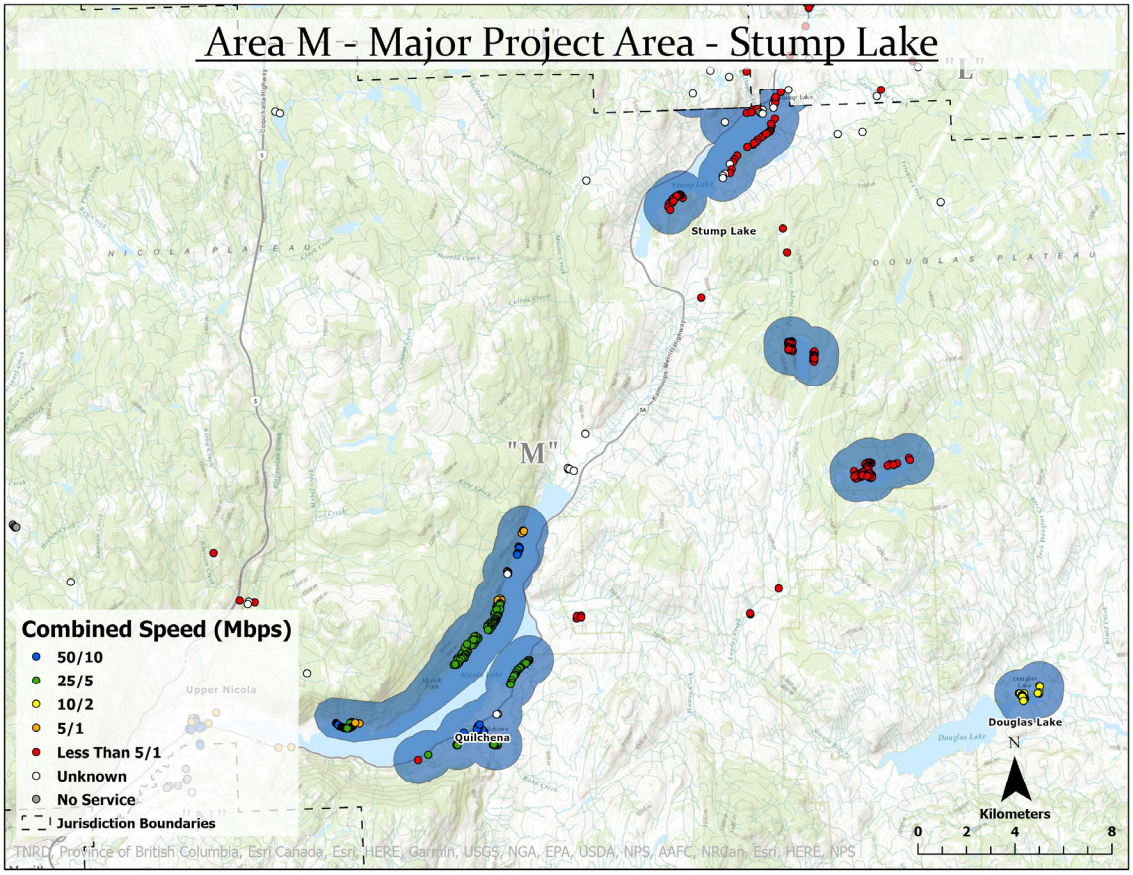

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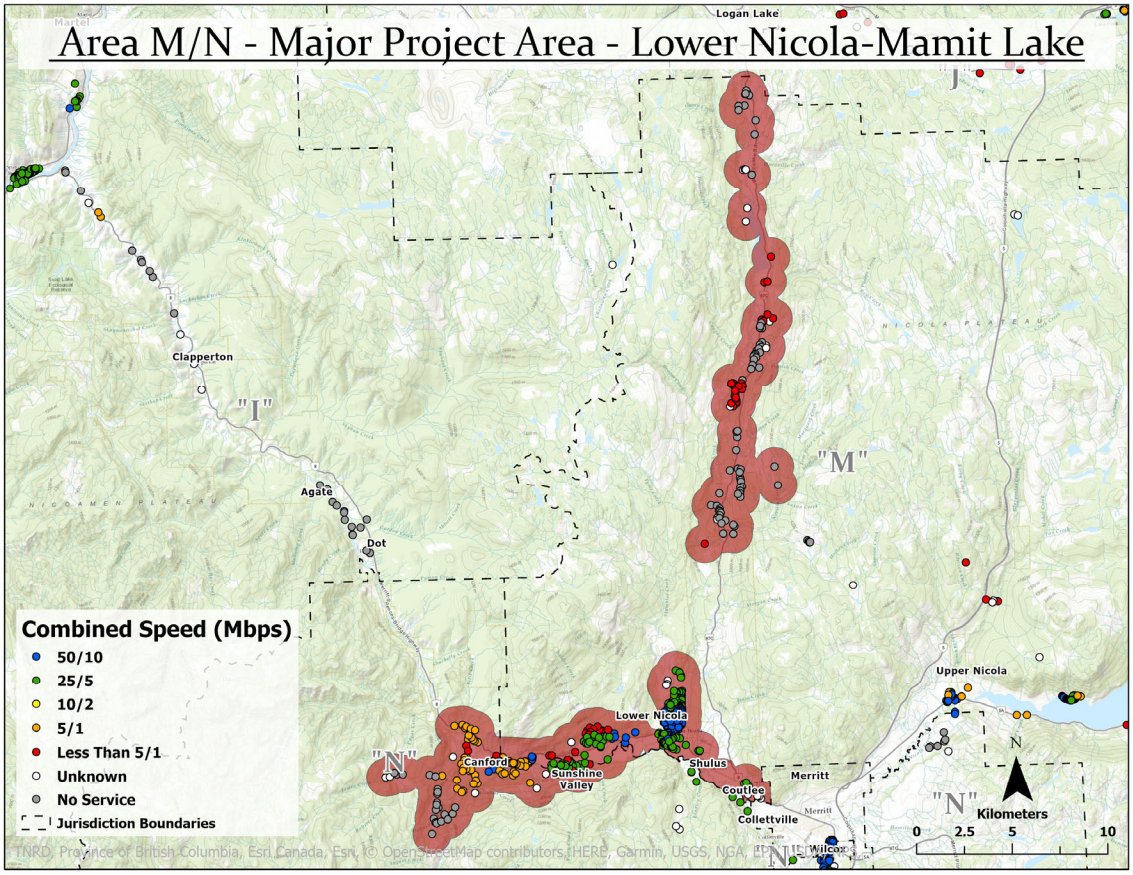

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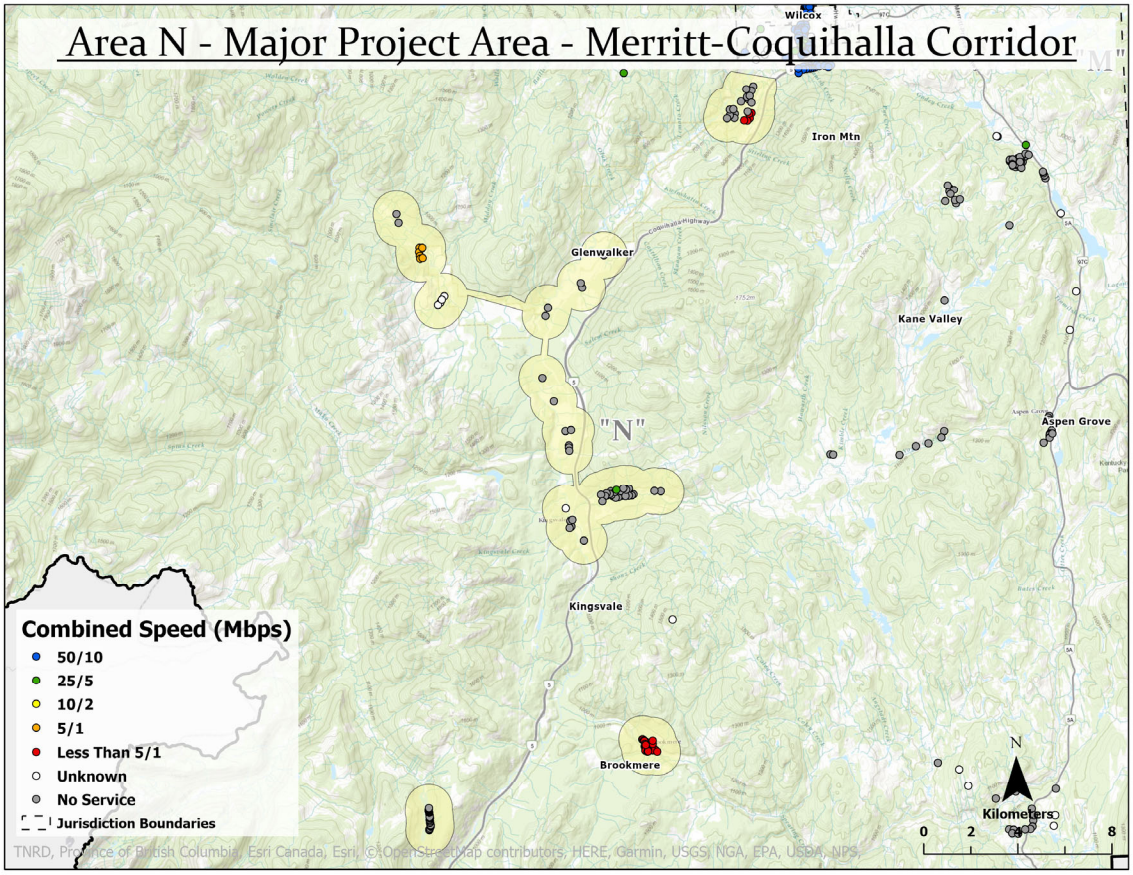

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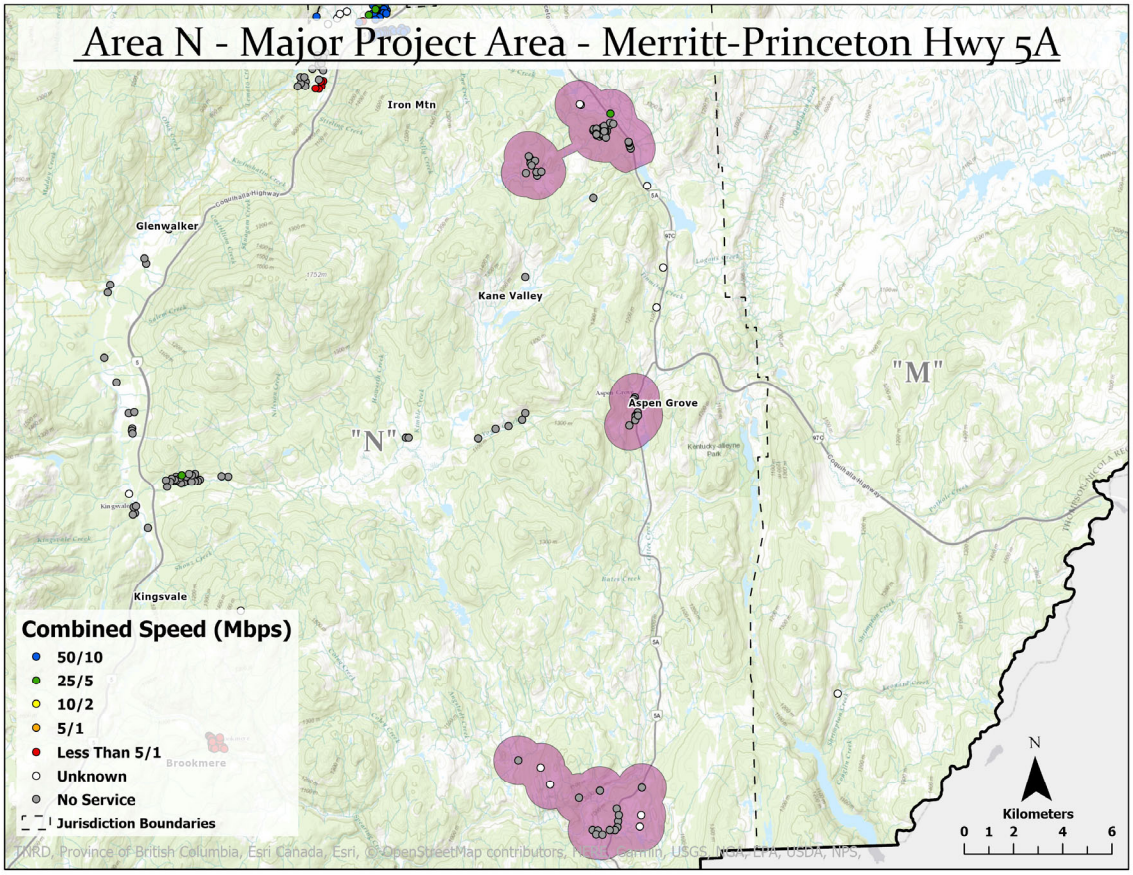

