CENGN Overview

CENGN Vision and Mission

Advancing global technology innovation for the prosperity of all Canadians

CENGN drives technology innovation and industry growth through our test bed, technical expertise, talent development, and partner ecosystem

Solidifying Canada's Leadership in Networking

Innovative Tech Solutions

Validation in Real Environments

GDP Growth

Professionals &

Highly Qualified

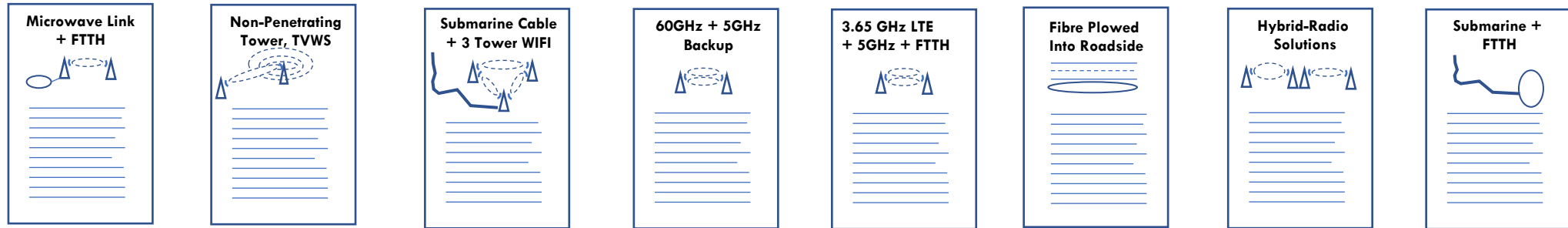Tech Business Growth

Job Growth

CENGN enables innovative tech solutions through its **Rural & Northern Ontario Residential Broadband Program**

Residential Broadband Projects Underway
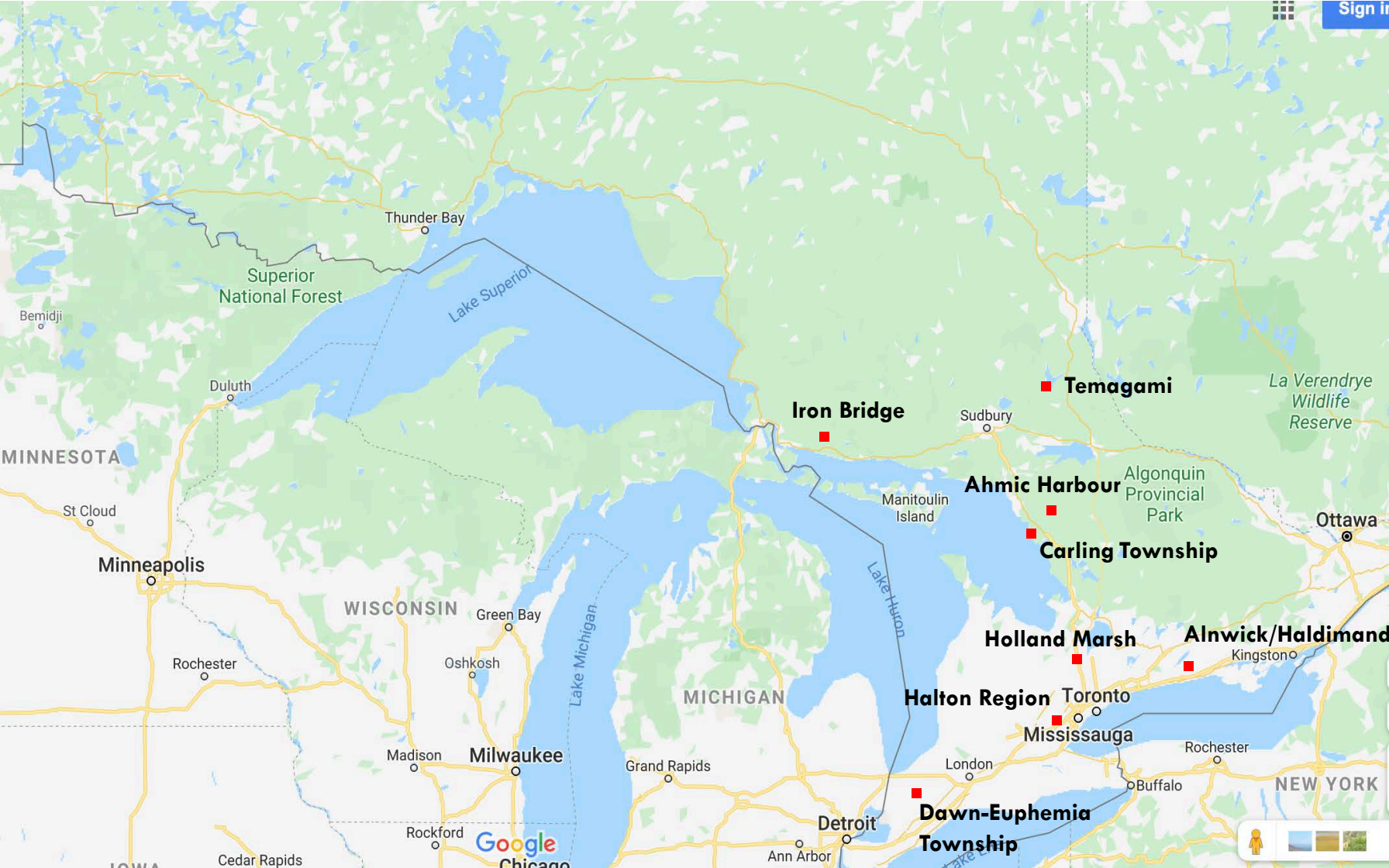
- **Carling Township**: Microwave middle km; FTTH buried in road shoulder

- **Migisi Sahgaigan First Nation**: Submarine cable middle km; FWA

- **Iron Bridge**: Hybrid FWA incl. TVWS

- **Ahmic Harbour**: Small footprint towers, 5GHz WIFI, and LTE FWA across lake

- **Temagami**: New tower, 5GHz WIFI, and TVWS FWA across large lake

- **Dawn Euphemia Township**: Multiple FWA: 5GHz WIFI, 24GHz MW, 3.65GHz LTE; FTTH

- **Halton Region**: Hybrid FWA: 60 GHz, 5 GHz WIFI heavily meshed, distributed pole-based architecture

- **Township of Alnwick/Haldimand**: Micro-duct FTTH

- **Holland Marsh**: 5G FWA for rural broadband, with Eband backhaul

- 2 more projects will be announced soon in Northwestern Ontario

- 2 or 3 more projects will be announced soon in Eastern Ontario

Compile Collection of Blueprints for Broadband Innovation

Microwave Link + FTTH	Non-Penetrating Tower, TVWS	Submarine Cable + 3 Tower WIFI	60GHz + 5GHz Backup	3.65 GHz LTE + 5GHz + FTTH	Fibre Plowed Into Roadside	Hybrid-Radio Solutions	Submarine + FTTH

Collection of Blueprints for Broadband Solutions For Small Northern and Rural Communities

High on Innovation

Low on Cost

Focusing on Micro-Projects

- Many small northern & rural communities only have 100-300 permanent or year-round homes within a 3-5 km radius of the centre of the hamlet or village

- Some communities double the number of users in the summer months

Key Properties of Micro-Projects

- These communities are too small to justify more than $150,000 - $350,000 Investment by WISPs

- $150,000 to $500,000 contribution by government funding can launch the project

- ROI typically can be within 2-4 years with 50% government funding

- Excellent service result for community with on-going investment by ISP

- Single invested small technology company or WISP makes sense for very small communities

Project Overview

Northern Project#3 – Problem Statement

Town of Temagami

Bear Island

Temagami First Nation

Lake Temagami
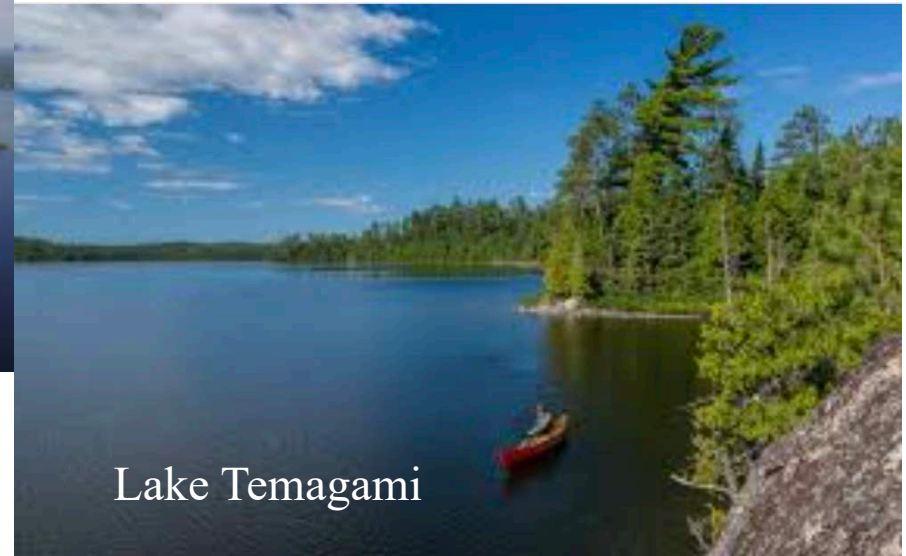
The technology design proposed for the project must extend broadband services from an existing broadband POP in a waterfront community to nearby homes or residences, with limited or no broadband high-speed internet access, that are across and surrounding a large nearby waterbody (such as a lake, river, or extended wetland).

The required solution will extend broadband capacity directly from an existing broadband POP within the selected host northern Ontario waterfront community, or using a network of extended POPs, access the outlying waterfront and nearby homes to extend residential broadband access for homes and cottages up to 3-5 km away .

Temagami + Temagami First Nation

Regional Fibre Routes

Ontera/Bell fibre optics --------

Underground fibre optic routes within rail or pipeline Right of Ways (ROW) not shown on the map.

Temagami North

Temagami

Temagami First Nation

Bear Island

Temagami (Core)