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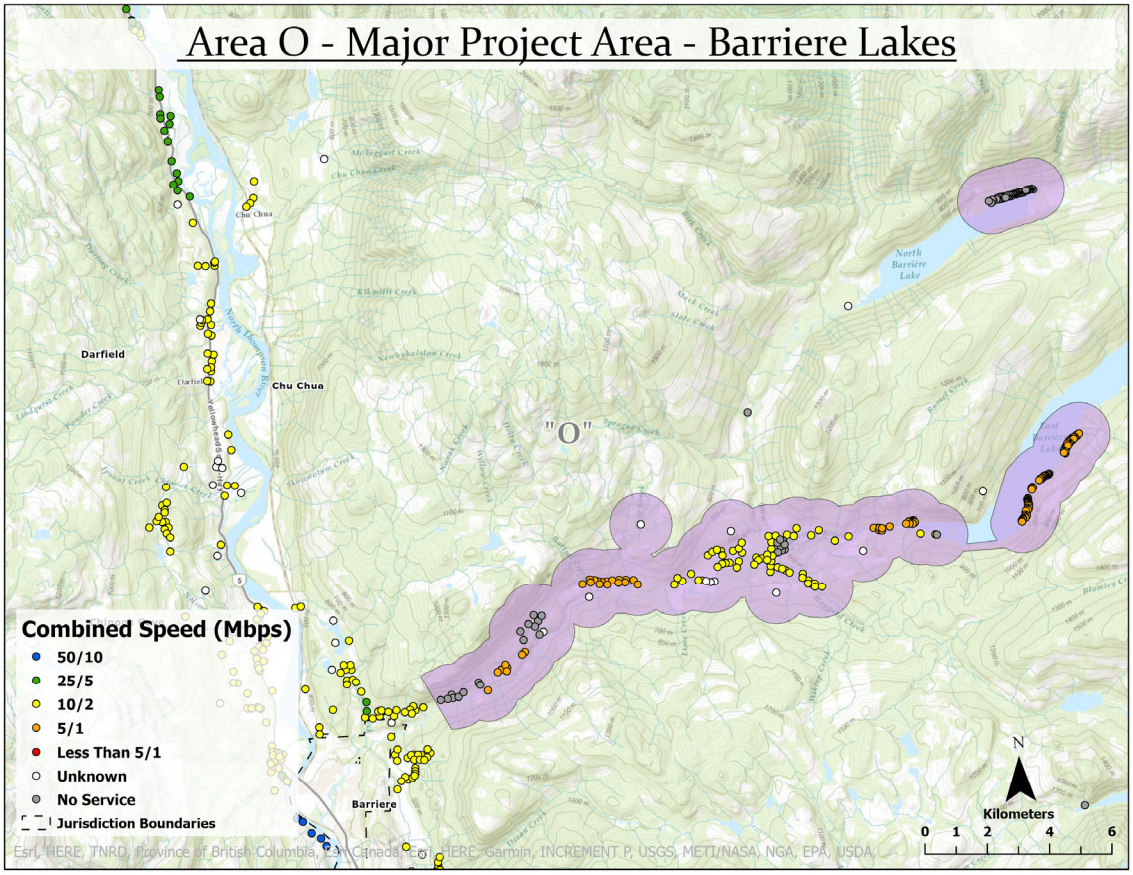

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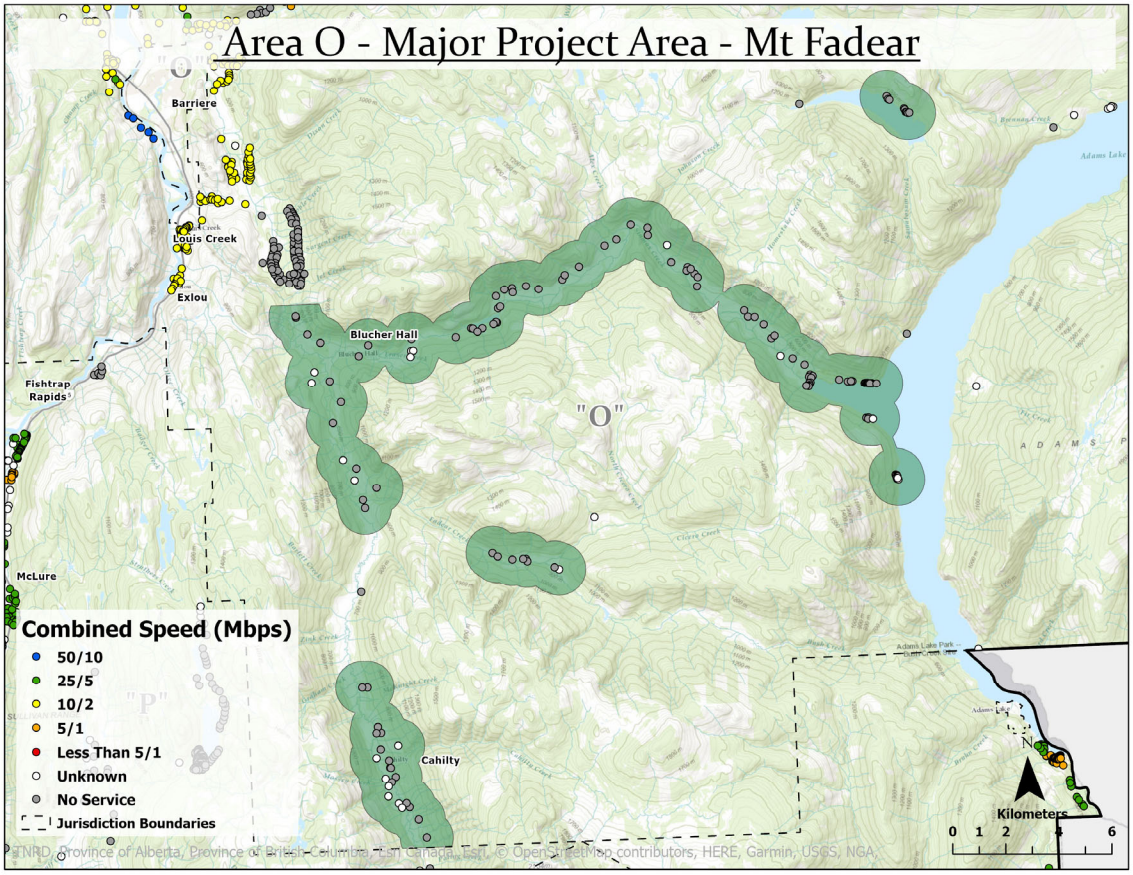

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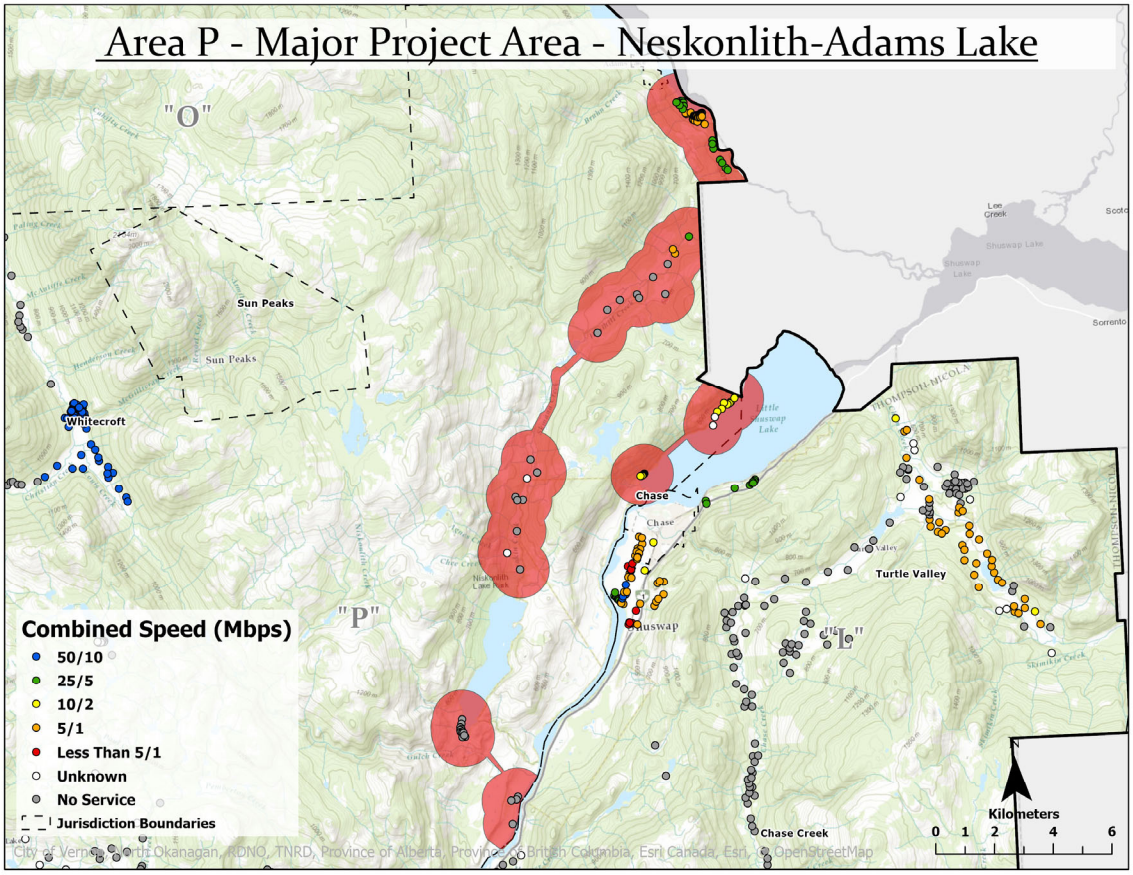