Marten River
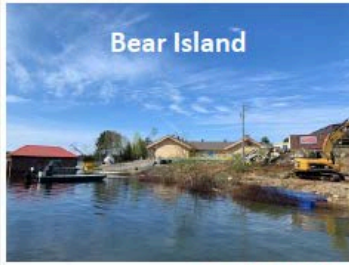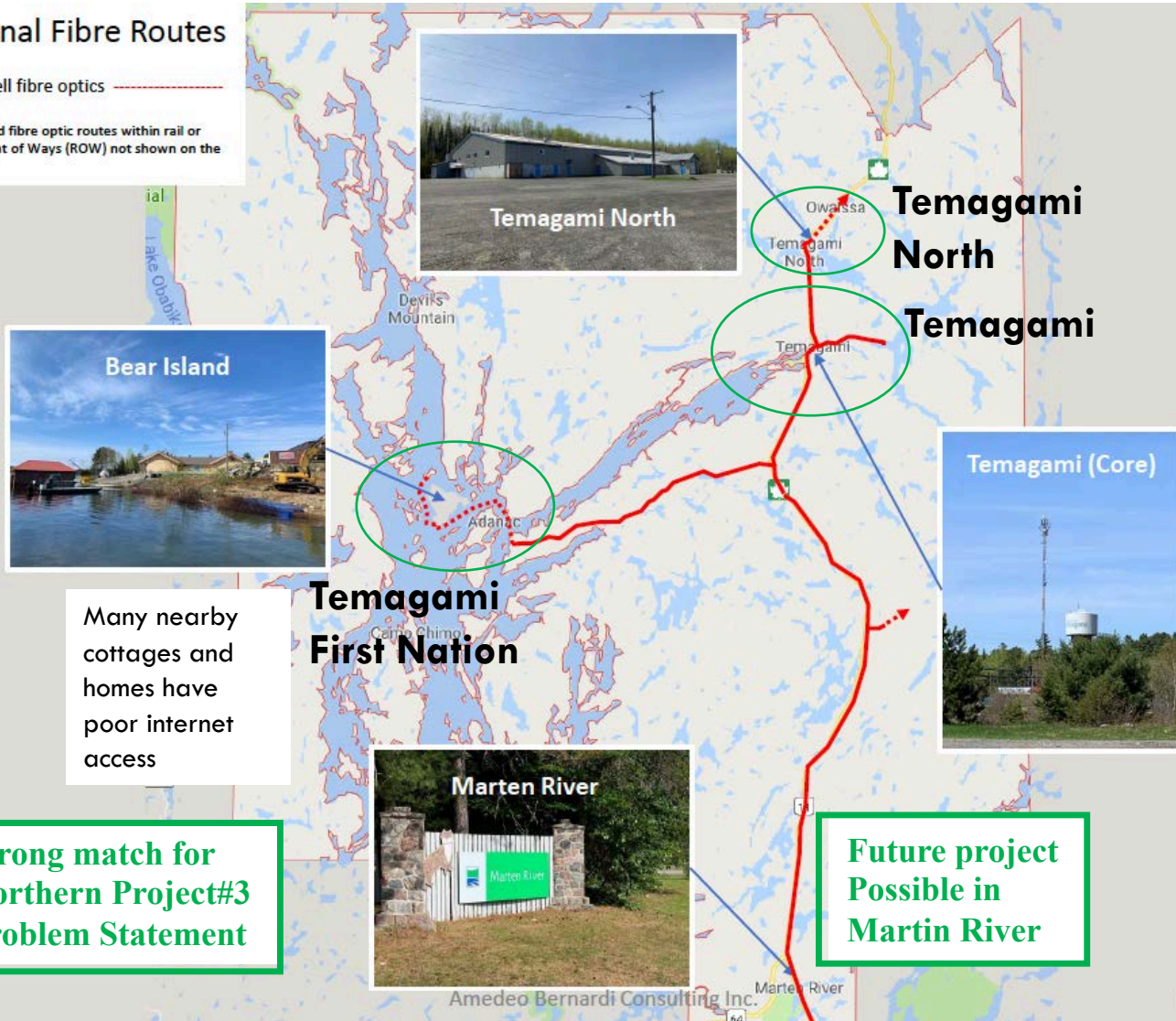
Many nearby cottages and homes have poor internet access

Strong match for Northern Project#3 Problem Statement

Future project Possible in Martin River

Amedeo Bernardi Consulting Inc.

Municipality of Temagami, Lake Temagami, and Temagami First Nation as host community selections for the project.

✓ Both municipalities and lake area have poor last km broadband service

✓ 3 communities have fibre internet access

✓ 2 communities could support FWA for residents of the east arm of Lake Temagami.

✓ Bear Island could support FWA for Temagami First Nation residents, along with both the north & south arm of Lake Temagami for lake shore residents.

✓ Strong business case with combined population of about 1,500 residents

✓ Detailed broadband gap analysis report available covering both communities

Municipality of Temagami

Town of Temagami

- Population of 762
- 5 municipal buildings
- 18 businesses
- At least 200 homes in the town area
- 100s of homes and cottages across the lake
- Homes extend both directions down the arm and across the lake

Lake Temagami

- Large number of homes and cottages across and down the lake from the town

Lake Temagami

Lake Temagami

- 100s of homes and cottages across the lake

- Homes extend both directions down the east arm and across the lake

- Fishing lodges and cottages extend up the north and south arms of the lake

Temagami First Nation

Bear Island

- Population of 250
- Approximately 90 homes in the main community
- Many homes and cottages across the lake as well
- Most homes are on the west and south part of the island

Lake Temagami

- Large number of homes and Cottages across and down the lake from the village

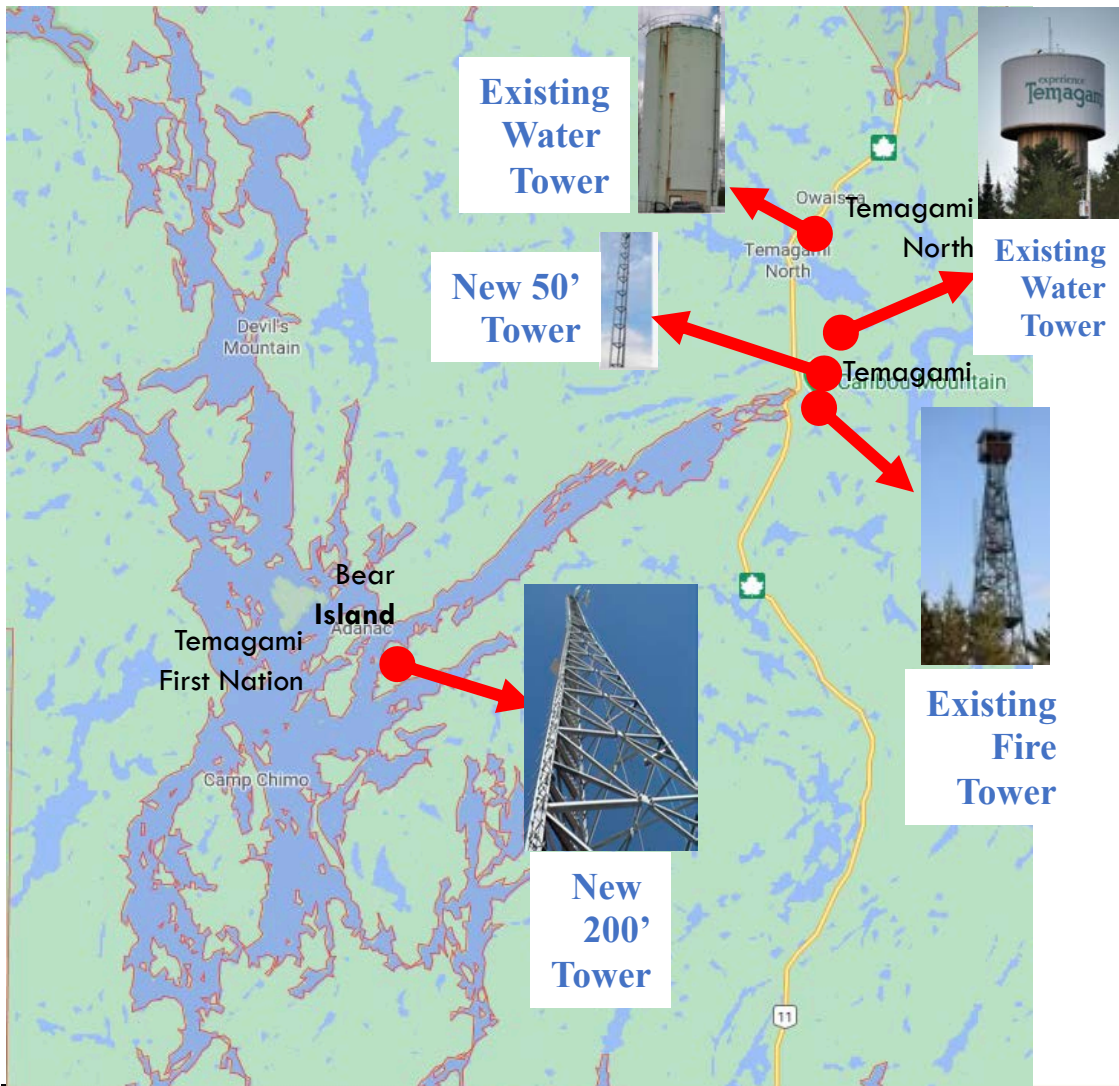Bear Island

Main Community

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Temagami North

Temagami North

- About 5.4 km north of Temagami
- Population of 500
- 1 municipal building
- 2 businesses
- Approx. 200 homes in the area
- Temagami North Water Tower will be reached using Fire Tower in Temagami
- Local internet coverage from Water Tower in Temagami North

Overview of Tower Locations

| Tower Location	Tower Type	Tower Height	Type of Service Supported	Area Supported
Temagami North	Existing Water Tower	80 ft.	2.4 GHz, 5.0 GHz Town-wide WIFI, FWA	Temagami North
Temagami	New 50' Tower attached to building	50 ft.	5 GHz Pt-Pt Backhaul 3.65 GHz LTE Backup	Internet Access Point
	Existing Water Tower	80 ft.	2.4 GHz, 5.0 GHz Town-wide WIFI, FWA	Temagami
	Existing Fire Tower	100 ft.	2.4 GHz, 5.0 GHz, TVWS, FWA	Temagami, Lake East Arm
Bear Island – Temagami First Nation	New 200' Self-Supporting Tower	200 ft.	5.0 GHz, TVWS, FWA Community-wide WIFI	Bear Island Lake Centre
Lake Temagami East Arm			5/0 GHz, TVWS	Lake East Arm, Lake Centre
Lake Temagami North Arm			5/0 GHz, TVWS	Lake North Arm, Lake Centre
Lake Temagami Centre/Hub			5/0 GHz, TVWS	Lake Centre, Temagami Island
Lake Temagami South Arm			5/0 GHz, TVWS	Lake South Arm, Lake Centre