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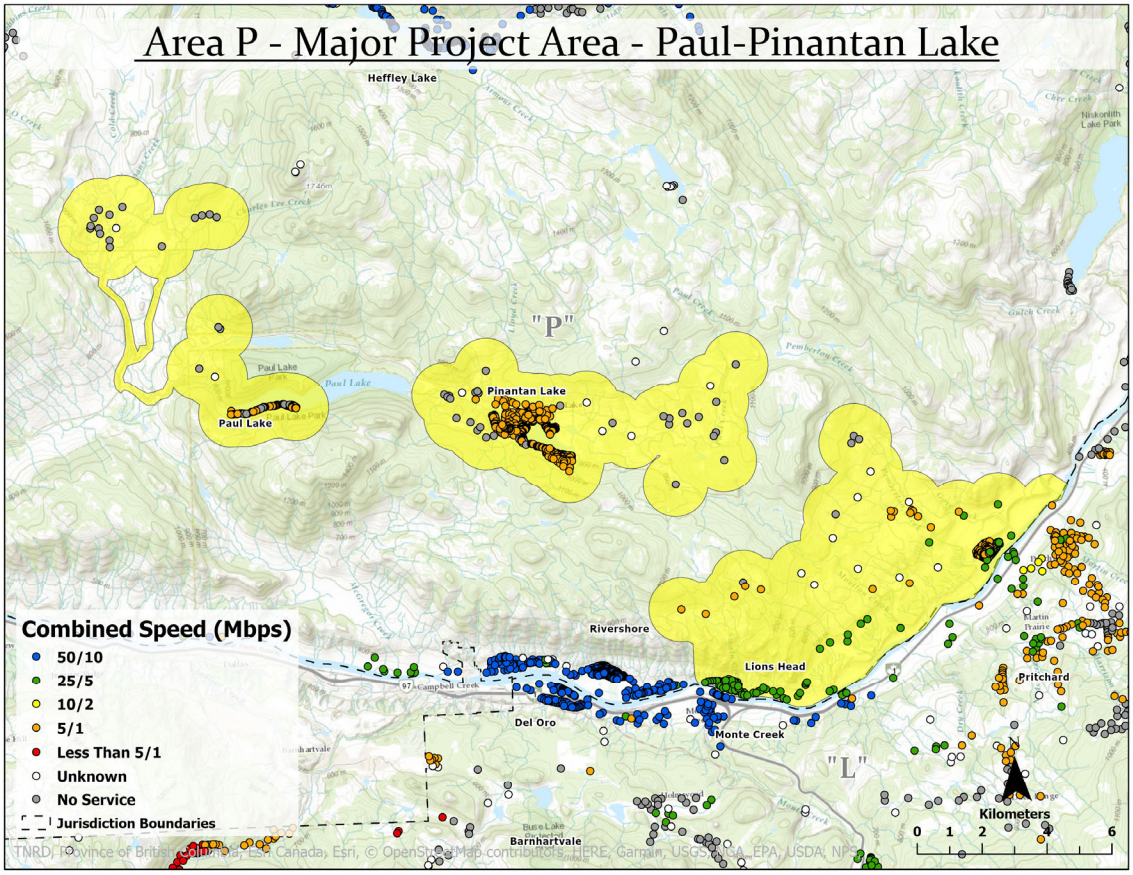

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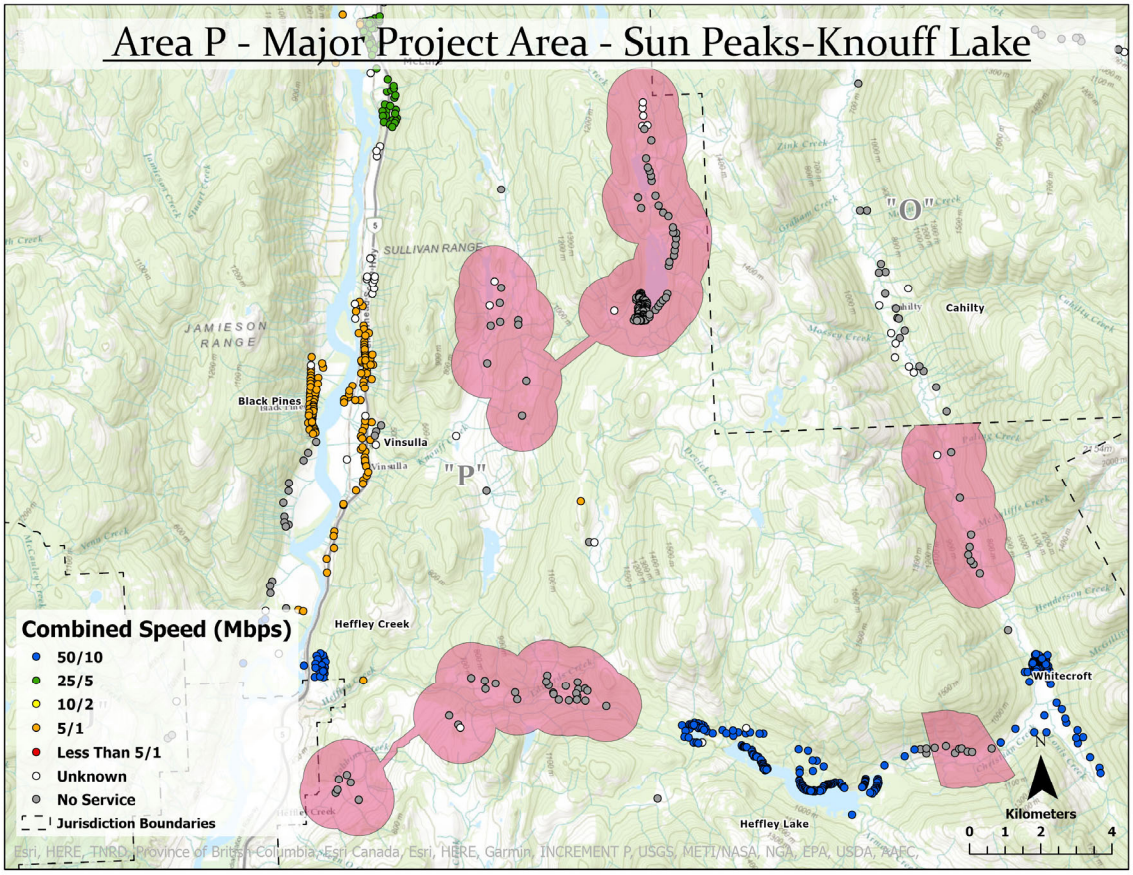

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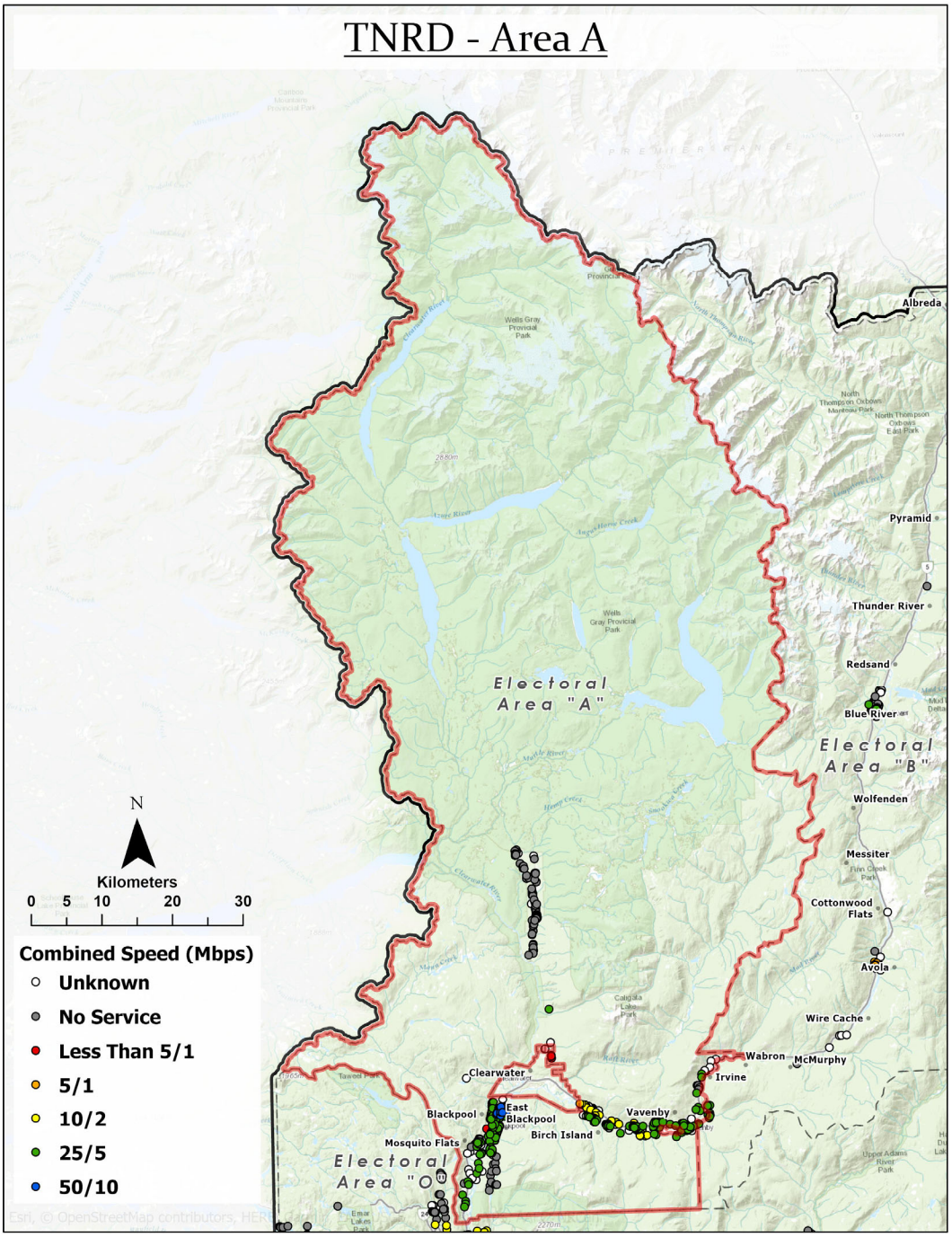
Electoral Area Points by Speed



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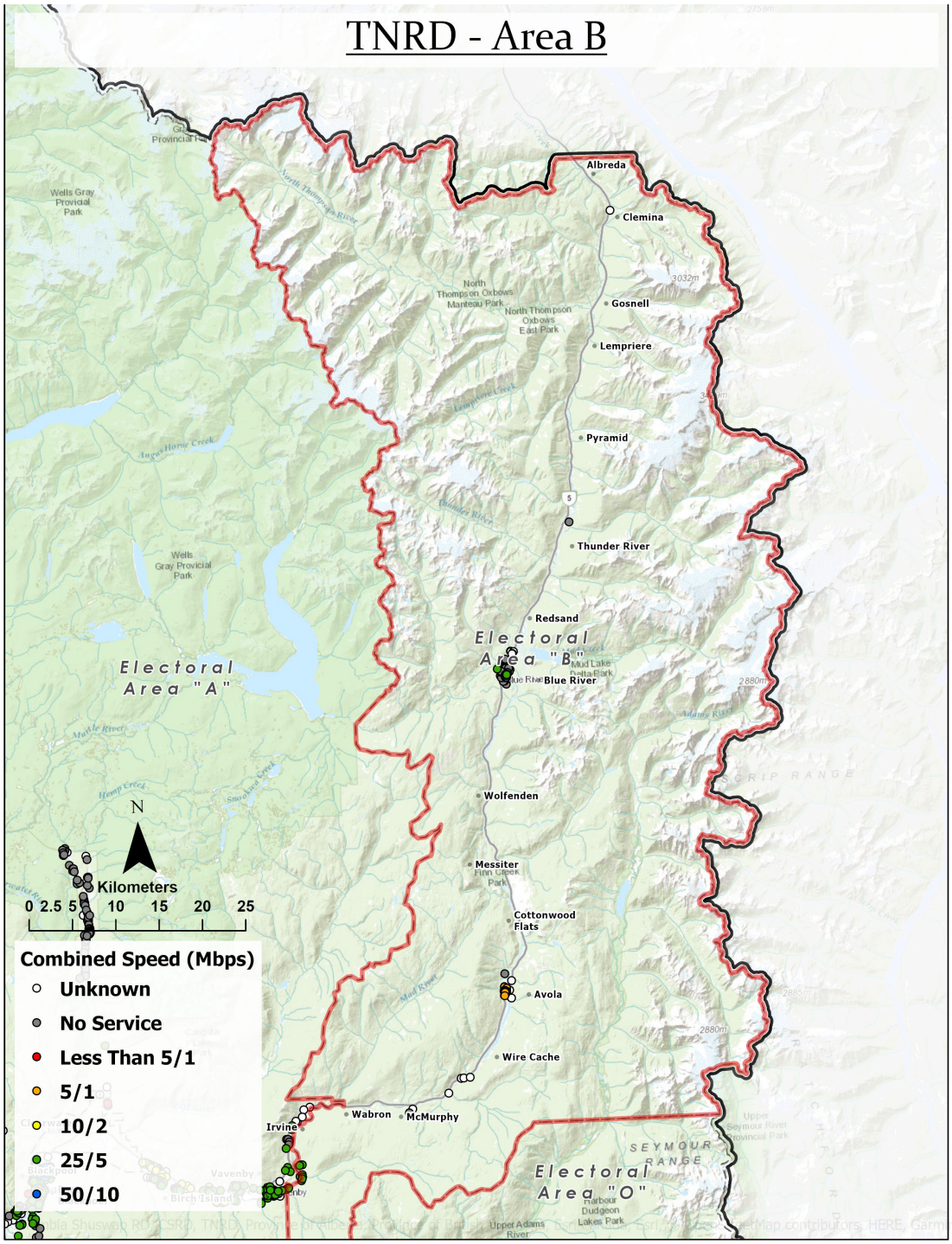