Wireless Network Overview
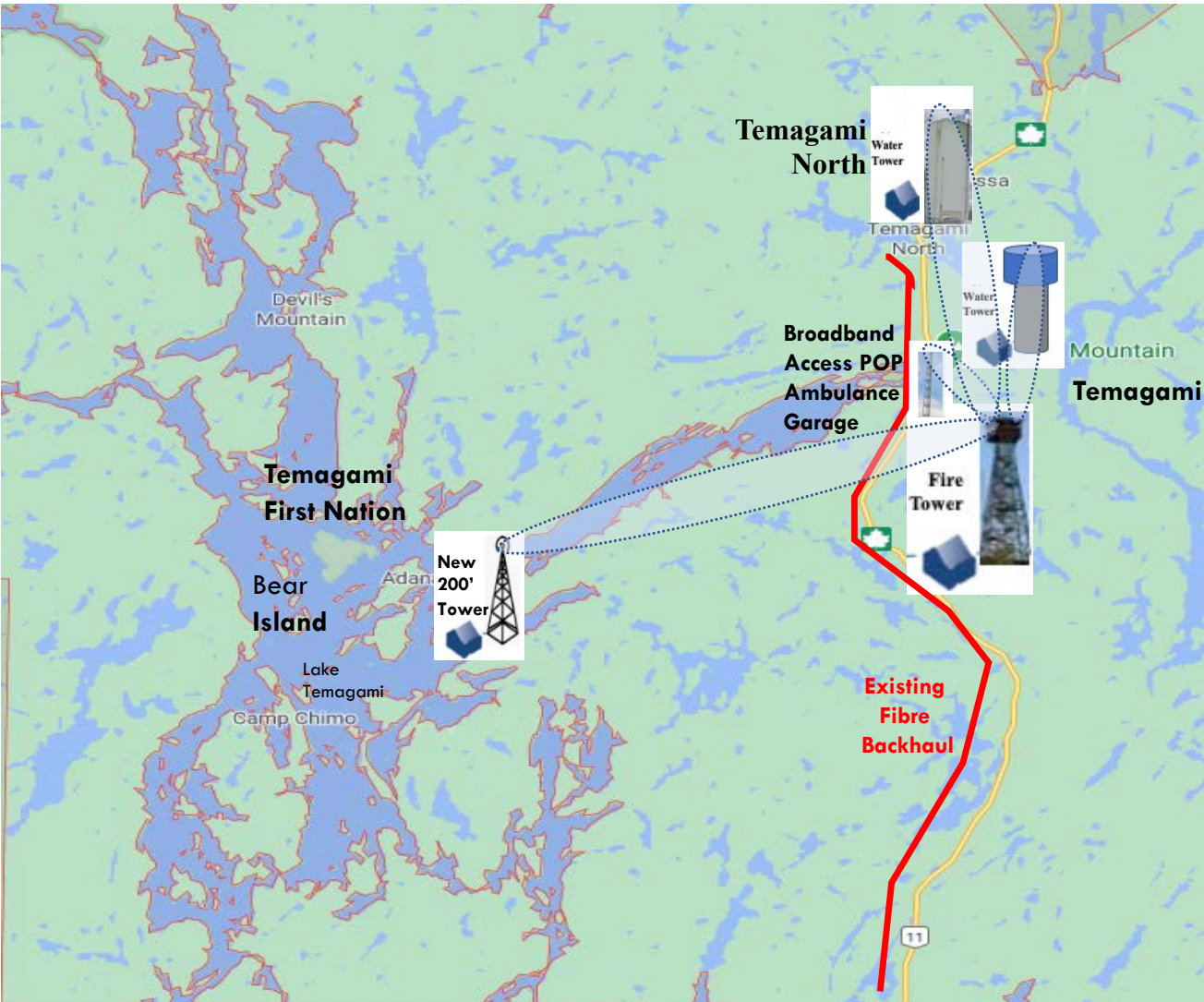
Multi-Tower Implementation

✅ **Temagami North Water Tower** will provide wireless internet access for North Temagami residents.

✅ **Temagami Ambulance Garage** will be the main internet access site and have a new small 50' Tower to connect using radio link to the Temagami Fire Tower.

✅ **Temagami Water Tower** will provide wireless internet access for Temagami residents.

✅ **Overlapping radio coverage in Temagami** for better service coverages for residents

✅ **Temagami Fire Tower** main hub site to connect internet access backhaul from other towers to the Temagami Ambulance Garage and provide fixed wireless internet access to Temagami residents.

✅ **New 200' Tower** providing wireless internet access for the hub area, east Arm, north arm, and south arm for Lake Temagami residents.

✅ **New 200 ft tower** will also provide wireless service coverage for Bear Island working with the Temagami First Nation to improve internet access services