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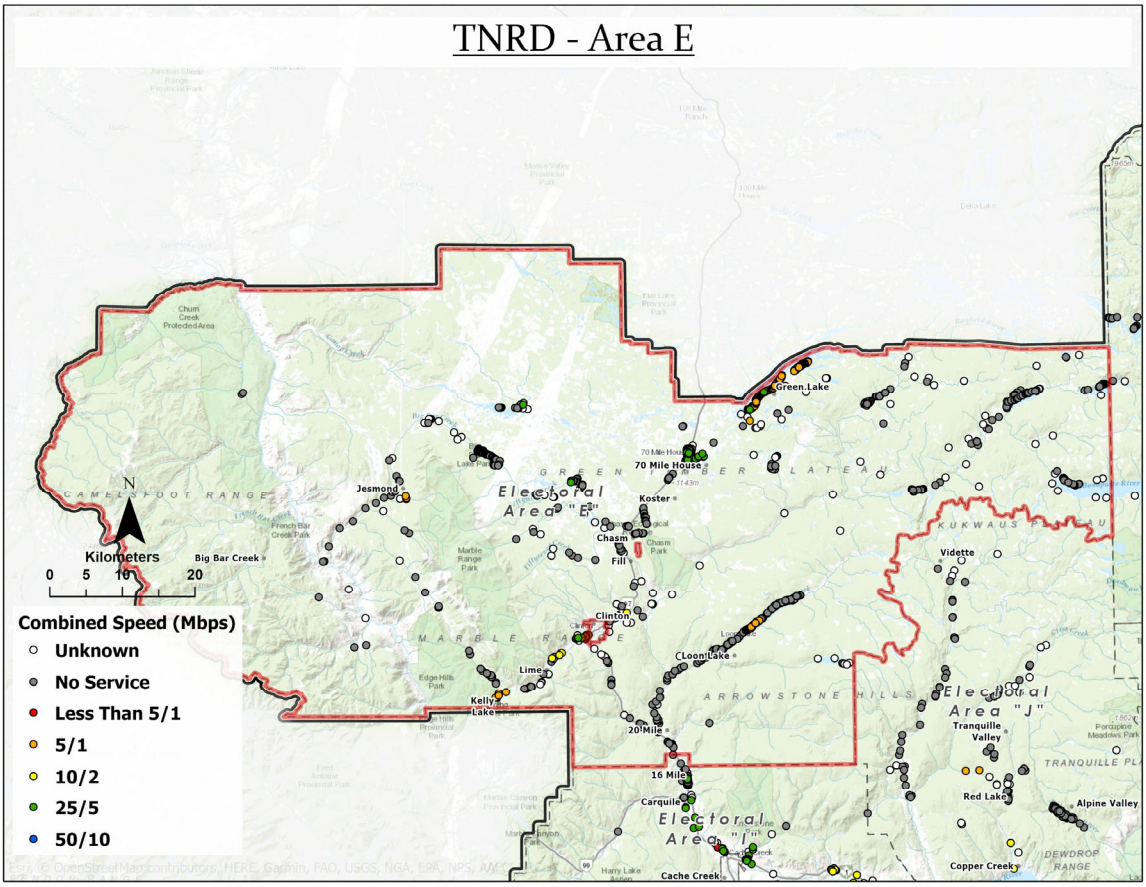

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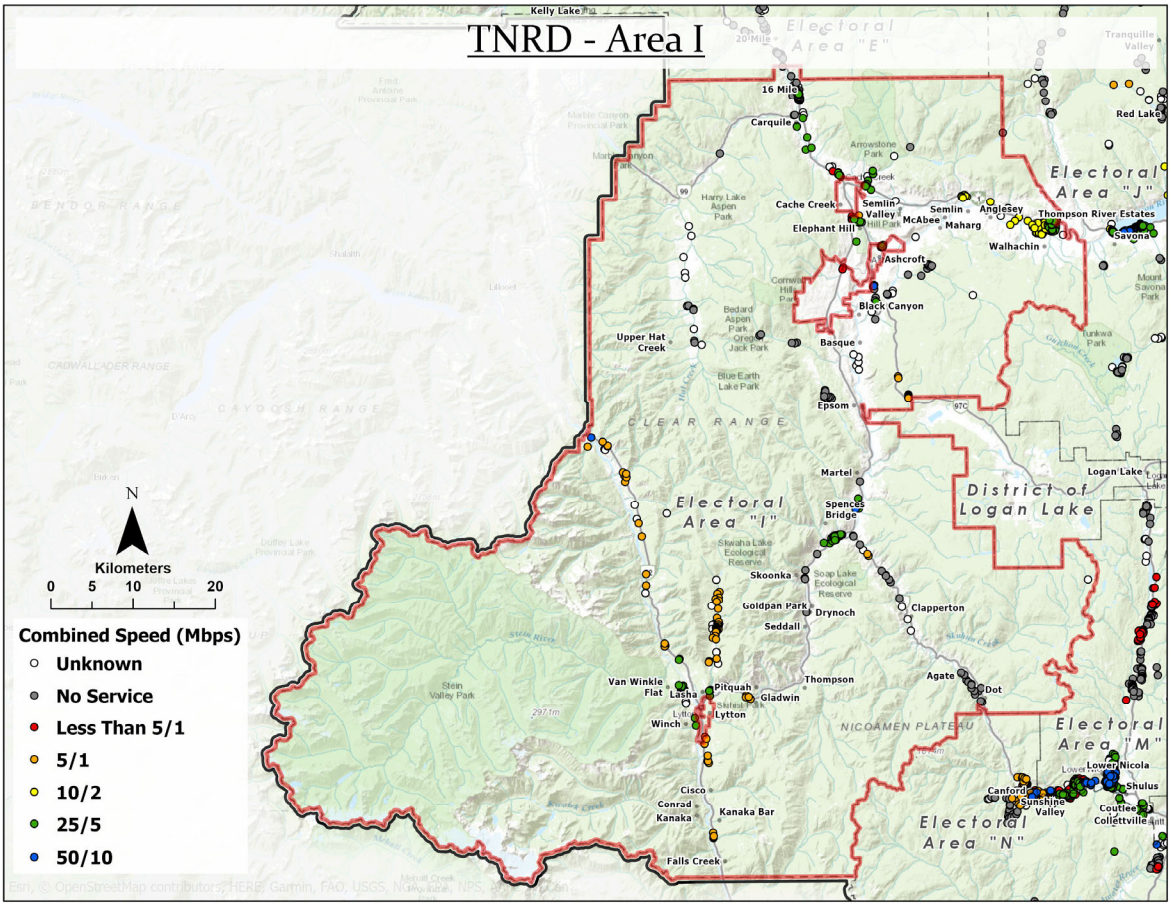

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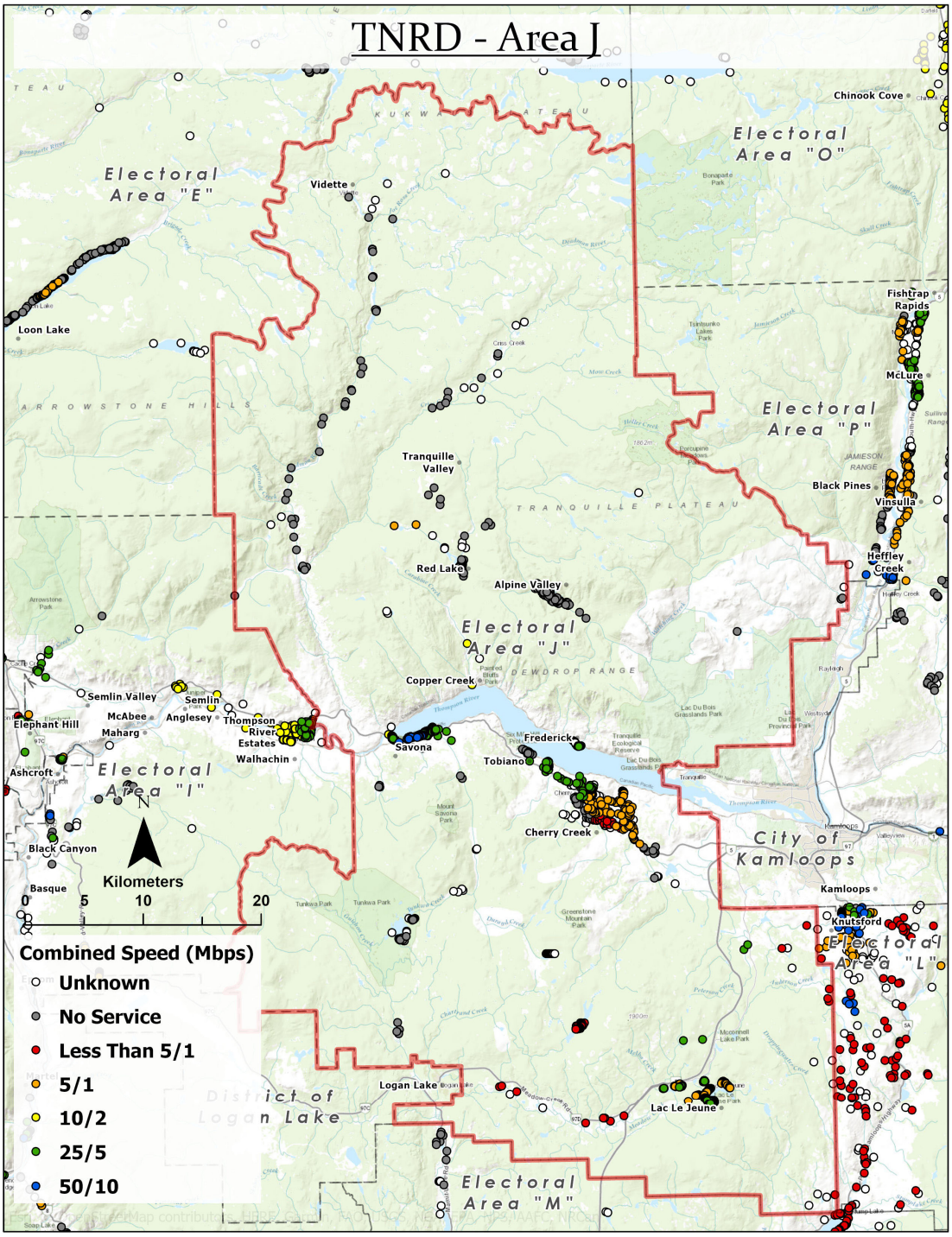