Advantages of Multi-Tower Radio Design

Legend
- 5GHz Backhaul
- WIFI/TVWS Distribution
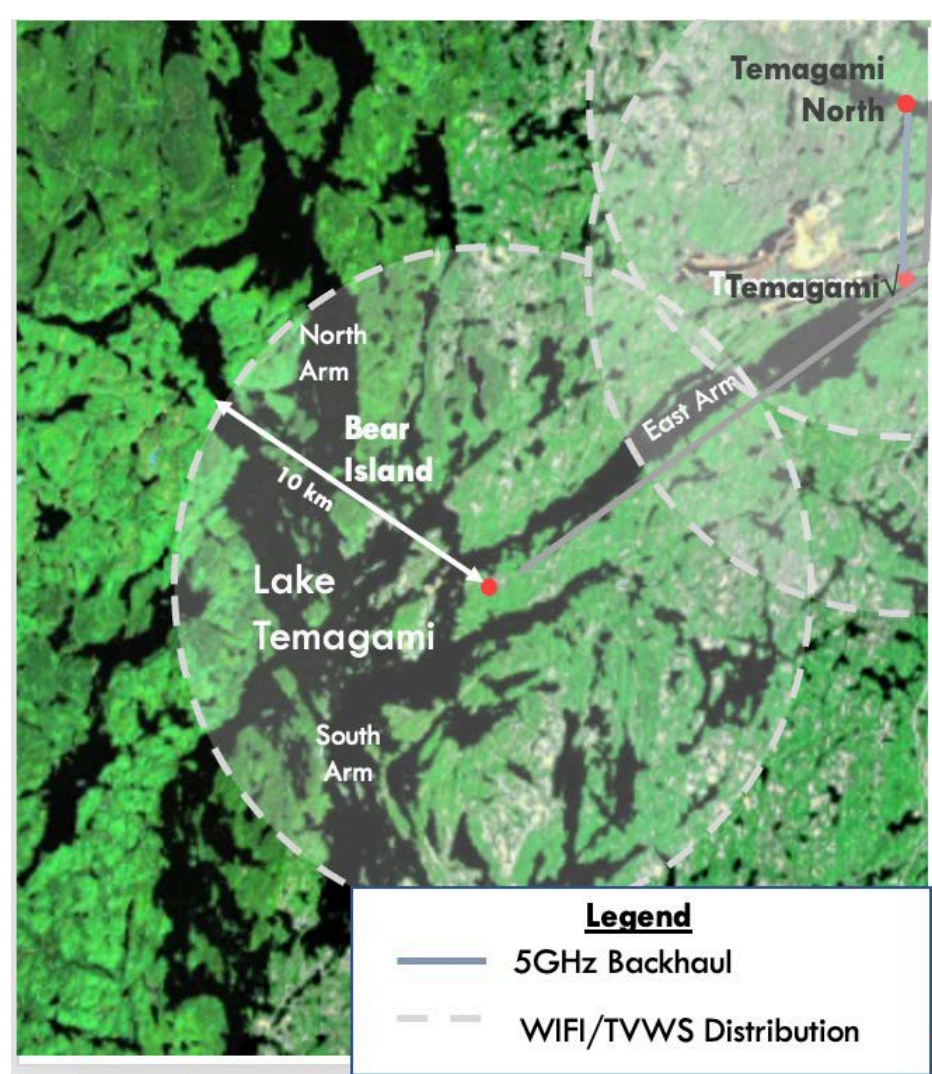
- ✅ **Interconnection of Sites for Higher Reliability**

- ✅ **Radio Signals from Different Directions** to reduce or eliminate radio shadows, more reliable service

- ✅ **Option for Redundant Internet Backhaul** to improve reliability and do load sharing

- ✅ **Higher bandwidth internet access** because stronger signals are available for internet access.

- ✅ **Much wider coverage down each arm of Lake Temagami** will improve coverage for both seasonal and permanent residents.

Technology Overview

Detailed Project Overview for Temagami & Temagami First Nation

Technology Overview

Symmetrical Horn TP Antennas

- No Side Lobes

- Very selective reception just to the main beam

- Facilitates spectral reuse for broadcast in different directions
  - Ideal for small towers or dense configurations

Hybrid Radio Tower Configurations

- Hybrid fixed wireless solution

- Supports 2.4GHz and 5.0 GHz Unlicensed internet access services

- TVWS Radio technology to get through tree cover

- Range of services offered
  - New 50/10 Mbps internet access services

Radio Technology Planned

- **New 5GHz LTU Radios**
  - **For longer distances**

Hybrid wireless solution: 5GHz, 3.65GHz, & TVWS

2.5 GHz WIFI better at penetrating trees to access homes

5.0 GHz WIFI - Target good LOS lower tree cover homes

- **Altai Base Station**

New guyed tower design and use of Existing Towers

New Tower

Existing Tower

Existing Tower

- **Solar Powered Equipment Shed**

6Harmonics – TVWS Radios

Tower Transmitter

Residential Receiver

New Solar-Powered Equipment Sheds

- Solar Powered with Inverter/Battery Backup
- High Reliability support for Tower Equipment
- Attractive and clean enclosure
- Climate Controlled (heating and ventilation provided)
- 5 Equipment Sheds included for Temagami Water Tower, Temagami Fire Tower, Temagami North Tower, and New 200' Tower

Technology Innovation

✓ **Multi-tower Placement on Both Sides of Lake Temagami**
  - Ensure wider coverage of entire lake shores and minimizes radio shadow impacts at shorelines

✓ **200' Tower Design to Extend Coverage to North and South Arms of Lake Temagami**
  - New tower extends wider coverage over the north and south arms as well as last km coverage for Temagami First Nation on Bear Island, possible future platform for improved cellular coverage in future

✓ **TVWS Radio Technology for Superior Internet Service through Dense Tree Cover**
  - TVWS technology will improve coverage to residents of Bear Island

✓ **New Antenna Technology to Reduce Interference and Support Spectral Reuse**
  - Boost performance and reduce interference for both 2.4GHz and 5GHz FWA
  - Support more residents per tower

✓ **New LTU 5GHz Technology**
  - Support up to 256 residents per tower
  - Longer transmission distances up to 30 km supported to reach residents further down the lake
  - Better over water support with this generation of radios, higher download and upload speeds

New Service Connections

Your New Community ISP Leepfrog Telecom

Headquartered in
Richmond Hill, Ontario

New wireless Internet Service Provider (ISP) for Temagami area, committed to provide high quality, high bandwidth, and affordably priced internet access.

- **Experienced wireless residential and commercial Internet Service Provider** (ISP)

- **Many wireless options** to maximize service quality, download speeds and customer satisfaction.

- **High quality protected network design** to ensure your access to the internet stays up

- **Affordably priced high-performance broadband access** – no data cap, low prices, no contract

- **Great customer support and service** – based in Calgary, with local support staff in the area

- **Optional low-cost monthly telephone –** use your phone from anywhere in the world while travelling

- **Optional low-cost TV service packages** – choose only the TV channels you want in your package

What do I need outside my home?

Option#1 – Clear LOS to Tower

Up to 150 Mbps Down / 15 Mbps Up

Altai Model C1xan

Outdoor

Optional Roof J-Mount

Indoor

- **No roof penetration**
- **Can be self installed**
- **Indoors or outdoors use**

Option#2 – Moderate Tree Cover

50 Mbps Down / 10 Mbps Up

Altai Model C1n

Outdoor

Optional Roof J-Mount

Indoor

- **No roof penetration**
- **Can be self installed**
- **Indoors or outdoors use**

Option#3 - High Density Tree Cover

50 Mbps Down / 10 Mbps Up

- **No roof penetration**
- **High Wind Resistance**
- **High Snow Resistance**

What do I need inside my home?

Option#1 – Clear Line of Site to Tower

Up to 200 Mbps Down and 20 Mbps Up

Zyxel Router
- with WIFI and Ethernet support for household devices

- **Easy self install**
- **Can be pre-configured**
- **Plug and Play**

Option#2 – Moderate Tree Cover

50 Mbps Down and 10 Mbps Up

Zyxel Router
- with WIFI and Ethernet support for household devices

- **Easy self install**
- **Can be pre-configured**
- **Plug and Play**

Option#3 - High Density Tree Cover

50 Mbps Down and 10 Mbps Up

Zyxel Router
- with WIFI and Ethernet support for household devices

- **Easy self install**
- **Can be pre-configured**
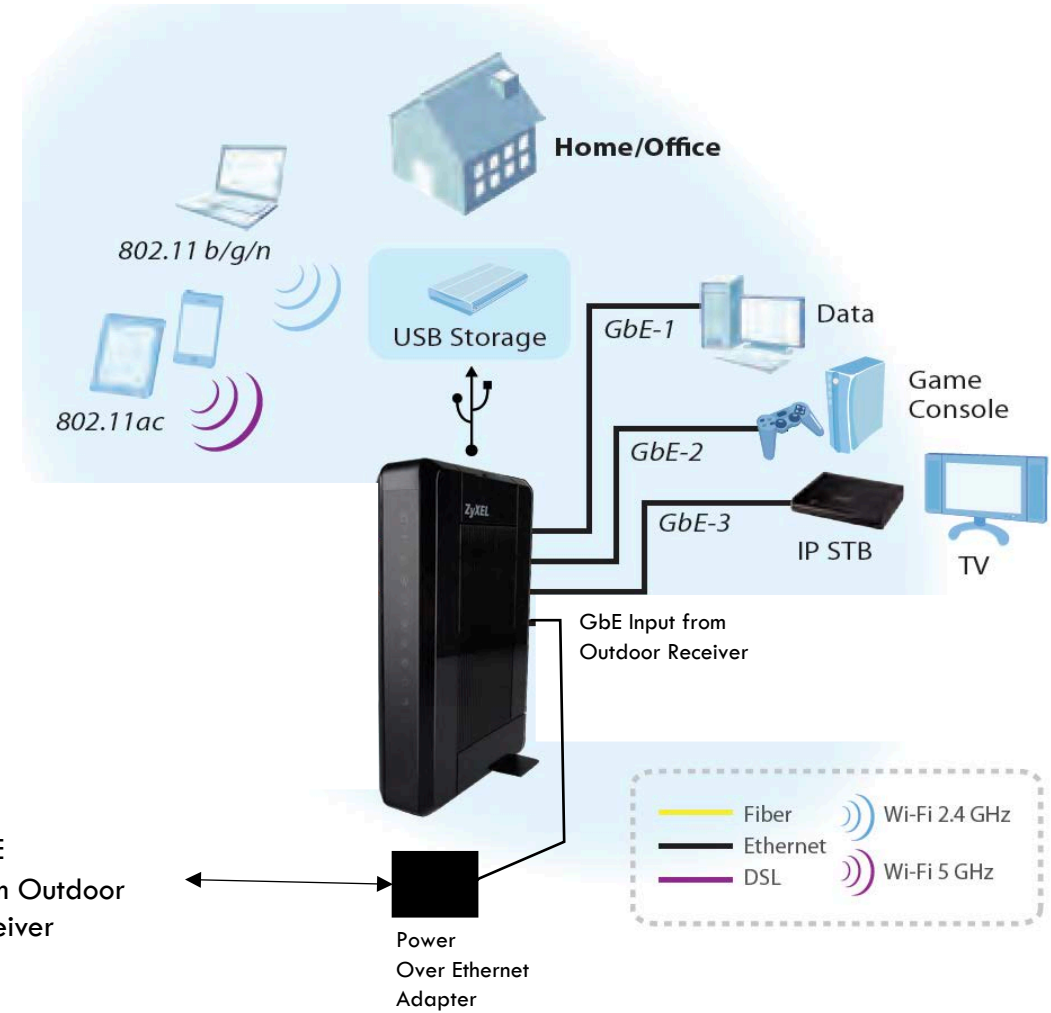- **Plug and Play**

Same Indoor Device for all 3 Options

Rear Panel
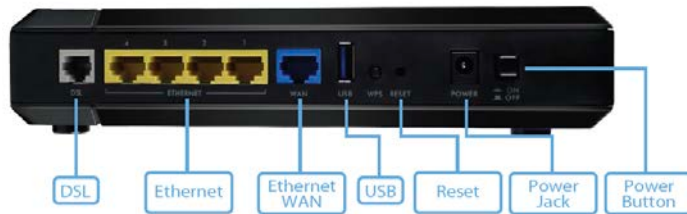
- Router/Switch
- Integrated Firewall
- Multiple GbE ports
- Dual Band WIFI Support
- USB Access