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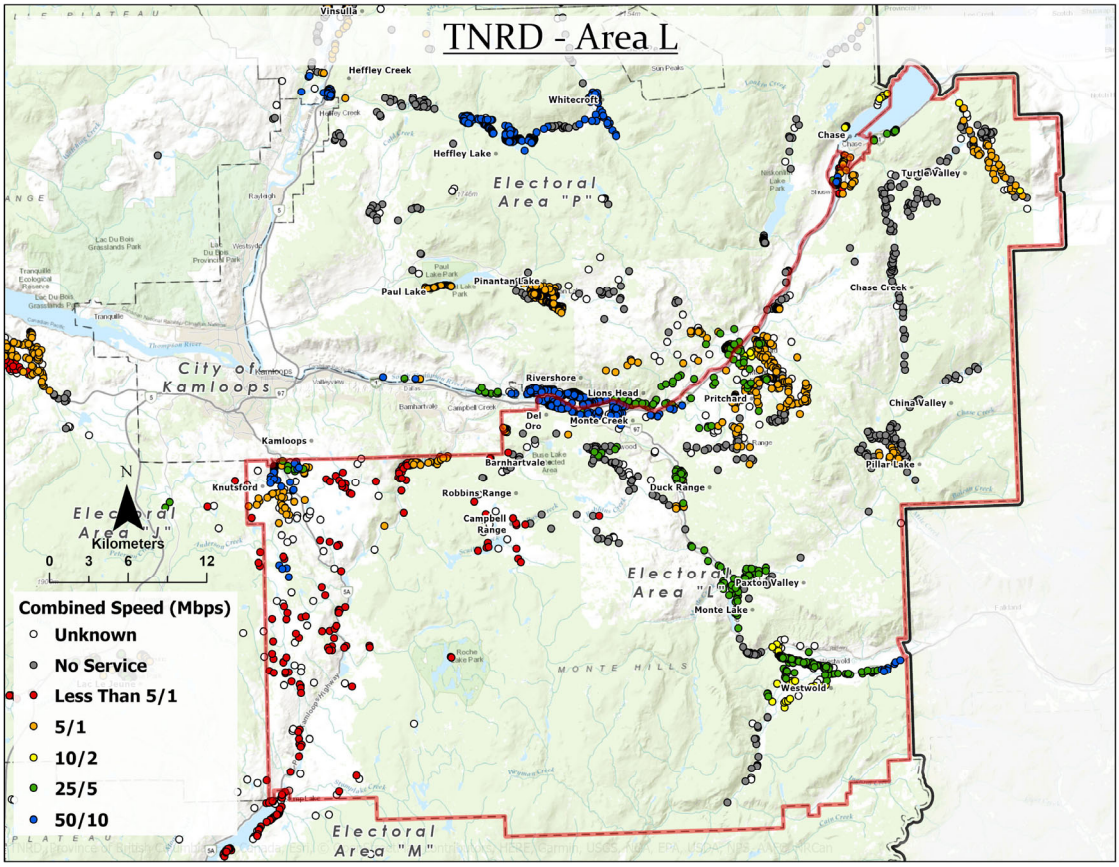

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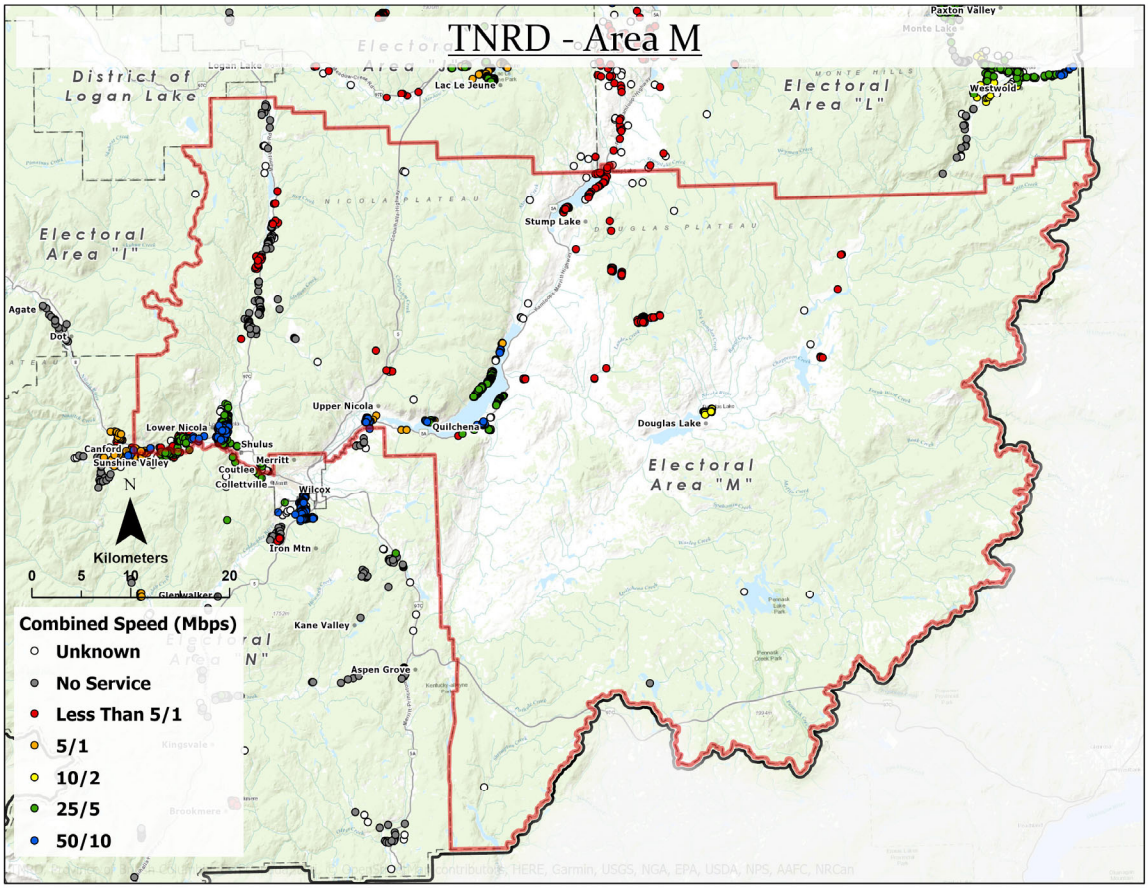

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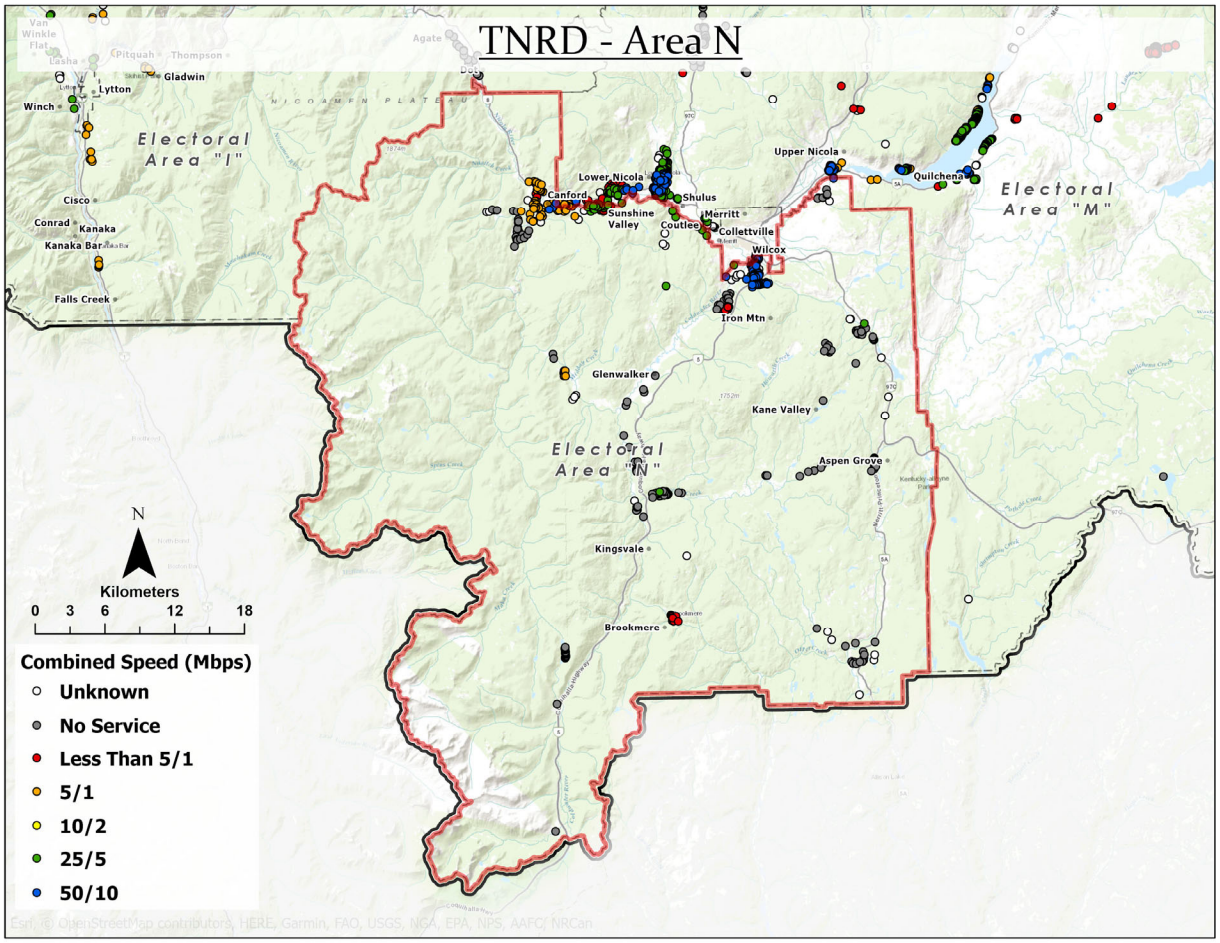

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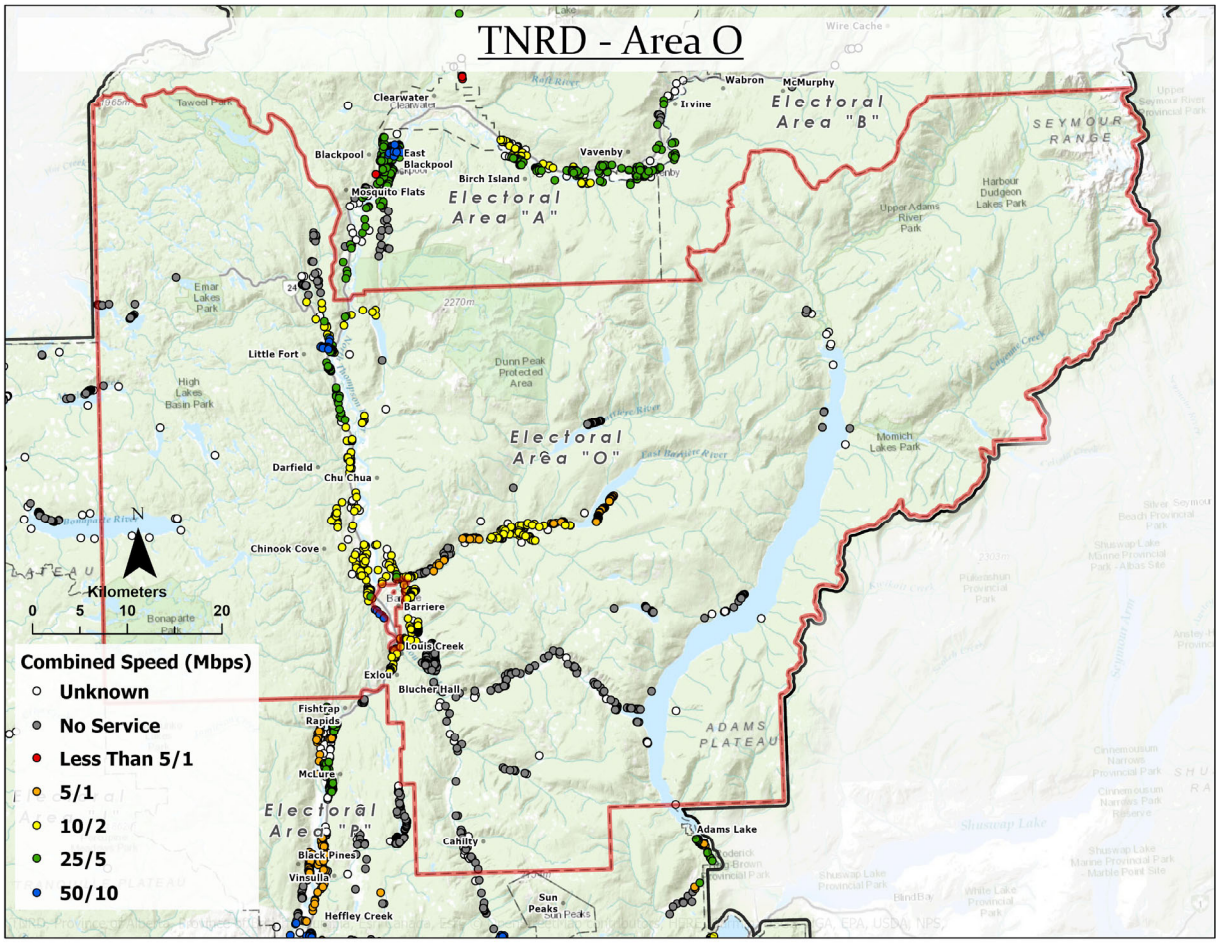

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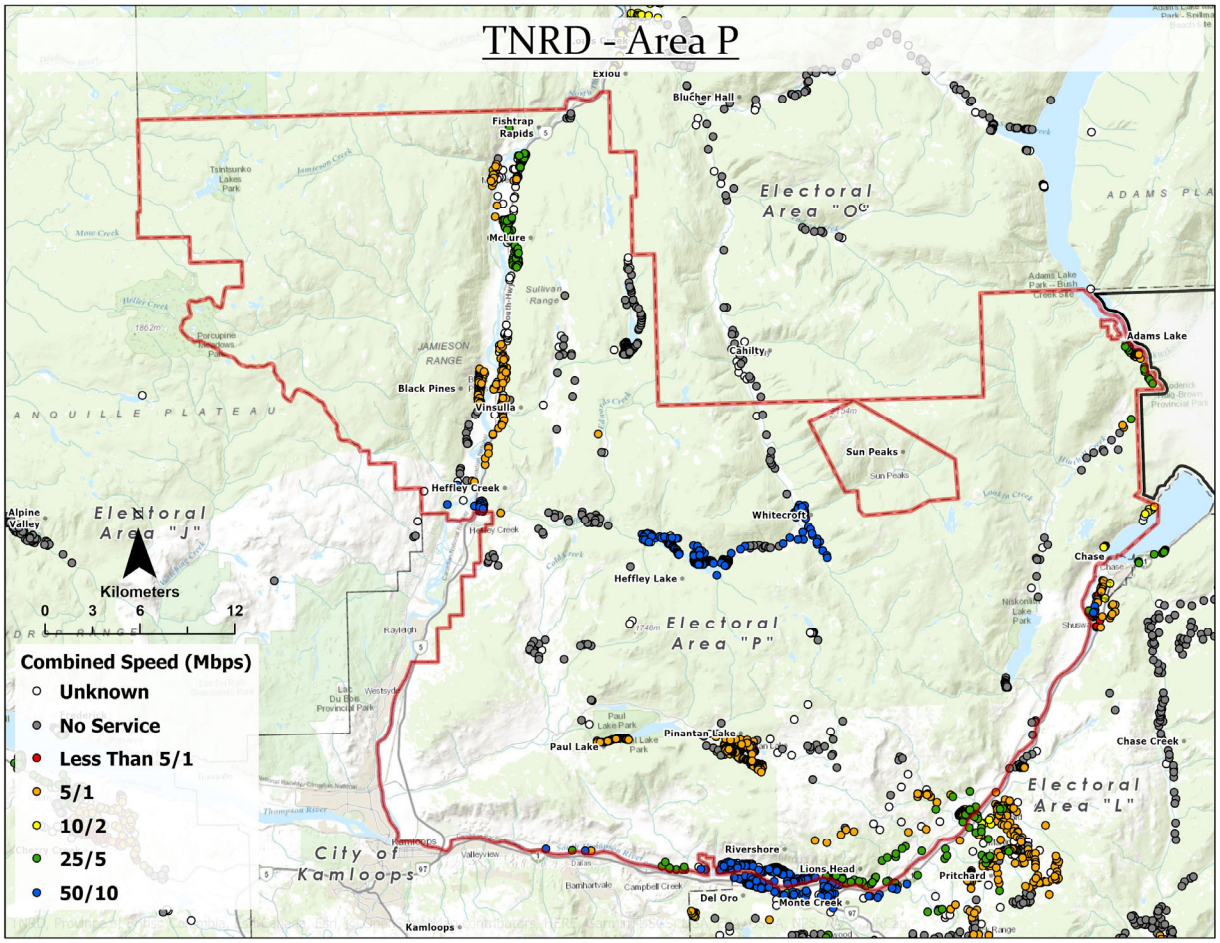
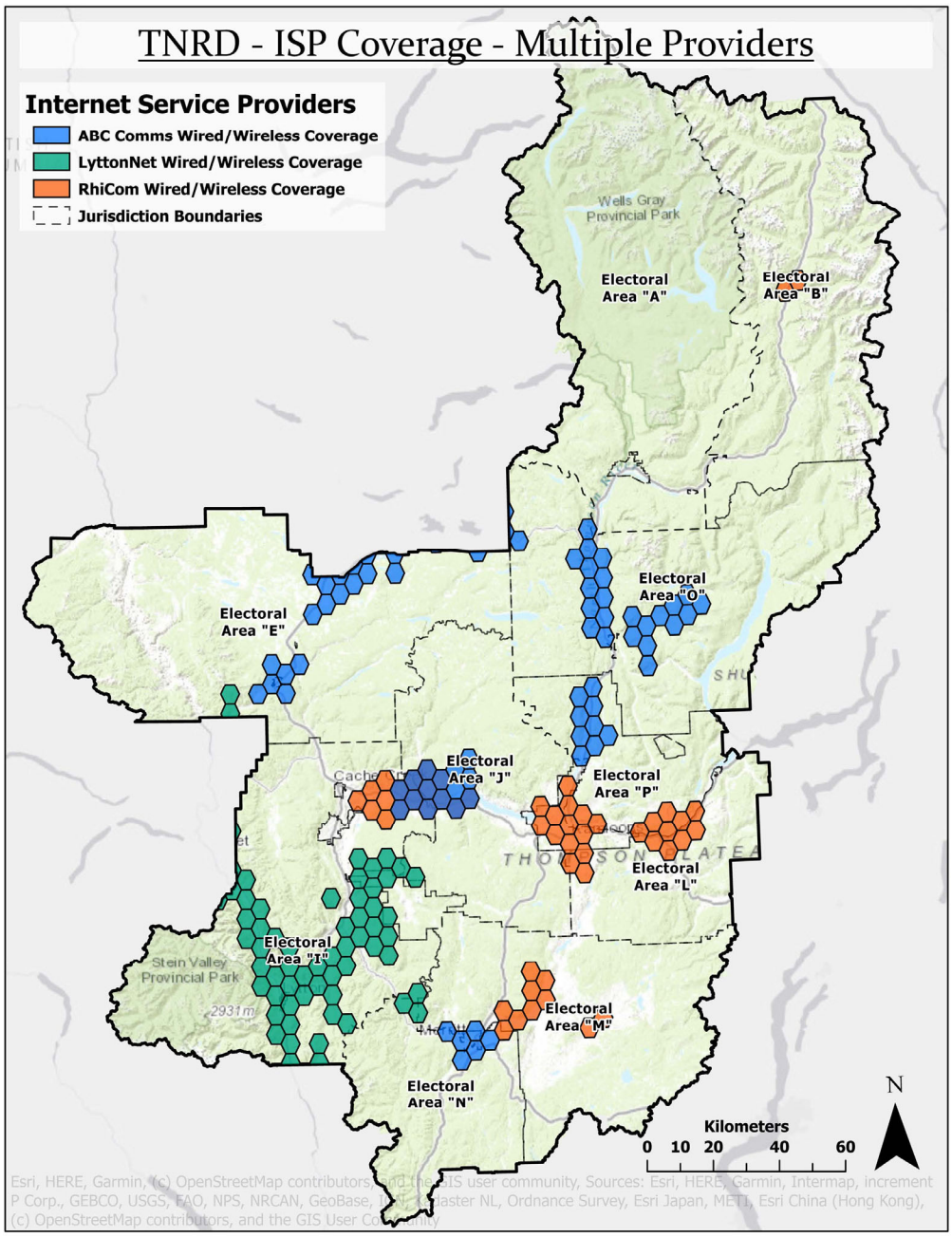


Appendix C – Service Provider Service Areas

These maps show the areas served by each of the service providers in the TNRD.



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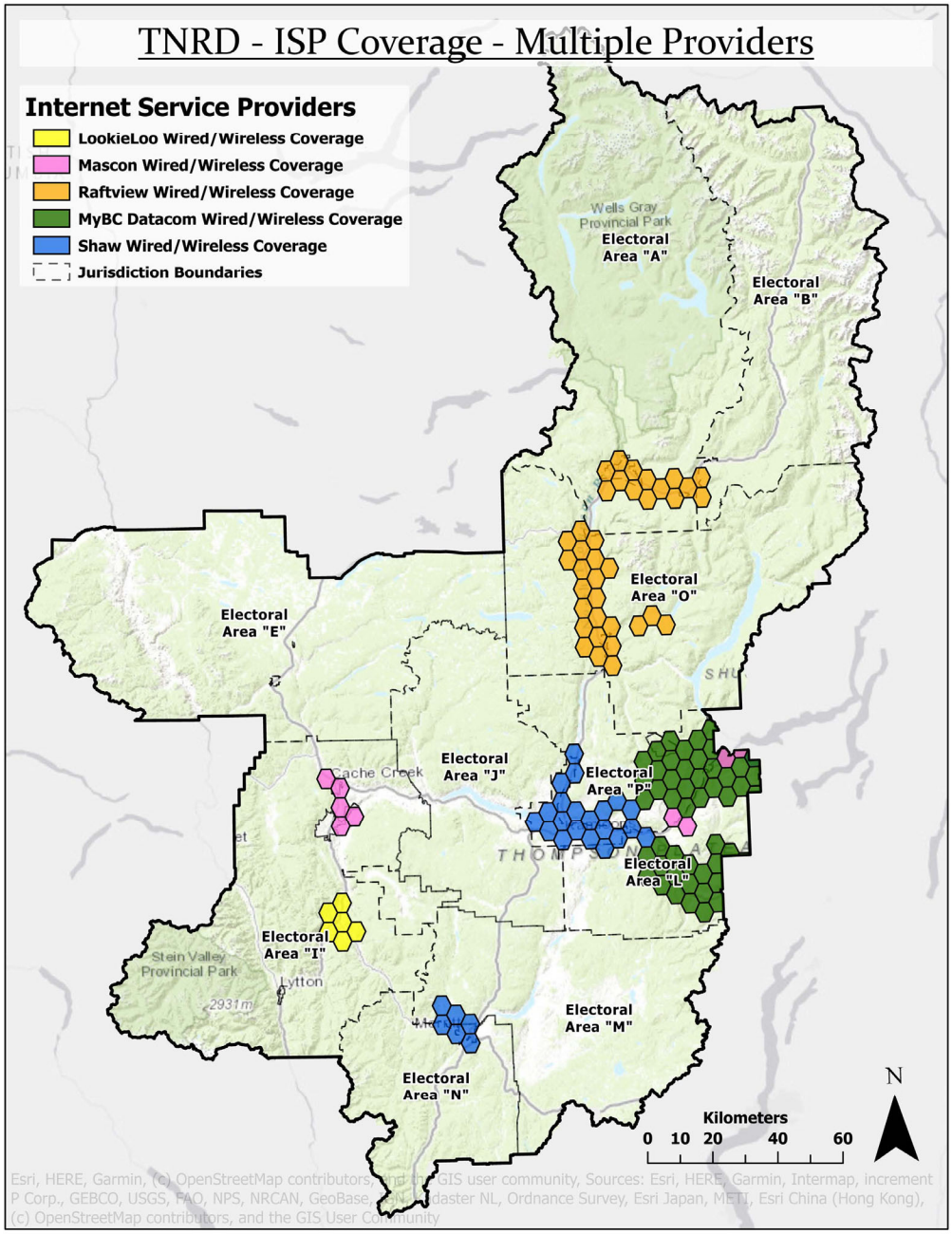