DSL | Ethernet | Ethernet WAN | USB | Reset | Power Jack | Power Button

802.11 b/g/n

802.11ac

Home/Office

USB Storage

GbE-1 — Data

GbE-2 — Game Console

GbE-3 — IP STB — TV

GbE Input from Outdoor Receiver

GbE From Outdoor Receiver

Power Over Ethernet Adapter

Fiber — Wi-Fi 2.4 GHz
Ethernet — Wi-Fi 5 GHz
DSL

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New Service Details for the Three Communities

New Internet Access Services for the Community

Residential Internet Packages

- **WIFI Residential Internet Access**
  - 50 Mbps Download / 10 Mbps Upload **(Unlimited Data)**   **$ 90 per Month**
  - 100 Mbps Download / 10 Mbps Upload **(Unlimited Data)**   **$ 125 per Month**
  - 150 Mbps Download / 15 Mbps Upload **(Unlimited Data)**   **$ 160 per Month**
  - 200 Mbps Download / 20 Mbps Upload **(Unlimited Data)**   **$ 195 per Month**

- **TVWS Residential Internet Access**
  - 50 Mbps Download / 10 Mbps Upload **(Unlimited Data)**   **$ 90 per Month**

Business and Commercial Packages

- **WIFI Business/Commercial Internet Access**
  - 50 Mbps Download / 10 Mbps Upload (Unlimited Data) $ 105 per Month
  - 100 Mbps Download / 10 Mbps Upload (Unlimited Data) $ 140 per Month
  - 150 Mbps Download / 15 Mbps Upload (Unlimited Data) $ 175 per Month
- 200 Mbps Download / 20 Mbps Upload **(Unlimited Data)** $ 210 per Month

- **TVWS Business/Commercial Internet Access**
  - 50 Mbps Download / 10 Mbps Upload (Unlimited Data) $ 105 per Month

New Optional Telephone Access Service

VoIP Residential Optional Telephone Packages

Cost per Month for Unlimited Cross-Canada Only Voice Coverage	Cost per Month with added Unlimited Cross-US Voice Coverage
$19	$22

VoIP Small Business Optional Telephone Packages

Cost per Month for Unlimited Cross-Canada Only Voice Coverage	Cost per Month with added Unlimited Cross-US Voice Coverage
$23	$36

New Optional Telephone Access Service

VoLTE/VoWIFI Mobile Optional Telephone Packages

Unlimited Cross-Canada Only Voice Coverage Included	Data Included Per Month (Mbytes)	Cost per Month	Cost per Month with added Unlimited Cross-US Voice Coverage
✅	300	**$25**	$45
✅	500	**$30**	$50
✅	1000	**$35**	$55
✅	5000	**$65**	$85
✅	10000	**$110**	$130

Service automatically switches between conventional cell tower access, to lower cost voice over any local WIFI in your home or any local WIFI near where you are using your phone. Can also be used internationally for low cost calling from international locations back to Canada over WIFI.

New Optional Television Access Service

Optional Residential Television Packages

Charge Type	Skinny TV Package	Skinny Plus TV Package	Lobby TV Package	5 Channel Picks	All-in TV Package
Monthly	$30	$40	$37	+ $12	$95

Optional Business/Commercial Television Packages

Charge Type	Lobby TV Package
Monthly	$37

Schedule Overview

Service Turnup – Schedule Overview

Project Milestones	Timing	
	Start	End
Project Award	**Dec/2020**	**Dec/2020**
Municipal Coordination	**Dec/2020**	**May/2021**
2.4GHz & 5.0GHz WIFI, TVWS Deployment for Temagami & East Arm	**May/2021**	**July/2021**
2.4GHz and 5.0GHz WIFI , TVWS Deployment for Temagami North	**May/2021**	**July/2021**
Build new tower on East Arm Peninsula	**Sept/2021**	**Oct/2021**
2.4GHz and 5.0GHz WIFI , TVWS for Bear Island, North & South Arm	**Oct/2021**	**Dec/2021**

- **Installation of radio equipment on existing towers can be done this summer.**

- **Residential services in Temagami and Temagami North can start by July.**

- **Services to Bear Island, north, and south arms of Lake Temagami can be started this October.**

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Detailed Project Overview for Temagami & Temagami First Nation

Testing and Monitoring Performance

Testing Your Internet Access Performance in Temagami and Temagami First Nation

- CENGN will be paying for an Internet Performance Tool customized for Temagami and Temagami First Nation

- Offers visual representation of how the existing service is performing for the community

- Allows tracking of improvement as more residents get connected to the new services

- Monitors connection for up to a year after installation

- No charge to use the tool for residents

- No charge to use the tool for the communities

Visualizing Your Internet Access Performance Improvements

Before   **After**

50 Tests Run

200 Tests Run

Detailed Project Overview for Temagami & Temagami First Nation

CENGN

Community Benefits of Project

✅ **High-speed Reliable Broadband Internet Services to Underserved Residents**
  - Fixed wireless access to the home for up to residents
  - No data cap!! Low monthly internet access charges.

✅ **Multiple Wireless Options for Access to Residents**
  - Choice of technology will be based on level of line-of-sight to the closest tower
  - Two choices optimized for near line of sight (some tree cover) or non line of sight (heavy tree cover)

✅ **This technology solution could be extended to the other nearby communities easily**
  - Significantly reduced incremental cost per community (eg. Martin River)

✅ **WIFI extension to municipal and band office staff can lower cell phone costs for community**
  - Access can be extended from this new tower to allow municipal workers to use WIFI instead of cell

✅ **Lower cost optional phone and television services**
  - Leepfrog Telecom will also offer optional lower cost value added services via wireless access

THANK YOU!

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