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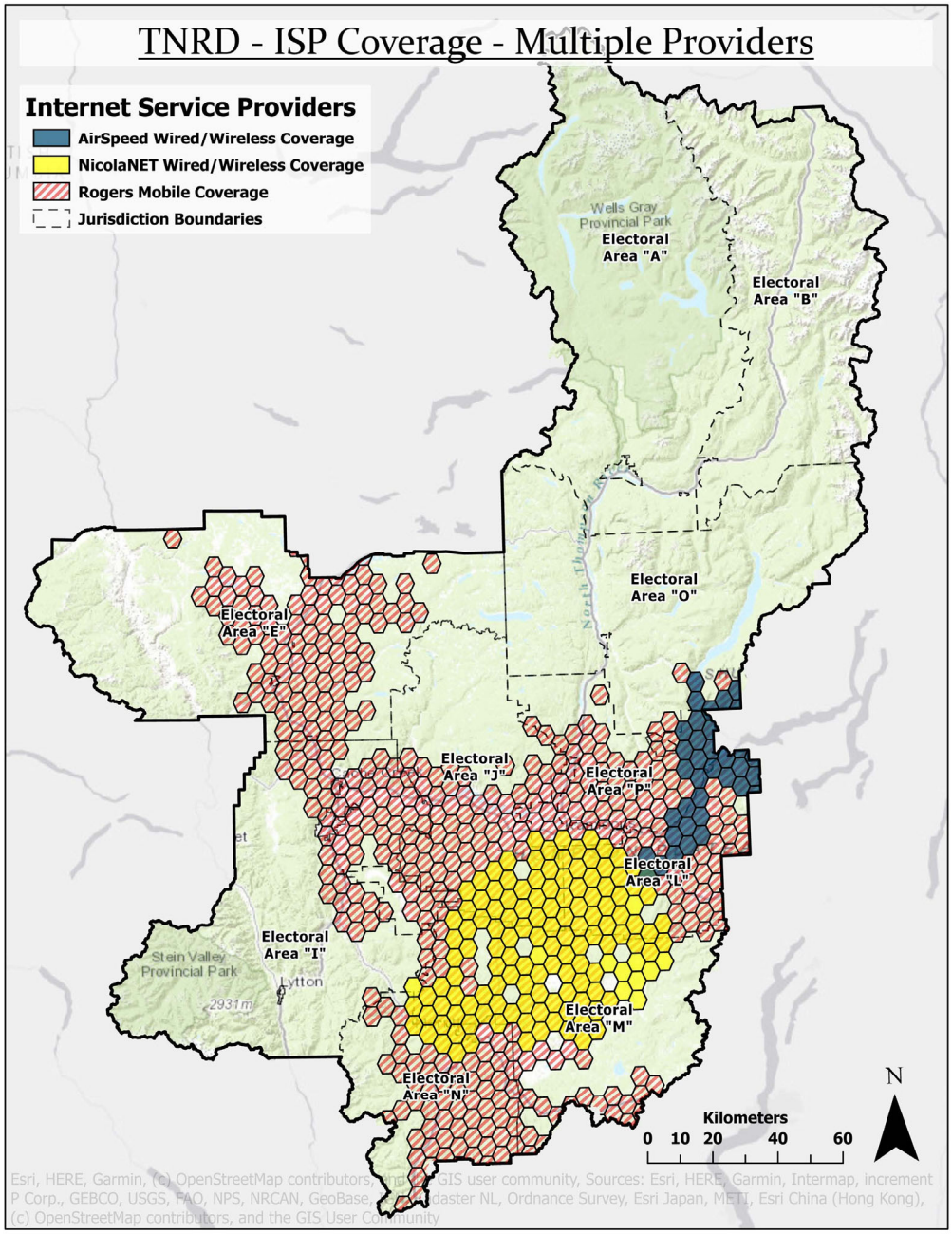

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Appendix D – Technology Overview

Technology Alternatives

In terms of technology, the primary obstacle for rural broadband is cost. Depending on the most suitable technology, the primary cost consideration may be associated with either the backbone or local access networks. A wide range of options are available and broadband services can be provided through a variety of technologies each with advantage and disadvantages. These technologies trade off high capital and operating costs with capacity, scalability and the ability to support the desired applications. The choice of technology needs to be assessed against the requirements for the particular situation and the cost of providing the services. While some technologies represent higher capital costs, the life expectancy may be factored over a long period of time (ie. 20 – 30 years) so capital costs need to be amortized over the lifetime of the asset when comparing technologies. This section of the document is a high-level introduction to these technologies.

Alternative technologies used to connect locations together are outlined below. Technology choice is dictated by the needs and circumstances of the service area. The challenge is to select technologies and configure them into systems that meet those requirements while minimizing life cycle cost.

As summarized above, **backbone or transport infrastructure** is the technology used to transmit and receive data over long distance to connect towns, cities, provinces and countries. Fibre optic cable (optical fibre), microwave radio, and satellite are the three principal transmission medias but fibre is, by far, the most desirable with very high scalable capacity, long life cycle and low operating cost. The challenge with fibre is the high initial cost and as such high capacity terrestrial microwave radio solutions, or even satellite, may be considered depending on the requirements.

Local access networks connect users to the backbone network in order to reach distant locations and applications. In broadband, the term applications, refers the services that people (subscribers) use including things such as the internet, video streaming or broadcast, voice communications, email, access to business services such as Microsoft Office 365, security services, business to business communications. These applications require high capacity, reliable connectivity.

Fibre to the Premise (FTTP, FTTH, FTTx) is the gold standard for broadband service to fixed locations such as homes, businesses and institutions, providing very high capacity, reliability and support for almost any application. As with backbone fibre, FTTP can be expensive to deploy as it requires a physical cable (or optical strand) to be connected from a local POP to every subscriber location.

Like fibre, **coaxial cable** service (typically used for Cable TV broadcast) and **Digital Subscriber Line (DSL)** service (over phone lines), share the requirement of installation of a physical cable from a local POP to the subscriber's premises. These technologies would typically be deployed in locations where this cable infrastructure already exists, thus avoiding the cost of construction. It would now be considered uncommon for a provider to construct new DSL or coaxial cable infrastructure rather than a fibre deployment. While coaxial cable can deliver capacity meeting, and exceeding, the CRTC Service Objective, DSL technology is limited in its ability to scale to these capacities. That said, neither technology can approach the capacity of fibre

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and as such, will likely not scale to meet the capacity requirements in the long term. Coaxial cable is also a shared technology as described below in Fixed Wireless.

The alternative to wired technology like optical fibre, coaxial cable or DSL is a radio-based "wireless" technology. **Fixed wireless** technology and unlicensed radio spectrum has been used as a low cost means of kick-starting internet service in low density rural markets. Fixed wireless is considered to be infrastructure that is fixed to a specific location, unlike technology used for mobile wireless described later. While no physical connection is required between the local POP and the subscriber's premises, high capacity wireless services typically requires "line of sight" to deliver reliable, high speed services. Any obstructions, including buildings, trees, or hills impair the signal resulting in no or poor service. Wireless technology, like coaxial cable, is a shared technology meaning that all subscribers using the wireless network are "sharing" the available capacity. The more subscribers using the service at one time, the less capacity each gets. The requirements to scale wireless service to high numbers of subscribers and capacities must be considered during the deployment of the network.

Cellular mobile technology, a variation of wireless, has become the de facto standard for voice and internet service direct to individual mobile devices. The data communication capability of current 4G (4th generation or LTE for Long-Term Evolution) cellular systems make this a viable broadband technology in appropriate circumstances. The emergence of 5G (5th generation) cellular over the next 5 to 10 years is expected to reinforce this trend (see emerging technologies below). While 5G technology is promising, it will require heavy investment in fibre to connect the local, high density of antennas to the backbone and ultimately globally provided services.

Finally, to reach isolated premises that are beyond terrestrial transport networks, fixed, or mobile wireless, direct to home **satellite** is the only viable choice. Xplornet's geostationary earth orbit satellite service is available across the region. Unfortunately, it suffers from high latency (the time it takes to send or receive information) resulting in some applications not functioning optimally and speeds can slow during periods of high usage. **Low earth orbit (LEO)** technology is emerging. The first to market with a direct to consumer play is Starlink. Starlink is currently (2021-02-19) in paid beta testing in northern US and southern Canada. As the satellite constellation fills in with more launches over the next few months to maintain continuous service, the service will become commercial. Beta test results support Starlink claims of 50 to 150 Mbps downlink speeds and 10 to 30 Mbps uplink speeds with round trip delay in the 20 to 40 ms range. Other broadband LEO systems are planned, but service is at least one or two years out and these may not be consumer service plays.

The following summarizes the key characteristics, advantages and disadvantages of the technologies used for broadband service delivery.

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Backbone and Local Access Technologies

Fibre optic cable - Backbone & Local Access

Extremely high capacity that is scalable for backbone / transport and local access. 10 Gbps already very common and 100 Gbps emerging.
[+] Long life cycle: 20 - 30+ years. Cost can be amortized over a long period of time.
[+] Low operating cost.
[+] High capacity, low latency, high subscriber counts.
[+] Very reliable.
[+] Very scalable. Upgrades to high capacity for relatively low cost.
[+] Supports a wide variety of applications.
[-] High initial (capital) cost.
[-] Acquiring right of way permits can be challenging
[-] Accessing existing underground and aerial infrastructure can be time consuming and expensive.
[-] Repair time can be long when cables break impacting network if redundant routes are not available.
[-] Not cost effective where low long-term capacity needs and long distances.
[-] Fixed to a specific location.

High capacity microwave - Backbone

High capacity microwave provides capacity up to approximately 1Gbps.
[+] Long hop distance is possible under optimal conditions (30 - 50 km). Higher distances may require multiple hops.
[+] Can be engineered for high reliability.
[+] Can be cost effective for one or two hops.
[+] Supports a wide variety of applications.
[-] Issues accessing or permitting to construct towers in some locations.
[-] High initial cost if tall tower required.
[-] High initial and recurring cost if remote tower sites are required.
[-] Can be support and power challenges for remote areas such as accessing mountain tops.
[-] Relatively low capacity: scales from under 100 Mbps to over 1 Gbps.
[-] Appropriate spectrum scarcity an increasing issue.
[-] Fixed to a specific location.

High-throughput satellite (Geostationary) - Backbone & Local Access

Well established technology with a competitive marketplace.
[+] Can be used direct to home (DTH).
[+] Cost does not vary with distance within the coverage footprint.
[+] Good capacity.
[+] Relatively low initial capital costs.
[-] High cost for usage (bytes per month).
[-] Can be susceptible to service impacts with severe weather.
[-] Larger antenna sizes needed at high latitude sites.
[-] Fixed to a specific location.
[-] May not be well suited to some applications.

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Cellular mobile – Local Access

Open standards allowing mobility and connectivity anywhere, anytime.
[+] Huge global market and competitive ecosystem with ongoing evolution.
[+] Low cost for user equipment (competitive market).
[+] Versatile user equipment.
[+] Mobile services.
[-] Relatively high usage costs compared to fixed services (bytes per month).
[-] High initial costs for network build (poor return in low density markets).
[-] Relatively high operating cost (management and evolution).
[-] Limited competition in lower density markets.
[-] Shared technology. Additional subscribers degrade overall performance.
[-] Performance can be inconsistent. Latency can be high.
[-] Higher capacity usually requires significant investment in network upgrades to new technology.
[-] May not be well suited to some applications.

Fixed wireless– Local Access

Different technology with different coverage and capacity characteristics. A range of proprietary and semi-proprietary products are available.
[+] Can be fast to deploy (if antenna tower permitting is not an issue).
[+] Can have high capacity if high frequency (trade-off with coverage).
[-] Limited spectrum and licensed spectrum can be expensive.
[-] Unlicensed spectrum: performance may degrade from interference.
[-] Susceptible to weather and local weather can cause service issues.
[-] Usually needs fibre for sufficiently high capacity backhaul.
[-] Requires line of sight for high capacity and reliability.
[-] Shared technology. Additional subscribers degrade overall performance.
[-] Fixed to a specific location.
[-] May not be well suited to some applications.

Emerging Technologies

Low earth orbit satellite (LEO)

Only Starlink service is available for beta testing in Canada as of 2021-02-21.
[+] User speeds 50-150 Mbps downlink and 10-30 Mbps uplink.
[+] Delay in the 20 to 40 msec range.
[+] Potential to lower the cost of usage to isolated customer locations (beta service in Canada is $130 per month for unlimited usage).
[-] A competitive market may not emerge if other initiatives fail (OneWeb, Telesat LEO, etc).
[-] High inclined and polar orbits required for high latitude coverage.
[-] Long-term costs and performance are still uncertain.
[-] Current costs are not competitive for communities that are large enough to economically support fiber transport and fiber access networks (FTTH).

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Cellular 5G – Local Access
Next generation 5G cellular
[+] Potential for low usage costs with 5G and mmWave frequencies.
[+] Mobile and fixed services.
[-] Requires a heavy investment in fibre to connect numerous 5G antennas..
[-] Emerging now in Canada but mmWave frequencies have yet to be auctioned.

Summary of Technology Alternatives

In summary, rural and remote areas are low density, meaning network links are required over long distance and all else being equal, rural telecom service costs per subscriber will always be higher than urban.

- Fibre optic infrastructure for both transport and access is the long-term end game for fixed broadband. No other currently available technology can match the speed and reliability of fibre connectivity or scalability for the future.
- Cellular mobile to open global standards is, and will remain, the delivery mechanism of choice for mobile voice and data communications direct to individuals.
- Proprietary radio access systems in license-exempt and licensed bands can have a role to play if they are sufficiently inexpensive that payback is within their expected service life.
- Satellite remains the service of last resort for isolated customer locations. Current services that are based on long-delay geostationary arc satellites can be expected to yield market share to low earth orbit broadband satellite service as or if cost-performance proves-in.

Business and Operational Considerations

Infrastructure enables services to subscribers, but it does not provide the resources required to effectively manage, monitor and obtain revenue from the network. When referring to the SDP introduced earlier in this report, the OSS/BSS layer provides all the infrastructure required to perform the operational and business functions required for the network to operate successfully.

The OSS/BSS layer of the SDP includes many components that enable and support service to the customer. In summary:

- Personnel with appropriate knowledge and experience with operating a network.
- Customer support to effectively support subscribers of the network such as technical support and customer service support.
- The infrastructure and software applications required to effectively monitor, manage and operate the network.
- Business operations for the business such as customer service and billing.
- Equipment, tools and assets required to complete onsite activities.

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The OSS/BSS layer must include, but is not necessarily limited to:

Resources:

- The personnel required to:
  - support and provision network services;
  - provide maintenance activities on the network electronics and other infrastructure;
  - manage subscriber requests for adding, removing and changing existing services; and,
  - provide the expertise required to enhance services on the network.
- The support system, which includes the personnel, required to effectively support subscribers of the network such as technical support and customer service support.
- The processes and procedures related to the operation of the business.
- The equipment and tools required to complete onsite activities such as vehicles, tools, fibre splicing and testing equipment, network testing equipment, etc.

The personnel required to operate the network need the following skill sets:

- Overall management resources that are familiar with the operation of a network and can provide the overall guidance for the network operations.
- Technical resources that can effectively design, commission and support the electronic components of the network.
- Technical resources that can effectively design, commission and support the infrastructure components of the network such as POPs, power systems, environmental systems, outside plant, fibre, etc.
- Installation and maintenance skills that can provide the onsite support for the infrastructure, electronic components and subscribers.
- Customer service resources that can provide effective assistance to subscribers of the network.
- Sales resources that can manage new opportunities.

Business Systems:

- Customer database containing customer information.
- Billing systems to issue invoices and accept payments.
- Documentation storage.
- Reporting systems to gather, consolidate and report on customer usage that may be used for customer billing.
- Scheduling systems to book and schedule customer site visits and technician tracking that may be required.
- Remote access systems used to provide key support and business technicians access to the systems 7x24x365.

Operational Systems:

- Monitoring systems to monitor the network, locate problems, send alerts to support technicians, gather statistics, report on trends, etc.
- Trouble reporting systems to gather and maintain information on problems reported by customers for timely resolution.
- Provisioning systems to add, change and remove services to customers.

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- Logging systems to log network and customer events.
- Documentation storage.
- Manufacturer specific software required to operate and maintain network equipment.
- Backup and restore systems to maintain configuration backups and restore when required.
- Network maintenance software.
- Network operation systems that are required to make Internet services function. Eg. Domain Name Service (DNS)
- Network authentication and registration systems such as RADIUS and DHCP that are required to activate subscribers on the network.

The hardware and software systems are typically located in one or more datacenters (or POPs) on the network. The intent is to have a location suitable for the equipment required to run the software applications required to effectively operate the network. As these systems will contain sensitive operational and subscriber information, they would typically be implemented in a manner that provides security from external sources such as the internet. These systems contain the infrastructure that provide the daily operational functions for the network.

Along with appropriate resources and software applications the OSS/BSS systems include all the processes and procedures and physical equipment required to perform these functions. An example of a process would include the step by step procedure to install and activate a new subscriber on the network as a number of components need to be considered including the physical installation of the fibre drop, the equipment at the subscriber premises, connection of the subscriber in the POP, the activation of the service on the network, etc. Each of these functions needs to be completed in order for the service to be ready for the subscriber.

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Technology	FTTP/FTTH	Fixed Wireless	LTE 4/5G	DSL	Coaxial Cable	GEO Satellite	LEO Satellite
[+]	Unlimited capacity Easily scaled Very reliable Multiple services Low OPEX	Low capital cost Fast to deploy Big bang for your buck Common for regional ISPs	Good capacity Mobile services No wires Low cost for user Versatility in services	Cost effective if cable exists Supports multiple services Leverages existing phone lines	Cost effective if cable exists High capacity Supports multiple services	Available anywhere Can be moved easily	Available in remote locations Can be moved easily Good performance
[-]	High capital cost Requires permitting & approvals Fixed a specific location	Limited scalability Technology lifecycle Requires line of site Unreliable if designed wrong Interference concerns for unlicensed	Limited scalability Technology lifecycle Poorly suited to some services High usage costs to subscriber Limited ability for competition	Cable has high capital cost Scalability is limited Subject to reliability issues Subject to quality & distance Limited ability for competition	Cable has high capital cost Scalability is limited Unreliable if designed wrong Limited ability for competition	Lower capacity High latency Costly bandwidth Problems in extreme weather	New technology Not available eveywhere Will take time to build out Long term is unknown Only one provider at this time
Characteristics	Dedicated	Shared	Shared	Dedicated	Shared	Shared	Shared
	A/Symmetrical	Asymmetrical	A/Symmetrical	Asymmetrical	Asymmetrical	Asymmetrical	Asymmetrical
	Very Low Latency	Low latency	Medium Latency	Low latency	Low latency	High Latency	Low latency

Indicates an advantage or preferred characteristic
Indicates an disdvantage or less desireable characteristic
Indicates an acceptable characteristic

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Appendix E – Open Access Overview

British Columbia and Canada face a problem with connectivity in remote and rural communities of Canada. Many of these communities are faced with absolutely no connectivity or connectivity that is poor or unreliable. The primary challenge is that rural connectivity lacks a business case to invest capital and operational funds. Private enterprises do not provide services in these areas because it simply does not make business sense to do so. As a result, providers position requests for funding to build transport where it creates opportunities for them and local access in areas that may already be served, leaving rural areas untouched as a lower priority.

Government funding programs often require that infrastructure constructed using funds from these programs be available for other providers to use at pre-determined rates ("quasi open-access"). The challenge with this approach is that the lack of a business case makes it nearly impossible for one provider to provide services in these areas, let alone more than one. While it may be physically possible for more than one provider to service these areas, the business case dictates that it will likely be a single provider thus excluding any form of competitive services or pricing.

Government support to address the connectivity problem is appropriate but the distribution of funds is typically in the form of grants of funds to an existing (often for-profit incumbents) provider on the basis that it will provide new or enhanced services. Funds are granted to the provider on the basis that they use them to solve connectivity issues in these unserved or underserved regions. While quasi open-access is a step in the right direction, it doesn't go far enough.

The connectivity problem in rural BC is not going to fix itself, and using public funds to benefit private enterprise that are not motivated to solve the rural challenge is not the right approach. We need to think bigger. We need to think differently. Rural funding programs should support government priorities, not the priorities of the service providers. Rural funding should be done as part of much larger vision, with affordable choice for consumers.

In the traditional model, for a service provider to service a customer, they must construct all levels of the Service Delivery Pyramid ("SDP"). While this model may be acceptable in larger centers where there are enough subscribers to make a suitable business case for providers to essentially overbuild each other with different types of technology, in remote and rural communities, there is not enough subscribers to justify one provider building this infrastructure let alone more than one. Once a provider has built the infrastructure, there is virtually no chance that a second provider will provide any competitive services. In the short term, the funding can be considered a success and area residents do get improved services. In the long term though, as service requirements change due to progression in technology and connectivity requirements, these areas will lag behind once again and the problem of second-class connectivity will again be reality. Then government must, again, incent the provider to upgrade the service.

True Open Access ("TOA") networks alleviate the above problem by designing the solution in a way that addresses the problem at a broader regional level and encourages competition, provides support for government initiatives, choice of services and providers for the consumer. A TOA network leverages technology and a business model to allow multiple providers to share the network and deliver a variety of services to the consumer. In the end, the consumer is the winner with a choice of providers and services in a competitive market forcing providers to deliver innovative services at improved price points and high levels of customer service. In the case of rural connectivity, using this model over a larger number of communities, aggregating the costs under a single entity provides the opportunity to make more attractive business case with the benefit of choice to the consumer.

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